Taxonomic revision of four Nearctic Conopidae (Insecta: Diptera) genera

(*Dalmannia*, *Roberstomyia*, *Stylogaster* and *Zodion*)

with notes on all other Nearctic genera

Trevor Burt

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Trevor Burt

Abstract

Species concepts for *Dalmannia*, *Robertsonomyia*, *Stylogaster* and *Zodion* (Diptera: Conopidae) of the Nearctic [NE] region are reviewed or revised. Provided are descriptions of new species, with distributional, natural history, host data where available, preliminary molecular data including pairwise distances, neighbour-joining trees and parsimony trees, and illustrated keys to species. Species concepts for *Zodion* have been refined due to many new species: *Z. alexanderi*, *Z. dawkinsi*, *Z. dillahuntyi*, *Z. harrisi*, *Z. hauseri*, *Z. hirsialiae*, *Z. hitchensi*, *Z. lisafyrea*, *Z. meigeni*, *Z. oharai*. A new species of *Stylogaster* is also presented: *S. beresfordi*. The NE region is home to at least 84 recognized conopid species, listed in the Appendix. Some junior synonyms of *Z. fulvifrons* Say, (*Zodion bistria* Walker, *Zodion lativentre* Graenicher, *Zodion sayi* Banks, *Zodion obscurum* Banks) have been transferred to synonymy under *Zodion intermedium* Banks, upon examination of dorsal vestiture and by comparing genitalia. An overview of other Nearctic genera (*Myopa*, *Physocephela*, *Physoconops* and *Thecophora*) is given.

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Author contributions for Revision of Nearctic *Stylogaster* (Burt et al., 2015): L.R. provided insight into Neotropical *Stylogaster* and examined type material of most world species. He also provided guidance with character selection. T.O.B. and J.H.S. worked together equally on specimen examination, species concept formulation, and data organization. T.O.B. took the lead in preparation of the manuscript and key and produced all of the drawings used in the paper. J.H.S. reworked and fleshed out the manuscript.

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Preface

Chapters 1-4, have not been yet been published with the exception of the *Stylogaster* Section 3.12. Trevor Burt was responsible for collecting and analysing the data contained therein under the supervision of J.H. Skevington. Costs associated with COI mtDNA extraction and sequencing, and collecting expeditions were covered by an NSERC grant awarded to J.H. Skevington. Scott Kelso

carried out some COI extractions at the molecular lab at the CNC, Ottawa, Ontario. Some extractions and sequencing was completed at the University of Guelph, Guelph, Ontario, Canada.

Chapter 5 on *Stylogaster* has been published (Burt et al., 2015). L.S. Rocha provided some insights in diagnoses as he has seen most type material of world *Stylogaster*. J.H. Skevington helped refine species concepts and the final manuscript. Trevor Burt wrote and refined the manuscript, photographed specimens and provided illustrations for the key to species. David Moll provided field photos of a male and female of *Stylogaster beresfordi*. Chapter 5 has been slightly altered in form and some terminology in order to match unpublished chapters. The paper was published in and open access form in The Canadian Entomologist, with a creative commons agreement, and thus, no permission is required to reprint portions of the text or figures.

Work published during the span of the MSc but were not included as a chapter include:

Rocha, L.S.G., Burt, T.O., de Mello-Patiu, C.A. & Skevington, J.H. (2015) The first *Stylogaster* Macquart, 1835 (Diptera: Conopidae) fossil, from Oligo-Miocene Dominican amber, and some phylogenetic and biogeographic considerations. Fossil Record 18: 119-125.

1.1 Chapter 1: INTRODUCTION

Conopidae are a small but interesting family of koinobiont, endoparasitic flies placed in the arguably paraphyletic subsection Acalyteratae, in the Section Schizophora (Gibson et al, 2012). Conopids can be found worldwide except for some of the Pacific Islands and the Poles and in the New World they are absent north of 50° latitude. At present there are an estimated 806+ recognized species, with roughly 34 unpublished synonyms (Stuke, 2015 pers. comm.). They are highly variable in appearance, with striking yellow and orange stripes and bands, to dull brown or black and without maculation. They tend to resemble their hosts, usually wasps and bees. Only *Stylogaster* vary from this host range and appear to specialize on orthopteroid families and possibly Diptera (Kotrba, 1997). At this time, very little is known about the hosts of conopids. Some species have been reared from a variety of bumblebees, and wasps (Freeman, 1966; Bohart, 1938; Kotrba 1997; Malfi et al., 2014; and Gibson et al., 2014). The eggs of *Stylogaster* have been found in a variety of potential hosts but only some have been successfully reared (Burt et al. 2014). For example, *Stylogaster* eggs have been found stabbed into the eyes of several species of flies (Couri & Pont, 2006), but none have ever been successfully reared from these instances, thus it is unclear if these are parasitizing attempts, or accidental, or a defensive mechanism of some *Stylogaster* species not yet understood.

The morphology of Conopidae is unique, especially among the females, whose genitalia are very distinct. The females (except for *Stylogaster*) possess enlarged and elongated genital plates (sternites-5 and 6) that oppose each other like a thumb and forefinger. They

are used to clasp hosts and, like a can opener, pries open the host abdomen and insert the eggs beyond the integument (Figs. 7 A-C, E-F) (Camras & Hurd, 1957). The eggs then develop within the host until the fully formed adult emerges. *Stylogaster* are unique even within Conopidae, as the females do not possess clasping plates, but rather sternites 6-8 form an elongated, tube-like terminus (Fig. 7 D). The eggs themselves are highly specialized darts with a sharp sclerotized tip, which are implanted into the cuticle of the host (Figs. 43 D, 44 C. 45 C) (Burt et al., 2014). At present there are a variety of hypotheses concerning the mechanism behind this implantation (Kotrba, 1997). Most likely the egg is stabbed or hammered into the cuticle rather than dropped, thrown, or shot at the host. Males generally appear morphologically similar to females, save the terminus features but can be generally distinguished from females with the naked eye, though it is more difficult in smaller species, and in *Dalmannia*. Instead of two opposing genital plates, as distinct as in *Physocephala* (Fig. 7 A), or *Physoconops* (Fig. 7 B), female *Dalmannia* have an elongated spike-like ovipositor that they presumably use to stab eggs into their hosts (Fig. 14 D-E).

1.2 Diagnosis of Conopidae (see also Diagnostic Checklist of Conopidae below)

Hennig (1973) identified Conopidae as distinct from other Schizophora due to their large heads compared with their bodies (Hennig, 1973). This feature has resulted in their common name, the “Thick-headed flies.” The head is quite wide, as wide as thorax. The vertex or frontal vitta is generally long or comparable to the length of the antennae, with a distinct ptilinal suture above the antennae insertion. The ocellar triangle is about as wide as the frontal vitta is long, but often less so. The antennae are distinctly three-segmented (scape, pedicel, and flagellum), with a short, conical arista. The facial carina is distinct.

The mouthparts are also distinctive with an elongated proboscis with 2-3 bends and short palps. The proboscis is aligned with the strong facial groove that extends just beneath the antennae, forming a deep, pronounced channel. It is easier to diagnose a female conopid from other Schizophora given their distinctive abdominal shapes. Female abdomens are modified and specialized for oviposition on variety of hosts. Generally the abdomen appears like a clasping wrench, or can-opener with an elongated genital plate (sternite-5) opposing syntergosternite-8+9, and sternite-7 (Fig. 1 D). Females of *Dalmannia* (Fig. 14 D-F) form more of a piercing ovipositor without a strong opposing genital plate, and *Stylogaster* is even more specialized with its narrow and elongate abdomen. Tergites 6-8 are cylindrical and fused (Fig. 7 D, 42 C, 43 B).

1.3 Current status of taxonomy

1.4 Family classification

There has been some question as to whether or not Stylogasterinae should be its own family or remain within the family Conopidae as a distinct subfamily. Skevington, Rocha and Gibson (pers. comm.) feel *Stylogaster* should remain a genus within Conopidae, while others like Marshall (2012) have treated them as a distinct family. Gibson et al. (2010), have shown with phylogenetic analysis that *Stylogaster* is sister to all other conopids, and thus a division is arbitrary and would need to be justified purely on their distinctive morphology and life history (life cycle) or host selection; it is widely understood that *Stylogaster* parasitizes orthopteroids, while all other conopids parasitize Hymenoptera. I have followed the traditional treatment and retain *Stylogaster* as a genus within the family Conopidae. The closest relatives of conopids (s.l.) are still unclear although Gibson et al. (2010) suggest that they are perhaps either basal Schizophora or

related to a clade including lauxaniids. Wiegmann et al. (2011) support the latter and suggest that they may be part of the Sciomyzoidea (sister to Lauxanioidea) while Han and Ro (2005) hypothesize that diopsids are their closest relatives.

1.5 Generic classification

Aside from the discussion of the generic classification of *Stylogaster* within the family Conopidae, most other genera have been retained since their initial establishment. There are a few exceptions in the history of the classification of some of the genera, but this is mainly due to overemphasis of certain characters over others, and in some cases, the apparent lack of knowledge of the existence of an established group or species. Species have often been mistakenly placed within a genus based on characters that overlap with other genera. This seemed to happen most with *Zodion*, *Thecophora*, and *Myopa*, which are all very superficially similar, but only *Thecophora* and *Myopa* are closely related while *Zodion* is its own tribe (Gibson & Skevington, 2013). *Myopa* tend to appear robust, and somewhat dumpy, much like the majority of *Zodion*. *Zodion*, however, contains several species such as *Z. abitus*, *Z. anale* and those in the americanum group that are quite small like the majority of *Thecophora*. As such, there exists a long history of confusion in species placement between these three groups in particular.

Robertsonomyia was established based on the unique morphology of *R. palpalis* (Malloch, 1919); distinct ctenidia (3-5) appear along the ventrolateral edges (inner and outer) of the femora (variably present on the front and mid; always present on the hind femora) (Fig. 17 A-C). Other synapomorphies such as a tendril-like labellum define the genus, but otherwise they strongly resemble *Zodion* species. The genus is not monotypic. *Robertsonomyia parva* Adams is a typical example of the genus. We retain this genus

based on morphological characters specified in detail in Chapter 3 below. Molecular data have been extracted and sequenced for the first time and is outlined in the Remarks section of the species' descriptions. This is the first taxonomic assessment of conopids to include both morphological and molecular data.

1.6 Nearctic region taxonomy

Parsons (1948) completed an exhaustive revision of Nearctic Conopidae, which provided a thorough update of the status of the primary and secondary types, with generic and species-level keys, and a short history of classification issues within the group.

Additionally, he provided generic level descriptions and many comments on distribution and biology.

Sid Camras M.D. started working on conopid taxonomy as early as 1945 (Skevington et al., 2010). His work covered virtually all genera in all biogeographic regions. He has generated several revisions, descriptions of new species, and provided keys to species for *Physocephala* and *Thecophora* for the Nearctic region in particular. Much of this present revision is based on his incredible body of work. Camras examined most type specimens and developed species' concepts on the basis of external morphology, and little else. He did not (with the exception of some *Stylogaster*), ever examine genitalia and use the data to inform his species concepts and he never used molecular data.

Unfortunately, previous keys for Nearctic Conopidae are usually not illustrated, are often regional in scope, or are difficult to use due to his selection of diagnostic characters that are variable. Camras typically only used a single character per couplet for species delimitation and omitted other characters that would have proven useful. For example, the key to *Physocephala* of North America (Camras, 1957) is largely based on colour and

maculation patterns, which is now recognized as incredibly variable in other genera, and often dependent on the collection method and age of the specimen. A specimen collected and stored in alcohol tends to appear much lighter, almost bleached, compared to a specimen captured in a sweep and immediately pinned. This discrepancy has led to occasional misidentifications by those who are less familiar with the group.

1.7 A Brief history of Nearctic conopid phylogenetics

Conducting a comprehensive systematic analysis of Nearctic conopids has been a pet project of Dr. Jeff Skevington for a number of years. He has been collecting specimens for the express purpose of extracting molecular data, and has amassed close to 600 specimens that cover a variety of regions. Extracting molecular data from conopids has proven to be a difficult task and consequently many primers had to be developed. Gibson et al., (2010, 2011; 2012) have taken a multigene (COI, cyB, 12S, 28S, AATS, CAD, EF1a, PGD, TPI, and *white* DNA) approach to establishing the higher classification of Conopidae within the Schizophora. Additionally, Gibson et al. (2010) were able to clearly delineate genera, and establish five subfamilies (see 2.12: Alpha Taxonomy below). Burt et al. (2014) analysed *Stylogaster* species using more exemplars but restricting analysis to COI data only (the use of pinned specimens restricted the study to multi-copy mtDNA). *Myopa*, *Dalmannia*, *Zodion* and *Physocephala* were used as outgroups in a Bayesian phylogenetic analysis.

1.8 Biology and natural history (Fossil and Life history)

Conopidae is a family of roughly 806+ species (Clements & Stuke, in prep, 2015) of diverse flies that are found in virtually every region. They are internal parasitoids of Hymenoptera and may mimic their hosts (Camras & Hurd, 1957). They are often very

brightly coloured and mistaken for solitary bees or wasps gathered near flower heads, on hilltops, or, when the temperature rises in the mid-afternoon, they can often be found on rocks near bodies of water like streams or rivers.

Conopids are interesting flies due to their unique morphology, variety, life cycle and what is understood about their life history thus far. The group is sexually dimorphic due in part to the divergent genital characters, and sexes are often difficult to associate due to the wide morphological variability within species. Distinguishing the sex of conopid specimens can usually be accomplished with the naked eye. The female abdomen is highly specialized and when viewed laterally. The ventral genital plate (sternite-5 or theca) is shaped into an elongate, fang-like structure that opposes syntergosternite 7+8 to form a clutching apparatus. This feature is most apparent in larger species of the genera *Physocephala* (Fig. 7 A), *Physoconops* (Fig. 7 B), *Myopa*, and *Zodion* (Fig. 7 F). In *Thecophora* (Fig. 7 C) the ventral genital plate is less prominent, and the small size of the species can make it difficult to discern without a microscope. These distinctive abdomens are used to effectively “grab” the abdomen of a prospective host bee or wasp midflight, separating the host’s abdominal segments and inserting eggs. The postabdomen of the females of *Dalmannia* differ and form an elongated and curved, black, tooth-like ovipositor which levers forward against the ventral abdomen to create a piercing apparatus (Fig. 10 C, 14 D-E).

The abdomens of the females of *Stylogaster* are completely different (Fig. 7 D). Segment 6 (fused sternite-6) is elongated into a stylus, or tube-like structure and fused to sternite-7 and 8, and further terminating into an arrow-shaped hypoproct. Thus, the method of oviposition is certainly different from other conopids. Not only are the abdomens unlike

other conopids, the eggs (Fig. 43 D, 44 C, 45 C) are specialized with a sclerotized harpoon-like, or dart-shaped tip that is inserted into the host cuticle in a manner not yet fully understood. A number of hypotheses have been offered. Kotrba (1997) suggests that historically there have been two serious possibilities considered: “Shoot or stab.” With critical examination of the internal anatomy she concludes that it is unlikely there exists any features that would allow for egg-shooting functionality. She admits the egg would be under great pressure if it were “stabbed” into host cuticle. *Stylogaster* hosts are orthopterans (Rettenmeyer, 1961; Bates, 1863; Smith & Cunningham-van Someren, 1985; Lopes, 1937). *Stylogaster* have been observed diving toward orthopterans with great speed presumably for the purpose of oviposition (Bates, 1863; Rettenmeyer, 1961). However, the actual moment of oviposition has never been observed. I suggest the method of *Stylogaster* oviposition involves more of a “hammering” motion, with the sharp, sclerotized hypoproct acting as the contact point, with the intense pressure of the swinging abdomen directly transferred to the sclerotized tip without any damage to the egg itself (Burt et al., in prep. 2016).

Conopids are highly variable, even within species, thus complicating the development of good species concepts. Host selection, climate, temperature, and general environmental conditions are thought to play a large role in body size, though body proportions seem to be unaffected. In general conopid sizes vary. In the Nearctic region in particular, their size ranges from very small (~3 mm; *Zodion americanum* group *Dalmannia vitiosa* and most *Thecophora*) to very large (~20 mm; *Physocephala floridanus* (Fig. 7 A)). There is a wide range of colour variation and vibrancy in the group. The bodies of *Thecophora* are almost always black (Fig. 7 C), or very dull brown, with black or pale legs, or a mix.

Dalmannia is easily the most vibrant of the Nearctic genera, with black bodies and bright, striking yellow maculation. The remaining genera are a mix of bright and pale yellow, brown, black, gray, red, and cobalt blue, usually contrasted with bare black maculation or silver or golden microtomentum. Colour and vibrancy seem to vary clinally in some species such as *Zodion intermedium* Banks and *Stylogaster neglecta* Williston.

Because conopids are both nectarivorous and parasitic they tend to be found near areas where their food and preferred hosts congregate: near a variety of flowers (Compositae, Labiatae, and Umbelliferae, and surely many others; see Freeman, 1966 for exhaustive plant associations –associations are given with species descriptions if known), sometimes on hilltops for mating (Mei et al., 2008), or on cool rocks near shallow streams when afternoon temperatures increase (pers. observ. 2013).

Once a conopid successfully parasitizes a host, the eggs (dissections show usually more than one egg has been inserted) gestate and larvae form. It is unclear if more than one adult can be reared from a given host, but thus far, records of single conopid emergences are all that are available. Freeman (1966) completed a very good host review for the Nearctic region, and Smith (1966, 1967, 1969) worked on conopid biology and life cycles of various world conopids, including the Nearctic region. Gibson et al (2014) also updated host records and provided valuable information on self-burial behaviour in parasitized bumblebees, and captured a full eclosion on video, highlighting the use of the ptilinum to break free of the bee carcass.

1.9 Parasitism

Not all conopids have been associated with hosts; host information is given with the species descriptions if known.

For an exhaustive list of the known associated conopid hosts please refer to Cole (1921), Freeman (1966), Smith (1966-67, 1969), Bohart (1938, 1941), Bohart & MacSwain (1939, 1940), Camras & Hurd (1957), Foote & Gittins (1961), Severin (1937), Kotrba (1997), Malfi et al. (2014), and Gibson et al (2014).

1.10 Secondary parasitism

Cole (1921) recorded meloid (triungula) beetle larvae on at least three specimens of *Thecophora modesta*. Freeman (1966) gives an account of a 1964 collection excursion to Steptoe Butte, Washington where he collected 24 conopids of which five had meloid triungulins attached. He did not specify which conopids were collected. He also examined some specimens with rhipiphorid triungulins in museums.

Girault (1911) dissected *Bombus pensylvanicus* Fabricius to find conopid pupae parasitized by *Mestocharis williamsoni* Girault. The pupae remained unidentified as none survived to adulthood. Peck (1951) concluded that *Physocephala sagittaria* Say was the host of the parasitic *M. williamsoni*.

1.11 Fossils

Notable fossil conopids include *Palaeomyopa tertiaria* Meunier and *Palaeosicus loewi* Meunier (Meunier, 1899, 1912, 1916) which were synonymized by Hennig (1966).

Another fossil containing seven specimens of *Palaeomyopa* is currently being described (Burt & Skevington, 2015; in prep). More recently the first fossil *Stylogaster* has been described; *Stylogaster grimaldii* Rocha, Burt, Mello-Patiu and Skevington (Rocha et al., 2015). All fossil conopids to date have been discovered in Baltic amber from the Oligo-Miocene boundary to the middle Miocene (14 Mya).

1.12 Alpha taxonomy

The taxonomy of Nearctic Conopidae has been fairly thoroughly examined by a number of individuals throughout various periods.

S.W. Williston (1883) provided a variety of descriptive notes on North American Conopidae.

N. Banks (1916) described several species and completed valuable taxonomic work on *Zodion* and *Myopa*, providing more detailed descriptions than his predecessor.

G.E. Bohart (1938) has thus far provided the only thorough treatment of *Dalmannia* with diagnostic descriptions and a reasonable key to species. He also completed a fairly comprehensive review of Western United States' *Physocephala* species (Bohart, 1941).

O. Kröber has done extensive work on conopids, describing several new species and providing several detailed examinations of the family (Kröber, 1925, 1927, 1928, 1929, 1930, 1933, and 1937).

K.G.V. Smith did a lot of work on conopids (Smith, 1959, 1966, 1967, 1969, 1975, 1979, 1980, 1987) from a variety of regions without specific generic emphasis.

M.C. Van Duzee provided valuable notes on North American Conopidae (Van Duzee, 1927, 1931, 1934), including decent descriptions and keys, though none of these comprehensively include all species.

Except for *Physoconops*, S. Camras in particular has treated the North American fauna thoroughly, updating many old descriptions and rewriting many keys. His work on *Thecophora* (*Occemyia*) (Camras, 1945), was his first major revision, and laid the foundation for future work on this difficult group. His reviews of *Myopa* (Camras, 1953), *Physocephala* (Camras, 1957, 1996), *Physoconops* (*Conops*) (Camras, 1955), *Robertsonomyia* (*Zodion*) (Camras, 1979) and a variety of notes and reviews of *Zodion*

(Camras, 1943, 1944, 1945, 1954), and general New World conopid studies (Camras, 1955, 1963, 1965), have proven invaluable in providing a solid background understanding of the group and its many conceptual problems, and checkered taxonomic past. Camras described *Palaeomyopa tertiaria*, one of the few conopid fossils (Camras, 1994). Camras and Parrillo (1995) also worked on New World *Stylogaster*, with special focus on the Neotropical region, as only two species were known to exist in the Nearctic region north of Mexico at the time.

J-H. Stuke has been working on conopid taxonomy and systematics for the majority of his career but has not worked specifically on Nearctic fauna aside from bulk determinations at a variety of N. American collections. He has described many species from virtually every other region and set a high standard for descriptive format and terminology, closely following Cumming and Wood (2009), and Gibson and Skevington (2012).

The majority of work to date has either had a subregional focus or has not been comprehensive at the species or genus level. In some cases the keys provided were not complete, or ambiguous, and, until recently, almost never illustrated. Additionally, no previous taxonomic paper on conopids has included molecular evidence to support species' concepts.

Gibson et al. (2010, 2012, 2013) conducted large-scale molecular examinations of the family, extracting and comparing multiple genes from 28 taxa in 11 Families (COI, cytB, 12S, 28S, AATS, CAD, EF1a, PGD, TPI, and white DNA sequence data) and extensive morphological analyses (111 characters). They concluded Conopidae should be placed within the Schizophora, possibly as sister to all other extant taxa or sister to the

Lauxaniidae depending on analysis (Parsimony vs. Bayesian). Much of the COI data from this study have been folded into new molecular data to generate support for species concepts and species-level relationships.

Conopidae can thus be summarized in the following way: They are acalyterate Diptera placed with confidence in the Section Schizophora (Gibson et al. 2010; Gibson et al. 2012), and can be broken into five Subfamilies: Conopinae, Dalmanniinae, Myopinae, Stylogastrinae and Zodioninae. The Nearctic region contains eight recognized genera: *Dalmannia*, *Myopa*, *Physocephala*, *Physoconops*, *Robertsonomyia*, *Stylogaster*, *Thecophora* and *Zodion*. Eighty-four species are listed below, though not all are addressed here. Examination of *Myopa* and *Physoconops* have revealed subtle species' complexes full of new species. *Thecophora* is a morphologically cryptic genus requiring thorough retreatment. Examination of genitalia and molecular data have suggest there are 8-10 species.

1.13 Goals of this study

The goal of this study is to refine species concepts, present focused and illustrated keys, and provide a revision of several genera of Conopidae of the Nearctic region, north of Mexico. Some species that also appear in Mexico have been included and described here only because they appear in the southern United States. It was beyond the scope of the work to include Mexican species that were not recorded north of the Mexico-USA border. This work represents a small part of an ongoing attempt to refine our understanding of the Nearctic conopids.

2.1 Chapter 2: MATERIALS & METHODS

The majority of specimens examined were dry, pinned, or side-mounted adults. Adults collected in the field via Malaise traps and stored in 95% ethyl alcohol were most often critical-point dried and pinned. In all cases where body parts detached and could be correctly associated with the specimen, the parts were glued to card-stock points above the collection label. All specimens were given a unique voucher number (see Material examined for each species' description).

Genitalia dissections were carried out by carefully cutting the abdomen with microscissors to either sever the abdomen near the genitalia, thus leaving the bulk of the abdomen intact, or by removing the abdomen entirely. The age and fragility of the specimen usually dictated which method we employed. The genitalia were placed in 1.5 mL Eppendorf tubes (Eppendorf Canada, Mississauga, Ontario, Canada) and immersed in 85% lactic acid and brought to boil for no less than 4 hours on a 95°C dry bath incubator (Fisher Scientific, Toronto, Ontario, Canada). Once the genitalia were macerated, the lactic acid was removed with 70% ethyl alcohol in 2-3 washes, and placed on a glass depression slide in glycerin for dissection. Males were disarticulated between the epandrium and neighboring sternite with great care taken to keep internal parts such as the phallus, hypandrium, and ejaculatory apodeme intact. Genitalia were examined under a Nikon SMZ1500 dissecting microscope with a HI-150 High Intensity Illuminator (Nikon, Canada, Inc. Mississauga, Ontario, Canada). Genitalia were measured and hand-drawn mainly at anterior and lateral orientations to best illustrate important characters.

Genitalia were ultimately stored in genitalia vials with a small amount of glycerin and placed on the pin with the specimen.

Drawings were scanned at 1200 dpi using a Hewlett-Packard 3200C flatbed scanjet (Hewlett-Packard Company, Palo Alto, California, United States of America) and saved as a TIFF file.

Range maps were created with geo-coded data and SimpleMappr (Shorthouse, D. P. 2010).

Some specimens were photographed with a Canon 50D EOS Digital Camera with an MP-E 65 mm macro lens (Canon Canada Inc., Mississauga, Ontario, Canada). Images were stacked using Zerene Stacker version 1.04 (Zerene Systems, Richland, Washington, United States of America). The resulting images were further manipulated with Adobe Photoshop CS4 software (Adobe Systems Incorporated, San Jose, California, United States of America). Adobe Illustrator CS4 (Adobe Systems Incorporated) was used to prepare figure plates from all images (photos, range map tiffs and raw figure drawings). Measurements (total body length) were recorded from the anterior of the face or head (including antennae) to the posterior abdomen or genitalia. In most cases, no fewer than eight specimens were measured to gain an average species length.

Molecular methods and analysis follow Skevington and Thompson (2012). Most genetic work was carried out at the molecular laboratories at the CNC in Ottawa, Ontario, Canada and at the University of Guelph, Guelph, Ontario, Canada. The majority of data have been archived in BOLD and can be accessed through the Barcode of Life Data Systems (BOLD) (<http://www.barcodinglife.org/>) within the public project “Nearctic *Stylogaster* (NESTY)” or the “Conopidae of the World (CONW)”

(<http://www.boldsystems.org/views/projectmenu.php?&>). Additionally, most sequences were deposited in GenBank (*Stylogaster* Table 1). No insertions or deletions existed in the cytochrome c oxidase subunit I (COI) data so alignment was unambiguous. Some sequences have yet to be made public but will be added to BOLD and GenBank for access and review.

2.2 Obtaining mtDNA from old, dry specimens

Old and dry museum specimens are often difficult to extract any molecular data from, due to degradation over time. Lack of fresh material prompted the employment of more aggressive extraction methods to obtain mitochondrial deoxyribonucleic acid (mtDNA) from older material, by using a whole body soak in a tissue lysis (ATL) buffer to moisten the specimen to release any available DNA strands, combined with actively targeting much shorter regions. Scott Kelso (AAFC) developed these protocols in the molecular lab at the CNC.

Dry specimens were pre-soaked still on their pins, in a ~1 ml Buffer ATL, inside a 2ml sterile microfuge tube, and then incubated @ 56°C for about 1 hour to rehydrate (specimens were far less likely to break during pin removal when specimens were pre-soaked).

Pins were removed from specimens by applying downward pressure on the pre-soaked specimens with a pair of “Eliminase-treated” forceps (“Eliminase” solution denatures contaminant DNA & ribonucleic acid (RNA) (Decon Laboratories)) on forceps when soaked for ~1 minute and then rinsed in clean 100% ethanol (EtOH).

Total genomic DNA was extracted from whole pinned specimens using a standard DNeasy Tissue kit (Qiagen Inc., Santa Clara, CA), following manufacturers protocol for

overnight extractions.

Genomic DNA was eluted off of the DNeasy columns with 200 μ L of autoclaved, distilled water (adjusted to pH 8.5-9.0 with concentrated sodium hydroxide (NaOH)) instead of the manufacturer's elution buffer (Buffer AE). The 200 μ L effluent was dried on a Speedvac 100 to concentrate the total DNA. The resulting dry total DNA pellet was then resuspended in ~25-50 μ L (depending on the relative size of the specimen) of Qiagen Buffer AE for long-term storage. The purified total DNA was stored at 4°C after polymerase chain reaction (PCR) and transferred to -20°C for long-term storage.

Following all extractions, specimens were critical-point dried before being remounted on points for morphological examination.

2.3 PCR amplification

New PCR primers were developed to amplify a ~215bp fragment located at the 5' end of the COI-barcode sequence. This region of the COI-barcode was chosen because it contains a high degree of genetic variability within Conopidae. These primers are still in refinement stages and will be published sometime in the very near future.

PCR amplification was carried out in 25 μ L reactions with 12.75 to 15.75 μ L double-distilled water (ddH₂O), 2.5 μ L 10x ExTaq PCR buffer (containing 20 mM magnesium chloride (MgCl₂), 0.625 μ L 25 mM MgCl₂, 1 μ L of each 10 μ M primers (COI-561F & COI-780R), 2 μ L 10 μ M deoxynucleotide (dNTPs), 0.125 μ L ExTaq HS DNA polymerase (Takara Bio USA, Madison, WI) and 2 to 5 μ L of genomic DNA template. Amplification cycles were performed on an Eppendorf ep Gradient S Mastercycler (Eppendorf AG, Hamburg, Germany).

5 μ L of each PCR product was run on 1% agarose gels containing ethidium bromide

(EtBr) and visualized under ultraviolet (UV) illumination.

Positive PCR products were purified with ExoSap-IT reagent (USB Corp., Cleveland, OH) following manufacturer's recommendations prior to sequencing as ExoSap-IT reagent removes single stranded primers & DNA in the PCR product (Exo=Exonuclease I) and removes unincorporated dNTPs from the solution (SAP=Shrimp Alkaline Phosphatase).

2.4 DNA sequencing and editing

Sequencing methods generally follow Burt et al. (2015).

Sequencing of purified products was performed at the Agriculture and Agri-Food Canada, Eastern Cereal and Oilseed Research Centre Core Sequencing Facility (Ottawa, ON, Canada). Sequencing reactions were carried out using an applied biosystems (ABI) BigDye_ Terminator v3.1 Cycle Sequencing kit (PE Applied Biosystems, Foster City, CA). Reactions were carried out in a volume of 10µL, containing 5 µl purified PCR template, 1.5 µl 5X Sequencing Buffer, 2µl ddH₂O, 0.5µl 10 µm primer and 1µl ABI Big Dye. Sequencing reactions were purified using the ABI ethanol/Ethylenediaminetetraacetic acid (EDTA)/sodium acetate (NaOAc) precipitation protocol and were analysed on an ABI 3130xl Genetic Analyzer (PE Applied Biosystems). All sequence chromatograms were edited and contigs formed using Sequencer 5.2.4 (Gene Codes Corp., Ann Arbor, MI).

2.5 Molecular analysis

Sequences were aligned in Mesquite (Maddison and Maddison 2011) with Probability Model: Jukes-Cantor; Minimal Stop-codons; Genetic Code specification: Invertebrate mitochondrial; and Parsimony analyses were run on PAUP* (Swofford 2001), with 500-

1000 trees generated and concatenated in a strict consensus without rooted outgroups. Full or longer COI sequences were cut to match the 215 bps extracted from Nearctic *Dalmannia*, *Robertsonomyia*, *Stylogaster*, and *Zodion* and a heuristic parsimony analysis was performed on PAUP* (Swofford, 2001) with stepwise-addition and 100-1000 random replications. PAUP* (Swofford, 2001) was also used to generate Bootstrap statistics (1000 replications) to gain branch supports for Parsimony analyses. Interspecific and intraspecific genetic pairwise distances were gathered where possible. Pairwise distance results are outlined in the Remarks section of species' descriptions.

2.6 Molecular analysis of *Robertsonomyia*

One long sequence (658 bps) and one short sequence (338 bps) of COI were obtained from *R. palpalis* and *R. parva* respectively and added to a 71 taxon molecular and morphological data set generated by Gibson et al. (2012; 2013). The data set comprises a matrix of five genes (28S, 12S, COI, CytB and AATS) and 111 morphological characters. Data for 28S, 12S, CytB, AATS and morphology are not available for *Robertsonomyia*. Multiple non-conopid outgroups were included (*Chyliza scrobiculata* Melander (Psilidae), *Lonchoptera tristis* Meigen (Lonchopteridae), *Conicera dauci* Meigen (Phoridae), *Toxomerus marginatus* Say (Syrphidae), *Strongylophthalmyia angustipennis* Melander (Strongylophthalmyiidae), *Minettia lupulina* Fabricius (Lauxaniidae). Parsimony analyses were performed with PAUP* (Swofford, 2001) with a tree bisection-reconnection (TBR) branch swapping heuristic search employing stepwise-addition with non-additive multistate characters and 1000 random replications. (*see* Results and Discussion (*Robertsonomyia*) in Chapter 3 Section 3.11 below).

2.7 Bayesian Analysis of *Stylogaster*

Models of evolution were determined based on the Akaike Information Criterion (AIC) using ModelTest 3.7 (Posada and Crandall 1998). Bayesian analyses were conducted using MrBayes 3.1.2 (Ronquist and Huelsenbeck 2003) with a Markov Chain Monte Carlo (MCMC) method. Four chains (three hot, one cold) were run simultaneously for 10 000 000 generations. Trees were sampled every 1000 generations and each simulation was run twice. Following the discard of the first 1000 samples as burn-in, 9000 samples were used for each simulation to generate a majority-rule consensus tree and posterior probabilities for each node. Analysis was conducted using the Cyberinfrastructure for Phylogenetic Research (CIPRES) (Miller *et al.* 2010) and a cladogram (majority-rule consensus) was generated using Mesquite (Maddison and Maddison 2011).

2.8 Note on type material

Where possible, types were gathered and used for descriptive comparison. In some cases the loan of a type was restricted due to the cost, museum policy, or fragility of the specimen. In most of these instances Hi-Resolution photographs were used to gain a sense of morphology.

The following eight type specimens are confirmed to be either lost or destroyed (Mawdsley, 1993):

Valid Genus-Species, Authority - Original Genus-Species, Authority

Myopa vesiculosa Say / *Myopa vesiculosa* Say Type

Physocephala marginata Say / *Conops marginata* Say Type

Physocephala sagittaria Say / *Conops sagittaria* Say Type

Physocephala tibialis Say / *Conops tibialis* Say Type

Stylogaster biannulata Say / *Myopa biannulata* Say Syntype

Thecophora longicornis Say / *Myopa longicornis* Say Type

Zodion fulvifrons Say / *Zodion fulvifrons* Say Syntype

Zodion fulvifrons Say / *Zodion abdominalis* Say Syntype

These types were part of the *Thomas Say* Collection. A good portion of the Say Collection was destroyed by dermestids (Mawdsley, 1993). The types listed above have been traditionally associated with ANSP (The Academy of Natural Sciences of Drexel University; Philadelphia). After speaking with Dr. Jason Weintraub, the Academy's collection manager, we have learned that this is false; these specimens did not ultimately end up in Philadelphia but were destroyed before arriving. Parsons (1948) claimed that *Myopa vesiculosa* and *Physocephala tibialis* (*Conops tibialis* Say) are lost.

For type specimens that are undoubtedly destroyed, Neotypes will be selected within the individual species' descriptions.

Overall, obtaining the large number of types required to complete this revision has been daunting, with many long delays, upwards of 12 months in some cases. In many instances museum collection managers have been unresponsive to loan requests. However, collection managers at the institutions listed in the acknowledgements have been very helpful in providing loan material and many types.

2.9 Collection Abbreviations

AMNH	American Museum of Natural History, New York, NY, USA
ANSP	The Academy of Natural Sciences of Drexel University; Philadelphia, USA
BMNH	The Natural History Museum, London, England
CAS	California Academy of Sciences, San Francisco, CA, USA

CDFA	California Department of Food and Agriculture, Sacramento, CA, USA
CNC	Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, ON, Canada.
CUIC	Cornell University Insect Collection, Ithaca, NY, USA
DEBU	Department of Entomology: Biology Department; University of Guelph, Guelph, Ontario, Canada
FSCA	Florida State Collection of Arthropods
FMNH	Field Museum of Natural History, Chicago, IL, USA
HNHM	Hungarian Natural History Museum, Budapest, Hungary
INHS	Illinois Natural History Survey, Champaign, IL, USA
KSU	Kansas State University, Manhattan, KS, USA
LACM	Natural History Museum of Los Angeles County, Los Angeles, CA, USA
MCPM	Milwaukee City Public Museum, Milwaukee, USA
MCSNM	Museo Civico di Storia Naturale, Milan, Italy
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, MA, USA
MLUH	Martin-Luther-Universität, Wissenschaftsbereich Zoologie, Saxony, Anhalt, Germany
MNHNP	Museum National d'Histoire Naturelle, Paris, France
NHMW	Naturhistorisches Museum Wien, Vienna, Austria
NMW	Muzeum Narodowe w Warszawie, Warsaw, Poland
NRS	Naturhistoriska riksmuseet, Stockholm, Sweden
OSU	Oregon State University, Corvallis, OR, USA

SMF	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt, Germany
UCD	Bohart Museum of Entomology: University of California, Davis, CA, USA
SEMC	Snow Entomological Collection, Division of Entomology, KU Biodiversity Institute; Lawrence, USA
UMO	University Museum of Natural History, Oxford University, Oxford, England
USNM	United States National Museum, Washington, DC, USA
UZMC	University of Copenhagen, Zoological Museums, Department of Entomology, Copenhagen, Denmark
ZMHU	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany

2.10 Format of Descriptions

Morphological terminology generally follows Cumming and Wood (2009) and Gibson and Skevington (2012). Preliminary identifications relied heavily on keys provided mainly by Sid Camras (see Alpha Taxonomy below), with multiple determinations by S. Camras, B.A. Freeman, J.F. Gibson, J.H. Skevington and J-H Stuke.

Name	This is the current valid name, with author and year.
Figures	Complete list of all figures associated with species.
Synonymy	Complete list of all junior synonyms with authors, year and page number.
Type material	Only relevant types are listed with author, year and page, type locality, as well as a general description of condition and depository or any other noteworthy issues.

Material dissected	A list of any genitalic dissections (Unique ID's are given with sex)
Additional material examined*	A complete material examined list (following Zootaxa format)
Diagnosis	A brief summary of specific characters generally used to distinguish the species.
Description	Sex, and range of body length (mm) excluding antennae. Males and females are both described/redescribed under the following sections: Head, Thorax, Abdomen, Terminalia/Genitalia.
Etymology	In the case of new species etymology will be provided. In the case of redescription of established species where etymology is not known, none is provided.
Host	Any known host data will be provided.
Distribution	Current range data will be described with reference to a range map.
Habitat	Any habitat trends (elevations, locations) will be noted including plant associations.
Remarks	General emergence data or aspects that are deemed unusual about the species (eg. only one exemplar exists; only diagnosable by genitalia dissection, etc.) will be outlined.

*Additional Material Examined: Long deposition and database names with unique identifiers on labels have been reduced to acryonyms:

CNC Diptera

CNCD#

J. Skevington Specimen

JSS#

2.11 Intraspecific variation

Intraspecific variation presents some difficulty in establishing species concepts. There are many factors suspected to contribute to variation aside from genetics (environment: temperature, host choice, humidity). Malfi et al (2014) have shown that host size is directly proportional to the size of the parasitoid generated. This work focused on *Physocephala*'s parasitic relationship to a variety of *Bombus* species.

Accounting for colour differences appears to be one of the more challenging problems that can arise. Trapping methods and storage can have an effect. Specimens swept and pinned seem to retain strong colours, while specimens captured in Malaise traps or those that have been stored in ethyl alcohol often appear to have a “bleached” quality, less vibrant colours, somewhat faded. Climate, geographical clines, and the choice of host (size, health, climate, etc.) can also affect colour. Colour, in general, has been used as a distinguishing character with caution.

Body size seems to vary a great deal across most of the genera, but the general body proportions do not, thus the use of overall size has been referred to sparingly in diagnosis. Body proportions (eg; antennal length relative the head) remain fairly consistent and have yielded several diagnostic characters.

Due to the large number of specimens obtained from a variety of museums and collections, many species series could be established and closely examined from a variety of locations within each species' range. This allowed for a greater account and understanding of any intraspecific variation.

2.12 Species Concepts

In the section to follow (2.13 Alpha Taxonomy) the general taxonomic history of conopids is outlined. Formally species have been based on an exterior morphology concept. This approach is without the benefit of genitalic dissections or informative molecular data or reference to distribution. The present work incorporates all of these elements in different ways depending on the difficulty of the group. Exterior morphology and male genitalic dissections have been mainly used to develop concepts, which have been further refined with molecular data. These different approaches were never employed in isolation but in concert with each other. Once concepts were established, specimen sorting informed distribution. These concepts are therefore a combination of morphological (exterior and genitalic) and genetic data.

3. Chapter 3: RESULTS & DISCUSSION

3.1 Key to Nearctic genera of Conopidae

1. Arista or style (antennae) insertion at apex of flagellum (Figs. 5 E, J); area of gena below eye much less than half area of eye when viewed laterally (Figs. 5 E, F, H) . . . 6

Arista or style (antennae) insertion well before apex or at dorsal mid-length of flagellum (Figs. 5 I, K); area of gena below eye about half area of eye or greater when viewed laterally (Figs. 5 A-D, G) . . . 2
2. Wing cell c+sc absent (Fig. 13 E); proboscis with single basal bend and second bend at about half the length (Figs. 5 A-C), pointing up or forward and then downward . . . 4
 - Wing cell c+sc present (Fig. 4 A, D); proboscis with single basal bend (Figs. 5 D), pointing up or forward . . . (Zodioninae) . . . 3
3. Ctenidia (2-6) present distally along ventrolateral margins (inner and outer) of femora (Fig. 17 A-C) . . . **Robertsonomyia Malloch**
 - Ctenidia absent . . . **Zodion Latreille**
4. Ctenidia are absent; abdomen colour pattern bright, striking yellow against black (*see* Figs. 11 A-G *for patterns*). . . (Dalmaniinae) . . . **Dalmannia Robineau-Desvoidy**

- Ctenidia (2-6) present distally along ventrolateral margins (inner and outer) of femora (*like* Fig. 17 A-C); abdomen colour pattern variable but tends to be dull red, brown, and black . . . (*Myopinae*) . . . 5
- 5. Viewed dorsally, abdomen almost as wide as long; tergites 2 and 3 wider than 1 and 4 (Fig. 6 B); palpi long, about $\frac{1}{2}$ length of proboscis after first bend (Fig. 6 B); first arisal article plump, somewhat truncate and defined next to second segment (Fig. 5 B, K) . . . ***Myopa* Fabricius**
- Viewed dorsally, abdomen narrow and long; tergites 2 and 3 about same width as 1 and 4 (Fig. 6 E); palpi shorter, about $\frac{1}{4}$ length of proboscis after first bend (Fig. 5 C); first arisal article rounded, not truncate and ill-defined next to second segment (Fig. 5 I) . . . ***Thecophora* Rondani**
- 6. Spurious vein or faint crease in cell r_{4+5} absent; anal cell somewhat small with alula greatly reduced; facial carina not strongly pronounced and protruding (Fig. 5 E); anepimeron with strong black bristle; proboscis with two bends and as long or longer than abdomen (Fig. 5 E); scape not skinny and elongated, less than or about as long as pedicel (Fig. 5 E) . . . (*Stylogasterinae*) . . . ***Stylogaster* Maquart**
- Spurious vein or faint crease in cell r_{4+5} along M_2 present; anal cell somewhat large with alula not reduced (as in Fig. 4 A, D); facial carina strongly pronounced and protruding (Figs 5 F, H); anepimeron without strong black bristle; proboscis with a single bend and not as long as abdomen; scape skinny and elongated, about as long as flagellum (Figs 5 F, H) (*Conopinae*) . . . 7
- 7 Specimen collected in Bermuda; tg-2 not long and narrow but about as wide as long, not overly constricted compared to 3rd when viewed dorsally

. . . ***Conops* Linneaus** (recorded from a single specimen: *Conops bermudensis* Parsons, 1940)

- Specimen not collected in Bermuda; tg-2 long and narrow, longer than wide constricted compared to 3rd when viewed dorsally . . . 8
- 8. Ocelli present (Fig. 8 C-D), though may be greatly reduced with a small tubercle .

. . ***Physoconops* Szilady**

- Ocelli absent (Fig. 8 A-B), with tubercle reduced at most to a slight indentation

. . ***Physocephala* Schiner**

3.2

DALMANNIA

Class **Insecta Linnaeus, 1758**

Order **Diptera Linnaeus, 1758**

Family **Conopidae Latreille, 1802**

Subfamily **Dalmanniinae Hendel, 1916**

Genus ***Dalmannia* Robineau-Desvoidy, 1830**

Introduction

Dalmannia is a Holarctic genus of rarely collected flies. There are an estimated twenty species worldwide and six species occur in North America. Species tend to have restrictive ranges with the exception of *D. vitiosa* Coquillett that is dispersed throughout the continent. Bohart (1938) believed they were strongly associated with solitary bees (*D. picta* has been associated with *Diandrena* spp. as reported by Bohart from Mohave, California (1938) and likely selects them as hosts).

They are easily diagnosed from other conopids by their small size, black bodies with striking yellow maculation, and a distinct dorsal arista. Williston (1883) recognized the genus and provided minor diagnostic details, with later revision by Van Duzee (1927) who recorded five species. Banks (1916) also included a key with his conopid overview with the first description of *D. pacifica*, but only included four species. Bohart (1938) improved descriptions, included a new species (*D. heterotricha* Bohart), and refined the key. Camras (1957) prepared an updated key but limited it to California species. At present very little is known or understood about the biology and habits of this genus.

Dalmannia vitiosa was suspected to be a complex of species given the expanse of its range; however, after careful examination of morphology, several genitalic dissections combined with analysis of limited COI data (see Remarks under *D. vitiosa* Description), the original concept of *D. vitiosa* stands.

3.3 General diagnosis of genus

Dalmannia are generally small, plump flies with strikingly bright yellow colouration against black; tend to be slightly bushy with setae, yet somewhat shiny. The sub-costa (sc_1) cell is virtually absent (Fig. 13 E). The arista point of insertion is well before the apex or at about the dorsal mid-length of flagellum. Three ocelli are present. The frontal suture is not strongly pronounced or protruding (Fig. 5 A) and the scape is not elongated and skinny, but reduced (Fig. 5 A), smaller than the flagellum. The proboscis has a basal bend and second bend at about half the length (Fig. 5 A), pointing up or forward and then downward. The area of the gena below the eye is about half the area of the eye or greater when viewed laterally (Fig. 5 A). The second tergite is not overly constricted compared to the third (Fig. 6 A), appearing fat and round when viewed dorsally (Fig. 11 A-G).

Dalmannia genitalia are also notable from other conopids. Females always have a piercing ovipositor (as in Fig. 14 C-E) as opposed to a clasping type (Fig. 1. D). Male genitalia lack surstyli completely, and have pronounced, very long, ribbon-like distiphallus (Fig. 9 A-H, 10 A-B).

3.4 Key to the *Dalmannia* of the Nearctic Region

- 1 A small species (~3-5 mm); dorsal thoracic pale maculation (generally yellow) almost always absent from post-pronotal lobes; if present on scutellum it is only

faintly evident on posterior tip (Fig. 13 B); bm-cu (basal medial-cubital crossvein) absent (Fig. 13 D) . . . ***D. vitiosa* Coquillett**

Widespread in Canada (AB, BC, NB, ON, QC, SA) and USA (AZ, CA, CO, IO, KY, MI, MS, MO, NM, NY, NC, TN, TX, UT, VA) (Map 1B).

- Moderately-sized species (~6-8 mm); dorsal thoracic pale maculation obviously present on post-pronotal lobes and scutellum (Figs. 13 A, C); bm-cu crossvein present (Fig. 13 E) . . . 2
- 2 Dorsal abdominal pale maculation nearly covers entire abdomen with maculation on posterior tergites less pronounced (Fig. 11 D); mid and hind basitarsomere of female has a tarsomere-plate (Figs. 15 C-D)

. . . ***D. pacifica* Banks**

Western United States (CA, OR, UT) (Map 1A).

- Dorsal abdominal pale maculation broken up by black colouration (Figs. 11 A-C, E-F); maculation appears mainly as pale stripes across dorsal abdomen; mid and hind basitarsomere of female with variable, reduced tarsomere-plate (Fig. 15 B) . . . 3
- 3 Dorsal abdominal maculation appear as thin pale stripes (1/5th of posterior tergite) with a moderate median peak on the 3rd, 4th and 5th tergites only (Fig. 11 C) (and on 6th tergite in female); if peaks appear on either side of median peak they are faint and very reduced; gena very often with black or darker patch (Fig. 12 E); dorsal thorax with postpronotal lobes pale with anterior darker area often covering half the lobe (Fig. 13 C) . . . ***D. nigriceps* Loew**

Widespread in eastern and midwestern Canada (MB, NB, NS, ON, QC) and USA (CO, GA, ME, MI, MS, NH, NJ, NY, TX, UT, VA) (Map 1A).

- Dorsal abdominal maculation appears as thick pale stripes (more than 1/5th of posterior tergite) with pronounced median peaks and pronounced irregular peaks on either side of the median peak (Figs. 11 A, B, E); gena always without black or darker patch (Fig. 12 D); dorsal thorax with postpronotal lobes either completely pale or with anterior darker area limited (less than half the lobe) (Fig 13 A) . . . 4
- 4 Dorsal abdominal maculation appears as thick pale stripes with median peaks appearing on 3rd, 4th, and 5th tergite (and 6th tergite if female), but not on 2nd tergite where stripe is present (Fig. 11 B); viewed laterally, setae white, long and bushy (Fig. 12 C); females: mid and hind trochanters without concentrated patch of black gripping spines (Fig. 15 F) . . . ***D. heterotricha* Bohart**

Endemic to California (Map 1B).

- Dorsal abdominal maculation appears as thick pale stripes with median peaks appearing on all tergites where maculation is present (2-5 tergites) (and 6th tergite if female) (Figs. 11 A, E); viewed laterally, setae white or black, not bushy, but generally short and depressed (Figs. 12 A-B); females: mid and hind trochanters with concentrated patch of black gripping spines (Fig. 15 E) . . . 5
- 5 Dorsal abdominal maculation with weak marginal and medial peaks, irregular (Fig. 11 E); body length between 5-6 mm; setae mainly white and slightly depressed (Fig. 12 B); golden setae absent around the postpronotal suture; leg setae in particular are white; variable presence of minor dark maculation on pale tibia, distally toward tarsus; wings often appear clear, and rarely smoky

... ***D. picta* Williston**

Widespread in Canada (NB, ON) and USA (CA, CO, MS, NV, UT, WA) (Map 1A).

- Dorsal abdominal maculation with strong marginal and medial peaks, irregular (Fig. 11 A); body length between 6-7 mm; setae mix of black and some white (variable), very short and strongly depressed (Fig. 12 A); sparse golden setae present around the postpronotal suture; leg setae in particular are black; no maculation on tibia; tibia entirely pale; wings often appear cloudy, or smoky brown ... ***D. blaisdelli* Cresson**

Western Canada (BC) and USA (CA) (Map 1B).

3.5 Descriptions

***D. blaisdelli* Cresson, 1919**

Figs. (Fig. 9 A-B), Map 1 B (▲).

Synonymy

Dalmannia blaisdelli Cresson, 1919: 190. Type locality: United States of America,

Colorado. Type depository: type, ANSP.

Type material. *Dalmannia blaisdelli* Cresson, 1919: Type; A. Awaiting type from ANSP.

Material dissected. CNC196279 (♂).

Additional material examined. CANADA: British Columbia: Oliver, 49.18333°N

119.55°W, 14.V.1959, coll. R. Madge, CNC196305, (1♂ CNC); Vernon, 50.255069°N

119.292145°W, 13.V.1907, 8.IX.1913, CNC196304, CNC79711, CNC79712, (2♂ 1♀

CNC); **USA: California:** Blue Lakes, Lake County, 39.174715°N 123.015228°W, 16.V.1922, coll. E.P. Van Duzee, CNCN196279, (1♂ CNC); Cold Creek, Monticello Dam, Solano County, 38.513711°N 122.103802°W, 17.V.1975, coll. R.W. Brooks, CNCN249922, (1♂ UCDC); Davis, 38.544904°N 121.740514°W, 17.V.1949, coll. H.A. Hunt, CNCN196281, (1♀ CNC); Del Norte Co., ca. 4.5 mi. NE Gasquet Eighteen-mile Creek, 41.855833°N 123.912222°W, 31.V.2009, coll. S.E. Brooks, CNCN28478, (1♂ CNC); Del Norte County ca. 4.5 mi NE Gasquet Eighteen-mile Creek, 31.V.2009, coll. S.E. Brooks, CNCN187797, (1♂ CNC); Grace Valley, 27.VIII.1921, CNCN196280, (1♀ CNC); Independence Lake, Sierra County, 39.483889°N 120.284861°W, 23.VI.1976, coll. N.J. Smith, CNCN249921, (1♂ UCDC); Mount Hamilton, 37.341883°N 121.643002°W, 14.IV.1936, coll. G.E. & R.M. Bohart, CNCN190110, (1♂ CNC); Sagehen Creek, Nevada County, 39.432115°N 120.24123°W, 28.VI.1978, coll. R.M. Bohart, CNCN249918, (1♂ UCDC).

Diagnosis: Dorsal setae pale yellow or golden, generally very short, and depressed (shorter than arista) (Fig. 12 A); tarsomere-1 (tm-1) only slightly elongate (about twice as long as remaining tarsomeres); tm-2-5 about same length; tarsomeres' combined length as long as tibia (males); not as long as tibia (females); cuticle of tergites with brownish-black bands with very thin posterior yellow bands with three strong, forward-projecting peaks (Fig. 11-A); female tm-1 (mid and hind) with tarsomere-plate (tm-pt); front tm-1 with smaller tm-pt; short black trochanter gripping spines (tr-gs) appear on inner-ventral trochanters (mid and hind).

Description

Male

Head. Antenna dark brown with golden microtomentum; pedicel and flagellum about equal length; arista inserts ventrally, sub-apically, about $\frac{3}{4}$ length of flagellum; scape and

pedicel with spiky black setae; eyes brown; frons, antennal grooves and facial carina pale yellow with white or silver microtomentum; gena pale yellow; frons without setae; gena with sparse, pale setae if present at all; frontal vitta dull, dark yellow with wide, black medial stripe that extends from ocellar triangle to antennal insertion, with matching microtomentum; ocellar triangle with three ocelli somewhat glossy, black with dull yellow at margins with very sparse black setae about ocellar triangle; occiput and postgena black with narrow stripe of pale yellow extending from under eye to just behind eye, with bushy, pale setae; palpi brownish-black with many black setae; proboscis when fully extended, about $\frac{3}{4}$ length body, mainly black and brown, double geniculate; first bend upward, second bend downward.

Thorax. Scutum black, except well-defined pale yellow postpronotal lobe and the very posterior tip of scutellum, entirely covered with short white or golden setae that are depressed (shorter than arista); lateral thorax black or brown or brownish-black, shiny, with anepimeron mainly unicolourous, with fine, black setae on katepisternum.

Wing. Membrane brownish-gray with total microtrichia coverage; r_{4+5} cell open (without petiole) (Fig. 13 E); r-m cross-vein present (Fig. 13 E); halter pale yellow, variably darker brown basally, without setae.

Legs. Coxae mainly glossy; front coxa with very little brown microtomentum; coxae generally unicolourous dark brown, or brown with long black setae on front; mid coxa often with mix of pale and black setae; hind coxa usually with pale setae; femora mainly brown with yellow distally; mid femur posterolaterally with slight yellow strip; femora with mix of white and black setae; tibiae pale yellow with short pale setae dorsally, with short black setae ventrally; hind tibia with concentrated patch of shorter black and pale

setae, inner laterodistally; tarsomeres (tm-1-5) dark brown with short black setae dorsally, slightly golden ventrally; tarsomere-1 elongate (twice as long as remaining tarsomeres); tm-2-5 about same length; tarsomeres combined length about equal to tibial length; tarsi yellow with black tips with yellow pulvilli.

Abdomen. Abdomen flat and curled ventrally (when viewed laterally), wide and rounded (when viewed dorsally); dorsally, tergite-1 (tg-1) dark brownish-black, with yellow band anteriorly; tg-2 dark brown with thick band of yellow with three moderately strong, forward-projecting peaks; tg-3-5 dark brown with very thin posterior yellow bands with three, strongly forward-projecting peaks (medial and laterally) (Fig. 11 A); tg-6 dark brown with three dull yellow spots or stripes with some black setae at the posterior apex; abdomen with pale or golden setae; shorter than arista and depressed, slightly longer at lateral margins (Fig. 12 A); sternites (st-1-5) pale yellow.

Male Genitalia: (Fig. 9 A-B) Epandrium with Y-shaped opening posteriorly, fully exposed, brown with many black bristles; cerci reduced, small opening, when viewed posteriorly, with many short, black setae; hypoproct projecting forward, slightly pointed; surstylus absent; hypandrium short and broad, extending posteroventrally below the epandrial opening; hypandrial sheath a rounded, protrusion; epiphallus protruding, bulbous; phallapodeme tubular, longer than hypandrium (by $\frac{1}{4}$); distiphallus elongate (as long or longer than phallus abodeme), tubular (sometimes appearing ribbon-like), completely external, covered in fine black setae; ejaculatory apodeme elongate, tapered; sperm pump circular, somewhat flat; ejaculatory duct short ($\frac{1}{4}$ length of phallapodeme).

Female. Appears as male with following differences: gena pale yellow, without brown line of maculation; front coxae often bi-colourous, brown basally, while paler brown or

yellow distally, variable; inner-ventral trochanters without trochanter gripping spines; tarsomere-1 (hind and mid) with tarsomere-plate; front tm-1 with slightly smaller plate; femora mainly yellow, with brown markings distally, sometimes evenly divided; mid femora often completely pale yellow; tarsomeres generally shorter than in males; combined length not equal to tibial length; sternites pale yellow; st-2-3 with slight protruding edge posteriorly; post-abdomen with modified tg-6-7 and syntergosternite-8+9 (synt 8+9) (see female genitalia).

Genitalia. Tergite-7 thin, elongated, sclerotized; shiny brownish-black with fine, black setae; tg-8 sharpened to a point, blade-like, dark brown, with cerci; genitalia curled ventrally overall, sharpened, tooth-like.

Hosts. Unknown.

Distribution. Map 1 B (▲). Found along the western coast of the United States, mainly concentrated in California.

Habitat. Found at a variety of elevations and hilltops as high as 771 m.

Remarks. Emergence April through August, peaking in May. Only one specimen is recorded in August. *Dalmannia blaisdelli* may be multivoltine, and the August specimen may represent a second emergence late in the season. Two sequences of COI have been obtained and can be found at Conopidae of the World (CONW) on BOLD: CNC DIPTERA 187797, CNC Diptera 28478.

***D. heterotricha* Bohart, 1938**

Figs. (12 C, 13 E, Fig. 11 B, 15 F), Map 1 B (■)

Synonymy

Dalmannia heterotricha Bohart, 1938: 134. Type locality: United States of America, California: Marin County, Point Reyes Peninsula, north side. Type depository: holotype, CAS.

Type material. *Dalmannia heterotricha* Bohart, 1938: Holotype; ♀; USA: California: Marin County, Point Reyes, peninsula, north side (CAS). At the time of publication the holotype from CAS had yet to arrive for examination.

Material dissected. none.

Additional material examined. U.S.A.: California: Point Reyes National Seashore, Marine County, 37.292661°N 122.382397°W, 22.V.1976, coll. R.R. Kimsey, M.L. Siri, CNCN249919, CNCN249920, (1♂ 1♀ UCDC); Point Reyes, 38.051039°N 122.971531°W, 3.V.1936, coll. G.E. Bohart, CNCN196474, (1♀ CNC); Pt. Reyes, 30.III.1956, coll. E. A. Kurtz, FMNH95496, (1♂ FMNH).

Diagnosis. Frontal vitta with long white bristles, quite bushy. Body appears bushy with white setae over all (Fig. 12 C). Abdominal tergites with brownish-black bands unbroken by yellow maculation (Fig. 11 B). Tarsomere-1 (mid and hind) of female with tarsomere-plate, without trochanter gripping spines on inner-ventral trochanters (Fig. 15 F).

Description

Male

Head. Antennae dark brown with faint golden microtomentum; pedicel and flagellum about equal length; arista inserts ventrally, sub-apically, about $\frac{3}{4}$ length of flagellum scape and pedicel with spiky black setae; eyes dark brown; frons, antennal grooves and facial carina and gena pale yellow with white or silver microtomentum; frons without setae; gena with sparse, pale setae; frontal vitta pale yellow with black medial stripe that extends from ocellar triangle to antennal insertion, with matching microtomentum; three

ocelli present in ocellar triangle, somewhat shiny, black with pale yellow at margins, with mix of long black and pale setae, bushy; occiput and postgena black with narrow stripe of pale yellow extending from under eye to just behind eye, with long, mainly pale, with a mix of black, setae; very bushy; palps black with many black setae; proboscis when fully extended, about as long as body, mainly black and brown, double geniculate; first bend upward, second bend downward.

Thorax. Scutum black, except well-defined pale yellow postpronotal lobe and the posterior tip of scutellum, entirely covered in a long (about as long or longer than flagellum), mainly white setae, with some sparse black setae variably appearing medially; lateral thorax black, shiny, with anepimeron pale yellow nearest wing insertion, with several black setae on katepisternum.

Wing. Membrane brownish-gray with total microtrichia coverage; r_{4+5} cell open (without petiolate) (Fig. 13 E); r-m cross-vein present; halter pale yellow, almost white without setae.

Legs. Coxae glossy, without microtrichia; front coxa bi-colourous, basally dark brown, distally, pale yellow; mid and hind coxae unicolourous dark brown without microtrichia; inner-ventral trochanters without short black thorn-like pegs; femora and tibia pale yellow; hind femur with brown maculation distal-dorsally; setae mix of pale and black on legs overall; hind tibia with concentrated patch of shorter black setae, inner-latero-distally; tarsomeres dark brown with short black setae dorsally; golden setae ventrally; tarsomere-1 and 5 about same length; tarsomere-2-4 shorter; tarsomere-1 with ventral, fan-like plate of black bristles; tarsi yellow with black tips with yellow pulvilli.

Abdomen. Abdomen flat and curled ventrally, somewhat wide and rounded dorsally; tergite-1 dark brownish-black dorsally, with paler brown (almost yellow) band anteriorly; tg-2-6 brownish-black with posterior bright yellow bands extended to lateral margins; tg-3-4 yellow bands project three forward peaks medially and at lateral margins (Fig. 11 B); brown bands not broken; sternites pale yellow; st-2-3 with slight protruding edge posteriorly; abdomen covered in thick, long (as long as arista or longer) white setae, bushy (Fig. 12 C).

Male Genitalia. undissected (lack of specimens).

Female Genitalia. Same as *D. blaisdelli*.

Hosts. Unknown.

Distribution. Map 1 B (■). Endemic to California where it is known only from the Point Reyes area.

Habitat. Unknown.

Remarks. Emergence March through May. Very rarely collected. A single short sequence (215 bps) of COI has been extracted and is available on BOLD.

***D. nigriceps* Loew, 1866**

Figs. (Fig. 9 C-D). Map 1 A (▲)

Synonymy

Dalmannia nigriceps Loew, 1866: 40. Type locality: United States of America, Virginia.

Type depository: lectotype, MCZ.

Type material. *Dalmannia nigriceps* Loew, 1866: Lectotype; A. Awaiting type from MCZ.

Material dissected. CNCD187798, CNCD196296, CNCD187799, CNCD196286, CNCD196814, CNCD196299 (6♂).

Additional material examined. CANADA: Manitoba: Aweme, 49.70864°N 99.60328°W, 4.VI.1912, 4.VI.1922, 5.VI.1925, coll. E. Criddle, R.D. Bird, R.M. White, CNCD196289, CNCD196293, CNCD196338, debu1156588, (2♂ 2♀ CNC, DEBU); Teulon, 50.387058°N 97.259644°W, 16.VI.1920, coll. A.J. Hunter, CNCD196287, (1♂ CNC); **New Brunswick:** Kouchibouguac National Park, 46.85°N 64.97°W, 19.VI.1975, 19.VI.1978, coll. S.J. Miller, CNCD196315, CNCD196318, CNCD85160, (2♂ 1♀ CNC); Tower Hill, Charlotte County, 45.285521°N 67.182516°W, 7.X.1946, coll. James V. Clark, CNCD196328, (1♀ CNC); **Nova Scotia:** Hants County, 45.144217°N 63.958031°W, 4.VI.1931, coll. C.E. Atwood, CNCD196319, (1♂ CNC); Kings County, 45.017428°N 64.610757°W, 30.V.1931, coll. C.E. Atwood, CNCD196314, CNCD196326, CNCD196330, (2♂ 1♀ CNC); Portapique Mt., 45.404724°N 63.700134°W, 16.VI.1975, coll. J.A. Herbert, CNCD196333, (1♀ CNC); Portapique, 45.405278°N 63.703611°W, 19.VI.1974, coll. A.T.F., CNCD196325, (1♂ CNC); **Ontario:** Chaffey's Locks, Leeds County, 44.5658°N 76.3242°W, 12.VI.1972, 15.VI.1972, coll. P. Ward, CNCD196320, CNCD196322, (2♂ CNC); Clayton, 45.191567°N 76.326277°W, 22.V.1981, coll. Babcock & Goulet, CNCD196302, (1♂ CNC); Constance Bay, Carleton County, 45.48°N 76.08°W, 27.V.1977, coll. M. Sanborne, CNCD196306, CNCD196308, (2♂ CNC); Constance Bay, 45.483889°N 76.081111°W, Oak savannah, in Oak Savannah, Malaise trap, 29.IV-31.V.2006, coll. J. Skevington, CNCD196339, CNCD79708, (2♀, CNC); Frontenac County, Lake Opinicon, 44.533502°N 76.37027°W, 26.V.1987, coll. D. Bell & M. Wood, CNCD187798, (1♂ CNC); Guelph, 43.544805°N 80.248167°W, 7.VIII.1972, coll. Brian K. Akey, debu1156587, (1♂ DEBU); Hilton Beach, 46.250000°N 83.883333°W, edge of hardwood forest & field, Malaise trap, 13.VI.1990, coll. J.E. Swann, debu1156589, (1♂ DEBU); Jordan, 43.133333°N 79.366667°W, 1.VI.1919, 12.VI.1917, 16.VI.1917, 20.VI.1920, 6.VI.1919, coll. H. Curran, W.A.

Ross, CNCD196283, CNCD196291, CNCD196316, CNCD196327, debu1156590, debu1156591, (4♂ 1♀ 1ex CNC, DEBU); L. Opinicon; Frontenac Co, 44.538422°N 76.366884°W, 26.V.1987, coll. D. Bell, D.M. Wood, CNCD28398, (1♀ ; Lake Opinicon, Leeds County, 5.VI.1971, coll. Sam Vander Kloet, CNCD196331, (1♀ CNC); Landon Bay, 3-4 miles East of Ganonoque, 44.332783°N 76.136109°W, 17.VI.1976, coll. A. Carter & W. Reid, CNCD196297, (1♂ CNC); Leamington, 42.083333°N 82.55°W, 11.VI.1937, 7.VI.1929, coll. G.S. Walley, CNCD196307, CNCD196329, (1♂ 1♀ CNC); Metcalfe, 45.235826°N 75.472712°W, Malaise trap, 13.VI.1993, coll. B.E. Cooper, B.E. Cooper MT, CNCD187799, CNCD79709, (1♂ 1♀ CNC); Orillia, 44.609505°N 79.42068°W, 30.V.1920, coll. H. Curran, CNCD196292, (1♂ CNC); Ottawa, 45.42153°N 75.697193°W, 427m, 23.V.1964, coll. J.R. Vockeroth, CNCD196313, (1♂ CNC); Perth Road, Frontenac County, 44.466045°N 76.491977°W, 3.VI.1971, 5.VI.1971, coll. P. Ward, CNCD190111, CNCD196321, (2♂ CNC); **Quebec**: Aylmer, 45.400002°N 75.849998°W, 8.V.1924, coll. C.H. Curran, JSS26136, (1♂ AMNH); Co. Vaudreuil, Summit of Mount Rigaud, 45.466389°N 74.326389°W, hilltop, 24.V.2015, 5.VI.2008, coll. J. Gibson, S. Kelso, M. Jackson, C. Vincent, J.H. Skevington, C. Peet-Pare, CNC395934, CNCD12811, CNCD12812, CNCD12813, CNCD12814, CNCD12815, CNCD12816, CNCD12817, (8♂ CNC); Eardley, 45.551817°N 76.099233°W, 14.V.1959, coll. J.R. Vockeroth, CNCD196295, (1♂ CNC); Hull, 45.4°N 75.7°W, 4.VI.1923, coll. C.H. Curran, CNCD196335, (1♀ CNC); Masham Township, 45.683333°N 76.05°W, hilltop, 8-9.VI.1974, coll. D.M. Wood, JSS17609, JSS17610, (1♂ 1♀ CNC); Old Chelsea, summit of King Mountain, 45.48°N 75.87°W, 351m, hilltop, 31.V.1965, coll. J.R. Vockeroth, CNCD89216, JSS17637, (2♂ CNC, MZUL); hilltop, 13.VI.1961, 9.VI.1971, coll. D.M. Wood, J.R. Vockeroth, CNCD85159, JSS17608, (2♂ CNC); **U.S.A.:** **Colorado**: Boulder, 4 miles Northwest, 40.013374°N 105.317523°W, 2103m, Ponderosa Pine, Ponderosa pine, 17.VI.1961, 8.VI.1961, coll. B.H. Poole, C.H. Mann, W.R.M. Mason, CNCD196282, CNCD196285, CNCD196303, CNCD196310, CNCD196323, CNCD196337, (5♂ 1♀ CNC); 2713m, 8.VI.1961, coll. W.R.M. Mason, CNCD196317, (1♂ CNC); Boulder, 5 miles

South, 39.936516°N 105.678611°W, 1768m, 12.VI.1961, 19.VI.1961, coll. B.H. Poole, W.R.M. Mason, CNCDD196286, CNCDD196311, (2♂ CNC); Boulder, 40.014986°N 105.270546°W, 1453m, 27-28.V.1922, coll. R.M. White, CNCDD196294, (1♂ CNC); 1676m, 16.VI.1961, coll. B.H. Poole, CNCDD196284, (1♂ CNC); 1829m, 4.VI.1961, coll. B.H. Poole, CNCDD196332, (1♂ CNC); 2134m, 5.VI.1961, coll. B.H. Poole, CNCDD196298, CNCDD196301, CNCDD196334, (2♂ 1♀ CNC); **Georgia**: Pine Mountain, Rabun County, 33.675951°N 84.11491°W, 427m, 15.V.1957, coll. W.R.M. Mason, CNCDD196312, (1♂ CNC); **Maine**: Agriculture Experimental Station, Orono, 44.898465°N 68.669873°W, 28.VI.1916, CNCDD196300, (1♂ CNC); Dryden, 44.586729°N 70.209783°W, 1.VII.1959, coll. G.H. Heinrich, CNCDD196296, (1♂ CNC); **Michigan**: Lake County, 39.207392°N 106.329533°W, 31.V.1945, coll. R.R. Dreisbach, CNCDD196467, (1♀ CNC); Shiawassee County, 42.95°N 84.14°W, 13.VI.1943, 6.VI.1943, coll. R.R. Dreisbach, CNCDD196290, CNCDD196336, (1♂ 1♀ CNC); **Mississippi**: Oxford, 34.366495°N 89.519248°W, V.1940, coll. F.M. Hull, CNCDD196324, (1♂ CNC); **New Hampshire**: Franconia, 44.22724°N 71.747804°W, coll. Mrs. A.T. Slosson, JSS26133, JSS26134, (2♂ AMNH); **New Jersey**: Browns Mills, 39.97262°N 74.58293°W, 10.VI.1921, JSS26132, (1♂ AMNH); **New York**: Aurora, 42.749931°N 76.701141°W, 16.VI.1893, coll. JLZ, JSS26135, (1♂ AMNH); **Texas**: Kerrville, 30.047433°N 99.140319°W, flowers of *Prunus* sp., on flowers of *Prunus* sp., sweeping, 2.IV.1959, coll. J.F. McAlpine, J.P. McAlpine, CNCDD196288, CNCDD196299, (2♂ CNC); **Utah**: Washington Co. Pine Valley, N. Juniper Cmgd., 2103m, sweeping, 2.VI.1980, coll. R. Hardy, CFDA-INS10141, (1♂ CDFA).

Diagnosis: Female: Frontal vitta with sparse black bristles, not bushy; body with white setae over all (Fig. 12 B); abdominal brownish-black bands unbroken with pale yellow maculation on tg-2-4 projecting forward medially only (Fig. 11 C); female tarsomere-1 (tm-1) with tarsomere-plate, with trochanter gripping spines on inner-ventral trochanters (Fig. 15 E).

Description

Male

Head. Antennae dark brown with very faint golden microtomentum; pedicel and flagellum about equal length; arista inserts ventrally, sub-apically, about $\frac{3}{4}$ length of flagellum scape and pedicel with spiky black setae; eyes dark brown; frons, antennal grooves and facial carina and genae pale yellow with white or silver microtomentum; gena often appears dark brown (males), or with dark brown marginal (ventral) line, though variable; frons without setae; genae with sparse, pale setae if present at all; frontal vitta pale yellow with black medial stripe that extends from ocellar triangle to antennal insertion, with matching microtomentum; three ocelli present in ocellar triangle, somewhat shiny, black with dull yellow at margins, with black setae, sparse; occiput and postgena black with narrow stripe of pale yellow extending from under eye to just behind eye, with long, pale or white setae, bushy; palps black with many black setae; proboscis when fully extended, about $\frac{3}{4}$ length body, mainly black and brown, double geniculate; first bend upward, second bend downward.

Thorax. Scutum black, except well-defined pale yellow postpronotal lobe, and the posterior tip of scutellum, entirely covered in a long (about as long as arista), mainly white setae, with some sparse black setae variably appearing medially; lateral thorax black, shiny, with anepimeron pale yellow nearest wing insertion, with several fine, black setae on katapisternum.

Wing. Membrane brownish-gray with total microtrichia coverage; r_{4+5} cell open (without petiolate) (Fig. 13-E); r-m cross-vein present; halter pale yellow, almost white without setae.

Legs. Coxae mainly glossy, with some golden microtomentum; front coxae slightly bi-colourous, basally dark brown or black, distally only slightly paler with sparse, long black setae; mid and hind coxae unicolourous dark brown with little microtomentum and distal black setae; femora dark brown with pale yellow apical band with black setae; tibia pale yellow with short pale setae dorsally, with short black setae ventrally; hind tibia with concentrated patch of shorter black setae, inner-latero-distally; tarsomeres dark brown with short black setae dorsally; tarsomere-1 (tm-1) and tm-5 about same length; tm-2-4 shorter; tarsi yellow with black tips with yellow pulvilli.

Abdomen. Abdomen flat and curled ventrally, somewhat wide and rounded dorsally; tergite-1 (tg-1) dark brownish-black dorsally, with very thin, paler brown (almost yellow) band anteriorly; tg-2-6 brownish-black with thin, posterior, bright yellow bands extended to lateral margins; tg-3-4 yellow bands project forward peaks medially (Fig. 11 C); brown bands not broken; tergites 1-4 with pale setae; tg-5-6 with black setae; as short or shorter than arista; sternites pale yellow; st-2-3 with slight protruding edge posteriorly.

Male Genitalia. (Fig. 9 C-D) Epandrium fully exposed, dark brown with many black bristles; cerci reduced, triangular-shaped when viewed posteriorly, with many long, black setae; surstylus absent; hypandrium broad, extending posteroventrally below the epandrial opening; hypandrial sheath a rounded, smooth protrusion; epiphallus protruding, bulbous; phallapodeme tubular, longer than hypandrium (by $\frac{1}{4}$); distiphallus elongate (as long or longer than phallus abodeme), tubular (sometimes appearing ribbon-like), completely external, covered in fine black setae; ejaculatory apodeme elongate, tapered; sperm pump circular, somewhat flat; ejaculatory duct short ($\frac{1}{4}$ length of phallapodeme).

Female. Same as male with following differences: Inner-ventral trochanters without trochanter gripping spines; femora often more yellow than dark brown; mid femora often completely yellow; tm-1 (mid and hind) with tarsomere-plate; gena pale yellow; post-abdomen with modified tg-6-8 (see Female genitalia).

Female Genitalia. Same as *D. blaisdelli*.

Hosts. Unknown.

Distribution. Map 1 A (▲). Fairly widespread through North America, though mainly concentrated in southeastern Canada, and scattered in the western States and Manitoba.

Habitat. Found at various elevations and hilltops as high as 827 m or around oak savannahs, Ponderosa pines, or edges of hardwood forests and about fields, on flowers of *Prunus sp.* Linnaeus.

Remarks. Emergence April through October, with peak activity in June. Five attempts have been made to extract COI with four failures with details available on BOLD, a single success not yet made public. The sequence is ~215 bps.

***D. pacifica* Banks, 1916**

Figs. (9 E-F, 11 D), Map 1 A (■)

Synonymy

Dalmannia pacifica Banks 1916: 591. Type locality: United States of America, Oregon:

Corvallis. Type depository: syntype, MCZ, ORSU.

Dalmannia hirsuta Van Duzee, 1927: 591. Type locality: United States of America,

Oregon: Corvallis. Type depository: type, CAS.

Type material. *Dalmannia pacifica* Banks, 1916: Syntype; A. Awaiting type from MCZ.

Dalmannia hirsuta Van Duzee, 1927: Type; A. Awaiting type from CAS.

Note on types. The type for *D. hirsuta* Van Duzee was seen at CAS (2013) but not photographed or dissected. The type has been requested from CAS but has not arrived as of yet.

Material dissected. CNC196463 (♂)

Additional material examined. **USA: California:** 3.2 miles West of Hwy 120 on Evergreen Road, Stanislaus County, 37.821372°N 119.917528°W, 1448m, *Limnanthes alba alba*, 2.VI.1976, coll. R.W. Brooks, CNC196462, (1♂ UCDC); Berkeley, 37.875149°N 122.243713°W, 25.III.1934, coll. G.E. & R.M. Bohart, CNC196461, (1♂ CNC); Colusa County, Bear Valley, 13.5 km North of Wilber Springs, 38.513298°N 119.93445°W, 11.IV, UC_BME91880, (1♂ UCDC); Davis, 38.544904°N 121.740514°W, 2.VII.1934, coll. G.E. & R.M. Bohart, M.A. Cazier, CNC196462, CNC196466, JSS26137, JSS26138, JSS26139, (3♂ 2♀ AMNH, CNC); Elk Grove, Sacramento County, 38.408791°N 121.371612°W, 21.IV.1950, coll. E.C. Carlson, CNC196464, (1♂ CNC); Guadalupe, Santa Clara County, 34.97226°N 120.571986°W, 15.V.1976, coll. R.T. Ross, CNC196463, (1♂ UCDC); Mount Diablo, 37.881591°N 121.913847°W, 26.IV.1942, coll. J.W. Tilden, CNC196468, (1♀ CNC); Old Adobe Road, near Petaluma, Sonoma County, 38.276393°N 122.622308°W, 30.V.1957, coll. W.R. Bauer, J.S. Buckett, CNC196465, (1♂ UCDC); Paradise Cove, Marin County, 37.89472°N 122.45639°W, 12.IV.1947, coll. E.L. Kessel, CNC196463, (1♂ CNC); JSS19855, (1ex ; **Oregon:** 6 mi. N Lakeview, Lake Co., 42.238995°N 120.366758°W, 30.VI.1971, coll. K. J. Goeden, FMNH95576, FMNH95583, FMNH95617, (3♂ FMNH); Siskiyou, 42.075°N 122.605833°W, 14.VI.1959, coll. Kelton & Madge, CNC196465, (1♀ CNC); **Utah:** Blacksmith Fork Canyon, 41.627727°N 111.804051°W, 9.VII.1935, coll. C.F. Smith, J.A. Rowe, JSS26140, (1♂ AMNH); Wash. Co. Paradise Canyon, Malaise trap, 13-19.V.1983, coll. Dan Beck, JSS28903, (1♀ LACM).

Diagnosis: Tarsomere-1 elongate (twice as long as remaining tarsomeres); tm-2-5 about same length; abdominal brownish-black bands completely broken with pale yellow maculation on tg-2-5 (Fig. 11 D); genae often very dark (Fig. 12 E); female tarsomere-1 (tm-1) (front, mid and hind) with tarsomere-plate (Fig 15 C-D); front tm-1 with much smaller plate; tronchanter gripping spines appear on inner-ventral trochanters (mid and hind) (Fig. 15 E).

Description

Male

Head. Antennae dark brown with golden microtomentum; pedicel and flagellum about equal length; arista inserts ventrally, sub-apically, about $\frac{3}{4}$ length of flagellum scape and pedicel with spiky black setae; eyes brown; frons, antennal grooves and facial carina pale yellow with white or silver microtomentum; gena often appears dark brown (males); frons without setae; gena with sparse, pale setae if present at all; frontal vitta dark yellow with wide, black medial stripe that extends from ocellar triangle to antennal insertion, with matching microtomentum; ocellar triangle with three ocelli, somewhat shiny, black with dull yellow at margins with many long black setae above eye and about ocellar triangle, somewhat bushy; occiput and postgena black with narrow stripe of pale yellow extending from under eye to just behind eye, with bushy, pale or white setae; palps black with many black setae; proboscis when fully extended, about $\frac{3}{4}$ length body, mainly black and brown, double geniculate; first bend upward, second bend downward.

Thorax. Scutum black, except well-defined pale yellow postpronotal lobe, and the posterior tip of scutellum, entirely covered in a long (about as long as arista), mainly white or pale yellow setae, with some sparse black setae variably appearing posteriorly

and along margins; scutellum with some posterior black setae, sparse; lateral thorax black, shiny, with anepimeron pale yellow nearest wing insertion, with several fine, pale yellow and black setae on katepisternum.

Wing. Membrane brownish-gray with total microtrichia coverage; r_{4+5} cell open (without petiolate) (Fig. D-8 E); r-m cross-vein present; halter pale yellow, almost white without setae.

Legs. Coxae mainly glossy, with very little microtrichium; front coxa slightly bicolourous, basally light brown or brown, distally paler yellow with sparse, long black setae; mid and hind coxae unicolourous dark brown with little microtrichium and distal black setae; femora mainly pale yellow with patchy, irregular and variable, brown maculation appearing dorsally, usually apically, with black setae; tibia pale yellow with short pale setae dorsally, with short black setae ventrally; hind tibia with concentrated patch of shorter black setae, inner-latero-distally; tarsomeres dark brown with short black setae dorsally; tarsomere-1 (tm-1) elongate (twice as long as remaining tarsomeres); tm-2-5 about same length; tarsi yellow with black tips with yellow pulvilli.

Abdomen. Abdomen flat and curled ventrally (when viewed laterally), somewhat wide and rounded (when viewed dorsally); tergite-1 dark brownish-black dorsally, with yellow band anteriorly; tg-2 dark brown with posterior yellow band with three forward projecting peaks (medially and laterally); tg-3-6 brownish-black cuticle with bright yellow bands extended to lateral margins breaking up brown bands into isolated spots; (Fig. 11 D); abdomen with pale setae; as long as arista, rarely longer; sternites pale yellow; st-2-3 with slight protruding edge posteriorly.

Male Genitalia. (Fig. 9 E-F) Epandrium fully exposed, dark brown with many black bristles; cerci reduced, irregularly oval-shaped when viewed posteriorly, with many short, black setae; hypoproct projecting forward, slightly rounded; surstylus absent; hypandrium broad, extending posteroventrally below the epandrial opening; hypandrial sheath a rounded, smooth protrusion; epiphallus protruding, bulbous; phallapodeme tubular, longer than hypandrium (by $\frac{1}{4}$); distiphallus elongate (as long or longer than phallus abodeme), tubular (sometimes appearing ribbon-like), completely external, covered in fine black setae; ejaculatory apodeme elongate, tapered; sperm pump circular, somewhat flat; ejaculatory duct short ($\frac{1}{4}$ length of phallapodeme).

Female. Same as male with following differences: Gena pale yellow, with a variably present brown spot; inner-ventral trochanters without trochanter gripping spines; tarsomere-1 (front, mid and hind) with tarsomere-plate; front tm-1 with much smaller plate of bristles; gena pale yellow; post-abdomen with modified tg-6-8 (see Female genitalia).

Female Genitalia. Same as *D. blaisdelli*.

Hosts. *Halictus sp.* (Freeman, 1966)

Distribution. Map 1 A (■). Found mainly along the western coast of the United States, California.

Habitat. Found at various elevations and hilltops as high as 1448 m. Recorded nectaring on *Wyethia* Nuttall blooms and *Limnanthes alba alba* Hartweg.

Remarks. Emergence March through July, peaking in June and July. Two short sequences of COI have been extracted and show an intraspecific pairwise distance of 3.0%. Generally an intraspecific variation that exceeds 1.5-2.0% could indicate a subtle

species complex. *D. pacifica* may be revealed as two distinct species. Morphology and genitalia does not bare this out at this time. The 3.0% pairwise distance may be an artifact of the very short sequences used in the analysis. One of these sequences (658 bps) is available on BOLD under the Conopidae of the World (CONW) (Jeff Skevington Specimen 19855).

***D. picta* Williston, 1883**

Figs. (Fig. 9 G-H), Map 1 A (●)

Synonymy

Dalmannia picta Williston, 1883: 94. Type locality: United States of America, New Mexico Type depository: type, UKAL.

Types material. Awaiting type from UKAL.

Material dissected. CNCD196471, CNCD28479 (2♂).

Additional material examined. **CANADA: British Columbia:** Oliver, 49.18333°N 119.55°W, 16.V.1939, coll. J.K. Jacob, CNCD196473, (1♀ CNC); Vaseaux Lake, Oliver, 49.283333°N 119.533333°W, 29.V.1949, coll. L.A. Kelton, CNCD190112, (1♂ CNC); **New Brunswick:** Tower Hill, Charlotte County, 45.285522°N 67.182517°W, 6.IX.1946, coll. James V. Clark, CNCD196529, (1♂ CNC); **Ontario:** Hilton Beach, 46.25°N 83.883333°W, edge of hardwood forest & field, Malaise trap, 31.V.1990, coll. J.E. Swann, debu1157399, (1DEBU); **U.S.A.: California:** 4 mi N Hallelujah Jct. Lassen Co, 25.V.1965, coll. T. R. Haig, CFDA-INS10162, (1♂ CDFA); Alpine County, Monitor Pass, 38.675356°N 119.620648°W, 11.VI.1974, coll. M.K. Sears, debu1156592, (1♂ DEBU); Claremont, 34.0967°N 117.7198°W, coll. Baker, Essig, Metz, CFDA-INS10091, CFDA-INS10150, CFDA-INS10154, (2♂ 1♀ CDFA); 43.37674°N 72.346756°W, CNCD196472, (1♂ CNC); Fan Hill Can., 10 miles North East of

Thousand Palms, 33.923338°N 116.26849°W, 6.IV.1955, coll. W.R.M. Mason, CNCN196471, (1♂ CNC); Jacumba, San Diego Co., 31.V.1956, coll. R. Snelling, CFDA-INS10156, (1♂ CDFA); Middletown, Lake County, 38.752336°N 122.615108°W, 26.X.1958, coll. W.R. Bauer, J.S. Buckett, CNCN249926, (1♂ UCDC); Riverside Co. 5km NE Gorney Valley, 26.V.1981, coll. D. M. Fox, CFDA-INS10103, (1♂ CDFA); **Colorado**: Boulder, 4 miles Northwest, 40.013374°N 105.317523°W, 2103m, 8.VI.1961, coll. B.H. Poole, CNCN196475, (1♀ CNC); The south fork, Rio Grande, 37.6°N 106.716667°W, 2438m, 17.VI.1919, CNCN196470, (1♂ CNC); **Mississippi**: Oxford, 34.366497°N 89.519250°W, V.1940, coll. F.M. Hull, CNCN196531, (1♂ CNC); **Nevada**: Clark Co. 1.1 mi. W-SW Corn Creek Springs, 36.439235°N, -115.358067°W, 872m, 2383m, 5.IV.2004, 13.V.2004, coll. T. Griswold, Malaise trap, JSS28895, JSS28902, JSS28912, (1♂ 2♀ LACM); **Utah**: Cache Co., Green Canyon, 20.V.1997, coll. F. D. Parker, JSS28894, (1♂ LACM); Iron Co., 2 mi. E of Cedar City, 37.678277°N 113.02573°W, 20.VI.1999, coll. L. Packer, CNCN28479, (1♂ CNC); **Washington**: 7 km S Cheney, 47.487500°N 117.575833°W, 717m, 21.V.1987, coll. K.G.A. Hamilton, CNCN8921, (1♀ CNC); 2256m, CNCN196469, (1♂ CNC).

Diagnosis: Membrane clear basally to gradient brownish-gray distally; tarsomere-1 (tm-1) only slightly elongate (about twice as long as remaining tarsomeres); tm-2-5 about same length; tarsomeres very short over all; abdominal tergites with brownish-black bands unbroken with by pale yellow maculation on tg-2-6 (Fig. 11 D); female tm-1 (front, mid and hind) with tarsomere-plate (Fig. 15 C-D); front tm-1 with smaller plate; trochanter gripping spines present on inner-ventral trochanters (mid and hind) (Fig. 15 E).

Description

Male

Head. Antennae dark brown (variably with lighter brown on flagellum) with golden microtomentum; pedicel and flagellum about equal length; arista inserts ventrally, sub-

apically, about $\frac{3}{4}$ length of flagellum scape and pedicel with spiky black setae; eyes brown; frons, antennal grooves and facial carina pale yellow with white or silver microtomentum; genae pale yellow with thin, marginal brown line (males); frons without setae; genae with sparse, pale setae if present at all; frontal vitta dark yellow with wide, black medial stripe that extends from ocellar triangle to antennal insertion, with matching microtomentum. Ocellar triangle with three ocelli, somewhat shiny, black with dull yellow at margins with very sparse pale setae about ocellar triangle; occiput and postgena black with narrow stripe of pale yellow extending from under eye to just behind eye, with bushy, pale or white setae; palps black with many black setae; proboscis when fully extended, about $\frac{3}{4}$ length body, mainly black and brown, double geniculate; first bend upward, second bend downward.

Thorax. Scutum black, except well-defined pale yellow postpronotal lobe, and the very posterior tip of scutellum, entirely covered white setae (generally shorter than arista); lateral thorax black or brown or brownish-black, shiny, with anepimeron pale yellow nearest wing insertion, with fine, pale yellow setae on katepisternum.

Wing. Membrane almost always clear; variably clear basally to gradient brownish-gray distally with total microtrichia coverage; r_{4+5} cell open (without petiolate) (Fig. 13 E); r-m cross-vein present; halter pale yellow without setae.

Legs. Coxae mainly glossy; front coxa with very little golden microtomentum; coxae unicolourous dark brown, or brown with long white setae; less on front coxa; femora mainly brown; mid femur posterolaterally with slight yellow strip; femur with mix of white and black setae; tibia pale yellow with short pale setae dorsally, with short black setae ventrally; hind tibia with concentrated patch of shorter black setae, inner latero-

distally; tarsomeres dark brown with short black setae dorsally; tarsomere-1 elongate (twice as long as remaining tarsomeres); tm-2-5 about same length; tarsi yellow with black tips with yellow pulvilli.

Abdomen. Abdomen flat and curled ventrally, somewhat wide and rounded dorsally; tergite-1 dark brownish-black dorsally, with yellow band anteriorly; tg-2 dark brown with posterior yellow band with only slight forward projecting medial peak; tg-3-6 brownish-black with bright yellow bands extended to lateral margins with three forward projecting peaks (medial and laterally) (Fig. 11 D); abdomen with pale setae; shorter than arista, or rarely just as long; sternites pale yellow; sternites without strong protruding edge posteriorly.

Male Genitalia. (Fig. 9 G-H) Epandrium brown, fully exposed, brown with many black bristles; cerci reduced, triangular-shaped when viewed posteriorly, with many short, black setae; hypoproct projecting forward, only slightly pointed; surstylus absent; hypandrium broad, extending posteroventrally below the epandrial opening; hypandrial sheath a rounded, smooth protrusion; epiphallus protruding, bulbous; phallapodeme tubular, longer than hypandrium (by $\frac{1}{4}$); distiphallus elongate (as long or longer than phallus abodeme), tubular (sometimes appearing ribbon-like), completely external, covered in fine black setae; ejaculatory apodeme elongate, tapered; sperm pump circular, somewhat flat; ejaculatory duct short ($\frac{1}{4}$ length of phallapodeme).

Female. Same as male with following differences: Gena pale yellow, without brown line of maculation; inner-ventral trochanters without trochanter gripping spines; tarsomere-1 (front, hind and mid) with tarsomere-plate; front tm-1 with smaller plate. Post-abdomen with modified tg-6-8 (see Female genitalia).

Female Genitalia. Same as *D. blaisdelli*.

Hosts. *Andrena* (*Diandrena*) *sp.* Thorp (possible host) (Bohart, 1938; Freeman, 1966).

Distribution. Map 1 A (●). Fairly widespread through North America.

Habitat. Can be found at various elevations and hilltops as high as 743 m, at edges of hardwood forests, around fields, on *Brassica nigra* Linnaeus.

Remarks. Emergence April through to October, peaking in May. A single short sequence (591 bps) of COI has been extracted and is available at BOLD under the Conopidae of the World (CONW) (CNC Diptera 28479).

***D. vitiosa* Coquillett, 1892**

Figs. (10 A-B, Fig. 11 F-G), Map 1 B (●)

Synonymy

Dalmannia vitiosa Coquillett, 1892: 150-151. Type locality: United States of America,

California: Los Angeles Co. Type depository: type, USNM.

Type material. *Dalmannia vitiosa* Coquillett, 1892: Type; ♂; USA: California: Los Angeles County; coll. Coquillett; USNM-type#10427; (USNM).

Material dissected. CNCN28399, CCD196486, CNCN196484, CNCN196515, CNCN196490, CNCN196488, CNCN196516 (6♂, 1♀).

Additional material examined. **CANADA: Alberta:** Elkwater, 49.7°N 110.266667°W, 1158m, 10.VI.1956, coll. O. Peck, CNCN196485, (1♂ CNC); Jumping Pound Creek, 20 miles West of Calgary, 51.183°N 114.5°W, 15.VI.1962, coll. K.C. Herrmann, CNCN79713, (1♀ CNC); Onefour, 49.1°N 110.4°W, On Cornus blossom, 2.VI.1956, coll. O. Peck, CNCN196504, CNCN79714, (2♂ CNC); **British Columbia:** Robson, Waldie Road, 49.334109°N 117.683333°W, 1768m, 19.VI.1947, coll. H.R. Foxlee, CNCN196489, (1♂ CNC); Robson,

49.33°N 117.68°W, 31.V.1944, coll. H.R. Foxlee, CNCD196516, (1♂ CNC); **New Brunswick**: 5 km SE Doaktown, 46.517538°N 66.093886°W, 13.VI.1979, coll. B. Andrews, CNCD28399, (1♂); 5 km Southeast of Doaktown, 46.510218°N 66.084743°W, 20.VI.1979, 8.VI.1979, coll. D. Maddison, D. Maddison, S. Falls, CNCD196512, CNCD196523, (1♂ 1♀ CNC); Kouchibouguac National Park, 46.849722°N 64.966944°W, 16.VI.1978, coll. D.B. Lyons, CNCD196478, (1♂ CNC); **Ontario**: Mer Bleu, 5 Miles East of Ottawa, 45.40331°N 75.5083°W, Malaise trap, 9.VI.1966, coll. D.D. Munroe, CNCD196500, (1♂ CNC); Metcalfe, 45.235826°N 75.472712°W, 1.VI.1982, coll. B.E. Cooper, CNCD79710, (1♀ CNC); Petawawa, 45.89°N 77.28°W, 7.VI.1961, coll. J.R. Vockeroth, CNCD196495, CNCD196520, (1♂ 1♀ CNC); **Quebec**: Co. Vaudreuil, Summit of Mount Rigaud, 45.466389°N 74.326389°W, hilltop, 5.VI.2008, coll. J. Gibson, S. Kelso, M. Jackson, C. Vincent, CNCD12810, (1♂ CNC); GaspÈ, 48.833333°N 64.483333°W, 24.VI.1954, coll. G.P. Holland, CNCD196476, (1♂ CNC); Masham Township, 45.683333°N 76.05°W, hilltop, 24-27.V.1973, coll. D.M. Wood, JSS17639, (1♂ CNC); Old Chelsea, summit of King Mountain, 45.48°N 75.87°W, 351m, hilltop, Malaise trap, 26.V.1965, JSS17638, (1♂ CNC); **Saskatchewan**: Scout Lake, 49.333333°N 106.°W, 1768m, 17.VI.1955, coll. J.R. Vockeroth, CNCD196488, (1♂ CNC); **U.S.A.**: **Arizona**: Glebe, III, coll. D.K. Duncan, JSS26142, (1♂ AMNH); **California**: Boyd, 5 mi SW New Cuyama, Sta. Barb. Co., 28.III.1957, coll. F. L. Blanc, CFDA-INS10155, (1♂ CDFA); Mendota, Fresno Co, III.1919, coll. R. L. Manchett, CFDA-INS10050, (1♀ CDFA); Sagehen Creek, Nevada County, 39.432115°N 120.24123°W, Perideridia, 2.VII.1978, 28.VI.1978, coll. E.A. Sugden, R.M. Bohart, CNCD249928, CNCD249929, (2♂ UCDC); 39.432117°N 120.241231°W, 25.VI.1966, coll. I.A. Boussy, CNCD249930, (1♀ UCDC); Sagehen Creek, Nevada County, 39.432115°N 120.24123°W, 14.VI.1974, coll. M.K. Sears, debu1156593, debu1156594, debu1156595, debu1156596, debu1156597, (5♂ DEBU); South Lk Lake Tahoe, El Dorado County, 39.127256°N 120.020296°W, 22.VI.1975, coll. R.O. Schuster, E.C. Toftner, CNCD249932, CNCD249933, (1♂ 1♀ UCDC); South Lk Lake, Tahoe, El Dorado County, 22.VI.1975, coll.

R.O. Schuster, E.C. Toftner, UC_BME91879, (1♂ UCDC); **Colorado**: Boulder, 5 miles South, 39.936516°N 105.678611°W, 1768m, 9.VI.1961, coll. C.H. Mann, CNCD196487, (1♂ CNC); Boulder, 40.014986°N 105.270546°W, 1646m, 10.VI.1961, coll. B.H. Poole, CNCD190113, (1♂ CNC); Delta Co. Beaver Gulch, 7.V.1991, coll. T. Griswold, JSS28905, (1♂ LACM); Valmont Butte, Boulder, 40.030834°N 105.211654°W, 1615m, 7.VI.1961, coll. B.H. Poole, CNCD196477, (1♂ CNC); **Iowa**: Ames, 42.033333°N 93.616667°W, 25.V.1928, coll. G.S. Walley, CNCD196522, (1♀ CNC); **Kentucky**: Morehead, 38.184536°N 83.430561°W, 16.VI.1963, coll. Freeman, CNCD196486, (1♂ CNC); **Michigan**: Baylesville, 19.V.1933, coll. C.H. Curran, JSS26141, (1♀ AMNH); **Mississippi**: A.M. College, 10.IV.1922, CNCD196493, (1♂ CNC); Agricultural College, Lafayette County, 33.455537°N 88.790429°W, 19.III.1921, coll. F.M. Hull, CNCD196519, (1♀ CNC); Agricultural College, 10.IV.1922, 18.III.1921, 3.IV.1921, 3.IV.1922, 6.IV.1922, CNCD196481, CNCD196494, CNCD196496, CNCD196498, CNCD196518, (4♂ 1♀ CNC); Lafayette County, 34.4°N 89.5°W, V-VI.1945, V.1951, coll. F.M. Hull, CNCD196479, CNCD196480, CNCD196482, CNCD196521, CNCD196524, (3♂ 2♀ CNC); Oxford, 34.366495°N 89.519248°W, 20.IV.1945, 20.IV.1946, IV.1944, V.1940, coll. F.M. Hull, H.R. Foxlee, CNCD196490, CNCD196492, CNCD196497, CNCD196501, CNCD196502, CNCD196511, CNCD196517, (6♂ 1♀ CNC); **Missouri**: Columbia, 38.951705°N 92.334072°W, Malaise trap, 7.V.1970, coll. F.D. Parker, CNCD249927, (1♂ UCDC); **New Mexico**: Santa Fe National Forest, Pacos Wilderness Area, trail above Windsor Creek, 35.918081°N 105.651965°W, in poplar/pine forest, pan trap, 27.V-6.VI.1991, coll. J.E. Swann, DEBU1156598, (1♀ DEBU); **New York**: Coram, Long Island, 40.86871°N 73.001495°W, 20.V.1935, coll. C.H. Curran, CNCD196525, (1♀ CNC); **North Carolina**: Highlands, 35.05°N 83.198859°W, 1158m, 6.V.1957, coll. W.J. Brown, CNCD196484, (1♂ CNC); Wagon Tree Gap, Haywood County, Blue Ridge Parkway, 35.373825°N 82.790025°W, 30.V.1965, coll. J.G. Chillcott, CNCD196503, (1♂ CNC); **Tennessee**: East Ridge, 34.994744°N 85.225664°W, 6.V.1952, coll. G.S. Walley, CNCD197320, (1♂ CNC); **Texas**: Kerrville, 30.047433°N

99.140319°W, Flowers of *Prunus* sp., flowers of *Prunus* sp., grass, sweeping, 1.IV.1959, 2.IV.1959, 3.IV.1959, 31.III.1959, coll. J.F. McAlpine, W.R.M. Mason, CNCN196483, CNCN196491, CNCN196499, CNCN196505, CNCN196506, CNCN196507, CNCN196508, CNCN196509, CNCN196510, CNCN196513, CNCN196514, CNCN196515, CNCN89217, (13♂ CNC, MZUL); **Utah**: Cache Co., Logan* Twin Cr., Malaise trap, 1-6.VI.1979, 1-6.VII.1979, JSS28910, JSS28914, (2♂ LACM); Franklin Basin, Cache County, 41.933256°N 111.566718°W, 28.VI.1974, coll. G.F. Knowlton, CNCN249931, (1♀ UCDC); **Virginia**: Giles County, Cascade Falls trail, 37.352795°N 80.600185°W, 19.V.1997, coll. S.A. Marshall, DEBU1156599, (1♀ DEBU).

Diagnosis: Very small species (~3-4 mm); tarsomere-1 (tm-1) and tm-5 slightly more elongate than 2-4; tm-3-5 about same length; tarsomeres combined length about equal to tibial length; abdominal brownish-black bands broken up with very thin posterior yellow (or dark reddish (South Eastern)) bands with three strong, forward-projecting peaks (medial and laterally); female tm-1 (front, mid and hind) with tarsomere-plate; front tm-1 with smaller plate of pegs (Fig. 15 A-B); trochanter gripping spines absent on inner-ventral trochanters (Fig. 15 F).

Description

Male

Head. Antennae dark brown and pale yellow, with golden microtomentum; usually, pedicel dark brown dorsally, pale yellow ventrally; flagellum generally brown, with some pale yellow ventrally; or entirely patchy brown; pedicel and flagellum about equal length; arista inserts ventrally, sub-apically, about $\frac{3}{4}$ length of flagellum scape and pedicel with spiky black setae; eyes brown; frons, antennal grooves and facial carina dull yellow with white or silver microtomentum; gena variable pale yellow, dull yellow, or dark brownish-

black; frons without setae; gena with sparse, pale setae if present at all; frontal vitta variably shiny or dull, pale or dark yellow with thin or wide, black medial stripe that often extends from ocellar triangle to antennal insertion, with matching microtomentum; ocellar triangle with three ocelli, somewhat glossy, black, often with dull yellow at margins with very sparse black setae about ocellar triangle; occiput and postgena black with narrow stripe of pale yellow extending from under eye to just behind eye, with bushy, pale setae; palps brownish-black with many black setae; proboscis when fully extended, about $\frac{3}{4}$ length body, mainly black and brown, double geniculate; first bend upward, second bend downward.

Thorax. Scutum black, including postpronotal lobe; scutellum almost always black (rarely dark yellow) at very posterior tip (Fig. 13 B); scutum entirely covered with a mix of white and black setae (about as long as arista); somewhat bushy; lateral thorax black or brown or brownish-black, shiny, with anepimeron mainly unicolourous, with fine, black setae on katepisternum.

Wing. Membrane always clear, with total microtrichia coverage; r_{4+5} cell open (without petiolate) (Fig. 13 E); r-m cross-vein almost always absent (Fig. 13 D); halter pale yellow, variably darker brown basally, without setae.

Legs. Variable: coxae mainly glossy; front coxae with very little microtomentum; coxae generally unicolourous brown, dark brown, black, or pale yellow with sparse pale setae on front; mid coxae often with mix of pale and black setae; hind coxa usually with pale setae; femora variably unicolourous or bicolourous or gradient: usually pale yellow, brown with yellow distally, dark brown (generally unicolourous), or brown basally to yellow gradient distally; femora with mix of white and black setae (usually longer than

arista); tibia usually unicolourous pale yellow, or with slight irregular brown patch distally (variable in coverage), with short pale setae dorsally, with short black setae ventrally; hind tibia with concentrated patch of shorter black and pale setae, inner laterodistally; tarsomeres (tm) dark brown with short black setae dorsally, slightly golden ventrally; tm-1 and 5 slightly more elongate than 2-4; tm-2-4 about same length; tarsomeres combined length about equal to tibial length; tarsi yellow with black tips with yellow pulvilli.

Abdomen. Abdomen flat and curled ventrally, somewhat wide and rounded dorsally; variable dorsally, tergite-1 (tg-1) dark brownish-black, with yellow (or dark reddish-brown band anteriorly (Southeastern species); tg-2 brown, dark brown or black with thin band of yellow posteriorly; tg-3-5 brown, dark brown or black broken by thin posterior bands of yellow (or dark reddish-brown) with three strong, forward-projecting peaks (medial and laterally) (Fig. 11 F-G); tg-6 brown, dark brown or black with three dull yellow spots or forward-projecting stripes; abdomen with mix of pale or golden and black setae over all; about as long as arista, and longer at lateral margins; sternites pale yellow; sternites without strong protruding edge posteriorly.

Male Genitalia (Fig. 10 A-B) Epandrium with rounded Y-shaped opening posteriorly, fully exposed, brown with many black bristles; cerci widened, somewhat square opening, when viewed posteriorly, with very few short, black setae; hypoproct projecting forward, slightly pointed; surstylus absent; hypandrium short and broad, extending posteroventrally below the epandrial opening; hypandrial sheath a with a slightly pointed dorsal protrusion; epiphallus variably protruding, bulbous; phallapodeme tubular, longer than hypandrium (by $\frac{1}{4}$); distiphallus elongate (as long or longer than phallus abodeme),

tubular (sometimes appearing ribbon-like), completely external, covered in very fine black setae; ejaculatory apodeme elongate, tapered; sperm pump circular, somewhat flat; ejaculatory duct short (1/4 length of phallapodeme).

Female. Appears as male with following differences: gena almost always pale yellow, without brown maculation; inner-ventral trochanters without trochanter gripping spines; tarsomere-1 (front, hind and mid) with tarsomere-plate; front tm-1 with smaller; sternites usually pale yellow, sometimes brown; st-2-3 with slight protruding edge posteriorly; post-abdomen with modified tg-6-8 (see Female genitalia).

Female. Genitalia. Same as *D. blaisdelli*.

Hosts. Unknown.

Distribution. Map 1 B (●). Widespread through North America.

Habitat. Can be found at a variety of elevations and hilltops as high as 539 m around long grasses, flowers of *Prunus sp.* Linnaeus, *Cornus* Linnaeus blossoms, *Perideridia* Reichenbach, or poplar and pine forests.

Remarks. Emergence March through July, peaking in June. Eleven sequences of COI have been extracted showing an intraspecific pairwise distance of 0.0-3.5%. Given the expansive range of this species it is possible that a subtle complex of species exists.

Exterior morphology has shown little variation as does the genitalia. More sequences of COI from across the range would be useful in determining if there are additional putative species.

3.6 Results and Discussion (*Dalmannia*)

Dalmannia are easy to recognize given their distinct pale yellow and shiny black coloration patterns of the abdomen and general gestalt. Dissection of the genitalia of

males has shown only very minor differences between species, and does not serve as a strong support for distinguishing species. Individual genitalic descriptions are useful, but generally only in concert with exterior morphology and molecular data if available.

Exploring species concepts via molecular data has been a slow process. Only in the last few years have we obtained the few COI sequences for this genus. Gaining fresh material is paramount to performing a robust Phylogenetic analysis, as extracting even short (215 bps) sequences from old, dried museum material has proven exceptionally difficult. At present there are only five sequences from Nearctic fauna made public on GenBank and at BOLD. Uploading newly obtained sequences has been an ongoing process and we expect to publish all COI sequences on BOLD and Genbank for open access. The present work represents a serious push to obtain sequences and further develop a picture of the species' relationships, though much more work is needed in this area.

Existing sequences representing earlier attempts have been combined with new extractions that are much shorter (215 bps) spanning only a section of the beginning of the 5' end. The older sequences, if longer and spanning this region have been cut down to match the newer sequences and used to generate a neighbour-joining tree (Fig. 39) and a strict-consensus parsimony tree with bootstrapping applied (Fig. 38). *Myopa* species were used as an outgroup for these analyses (*Myopa flavopilosa* Kröber, CNCD196682; *Myopa melanderi* Banks, CNCD232292; *Myopa willistoni* Banks, CNCD232176).

Parsimony analysis supports the monophyly of *Dalmannia* with a support of 88% and *D. vitiosa* as sister to all other Nearctic *Dalmannia* with 94% support (Fig. 38). *Dalmannia blaisdelli*, *D. heterotricha* and *D. pacifica* form a lineage with 60% support while *D. picta* and *D. nigriceps* are grouped with 75% support. *Dalmannia blaisdelli* and *D.*

heterotricha are putative sister taxa with 98% support (Fig. 38) (CI 0.732; RI: 0.598; RC: 0.438; HI: 0.268; sum of minimum and maximum lengths: 123-235).

Where multiple species' sequences are available (*D. pacifica*, *D. vitiosa*) intraspecific pairwise distances have been outlined above in the species description. Interspecific distances (*D. blaisdelli*: *D. vitiosa*: 22.7-24.2%; *D. nigriceps*: 14.6%; *D. pacifica*: 12.6%; *D. picta*: 20.6%; *D. heterotricha*: 3.5%. *D. nigriceps*: *D. vitiosa*: 32.2-32.7%; *D. pacifica*: 15.6%; *D. picta*: 14.8%; *D. heterotricha*: 15.6%. *D. pacifica*: *D. heterotricha*: 12.6%; *D. picta*: 20.3%; *D. vitiosa*: 3.0%. *D. picta*: *D. heterotricha*: 22.6%; *D. vitiosa*: 32.2-32.7%. *D. vitiosa*: *D. heterotricha*: 23.2-24.7%) show that the six currently recognized Nearctic species are valid, though this is tentative given the limited sequence data. This hypothesis is bolstered with distinct, species-specific morphology, excluding genitalia.

3.7

ROBERTSONOMYIAClass **Insecta** Linnaeus, 1758Order **Diptera** Linnaeus, 1758Family **Conopidae** Latreille, 1802Subfamily **Zodioninae** Gibson & Skevington, 2012Genus *Robertsonomyia* Malloch, 1919**Introduction**

The genus *Robertsonomyia* Malloch was initially considered congeneric with *Zodion*, and includes two Nearctic species: *Zodion parva* Adams and *Zodion palpalis* Robertson (now *Robertsonomyia parva* and *Robertsonomyia palpalis*) plus three additional species from Neotropical Mexico and Brazil, two of which have been synonymized with *Zodion* (*Zodion painteri* Camras, *Zodion pearsoni* Camras, and *Robertsonomyia mexicana* Camras). These species are unique due to the presence of short, rounded, ctenidia that appear along the distal, lateroventral margins (inner and outer) of the hind femora, and the long palpi (roughly 1/8th the total length of proboscis) (Malloch, 1919; Camras, 1979; Smith & Peterson, 1987). No other species of *Zodion* possess ctenidia. This character is what prompted the creation of *Robertsonomyia* by Malloch (1919). Camras later synonymized (1944) and subsequently validated *Robertsonomyia* when he revised the group (1979) based on strong argumentation by Parsons (1948) to retain the genus.

Interestingly, ctenidia are also present in all *Myopa* species and most species of *Thecophora*.

3.8 General diagnosis of genus

Nearctic *Robertsonomyia* appear very similar to *Zodion* in many respects. The facial profile is indistinguishable, as is the general body shape. They are a small species (3-4.5 mm) similar to *Zodion abitus* Adams. The distinguishing features of *Robertsonomyia* are the closed r_{4+5} wing cell with a petiole (Fig. 16 G), 2-5 rounded black ctenidia that appear along the distal ventrolateral margins (inner and outer) of the femora (Fig. 17 A-C).

These pegs do not appear in any *Zodion* species, but do appear in virtually all *Myopa*, and some *Thecophora* from the Nearctic region suggesting a possible relationship with these taxa.

3.9 Key to species of Nearctic *Robertsonomyia*

1. Labellum about same length as antennae (Fig. 17 E); dorsal thorax with many long setae and distinct black maculation (Fig. 17 F); dorsal abdomen somewhat bushy with many long setae; frontal vitta with many setae; tibia with many setae (Fig. 17 B) . . . ***R. palpalis* Robertson**
Canada (AB, MB) and the United States (AZ, CO, GA, MS, NB, NC) and Mexico
- Labellum generally longer than antennae (Fig. 17 D); dorsal thorax without many long setae, without distinct black maculation; rather shiny (Fig. 17 H); dorsal abdomen not bushy; setae generally short and sparse; frontal vitta with few setae if present at all; tibia with sparse short setae (Fig. 17 A) . . . ***R. parva* Adams**
Southern United States (AZ, CA, CO, IO, UT) and Mexico

3.10 Descriptions

***R. palpalis* Robertson, 1901**

Figs. (16 A-C, 16 G, 17 E, 17 F, 17 B), Map 2 (■).

Zodion palpalis Robertson 1901: 284. Type locality: United States of America, Illinois:

Carlinville. Type depository: holotype, INHS.

Sicus brevirostris Coquillett, 1902: 198. Type locality: United States of America,

Mexico. Chihuahua: Sierra Madre, Headwaters of Rio Peidras Verdes, 7300' elevation. Type depository: holotype, USNM (♂).

Zodion scapularis Adams, 1903: 34. Type locality: United States of America, Arizona.

Type depository: holotype, UKAL (♀).

Type material. *Zodion palpalis* Robertson, 1901: Holotype; ♀; 18698; Charles Robertson Collection; INHS Insect Collection.

Additional types examined. INHS 238, 793 (INHS). Allotype; ♂ 9572; Charles Robertson Collection. *Zodion palpalis* Robertson, 1901: Type (?); INHS Insect Collection; INHS 238, 792. (INHS). *Zodion palpalis* Robertson 1901: Type (?); ♂ 6296; Mexico: Chihuahua, Sierra Madre; HdR Piedras Verdes, Elevation 73000 ft; 829 Townsend Collection; (INHS). *Sicus brevirostris* Coquillett, 1902: Type (?); USNM.ENT 00915704 (USNM).

Notes on types: The holotype and allotype of *Zodion palpalis* Robertson (INHS) do not have collection data (location, date, collector, etc.) on any of the labels. Awaiting the holotype for *Z. scapularis* Adams, 1903 from SEMC.

Material dissected. CNCD82596 (♂).

Material Examined: **CANADA: Alberta:** Wainwright, 52.836459°N 110.858986°W, 27.VII.1957, coll. A.R. & J.E. Brooks, CNCN79890, (1♀ CNC); **Manitoba:** Transcona, 49.895556°N 97.005278°W, 9.VIII.1924, coll. G.S. Brooks, CNCN82596, (1♀ CNC); **U.S.A.: Colorado:** Nederland, Science Lodge, 39.961376°N 105.510831°W, 2896m, 29.VII.1961, coll. J.R. Stainer, CNCN28512, (1♂ CNC); **Georgia:** Dallas, 33.923714°N 84.840773°W, 23.V.1948, coll. P.W. Fattig, CNCN79891, (1♀ CNC); Yonah Mountain, 34.6375°N 83.713611°W, 6.X.1936, coll. P.W. Fattig, CNCN199821, (1ex CNC); **Mississippi:** Lafayette County, 34.4°N 89.5°W, V.1945, coll. F.M. Hull, CNCN199820, CNCN79893, (1♂ 1♀ CNC); **Nebraska:** Glen, Sioux County, 42.607°N 103.584°W, 1219m, 21.VIII.1906, coll. P.R. Jones, CNCN195569, (1♀ CNC); **North Carolina:** New River, 36.219657°N 81.636387°W, 20-30.IX.1944, coll. G.E. Bohart, CNCN79892, (1♂ CNC).

Diagnosis. The gena tends to be sparsely covered in short black setae; labellum elongate, about as long as antennae (Fig. 17 D); black maculation is distinct on dorsal thorax (Fig. 17 F); dorsal thorax with many black setae (Fig. 17 G); abdomen somewhat bushy; legs appear rather bushy with black setae (Figs. 17 B-C).

Description. Male. Body length (including antennae): ~4-4.5 mm.

Head. Antennae yellowish-brown with variable presence of light dusting of silverish-white microtomentum; somewhat bulbous, rounded and short; scape slightly darker brown; flagellum with darker brown patches basally; scape and pedicel with short, spiky black setae; flagellum bulbous, longer and larger than pedicel, rounded; eyes brown; frons, antennal grooves and facial carina pale yellow with light dusting of silvery microtomentum; frons and gena pale yellow with sparse black setae; frontal vitta elongate

and narrow, mainly yellow with brown at margin above eye, with a very thin line of silver microtomentum along lateral margins above eyes, with black setae; ocellar triangle somewhat shiny black with two long, black forward-facing bristles; occiput and postgena brownish-black with pale microtomentum with black bristles; sometimes postgena with paler bristles near gena; palps brown and elongated, slightly clubbed; single geniculate proboscis, shiny, brown, with elongated labellum, tendril-like (Fig. 17 D).

Thorax. Scutum dark brownish-blue with four black stripes; pair of short medial stripes extend just beyond posterior limit of post-pronotal lobe; sub-medial stripes extend from lobe just beyond the trasscutal suture (Fig. 17 F); dorsal thorax covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus (Fig. 17 G); scutellum dull black, with longer black setae; lateral thorax mainly dull black or dark brown; variably 1-3 black bristles at cervical sclerite.

Legs. Hind and mid coxae brown with many long black setae; front coxa brown with less long black setae (1-4); coxa with faint silver microtomentum; legs mainly unicolourous brown, though slightly paler at knees, covered in black setae, somewhat bushy (Figs. 17 B-C); posterior distal area of hind tibia with short, concentrated black setae; tarsomeres brownish-yellow with short black setae; femora with black ctenidia usually located ventrolaterally closer to the knee (Fig. 17 B); tarsi brown with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; r_{4+5} closed with petiole about as long as flagellum (Fig. 16 G).

Abdomen. Dull brown, somewhat bushy with black setae with light dusting of silver-white microtomentum; tergite-1 (tg-1) with lateral tufts of black setae; tg-2 with dorso-

lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally; tg-3-6 with regular black setae.

Male Genitalia (Figs. 16 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in many long setae, fairly uniform; hypoproct very reduced, but divided, and slightly rounded covered in short, fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, truncate, with sharp forward-facing tooth, with short, fine setae, distally only; posterior surstylus somewhat elongated, slightly pointed and narrow with a slight inward curl, with concentrated cluster of long black bristles (2-4) in line with surstylus; no membranous appendage present; hypandrium Y-shaped, elongate with a sharply rounded hypandrial sheath; postgonite skinny, elongated and pointed, slightly protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus large, generally bag-shaped with tomentum; with medial and some lateral sclerotization; phallapodeme elongated and slightly curled and pointed; sperm pump rounded, somewhat flat, with long and conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. Same as male except for specialized terminalia; abdominal tergites and sternites 5-8 modified; tg-5-6 narrow; syntergosternite-8+9 (synt 8+9) short, rounded, fused ventrally, forming a conical cylinder; with a pair of forward projecting lateral teeth; st-5 forms elongate and pointed genital plate (theca) with concentrated bristle field appearing ventrally; st-6 reduced; st-7 reduced, forming clasping plate in opposition to st-6 and st-5 (theca) with bristle field appearing ventrally; st-5-7 covered with many fine black setae; cerci appear ventrally from syntergosternite-8+9 (synt 8+9).

Hosts. Unknown.

Distribution. Map 2 (■). Distributed as far north as Alberta, Canada, through the mid-western and southwestern United States.

Habitat. Can be found at elevations as high as 883 m.

Remarks. Emergence May through October. A very short COI sequence (215 bps) has been obtained and will be made available at BOLD under the Conopidae of the World (CONW) project.

***R. parva* Adams, 1903**

Figs. (16 D-F, 17 D, 17 H, 17 A), Map 2 (▲).

Zodion parva Adams, 1903: 33-34. Type locality: United States of America, Arizona.

Type depository: type, (Unknown).

Zodion lovetti Van Duzee, 1934: 323. Type locality: United States of America,

Colorado. Type depository: type, (Unknown).

Note: The type depositories for *Zodion parva* Adams, 1903, and *Zodion lovetti* Van Duzee, 1934, are currently unknown and the types are possibly lost.

Type material. At the time of submission I was awaiting syntypes from SEMC, KU, Lawrence, Kansas.

Material dissected. CNCD199824 (♂).

Material Examined: MEXICO: Chihuahua: 6 km S Samalayuca, 31.287213°N

106.471716°W, 30.VIII.1991, coll. T. Griswold, JSS25506, (1♂ EMUS); **U.S.A.:**

Arizona: 10 miles North of Greasewood, Navajo County, 35.666296°N 109.859236°W,

1219m, 28.VIII.1967, coll. P.R. Jones, CNCD199822, (1ex CNC); 27.6 miles North of

Halbrook, 35.267639°N 110.049198°W, Gutierrezia, 28.VIII.1967, coll. J.C. Hall,

FMNH-INS95522, (1♂ FMNH); 5 miles North of Klagetoh, Apache County, 35.574693°N 109.530836°W, 29.VIII.1967, coll. J.C. Marc, CNC199825, (1ex CNC); **California**: Emery County, 2 miles East Little Gilson Butte, 38.58147°N 110.654849°W, 1554m, 24-26.VIII.1981, coll. Veirs/Griswold/Parker, JSS25508, (1♂ EMUS); San Bernadino County, Cottonwood Wash, Sec 3 T9N R12E, 768m, 2.XI.1983, coll. Parkers/Griswold, JSS25509, (1♀ EMUS); **Colorado**: Estes Park, 40.376877°N 105.52137°W, 2286m, 20.VII.1961, coll. C.H. Mann, CNC195560, (1♀ CNC); Maybell, 40.517746°N 108.087028°W, 18.VIII.1940, coll. R.H. Beamer, FMNH-INS95500, (1♂ FMNH); **Iowa**: Sioux City, 42.500162°N 96.401303°W, 20.VIII.1918, coll. C.N. Ainslie, CNC82595, (1♀ CNC); **Utah**: Emery Co, 2 air miles East Little Gilson BT, 38.58147°N 110.654849°W, 15-17.IX.1980, coll. D. Veirs, JSS25507, (1♀ EMUS); Emery Co, 2 miles East Little Gilson BT, 1554m, Malaise trap, 24-26.VIII.1981, coll. Griswold/Parker, JSS28926, JSS28927, JSS28943, (3ex LACM); Emery Co, 4 miles East Little Gilson BT, 38.591927°N 110.529038°W, Malaise trap, 16-17.IX.1980, coll. D. Veirs, JSS28949, (1ex LACM); coll. Timberlake, CNC199823, CNC199824, (1♂ 1ex CNC).

Diagnosis. Short black setae are absent from gena; labellum very elongate, long as or longer than antennae (Fig. 17 E); black maculation is absent from dorsal thorax; postpronotal lobe with distinct silverish-white microtomentum (Fig. 17 H); tibia with only short, sparse black setae (Fig. 17 A); dorsal thorax with sparse, long, black setae (Fig. 17 I); abdomen not bushy with setae.

Description. Male. Body length (including antennae): ~4-4.5 mm.

Head. Antennae yellowish-brown with variable presence of light dusting of silverish-white microtomentum; somewhat bulbous, rounded and short; scape slightly darker brown; flagellum with darker brown patches basally; scape and pedicel with short, spiky black setae; flagellum bulbous, longer and larger than pedicel, rounded; eyes brown; frons, antennal grooves and facial carina pale yellow with light dusting of silvery microtomentum; frons and gena pale yellow rarely with sparse black setae; frontal vitta elongate and narrow, mainly yellow with some brown at margin above eye, with a very thin line of silver microtomentum along lateral margins above eyes, with very few black setae; ocellar triangle somewhat shiny black with two long, black, forward-facing bristles; occiput and postgena brownish-black with pale microtomentum with black bristles; sometimes postgena with paler bristles near gena; palps brown and quite elongated, and clubbed; single geniculate proboscis, shiny, brown, with very elongated, labellum, tendril-like (Fig. 17 E).

Thorax. Scutum dark brownish-red, or brown without stripes (Fig. 17 H); post-pronotal lobe with strong presence of silverish-white microtomentum; dorsal thorax covered with very few black setae, with only slightly longer bristles at lateral margins along notopleuron and postalar callus (Fig. 17 I); scutellum dull brown, with longer black setae; lateral thorax mainly dull black or dark brown; variably 1-3 black bristles at cervical sclerite.

Legs. Hind and mid coxae brown with few (2-4) long black setae; front coxa brown with less long black setae (1-3); coxa with faint silver microtomentum; legs mainly unicolourous brown, though slightly paler at knees, with sparse presence of short, black setae, not bushy, rather bare (Fig. 17 A); posterior distal area of hind tibia with short,

concentrated black setae; femora with black ctenidia usually located ventrolaterally closer to the knee (Fig. 17 A) tarsomeres brownish-yellow with short black setae; tarsi brown with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; r_{4+5} closed with petiole about as long as flagellum (Fig. 16 G).

Abdomen. Dull brown, not bushy, with few black setae especially when viewed dorsally, with only a light dusting of silver-white microtomentum; tergite-1 (tg-1) with lateral tufts of black and pale setae; tg-2 with tufts of long black and pale bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally; tg-3-6 with regular black and pale setae.

Male Genitalia (Figs. 16 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in sparse long setae, fairly uniform; hypoproct very reduced, only slightly rounded covered in short, fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus sharply rounded to a distinct pointed, tooth-like, usually without setae; posterior surstylus somewhat elongated, slightly pointed and narrow with a slight inward curl, with concentrated cluster of long black bristles (2-4) in line with surstyli; no membranous appendage present; hypandrium Y-shaped, elongate with only a slightly rounded, almost flat hypandrial sheath; postgonite skinny, elongated and pointed, slightly protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus large, generally bag-shaped with tomentum; with only some medial and lateral sclerotization; phallapodeme elongated and pointed; sperm pump rounded, somewhat flat, with long and conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except Terminalia. Abdominal tergites and sternites 5-8 modified, specialized; tergites-5-6 narrow; syntygosternite-8+9 (synt 8+9) short, rounded, fused ventrally, forming a conical cylinder; with a pair of forward projecting lateral teeth; sternite-5 forms elongate and pointed genital plate (theca) with concentrated bristle field appearing ventrally; st-6 reduced; st-5 forms a clasping plate in opposition to syntergosternite-8+9 with bristle field appearing ventrally; sternites-5-7 covered with many fine black setae; cerci appear ventrally from syntygosternite-8+9 (synt 8+9).

Hosts. Unknown.

Distribution. Map 2 (■). Distributed throughout Nevada, Wyoming and Nebraska, south to Arizona and New Mexico.

Habitat. Found at a variety of elevations as high as 697 m on *Baileya pleniradiata* Harvey & A. Gray ex A. Gray (Freeman, 1966), and *Gutierrezia* Lagasca.

Remarks. Emergence July through November, peaking in August. A very short COI sequence (215 bps) has been extracted.

3.11 Results and Discussion (*Robertsonomyia*)

There has been some controversy regarding the validity of *Robertsonomyia*. The typical morphology (ctenidia on femora, tendril-like labellum, petiolate r_{4+5} wing cell, bulbous flagellum compared with the pedicel) provides some evidence in support of the validity of the group. However, these autapomorphies for the lineage provide no evidence that *Robertsonomyia* are not simply derived members of the *Zodion* clade. *Robertsonomyia* share many characters with *Zodion* and *Myopa* suggesting they are all closely related making its placement problematic from a morphological approach.

One long sequence (658 bps) and one short sequence (338 bps) of COI were obtained from *R. palpalis* and *R. parva* respectively and added to a 71 taxon molecular and morphological data set generated by Gibson et al. (2012; 2013). The data set comprises a matrix of five genes (28S, 12S, COI, CytB and AATS) and 111 morphological characters. Data for 28S, 12S, CytB, AATS and morphology are not available for *Robertsonomyia*. Multiple non-conopid outgroups were included (*Chyliza scrobiculata* Melander (Psilidae), *Lonchoptera tristis* Meigen (Lonchopteridae), *Conicera dauci* Meigen (Phoridae), *Toxomerus marginatus* Say (Syrphidae), *Strongylophthalmyia angustipennis* Melander (Strongylophthalmyiidae), *Minettia lupulina* Fabricius (Lauxaniidae). Parsimony analyses were performed with PAUP* (Swofford, 2001) with a tree bisection-reconnection (TBR) branch swapping heuristic search employing stepwise-addition with non-additive multistate characters and 1000 random replications.

Parsimony analysis produced two equally parsimonious trees (CI=0.2550; HI=0.7450; CI excluding uninformative characters=0.2290; HI excluding uninformative characters=0.7710; RI=0.5331). A strict consensus tree was produced with PAUP* (Swofford, 2001) (Fig. 50). Clade support was assessed using nonparametric bootstraps (BS – 1000 replicates).

Stylogaster falls outside of Conopidae within the present analysis. This could be due to the fact that few genes were used in the analysis or that we included third base positions in the analysis (Gibson et al 2012 excluded third positions). Gibson et al's (2012; 2013) 10 gene analysis provides strong support for a sister group relationship between *Stylogaster* and the rest of Conopidae. Otherwise, this analysis is congruent with previous published hypotheses. *Myopa* and *Thecophora* form a clade with 99% BS support.

Dalmannia is monophyletic with 80% BS support. The conopines form a distinct clade (with 78% BS support). *Zodion*, *Parazodion* and *Robertsonomyia* form a clade with 63% BS support. *Robertsonomyia* is nested within *Zodion* but with less than 50% support. *Robertsonomyia palpalis* and *R. parva* form a well-supported lineage (98%).

Poor support for the placement of *Robertsonomyia* is likely driven by considerable missing data. Support indices can collapse when gappy data are introduced into datasets (Wiens & Morrill, 2012). Jiang et al. (2014) urge that the inclusion of partial gene data is preferable and generally increases the accuracy of phylogenetic analyses. Obtaining multi-gene sequences (28S, 12S, CytB and AATS) and reworking the morphological dataset produced by Gibson et al. (2012; 2013) is likely to resolve the status of this genus. Fresh material of *Robertsonomyia* species is needed to obtain additional gene sequences. A full morphological phylogeny is beyond the scope of this thesis. Although the present data are compelling and suggest that synonymy of *Robertsonomyia* (and *Parazodion*) with *Zodion* may be warranted, nomenclatural changes are reserved until more data and a more robust analysis can be obtained. We thus take the conservative approach of retaining *Robertsonomyia* as a valid genus until more data are available.

3.12
STYLOGASTERClass **Insecta** Linnaeus, 1758Order **Diptera** Linnaeus, 1758Family **Conopidae** Latreille, 1802Subfamily **Stylogastrinae** Williston, 1885Genus ***Stylogaster*** Macquart, 1835

3.13 Note. Most of the following material has been published in the Canadian Entomologist by the Thesis author, who retains the rights:

Burt, T.O., Skevington, J.H., & Rocha, L. 2014. Revision of the Nearctic

Stylogaster (Conopidae: Diptera). The Canadian Entomologist, volume 147, issue 02, pp. 125-147.

3.14 Introduction

Stylogaster Macquart (Diptera: Conopidae) is a diverse genus of parasitoid flies in the family Conopidae (Camras and Parrillo 1985). They are most prevalent in the Neotropical and Afrotropical regions and until recently only two species were known to inhabit the Nearctic Region, *S. biannulata* (Say) and *S. neglecta* Williston (Camras and Parrillo 1985). The range of these two species extends from southern Ontario, Canada to Mexico (Camras and Parrillo 1985). Though sharing much of the same habitat and appearing morphologically similar, they are not particularly closely related according to molecular and morphological analyses (Gibson and Skevington 2013; Gibson *et al.* 2013).

These two species are most easily distinguished from each other by examination of the antenna. In *S. neglecta* the flagellum is nearly twice as long as the pedicel, while in *S. biannulata* the flagellum and pedicel are about equal length. Additionally, the abdomens of females of both species are distinctive; *S. biannulata* is more stout and short, while *S. neglecta* is longer and more slender (Camras and Parrillo 1985).

Stylogaster has a parasitoid life history with females injecting eggs into a variety of hosts, including crickets, cockroaches (Kotrba 1997; Woodley and Judd 1998), and possibly calyptrate Diptera (Smith 1967; Couri and Pont 2006; Couri and Silva Barros 2010). The latter are suspected to be accidental ovipositions, as larvae have not been reared from flies (Stuke 2012). Many *Stylogaster* species in Africa and the Neotropics are facultative or obligate army ant followers (Bequaert 1922; Aldrich 1930; Lopes 1937; Rettenmeyer 1961). The flies occur in diversity and numbers around the leading edge of ant swarms where they attack fleeing Orthoptera (personal observation).

Kotrba (1997) explored the possible methods of egg delivery and concluded that it is most likely that the eggs are stabbed into the host abdomen and are held there by elaborate barbs found on the eggs. Lopes (1937) first described the eggs of *Stylogaster* and noted that many of the eggs revealed species-specific features. As a result, the eggs of all three Nearctic species are described and illustrated below.

When not attending army ant swarms, *Stylogaster* adults may typically be found hovering over paths in forest understorey or nectaring on small white or yellow flowers such as fennel (*Foeniculum vulgare* Miller (Apiaceae)), mints (Lamiaceae), and daisies (Asteraceae) (Smith and Peterson 1987). In parts of their range where there are no army

ants, these are typically the only places to find these flies. They are relatively common but can be hard to spot (personal observation).

3.15 Materials and methods

See also Materials and methods. Chapter 2 above (Section 2).

Specimens were obtained from the following collections: American Museum of Natural History, New York, New York, United States of America (AMNH); Canadian National Collection of Insects, Arachnids, and Nematodes, Ottawa, Ontario, Canada (CNC); the University of Guelph Insect Collection, Guelph, Ontario, Canada (DEBU); the Los Angeles County Museum of Natural History, Los Angeles, California, United States of America (LACM); and the Museum of Comparative Zoology, Cambridge, Massachusetts, United States of America (MCZ).

Phenetic analyses were performed with PAUP* (Swofford, 2001). Neighbour-joining was used to explore species concepts for all 35 ingroup taxa. Bayesian methods were used with a reduced dataset (one exemplar per species) for creating phylogenetic hypotheses. Exemplars from all four other conopid subfamilies were used as outgroups for analyses (*Dalmannia pacifica* Banks, *Myopa clausa* Loew, *Physocephala burgessi* Williston, and *Zodion obliquefasciatum* Macquart). These taxa were used in Bayesian analysis (see Chapter 2: Methods and Materials above).

3.16 Results and Discussion (*Stylogaster*)

While testing species concepts for Nearctic conopids with mitochondrial DNA data (cytochrome oxidase c subunit 1), we discovered a putative cryptic species within *S. neglecta*. Upon closer examination, we found subtle, stable morphological differences between this putative new species and *S. neglecta*. For example, the ocellar triangle and

frontal vitta is always darker, almost black, in the new species, where it is rather pale, yellow to brown, in *S. neglecta*. Camras and Parrillo (1985) described the triangle as dull in *S. neglecta*. The scape of *S. beresfordi* **new species** is always darker than *S. neglecta* and shiny. Upon dissection of the male and female genitalia we found other differences between these species lending support to our hypothesis.

Separating *S. neglecta* and *S. beresfordi* from *S. biannulata* is trivial and can be done quickly by examination of the antennae. Male and female genitalia and eggs also differ considerably between these species.

3.17 General diagnosis of genus

Stylogaster is a unique genus even within the Conopidae given the unusual morphology of the female genitalia (Figs. 43 B, 44 E). The group over all appears more delicate, elongate, and brightly coloured; yellow and brown. Female genitalia is distinctive; tergite-7 (segment 7) is thin and elongate. The anal wing cell is rather small compared to other Conopids, with the presence of the sub-costa cell (sc_1). The arista inserts at the apex of the flagellum. The scape is not elongated and skinny, but reduced (Figs. 43 A, 44 A, 45 A), smaller than the flagellum. There are three ocelli. The frontal suture (facial carina (fcc)) is not strongly pronounced or protruding (Fig. 46 E). The area of the gena below the eye is much less than half the area of the eye when viewed laterally (Fig. 46 E). The proboscis has a single basal bend and a second bend about half the length (Fig. 46 E), pointing up or forward and then downward and is quite long, almost as long as the body when unfolded.

3.18 Key to species of Nearctic *Stylogaster*

1. Frontal vitta entirely black (Fig. 44 A); pedicel and flagellum about equal in length (Fig. 44 A); lighter species (pale yellow with darker orange brown areas on abdomen, and darker brown banding on hind tibia and distal end of femur through to tarsi) (Fig. 44 F); little or no lateral maculation on the thorax (slightly darker maculation on anepisternum) (Fig. 44 F); abdominal banding is fairly regular toward posterior (Fig. 44 G); thorax dorsal maculation (black) forks into three distinct points at posterior (Fig. 44 B); stylus (fused sternite 7) of female shorter and more robust than other Nearctic species with slight lateral ridge (Fig. 44 E)
 . . . *S. biannulata* (Say)
 Eastern North America (Fig. 47 B)
- Frontal vitta predominantly yellow (Figs. 45 A, F) or pale brown (Fig. 43 A, E) with black center; pedicel less than half the length of the flagellum (Figs. 43 A, 45 A); darker species (brownish yellow with darker brown areas on dorsal abdomen, and darker brown banding on hind tibia and distal end of femur through to tarsi) (Figs. 42 A, 43 E, 45 F); darker lateral maculation on and about anepisternum (brown, almost black) (Figs. 43 C, 45 E); abdominal banding becomes gradually darker toward posterior in males (Figs. 42 E, 45 F), in females banding is often vague; thorax maculation (dark brownish black) does not fork, but is rather truncate (Fig. 45 B); stylus (fused sternite 7) of female thin, smooth, long and slender without lateral ridge (Fig. 42 B) . . . 2
- 2 Frontal vitta predominantly yellow with black ocellar triangle (Fig. 45 A, F); scape pale (yellow); males with pale abdominal banding usually unbroken by darker median maculation (Fig. 45 F), in females banding is somewhat lacking; lateral and

ventral setulae on and near the first abdominal tergite usually black, though variably pale; male surstylus and postgonite both narrow, elongate (Fig. 46 B).

... ***S. neglecta* Williston**

Eastern North America (Fig. 47 B)

- Frontal vitta predominantly blackish brown with black ocellar triangle (Fig. 43 A); scape darker (brownish yellow); males with pale abdominal banding broken by darker median maculation (Fig. 43 E), in females banding is pale and darker brown; lateral and ventral setulae on and near the first abdominal tergite usually pale, though variably black; male surstylus and postgonite both broad, stubby (Fig. 45

A). ... ***S. beresfordi* Burt, Skevington & Rocha**

Southwestern North America (Fig. 47 B)

3.19 Descriptions

***S. beresfordi* nov. sp. Burt, Skevington, and Rocha, 2014**

Figs. (42 A–C, 43 A–F, 45 A), 47 B (Map) (▲).

Type material. Holotyp designation; ♂, United States of America: New Mexico: Grant County, 14 miles North of Silver City, Cherry Creek Campground, 32.91334°N, 108.22667°W, 2256m, 16–19.viii.1999, J.E. O’Hara, Malaise trap, CNC195998 (CNC).

Paratype series. United States of America: Arizona: Santa Cruz county, Patagonia, 31.53°N, 110.57°W, 5.viii.1995, 1♀, 13.viii.1995, 1♀, 20.viii.1995, 1♂, 27.viii.1995, 1♀, B. Brown and E. Wilk. MT, LACM ENT 319810, 319811, 319812, 319813 (LACM); Oak Creek County, viii.1947, 1♂, RMB Bohart, LACM ENT 319805 (LACM).

New Mexico: same location as holotype, 15-16.viii.1993, 1♂, 16-19.viii.1999, 3♂, 18-19.viii.1999, 1♀, CNC199772-4, 199801, 199803 (CNC); Manzano Mountains, 8 miles west Manzano, New Canyon Campground, 34.67167°N, 106.41°W, 2377m, 21-23.viii.1999, 3♂, 2♀, J.E. O'Hara, Malaise trap, CNC199802, 199810, 199811, 199812 (CNC). **Mexico: Chiapas:** Yerba Bueno, Highway 195, 16.93651°N, 92.89683°W, 24.vi.1969, 1♂, B.V. Peterson, abdomen missing, CNC199744 (CNC). **Sinaloa:** 15 miles West of El Palmito, 23.56142°N, 105.83710°W, 1524m, 20.vii.1964, 1♂, W.R.M. Mason, CNC199742 (CNC).

Additional material examined. United States of America: Arizona: Yavapai County, Bradshaw Ranger District, Prescott National Forest, Along Lynx Creek above Lynx Lake, 34.5298°N, 112.3842°W, 1695m, 12.vii.2013, 1♂, 1♀, D.D. Moll, photograph of male, sight record of female (Fig. 1C; BugGuide: <http://bugguide.net/node/view/826953/bgimage>).

Diagnosis: Distinguished from *S. biannulata* by the subequal length of the flagellum and pedicel; the flagellum is nearly twice as long as the pedicel (Fig. 43 A); the ocellar triangle and frontal vitta is always dark in colour (black or dark brown) (Figs 43 A, E), darker than in *S. neglecta*; lateral and ventral setae on first abdominal tergite are usually pale, though this is somewhat variable (generally black in *S. neglecta*); the male surstylus and postgonite are both broader and stubbier than in *S. neglecta* (Fig. 45 A).

Description. Male. Body length (including antennae) ~6–7 mm.

Head. Face pale yellow with faint silver microtomentum extending narrowly between eyes and frontal vitta, with 6–7 black setae in a row along inside of each eye; facial carina sharp and narrow; ocellar triangle with rounded protruding ocellar protuberance bearing 2 long setae; 2 long setae just posterior to protuberance; frontal vitta and ocellar triangle shiny and dark, brownish black surrounded by dull and darker V-shaped area runs along

inside of eyes above antenna; dorsal occiput with distinctive patches of silver microtomentum, and long white setulae; scape, pedicel and flagellum mainly yellow, with only slight brown darkening ventrally; arista wholly dark brown; flagellum twice length of pedicel; scape appears slightly darker than in *S. neglecta*; subtle light-coloured microtomentum on pedicel and flagellum.

Thorax. Laterally pale yellow with brown maculation on anepisternum and katepisternum; one long black seta on anepimeron next to one shorter seta variably present; single long pale seta on lateral prosternum; thorax dorsally longer than wide (Fig. 43 E); dorsal anterior postpronotum paler with pale microtomentum and single long black seta; dorsal thorax mainly black with slightly lighter brown area posteriorly and 2 very faint dark brown median stripes; dorsal thorax covered with short setulae only on area of darker maculation; 4 long black setae (not including setae on postpronotum) fairly evenly spaced along each side of dorsal lateral edge of thorax posteriorly while 2 postallar callus setae closer together; scutellum dark brown to black with 2 long posterior black setae, lighter than rest of dorsal surface of thorax.

Legs. Coxae pale yellow with hind coxa slightly darker; front coxa with 1–2 short black setae among pale setae; hind coxa has 1 longer seta laterally with 1–2 more medioventrally; mid coxa with several short pale and sparse black setulae anteriorly; hind legs covered in short black setulae, fore and mid legs mainly covered in pale setulae with only a few darker setulae interspersed becoming more regularly dark after tibia; fore and mid femora pale yellow; hind femur pale yellow with 3 darker brown bands (Figs 42 A–C, 43 C), final band appearing at junction with tibia; fore and mid tibiae and tarsi pale yellow with dark setulae, hind tibia mostly pale, becoming abruptly darker brown basally,

colour extending to tarsi; hind tibia with 3 black basal spurs; fore and mid tibiae with single pale spur; tm-2 about $\frac{3}{4}$ length of tarsomere-1 while t-3 is about $\frac{3}{4}$ length of tm-2; tm-4 and 5 equal to each other but each shorter than tm-3.

Wing. Costal vein covered in short setulae with 1 long black seta dorsobasally; allula reduced; halter yellow.

Abdomen. More bulbous posteriorly (Fig. 43 G); tergites pale yellow with darker brown banding and faintly darker secondary banding within, only noticeable dorsally at posterior edge of each tergite (tg), tg-4 and 5 darker overall with yellow banding slightly interrupted dorsally by darker maculation; tg-2 with most prominent darker band on and toward posterior edge; ventral sternites absent except for 5th, which bears sharp carina and reduced overall; abdomen entirely covered in short black setulae dorsally, laterally black setae alternate to paler yellow where maculation paler; lateral ventral edge of tergites have long pale setae interspersed with some black setae becoming mainly black toward the posteriorly; viewed dorsally, tergite with 2 long black setae extending posteriorly.

Male Genitalia. (Fig. 46 A). Epandrium bulbous, rounded, with 2 long, black posterior bristles amidst many black setulae; surstylus with two lobes: former with small black spines on inner face and black spines on outer face with concave groove basal-laterally; latter lobe with black setae at base; cercus double-lobed, with 1 lobe somewhat clubbed, while other sharper distally; dorsally; cercus with many long black setae; hypandrium flat and elongate, appearing bulbous and irregular with a short protruding lobe extending dorsally; postgonite somewhat elongate, bulbous and rounded basally, rather curled and cup-shaped with mixture of short setulae and black spines; phallus double-stranded, light

brown and elongate (Fig. 46 A); phallapodeme cylindrical and elongate, more bulbous distally; sperm pump only slightly smaller than epandrium, membranous; ejaculatory apodeme very rounded, teardrop-shaped.

Female. Similar to male, except banding less clear; ovipositor virtually indistinguishable from *S. neglecta* (Fig. 43 B), twice as long as thorax and head combined; first 5th of ovipositor pale yellow graduating to darker brown with last 5th pale yellow; setae of ovipositor sparse on darker areas becoming more regular toward posterior; setulae pale yellow to white on last 5th of tergite near terminalia.

Terminalia. Tergite-6 or stylus (segment 6) cylindrical, elongate and pale with sparse, short setae (Fig. 43); tergite-7 cylindrical and 1/3 as long as stylus with longer, coarser setae than stylus; tg-8 short and fused dorsally just before cerci of sternite-8, which are short and rounded with crop of long, bushy setulae; hypoproct arrow-shaped, short and moderately pointed with many long setae; genital brush very thick with long black spines, not extending to tip of hypoproct (Fig. 43 F).

Egg. Anterior tip (nonmicropylar end) sharply pointed (Fig. 43 D), highly sclerotized, with pair of ventral, posterior-facing (downward) spines or barbs, slightly shorter than in *S. biannulata* (*S. biannulata* egg, Fig. 44 C); barbs often encased within thin translucent film; tip in shape of arrowhead or harpoon when viewed ventrally or dorsally; body elongate, cylindrical, becoming gradually more bulbous posteriorly (micropylar end), giving egg club-shaped appearance; longitudinal slit between pair of sclerotized barbs where eversible sac originates upon inflation; viewed laterally, anterior end appears rounded, or softened blade, egg body posteriorly clavate; under high magnification surface appears sculptured, scales-like, less defined or altogether absent toward anterior tip.

Hosts. Unknown, but presumably crickets and/or cockroaches as in other known

Stylogaster (Smith and Cunningham-van Someren 1985; Woodley and Judd 1998).

Distribution. Fig. 47 B (▲). *Stylogaster beresfordi* is a southwestern Nearctic species, occurring from SW New Mexico and SE Arizona south through Mexico, between 1238–2377m in elevation.

Remarks. Bayesian analysis of COI data for 35 species of *Stylogaster* shows *S. beresfordi* to be the sister species to *S. neglecta* (Fig. 48). Morphologically, the two species are very similar, differing only in small differences in male genitalia and colouration. DNA evidence strongly supports our hypothesis that *S. beresfordi* is a valid species. Six specimens were sequenced and differ by only 0.0–0.2% and cluster together in as a monophyletic lineage in a neighbour-joining tree (Fig. 48). The uncorrected pairwise genetic distance between *S. beresfordi* and *S. neglecta* is 3.6–4.2%. The COI sequences are published in GenBank (Table 1).

***S. biannulata* Say, 1823**

Figs (44 A–G, 46 B), 47 B (Map) (●).

Synonymy

Myopa biannulata Say, 1823: 81. Type locality: United States of America, Pennsylvania. Type depository: ANSP.

Myopa ?stylata Fabricius. Wiedemann 1830: 243; Roeder 1892: 287.

Stylogaster ?stylatus (Fabricius). Macquart 1843: 175; OstenSacken 1878: 140, 259.

Stylomyia confusa Westwood, 1851: 269. Type locality: Unknown. Type depository: BMNH.

Synonymy by Loew 1851: 133.

Stylogaster biannulata: Williston 1883: 93 (redescription and discussion of *S. stylatus* misidentification by Macquart); Williston 1885: 394 (Conopidae redescrptions); Williston 1893: 120 (discussion of *S. stylatus* misidentification by Roeder); Snow 1903: 216 (checklist of the Diptera of Kansas, United States of America); Tucker 1907: 99 (checklist of insects of Kansas and Colorado, United States of America); Johnson 1910: 772 (checklist of the insects of New Jersey, United States of America); Johnson 1913: 69 (insects of Florida, United States of America); Britton 1920: 189 (checklist of insects of Connecticut, United States of America); Johnson 1925: 180 (checklist of Fauna of New England, United States of America); Leonard 1928: 803 (checklist of the insects of New York, United States of America); Aldrich 1930: 7,10 (key to New World *Stylogaster* species; redescription of *S. biannulata*); Curran 1942: 64 (key to New World *Stylogaster* species); Camras 1965: 632 (Nearctic catalogue); Camras 1967: 9 (notes, including documentation of 60 specimens over a swarm raid of *Eciton burchelli* (Westwood) (Hymenoptera: Formicidae) in Mexico); Papavero 1971: 13 (Neotropical catalogue); Camras and Parrillo 1985: 111, 115 (key to New World species; notes); Kotrba 1997: 620 (egg position); Woodley and Judd 1998: 658 (discovery of host, *Gryllus rubens* Scudder; description of egg and puparium); Gibson *et al.* 2013: 200, 204 (illustrations of male and female genitalia; phylogeny).

Type material examined: see Remarks section.

Additional material examined. Canada: Ontario: Essex County, Pelee Island, Porchuk property, 41.75°N, 82.64167°W, 28.viii-10.ix.2002, 1♂, Porchuk & Marshall, Malaise trap, debu216600 (DEBU); Vineland, 43.17080°N, 79.36400°W, 3.ix.1944, 1♀, H.R. Boyce, debu115709, (DEBU); Waterloo Region, Blair, Cruickston Creek, 43.37778°N, 80.34945°W, 3027.ix.2006, 2♂, Marshall & Cheung, debu278338, 278347 (DEBU); The Dells, 43.38194°N, 80.34223°W, elevation 265 m, 20.vi.2006, 17.vii.2006, 1♂, Bergeron & Cheung, Malaise trap,

debu26874, (DEBU); Puslinch, 43.43334°N, 80.08334°W, 18-20.ix.1983, 1♀, Coote& Marshall,
 Malaise trap, debu1157050 (DEBU); Arkell, 43.53729°N, 80.16782°W, 21.vi.1986, 1♂,
 29.vi.1986, 3♂, 2♀, E. Lippert, debu1157064, 1157070-4 (DEBU); 18.viii.1987, 1♀,
 25.viii.1987, 1♂, 1♀, 30.viii.1987, 1♂, 13.ix.1987, 1♂, Bob Westhaver, Malaise trap,
 debu1157065-9 (DEBU); Guelph, 43.54480°N, 80.24816°W, 23.viii.1987, 1♂, Bob Westhaver,
 debu1157090 (DEBU). Northumberland County, Barr property, ~7 km NE Centreton, 44.13°N,
 77.98416°W, 27.vi.-2.vii.2011, 1♀, 12-26.vii.2011, 1♀, Brunke&Paiero, Malaise trap,
 debu1152347, 1154032 (DEBU); Ferris Provincial Park, Drumlin Trail, 44.29134°N,
 77.79383°W, 1-15.ix.2003, 1♀, P.D. Careless, debu1157092 (DEBU). Chaffey's Locks, Leeds
 County, 44.5658°N, 76.3242°W, 31.viii.1973, 1♀, P. Ward, CNC Diptera 199681 (CNC); North
 Burgess Township, Lanark County, 44.80696°N, 76.31263°W, 7.ix.1970, 1♀, 19-26.vii.1971,
 1♂, D.M. Wood, Malaise trap, CNCD199695, 199708 (CNC); Innisville, 45.05140°N,
 76.25050°W, 12.vii.1961, 1♀, W.R.M. Mason, CNCD199687 (CNC); Metcalfe, 45.23582°N,
 75.47271°W, 25.ix.1982, 1 abdomen missing, 30.ix.1982, 1♀, 8.ix.1983, 1♂, 2♀, 22.ix.1983, 1♂,
 21.viii.1984, 1♂, 22.viii.1984, 1♂, 6.ix.1984, 2♂, 27.vi.1985, 2♀, 28.vi.1985, 1♀, 5.vii.1985,
 1♀, 7.vii.1986, 2♂, 5♀, 17.vii.1986, 1♀, 11.ix.1993, 1♀, 12.vii.1993, 1♀, 1♀, 27.viii.1994, 1♂,
 B.E. Cooper, CNCD28428, 89252, 195995, 199713, 199702-7, 199712-6, 199721-3, 199732-5,
 199793, 199797, 199805 (CNC); 2 Miles North of Metcalfe, 45.26540°N, 75.48873°W,
 20.iv.1952, 1♀, 25.vi.1982, 1♀, 28.vi.1982, 1♂, 1♀, 11.ix.1982, 1♂, 1♀, 14.ix.1982, 1♂,
 20.ix.1982, 1♂, 21.ix.1982, 1♂, 1♀, 22.ix.1982, 1♂, 6.x.1982, 1♂, 4.vii.1984, 2♀, 6.vii.1984,
 1♀, B.E. Cooper, CNCD79762-3, 89251, 199696-7, 199699-701, 199711, 199725-9, 199733
 (CNC); Ottawa, near Uplands Airport, 45.33334°N, 75.58334°W, 16-viii.1937, 1♂, 6♀,
 15.viii.1987, 1♂, 1♀, 6-12.vii.1989, 1♀, J.M. Cumming, Malaise trap, CNCD199698, 199792,
 199787-94, 199816-7 (CNC); Dunrobin, 45.42221°N, 76.02026°W, 18.vii.1972, 3♀, H.J. Teskey,
 Malaise trap, CNCD199685, 199689, 199719, (CNC); Quebec, 4 Miles North of Eardley,
 45.60581°N, 75.87640°W, 25.viii.1971, 1♀, D.M. Wood, CNCD199686 (CNC); Masham

Township, Gatineau County, 45.68334°N, 76.05°W, 6-8.vii.1974, 1 missing abdomen, 2.viii.1974, 1♀, 7-14.ix.1974, 1♀, 2.viii.1974, 1♀, 6-8.vii.1974, 1♀, 10-20.vii.1974, 1♀, 20-23.viii.1975, 1♀, 25-28.viii.1975, 1♀, D.M. Wood, CNCN199683, 199691, 199693, 199709, 199717-8, 199720 (CNC).

Mexico: Yucatan: Chichen Itza, 20.68428°N, 88.56778°W, no/day.vi.1929, 1524m, 2♀, JSS26053, 26056 (AMNH).

United States of America: Alabama: Baldwin County, Bon Secur, 30.3°N, 88.74°W, 19.x.2004, 5♀, E. Benton, Malaise trap, CNCN199736, 199738-41 (CNC); Auburn University, 30.55°N, 88.87°W, 15.xii.2004, 2♀, E. Benton, Malaise trap, CNCN195993, 199819 (CNC); Silver Hill, 30.56°N, 87.77°W, 15.xii.2004, 1♂, E. Benton, Malaise trap, CNCN195994 (CNC).

Florida: Okeechobee County, Archbold Biological Station, Lake Placid, Highlands County, Trail 1 SSo, 27.188°N, 81.338°W, 9.xii.1985, 1♂, 1♀, 13.xii.1985, 2♂, 25.xii.1985, 3♂, 1♀ M. Deyrup, Malaise trap, debu1157055, 1157056-62, DEBU; ...27.18966°N, 81.33813°W, 15.xii.1985, 1♂, 18.xii.1985, 1♂, 1♀, S.A. Marshall, 14-17.iv.1989, 5♂, Malaise trap, debu1157041-3, 1157045-9 (DEBU); ...27.20736°N, 81.33813°W, 4-10.viii.1987, 1♂, 1♀, CNCN199800, 199814 (CNC); ...27.297°N, 81.37°W, 9.xii.1985, 8♂, 2♀, 20.xii.1985, 3♂, 3♀, 9.xii.1985, 1♂, 1♀, M. Deyrup, Malaise trap, debu1157052-4, 1157063, 1157075-89 (DEBU); Highlands County, Hammock State Park, 27.46667°N, 81.53334°W, 17.iv.1989, 1♀, B.J. Sinclair, 13-17.iv.1989, 1♀, J.E. Swann, Malaise trap, CNCN199710, debu1157051 (CNC, DEBU); Gainesville, 29.65°N, 82.31667°W, 24.iv.1952, 1♂, G.S. Walley, 8-22.xii.1986, 1♀, W. Mason, Malaise trap, CNCN195559, 199795 (CNC).

Georgia: Pierce County, 5 km North of Bristol, 31.4935°N, 82.21492°W, 18.iv.1989, 1♂, K.N. Barber, sweep, roadside, debu1157044, (DEBU).

Illinois: Chicago, 41.87811°N, 87.6298°W, 6.vii.1895, 1♀, W.M. Wheeler collection, JSS26058 (AMNH).

Kansas: Manhattan, 39.18361°N, 96.57167°W, 29.x.1932, 1♀, C.W. Sabrosky, JSS26055 (AMNH).

Mississippi: Winston County, Tombigbee National Forest, 33.255°N, 89.091389°W, 10.viii.2013, 1♀, J.M. Cumming, Malaise trap, CNCN222738 (CNC); Agricultural College, 33.45553°N, 88.79042°W, 8.x.1920, 1♀, 6.x.1921, 1♀, CNCN199679, 199684 (CNC); Oxford, 34.36649°N, 89.51924°W,

v.1940, 3♂, 1♀, 10.vi.1945, 1♀, F.M. Hull, Frank M. Hull Collection C.N.C. 1973, CNC D79761, 85163, 199682, 199688, 199692 (CNC); Tishomingo State Park, 34.59941°N, 88.18456°W, 20.v.2013, G.A. Dahlem, Malaise trap, JSS26307, CNC; Rosedale, 39.32010°N, 76.51551°W, 9.ix.1922, 1♀, 14.ix.1922, CNC D199678, 199680 (abdomen and head missing)(CNC); Williamsville, 36.97249°N, 90.54833°W, x-xi.1968, 2♂, Malaise trap, 1♂, 1♀, J.T. Becker, CNC D199690, 199694, 199730-1 (CNC). **New York:** Rochester, 43.16103°N, 77.61092°W, 18.ix.1933, 1♀, R.L. Post, JSS26054, AMNH; Nyack, 41.09065°N, 73.91792°W, 1883, 1♀, JSS26057 (AMNH). **Ohio:** Springfield, 39.92423°N, 83.80882°W, 8.ix.1937, 1♀, R.H. Crandall, JSS26059 (AMNH); **South Carolina:** Dorchester County, Francis Beidler Forest, 10 km Northeast of Harleyville, 33.22064°N, 80.35419°W, 28.iv.1987, 1♂, Malaise trap, CNC D199813 (CNC); **Texas:** Hardin County, 4 miles East of Silsbee on Route 418, Roy E. Larson Sandylands Sanctuary, 30.3°N, 88.74°W, 17-19.v.1993, 1♀, J.M. Cumming, Yellow Pan Trap & Malaise Trap, CNC D199737 (CNC); Brazos County, College Station, Lick Creek Pk., 30.56223°N, 96.21472°W, 30.iii-5.iv.2000, 1♀, 5-9.iv.2000, 1♀, M. Buck, Malaise trap, debu110561, 114275, DEBU; Lamar County, Camp Maxey, 33.86427°N, 95.50661°W, 21.x-8.xii.2003, 1♀, W. Godwin, Malaise trap, JSS19827 (CNC).

Diagnosis: Antennae with near equal lengths of pedicel and flagellum (Fig. 44 A); ovipositor of female stout compared to *S. neglecta* and *S. beresfordi* (*S. biannulata* stylus Fig. 44 E).

Description. Male. Body length (including antennae) ~6–8 mm.

Head. Face pale yellow with extremely faint silver microtomentum extending narrowly between eyes and frontal vitta with 4–6 variably pale yellow or black setae in a row along inside each eye; facial carina sharp and narrow; ocellar triangle with slight, irregularly rounded ocellar protrusion with 2 setae just behind protrusion; frontal vitta and triangle are somewhat dull pale yellow near scape and becomes dark brown to black just before

ocellar protrusion, entirely surrounded by a dull and darker V-shaped area (Fig. 44 A); back of the head just behind eyes with distinctive patches of silver microtomentum, and long white setulae on lateral occiput; scape, pedicel and flagellum mainly yellow with darker brown on the flagellum, with feather-like arista mainly yellow, and pedicel mainly darker brown; flagellum equal in length with pedicel; scape with short subtle and sparse black pile; pedicel with moderately long, spikey black pile.

Thorax. Laterally pale yellow with light brown maculation on anepisternum and katepisternum (Fig. 45 F); thorax dorsally longer than wide (Fig. 45 B, G); dorsal anterior postpronotum paler with pale microtomentum and without long setae, dorsal thorax mainly black with slightly lighter brown area posteriorly; dorsal thorax covered with short pale setulae; 4 long black setae fairly evenly spaced along each side of the dorsal lateral edge of thorax distally, with 2 postallar callus setae closer together; scutellum dark brown to black with 2 posterior long black setae; scutellum slightly lighter than rest of dorsal surface of thorax.

Legs. Coxae pale yellow with hind coxa slightly darker; forecoxa with several long pale and black setae; hind coxa with mainly black, long and short setae, mid coxa with several long pale and sparse black setulae anteriorly; hind legs mainly covered in short black setulae except ventral surface of fore femur with longer black setulae; fore and mid legs covered in pale setulae with only a few darker setulae becoming more regularly dark after tarsomere 3; hind femur pale yellow with 2 darker brown bands (Figs 44 F, G); fore and mid tibiae and tarsi pale yellow setulae; while hind tibia is mostly pale, becoming more stout and broad, and abruptly darker brown basally, colour extends throughout hind tarsi (Fig. 3F); hind tibia has 3 fairly reduced and subtle basal spurs; fore and mid tibiae

with single pale spur; tarsomere 2 about $\frac{3}{4}$ length of tarsomere-1 (tm-1); tm-3 is about $\frac{1}{3}$ length of tm-2; tm-3–5 equal to each other; fore and mid tarsi pale yellow, except for brown 5th.

Wing. Costal vein covered in short setulae with 1 long black seta dorsal-basally; allula reduced; halter yellow.

Abdomen. More bulbous distally; tergites mainly pale yellow with gradient darker brown banding, darker towards posterior margin of tergite, when viewed dorsally (Fig. 44 G); ventral sternites mainly absent except sternite-5 (st-5), which bears sharp carina, reduced overall; dorsal abdomen entirely covered in short black setulae, anteroventrally tuft of paler yellow setae present; viewed dorsally, tg-3 appears somewhat fluted posteriorly, tg-4 bulbous.

Male Genitalia. Epandrium not bulbous, rather flattened dorsally, without long, posterior bristles, with many fine black setulae; surstylus slightly L-shaped with slight second lobe at bend, distal lobe with sparse black setulae on outer face and shorter black setae on inner face (Fig. 46 B); cercus single-lobed, and sickle-shaped, sharp and pointed distally; dorsally, cercus with many thin, long black setae; postgonite somewhat elongate, carnate dorsally, with short, sharp black spine-like setae ventrally only, appearing brush-like; phallus Y-shaped, single stranded later dividing into short double-stranded form, dark brown (Fig. 46 B); phallapodeme cylindrical and elongate, becoming narrower distally; sperm pump only slight, much smaller than epandrium (about size of surstylus), rounded; ejaculatory apodeme is thin, somewhat narrow, leaf or arrow-shaped, thin and somewhat flat (Fig. 46 B).

Female. Similar to male, except for genitalia; ovipositor shorter and stouter than in *S. neglecta* and *S. beresfordi*, with a slightly uneven lateral groove (Fig. 44 E).

Terminalia. (Fig. 44 D). Tergite-6 or ovipositor, cylindrical, only somewhat elongate and pale with sparse, short setae, and a lateral groove, or crease (Fig. 44 E); tg-7 cylindrical and 1/3 as long as ovipositor with longer, coarser setae; tg-8 short and fused dorsally, somewhat protruding dorsally, cerci of sternite-8 with sparse setulae (Fig. 44 D); hypoproct appears mildly arrow-shaped, short and stout, only moderately pointed with many medium length setae; genital brush slightly elongate and sickle-shaped, with long black spines, not extending to tip of hypoproct (Fig. 44 D).

Egg. The eggs of *S. biannulata* have been thoroughly described by Woodley and Judd (1998) but are re-illustrated and described here for comparative purposes (Fig. 44 C). Anterior tip (nonmicropylar end) sharply pointed and highly sclerotized with pair of ventral, posterior-facing (downward) spines or barbs, slightly longer than *S. beresfordi* or *S. neglecta* (*S. beresfordi* and *S. neglecta* eggs, Figs 43 D, 45 C); barbs are often encased within thin, translucent film; tip in shape of arrowhead or harpoon when viewed ventrally or dorsally; body elongate, cylindrical, becoming gradually more bulbous toward the posterior (micropyle end), club shaped; longitudinal slit opening between 2 sclerotized barbs where the eversible sac originates upon inflation; viewed laterally, anterior end appears much like a sharp and pointed blade while egg body posteriorly clavate; under high magnification surface appears sculptured, scale-like, that are less defined or altogether absent toward the posterior.

Hosts. Woodley and Judd (1998) noted that *Gryllus rubens* Scudder serves as the host for *S. biannulata*. These crickets were often parasitised more than once with larvae emerging

roughly 19–25 days later. Camras (1967) documented a collection of 60 adult specimens taken over a swarm raid of *Ecitonburchelli* in Mexico. It thus seems likely that they also attack more than just *Gryllus rubens*. More work is needed to understand host use in species of *Stylogaster*.

Distribution. Fig. 47 B (Map) (●). *Stylogaster biannulata* occurs from southern Mexico north to Oklahoma, Kansas and Nebraska, east to Florida in the United States of America and north to Ontario and southern Québec, Canada.

Remarks. Four COI sequences have been obtained and are published in GenBank (Table 1). Intraspecific variation amounted to 0.2–1.5%. The uncorrected pairwise genetic distance between *S. biannulata* and *S. beresfordi* is 15.0–21.9% and between *S. biannulata* and *S. neglecta* is 17.9–19.9%. Based on a combined five-gene and morphology phylogenetic analysis of Conopidae, *S. biannulata* was hypothesised to be in a different species group than *S. neglecta* (Gibson *et al.* 2013). Eleven of the 59 conopid species included in their dataset were *Stylogaster*. We now have additional COI data available for conopids and include 35 species of *Stylogaster* in the Bayesian analysis presented here (Fig. 48). We recover a similar pattern of relationships to those found by Gibson *et al.* (2013) despite using only COI data in the analysis.

The holotype of *S. biannulata* is missing and has been missing for decades. It was deposited in the Academy of Natural Sciences in Philadelphia. Until the authors have a chance to visit this collection in person it is likely not wise to nominate a neotype. Given the distinctiveness of the taxon, it also seems unnecessary to designate a neotype.

***S. neglecta* Williston, 1883**

Figs. 45 A–F, 47 B (Map) (■).

Synonymy

Stylogaster neglecta Williston, 1883: 91. Type locality: United States of America, Connecticut.

Type depository: syntypes MCZ, UKAL.

Stylogaster neglecta Williston. Williston 1894: G4 (checklist of insects); Townsend 1895: 64

(checklist of Diptera of North America); Johnson 1925: 180 (catalogue of insects of New

England, United States of America); Snow 1903: 216 (checklist of Diptera for Kansas,

United States of America); Jones 1907: 251 (a preliminary checklist of conopids in

Nebraska, United States of America); Williston 1908: 262 (description and checklist);

Banks 1912: 109 (checklist of insects); Banks 1916: 200 (checklist of insects of

America); Greene 1913: 45 (checklist and notes on natural history and behaviour);

Kröber 1914: 349 (catalogue of insects); Britton 1920: 189 (checklist of insects of

Connecticut, United States of America); Johannsen 1928: 803 (checklist of insects of

New York, United States of America); Aldrich 1930: 7, 10 (key to New World *Stylogaster*

species; redescription of *S. neglecta*); Curran 1942: 64 (key to New World *Stylogaster*

species); Papavero 1971: 13 (Neotropical catalogue); Camras and Parrillo 1985: 111, 115

(key to New World species; notes); Kotrba 1997: 620 (egg position); Gibson *et al.* 2013:

200, 204 (illustrations of male and female genitalia; phylogeny).

Type Material Examined: Holotype ♂, [United States of America: Connecticut],

Osten Sacken Coll., Type Wlstn., MCZ-ENT00000450 (MCZ).

Additional material examined. Canada: Ontario: Essex County, Pelee Island, Porchuk

property, 41.75°N, 82.64167°W, 26.vi.-8.vii.2002, 3♂, 8.vii-14.vii.2002, 3♂, 17-22.vii.2002, 1♂,

25.vii.2002, 1♂, 1♀, 25.vii-3.viii.2002, 2♂, 2♀, B. Porchuk, Malaise trap, debu198135, 198141,

198144, 198158-60, 216482, 216484, 216486-7, 227820-2(DEBU); Essex County, Point Pelee

National Park, 41.95834°N, 82.5125°W, 19.vii.1983, 1♀, Marshall, Logan & Grigsby,

20.vii.1978, 15♂, 2♀, J.M. Cumming, 16.vii.1976, 1♂, 1♀, S.M. Clark, 17.vii.1978, 1♂, 18.vii.1978, 1♂, 31.vii.1978, 1♂, D. Morris, 18.vii.1978, 2♂, W.A. Attwater, 20.vii.1978, 10♂, 22.vii.1979, 1♂, K.N. Barber, debu19035, CNCD199758-9, debu6005-18, 6023-8, 6030, 6032-6, 19032-3, 19036-7 (CNC, DEBU); Kingsville, 42.03650°N, 82.73909°W, 8.vii.1977, 4♂, 1♀, W.A. Attwater, debu1157113-5, 1157117, 1157119 (DEBU); Windsor, ~1.5 km S Ojibway Prairie, 42.22611°N, 83.07416°W, 19-30.vi.2001, 2♂, 30.vi-17.vii.2001, 1♀, P. Pratt, 18-31.vii.2001, 1♂, 2♀, S.M. Paiero, 42.29267°N, 82.99333°W, 4.vii.1984, 2♂, M.T. Kasserra, Malaise trap, debu1106076-7, 1107993-4, 1108002, 1108109, 1157094, 1157104 (DEBU); Maidstone Conservation Area, 42.21383°N, 82.78694°W, 21.vii.2000, 1♂, 1♀, S.A. Marshall, debu137396 (DEBU); Walpole, 42.61504°N, 82.51457°W, 12.vii.1979, 1♀, D. Morris, debu1157098 (DEBU); Elgin County, Fingal Wildlife Management Area, 42.67948°N, 81.32660°W, 13.viii.1997, 1♀, 29.vi.1998, 1♂, 3.viii.2000, 1♀, 27.vii.2002, 1♂, 1♀, Ian Carmichael, Newport Forest, ~3 km SW of Wardsville, 42.63111°N, 81.77861°W, 30.vii.2009, 1♂, G.F.G. Miranda, debu318212, CNCD195996-9, 199818 (CNC, DEBU); Regional Municipality of Haldimand-Norfolk, Cronmiller property, ~6 km W St. Williams, 42.6725°N, 80.49056°W, 20.vii.2011, 1♂, S.M. Paiero, debu1148553, DEBU; Manestar Tract, 6 km NNW St. Williams, 42.70472°N, 80.46056°W, 3.viii.2001, 1♀, M. Parchami-Araghi, debu166472 (DEBU); Turkey Point Provincial Park, 42.71167°N, 80.34223°W, 6-22.vii.2009, 1♀, 22.vii-3.viii.2009, 1♂, 3♀, S.M. Paiero, Malaise trap, debu336037, 1150079, 1150081, 1150085 (DEBU); Delhi Simcoe Railway, 42.85°N, 80.38334°W, 14.vii.2001, 2♂, 1♀, S.M. Paiero, sweep, debu1104992, 1106599, 1116587 (DEBU); Jordan, 43.13334°N, 79.36667°W, 13.vii.1919, H. Curran, Compared with type (of *Stylogasterneglecta* Williston, 1883); missing abdomen, 4.vii.1920, 1♂, C.H. Curran, 13.vii.1919, 1, 14.vii.1919, 1♂, 1, 18.vii.1919, 1♂, 1♀, 25.vii.1919, 1♂, W.A. Ross, CNCD199770, 199778-9, 199781-3, 199785, CNC, 17.vii.1919, 1♂, W.A. Ross, debu1157108 (DEBU); Brant County, Brantford Railway Prairie, 43.16667°N, 80.31667°W, 24.vii.2002, 1♀, S.M. Paiero, debu1115762 (DEBU); Hamilton, 43.23333°N,

79.95°W, 24.vii.1982, 1♂, Kevin Barber, debu1157099 (DEBU); Pinery Park, Chalet, 43.255124°N, 81.8388297°W, 9.vii.1991, 1♂, J. Malaise trap, debu1157106 (DEBU); Dundas, 43.263453°N, 79.9527°W, 7-11.vii.1970, 1♂, 7-11.vii.1972, 4♂, 2♀, D.M. Wood, CNCD 28437 (CNC); 24.vii.1975, 1♂, D.J. McComb, 21.vii.1981, 3♂, Cyrus Farivar, debu1157100, 1157102, 1157118, 1157112 (DEBU); Waterloo Region, Blair, RARE, Cruickston Creek, 43.37778°N, 80.34945°W, 301, 27.ix.2006, 1♂, Marshall & Cheung, debu278326 (DEBU); Cambridge, 43.38334°N, 80.31667°W, 24.viii.1989, 1♀, M.K. Sears, Malaise trap, debu1157097, DEBU; Freelon, 43.39779°N, 80.03642°W, 19.viii.1984, 1♂, M.T. Kasserra, debu1157105 (DEBU); Regional Municipality of Halton, Oakville, nr. Hwy 25 & Burnhamthorpe Rd., 43.45389°N, 79.79223°W, 26.vii-16.viii.2006, 6♂, 5♀, S.M. Paiero, Malaise trap, debu285658-63, 285665-7, 285686-7 (DEBU); Bronte Creek Provincial Park, 43.415°N, 79.76667°W, 19.vii.2002, 5♂, K.N. Barber, sweep, debu1157109-11, 1157120-1 (DEBU); Guelph, 43.54480°N, 80.24816°W, 27.vi.1955, 1♂, D.H. Pengelly, debu 1157116 (DEBU); Fergus, 43.7°N, 80.36667°W, 4.vii.1990, 1♀, S.A. Marshall, Malaise trap, debu1157095 (DEBU); Bothwell, 45.05140°N, 76.25050°W, 18.vii.1962, 1, S.M. Clark, missing abdomen, CNCD199784 (CNC); 2 Miles North of Metcalfe, 45.26540°N, 75.48873°W, 16.vii.1982, 1♀, B.E. Cooper, CNCD199775 (CNC). **United States of America: Georgia:** Rabun Bald, Rabun County, 34.964827°N, 83.298647°W, 914, 14.vii.1957, 1♂, J.G. Chillcott, CNCD199755 (CNC). **Kansas:** Lawrence, 38.97166°N, 95.23525°W, 22.vi.1922, 1♂, C.H. Curran, CNCD199780 (CNC). **Kentucky:** Manifee county, near Frenchburg, 37.98°N, 80.68°W, 2-8.vii.1997, 1♂, 15-22.vii.1997, 1♂, 2♀, Abnee and Sharkey, MT, Malaise Trap, LACM ENT 319801, 319802, 319803, 319804 (LACM). **Maryland:** Calvert County, Port Republic, 38.5°N, 76.53334°W, 3-5.vii.1993, 1, 8♂ and 3♀, 25.viii.2001, 1♂, D.M. Wood, 7-8.viii.1993, 1♀, Xuekui Sun, CNCD79785, 89262-3, 199762-7, 199769, 199806, debu1157101 (CNC, DEBU); Patuxent Wildlife Center, 38.53996°N, 76.74768°W, 6-22.viii.1979, 1♂, 2♀, 5.viii.1979, 1♀, E.E. Grissell & M. Schauff, CNCD199807-9, 199815 (CNC); Plummers Island, 38.97004°N, 77.17880°W, 3.vii.1921, 1 sex not determined,

14.vii.1921, 5♂, 1 sex not determined, J. Bequaert collection, JSS23095, 23096, 23097, 23098, 23099, 23100, 23101 (MCZC); 18.vii.1909, 1♀, G.P. Engelhardt, JSS23102 (MCZC).

Massachusetts: Auburndale, 42.34334°N, 71.24771°W, 16.vii.1903, 1♂, CNCD199756 (CNC); Riverside, 42.36768°N, 71.11367°W, 12.vi.no/yr, 1♂, 12.vi.1903, 1 sex not determined, A.P.

Morse, JSS23103, 23104 (MCZC). **Mississippi:** Oxford, 34.36649°N, 89.51924°W, v.1940, 6♂, F.M. Hull, Frank M. Hull Collection C.N.C. 1973, CNCD199751-2, 199760, 199771, 199776-7

(CNC). **Missouri:** Williamsville, 36.97249°N, 90.54833°W, 14.vii.1969, 1♂, 22.vii.1969, 1♀,

Malaise trap, CNCD199753, 199757 (CNC); La Clede County, Bennett Springs State Park,

37.72141°N, 92.85296°W, 1.viii.1984, 1♂, B.V. Brown, debu1157103 (DEBU); RufolfBennitt

Wildlife Area, Randolph County, south of Moberly, 39.24812°N, 92.45547°W, 25.vii.1970, 1♂, R.

Heitman, JSS26125, (AMNH). **New Jersey,** Riverton, 40.01150°N, 75.01489°W, 21.vii.1920, 1,

3♂, 1♀, Frank M. Hull Collection C.N.C. 1973, CNCD199743, 199747-50 (CNC); Alpine,

40.95593°N, 73.93124°W, 28.vii.1946, 3♂, 1♀, S.C. Harriot, JSS26085, 26086, 26087, 26088

(AMNH); Kalbfleisch Research Station, Huntington, Long Island, 40.80482°N, 73.33623°W,

9.vii.1918, 1♂, A. Nicolay, JSS26113, AMNH; Ramsey, 41.05741°N, 74.14089°W, 4.viii.1935,

1♂, JSS26114, AMNH; 40.01150°N, 75.01489°W, 15.vii.no/yr, 1♀, 5.viii.no.yr, 1♂, 30.vii.1888,

2♂, 22.vii.1920, 1♂, C.W. Johnson, JSS23105, 23106, 23107, 23108, 23109, 23110 (MCZC).

New York, Kalbfleisch Research Station, Huntington, Long Island, 40.80482°N, 73.33623°W,

26.vii.1962, 1♀, P.H. Arnaud, Malaise trap, CNCD199786 (CNC); Cold Spring Harbor, Long

Island, 40.87148°N, 73.45678°W, 18.viii.1932, 2♂, 19.viii.1932, 2♂, 22.viii.1932, 4♂,

23.viii.1932, 8♂, 26.viii.1932, 1♂, C.H. Curran, JSS26060, 26061, 26062, 26063, 26064, 26064,

26065, 26066, 26067, 26068, 26069, 26070, 26071, 26072, 26072, 26073, 26074, 26075, 26076,

26077, 26078, 26079, 26079, 26080, 26081 (AMNH); Tuxedo, Station for the Study of Insects,

41.23766°N, 74.19445°W, 25.viii.1928, 1♂, 28.viii.1928, 1♂, 1♀, C.H. Curran, JSS26082,

26083, 26084, AMNH; 27.viii.1932, 1♂, 1♀, Ethel Curran, JSS26073, 26081, AMNH;

40.80482°N, 73.33623°W, 19.vii.1962, 1♂, 1♀, 24.vii.1962, 4♀, 26.vii.1962, 1♂, 4♀,

28.vii.1962, 4♀, 1.15.viii.1962, 3♀, P.H. Arnaud, JSS26089, 26090, 26091, 26092, 26092, 26093, 26094, 26095, 26096, 26097, 26098, 26099, 26100, 26101, 26102, 26103, 26104, 26106, 26107, 26113, 26114 (AMNH); 19.vii.1962, 1♂, Rozen, Arnaud, Hessel, Woods, Statham, JSS26105, AMNH; 19.24.vii.1976, 1♂, 19.28.vii.1976, 1♂, 25.31.vii.1976, 2♂, M. Kamran JSS26108, 26109, 26110, 26110 (AMNH); 8.18.viii.1971, 1♂, P. & B. Wygozinsky, JSS26112, AMNH; Long Island, Flatbush, water works, 40.64092°N, 73.96243°W, 11.vii.1890, 1♂, JSS26124 (AMNH); Fishers, 43.0094°N, 77.45514°W, 9.vii.1933, 3♂, 16.vii.1933, 4♂, JSS26115, 26116, 26117, 26118, 26119, 26120, 26121 (AMNH); Mosholu, 40.87700°N, 73.88489°W, (no date) 1♂, JSS26122 (AMNH); Ithaca, Tompkins County, 42.44458°N, 76.49926°W, 22.vii.1979, 1♀, 23.vii.1979, 3♂, 1♀, 3.viii.1979, 1♂, J.E. Rawling, JSS23116, 23117, 23118, 23119, 23120, 26121 (MCZC). **Ohio:** Lawrence County, Dean State Forest, 38.68716°N, 82.62133°W, 13.vii.1989, 1♂, S.A. Marshall, debu1157096 (DEBU). **Tennessee:** Sevier County, Great Smoky Mountains National Park, ATBI Plot: Twin Creeks, 35.685°N, 83.499°W, 21.vii-9.viii.1999, 1♂, Parker, Stocks, Perterson, Malaise trap, CNC Diptera 199761 (CNC). **Vermont:** Calisol, 18.viii.1802, 1♂, JSS26123 (AMNH). **Virginia:** Buffalo Mountain, 2.5 km W of Moles Road, 36.79605°N, 80.47616°W, 1211, 24.vii.2009, 1♂, J. Skevington, JSS18593 (CNC); Fish Hatchery Lane, 2.5 km S Montebello, 37.84191°N, 79.13125°W, 825m, 22.vii.2009, 4♂, J. Skevington, JSS18799, 18868-9, 19843 (CNC); Falls Church, 38.86667°N, 77.16667°W, 14.vi.no/yr, 1♀, 22.vi.no/yr, 1♂, 28.vi.no/yr, 2♂, 17.vii.no/yr, 1♂, 27.vii.no/yr, 1♂, 5.viii.no/yr, 1♂, N. Banks, JSS23088, 23089, 23090, 23091, 23092, 23093, 23094 (MCZC); Glencarlyn, 38.86379°N, 77.12694°W, 17.vi.no/yr, 1♂, 21.vi.no/yr, 1♀, 2.vii.no/yr, 1♂, N. Banks collection, JSS23111, 23112, 23113 (MCZC).

Diagnosis. Distinguished from *S. biannulata* by the subequal flagellum and pedicel; the flagellum is nearly twice as long as the pedicel (Fig. 45 A); ocellar triangle usually light in colour (tan or yellow) (Fig. 45 A, F), lighter than in *S. beresfordi*; long ventral and

lateral setae on first abdominal tergite are usually black rather than pale, though this character is somewhat variable; male surstylus and postgonite are both narrower and more elongate than in *S. beresfordi* (Fig. 46 B).

Description. Male. Body length (including antennae) ~6–7 mm.

Head. As in *S. beresfordi* except the following: ocellar triangle shiny and pale yellow, rarely light brown, surrounded by dull and darker V-shaped area (Fig. 45 A); flagellum 2x length of the pedicel; scape appears subtly lighter than in *S.beresfordi* (*S. beresfordi* head, Fig. 43 A).

Thorax. Indistinguishable from *S. beresfordi* (*S. neglecta* thorax, Figs 45 B, E, F).

Legs. Indistinguishable from *S. beresfordi*.

Wing. Costal vein covered in short setulae with 1 long black seta dorsal-basally; allula reduced; halter pale yellow.

Abdomen. Generally indistinguishable from *S. beresfordi*, although *S. neglecta* often tends to be a slightly lighter brown dorsally than *S. beresfordi*.

Male Genitalia. Slight lateral groove extends almost the entire length of more elongate surstylus (Fig. 46 B); postgonite is somewhat more flattened, less scooping or cup posture than *S. beresfordi* (Fig. 46 B).

Female. Similar to male except abdominal banding is somewhat lacking; abdomen terminates in long and slender ovipositor which closely resembles *S. beresfordi* (Fig. 43 B); tg-5 is about 5 mm long with anterior portion pale yellow, followed by darker brownish black, and abruptly terminating in paler yellow; majority of ovipositor with short, irregular setulae on dorsal surface only, becoming distinctly regular and forming thick band of black pile towards dark, anterior end of ovipositor, the pile becoming rather

pale on distally palest area just before genitalia.

Terminalia. As in *S. beresfordi* except: genital brush is short, with very thick and long black spine-like setae, not extending to tip of hypoproct, setae sharply pointed (Fig. 45 D).

Egg: Very similar to *S. beresfordi*. Only discernable difference is microsculptured surface (Fig. 45 C) slightly more defined than *S. beresfordi* (Fig. 43 D). Egg described in detail by Taber and Maloney (2006).

Hosts: Unknown.

Distribution. Fig. 47 B (■). *Stylogaster neglecta* ranges from Ontario and southern Québec, Canada, south to Georgia and west as far as mid Nebraska and Kansas, United States of America. Camras and Parrillo (1985) suggested that the range extended farther west to Arizona and farther south to Sinaloa and Chiapas, Mexico. This is undoubtedly due to the inclusion of specimens of our new species, *S. beresfordi*, within the former boundaries of *S. neglecta*.

Remarks. Five COI sequences have been obtained and are published in GenBank (Table 1). The sequences were identical. Genetically and morphologically, this species is closest to *S. beresfordi* and is hypothesised to be its sister clade (Fig. 48).

3.20

ZODION

Class **Insecta Linnaeus, 1758**

Order **Diptera Linnaeus, 1758**

Family **Conopidae Latreille, 1802**

Subfamily **Zodioninae Macquart, 1834**

Tribe **Zodionini Rondani, 1856**

Genus ***Zodion* Latreille, 1797**

Introduction

Zodion is a beautiful group of flies with some of the most striking colour patterns of conopids. The genus has had some taxonomic difficulties due to the highly variably characters of some species. Banks (1916) completed a revision with a user-friendly key, though the descriptions are wanting for detail and clarity and many of his new species were later synonymized. Species concepts have been refined with taxa placed in “Group sections” (*obliquefasciatum* group, *fulvifrons* group) by Camras (1943, 1944, 1945, 1954). To date, Camras provided some of the best descriptions and keys and some of his methodology have been employed here. Freeman (1968) effectively resolved discrepancies between *Zodion auricaudatum*, *Zodion zebrinum*, and *Zodion albonotatum*, which have historically caused confusion among taxonomists, including Camras who never once referenced *Z. auricaudatum* (now a valid species) (Freeman, 1968).

3.21 General diagnosis of genera

Zodion can mainly be distinguished from closely related genera like *Myopa* by viewing the face laterally. The eye of *Myopa* is reduced relative to the over all head compared to all other conopid genera, and the facial profile is quite distinct with its upper carina protruding (Fig. 5 B), while this is not the case in *Zodion* (Fig. 5 D) where the eye appears more prominent on the face relative to the gena. The abdomen of *Thecophora* tends to be elongated, and somewhat narrow when viewed dorsally, which is contrasted with that of *Zodion*, which appears plump and more rounded distally. Additionally, *Zodion* is a variably colourful genus, unlike *Thecophora*. The apical sub-costa (c + sc) wing cell is present (Fig. 4 A, D). The arista point of insertion is well before the apex or at the dorsal mid-length of the flagellum (Fig. 5D). The scape is not elongated and narrow, but rather reduced (Fig. 5D), smaller than the flagellum. The area of the gena below the eye is about half the area of the eye or greater when viewed laterally (Fig. 5 D). There are three ocelli present. The frontal suture is not strongly pronounced or protruding (Fig. 5D). The second tergite is not overly constricted compared to the third as in *Physocephala* or *Physoconops* (Fig. 5 F-G) but is generally robust, not pinched (Fig. 6 C-D). The proboscis has a single basal bend (Fig. 5 D), pointing up or forward. The genus is distinguished from *Robertsonomyia* by the presence of a short, clasper-like labellum, and total absence of ctenidia. Also, the r_{4+5} cell is rarely closed in species of *Zodion*, and if it is, it is not petiolate as in species of *Robertsonomyia*.

3.22 Key to species of Nearctic *Zodion*

1. M_1 vein incomplete (Fig. 4 C) . . . ***Z. nigrifrons* Kröber**
Endemic to California (Map 3 B (▲))

- M₁ vein complete (Fig. 4 A-B, D) . . . 2
- 2. Body gray or dusty with distinct black spots (Figs. 18 F, 21 H)

. . . ***Z. pictulum* Williston**

Southern USA (AZ, NM) and Mexico (Map 4 C)

- Body without distinct black spots . . . 3
- 3. Gena pale yellow and postgena brownish-black (Fig. 19 I)

. . . ***Z. zebrinum* Bigot**

Southwestern USA (AZ, NM, TX) and Mexico (Map 4 C); also Costa Rica

- Gena pale yellow and postgena pale yellow (Fig. 19 J) . . . 4
- 4 Dorsal thorax blackish-brown, sometimes dusty, with two variably sharply defined brownish-gray, or grayish-white, microtomentous stripes extending full length of dorsum, divided by a single black stripe (Fig. 19 A); generally smaller species (~5-8 mm); frons often with irregular brown patch, variably present.

. . . ***Zodion anale* Kröber**

Eastern Canada (PEI), USA (AZ, CA, CT, FL, KS, MA, MS, MO, NC, NM, NV, TX, VA) (Map 3 B); also Mexico, Central and South America (Brazil, Chile, Costa Rica, Guatemala, Peru)

- Dorsal thorax not quite as below; two median stripes do not extend full length of dorsum; generally larger species (~8 mm); frons unmarked, pale yellow . . . 5
- 5. Dorsal thoracic setae longer, obviously present; dorsal thoracic microtomentum dull, brown, gray, or grayish-white, usually forming several (4-6) medial stripes (Figs. 18 A-E, 19 C); abdomen tends to be dull, or indistinctly patterned with microtomentum if at all . . . 10

- Dorsal thorax setae very short, almost absent; dorsal thoracic microtomentum striking, golden, gray, or silverish-white, usually forming two distinctive medial stripes (Figs. 18 G-I); abdomen tends to be distinctly or sharply patterned with bright microtomentum . . . 6
- 6. Pedicel longer than flagellum (Fig. 19 G); dorsal thorax and abdomen patterns of microtomentum not quite as above; body colour not distinctly orange . . . 8
- Antennae very short, bulbous, pedicel about equal length of flagellum (Fig. 19 H); dorsal thorax pattern variably defined with microtomentum and maculation pattern (Fig. 18K): scutum and scutellum variable light or dark brown, orangy; scutum with two medial microtomentous stripes; lateral thorax with golden stripe of microtomentum; dorsal abdomen tends to appear wider than thorax, bloated (especially in males), brown, or deep yellow, often two-toned, with golden microtomentum extending laterally (Figs. 20 G-H); lateral tibia with strong, bright golden microtomentum; wings generally smoky brown . . . 7
- 7. Area about prescutal suture usually with microtomentum; dorsal setae usually short, somewhat depressed; scutellum setae tend to be short; lateral thorax usually brownish-orange; posterior surstyli narrow and elongate (*reliability of identification to species is vastly increased with examination of genitalia (males), and reference to distribution.*) (Figs. 36 D-F) . . . ***Z. obliquefasciatum* Macquart**
Canada (MB), United States (AZ, CA, CO, IL, IA, KA, LA, MD, MO, MT, NE, NV, NM, OK, SD, TX, UT, VA, WA, WY) and Mexico (Map 4 B)
- Area about prescutal suture often without microtomentum though variable;

dorsal setae usually longer, not very depressed; scutellum setae usually longer, bushy; lateral thorax usually darker brown, or brown, with variable presence of orange; posterior surstyli paddle-like, rounded (*reliability of identification to species is vastly increased with examination of genitalia (males), and reference to distribution.*) (Fig. 36 A-C) . . . ***Z. lisafyrea nov. sp. Burt & Skevington***

Western Canada (AB, BC, SK) and USA (CA, MT, ND, NE, NV, OR, SD, UT, WY) (Map 4 B)

- 8 Frontal vitta mainly deep yellow with distinguished darker area around ocellar triangle; sharply divided (Fig. 19 E); dorsal thorax pattern of microtomentum and maculation (Fig. 18 G) as follows: scutum mainly dull brown with darker medial patches, with two obvious gray stripes of microtomentum; dorsal abdomen dark brown with grayish-brown microtomentum with ill-defined edges; antenna tend to be dark with pedicel longer than flagellum (Fig. 19 E)

. . . ***Z. californicum Camras***

Western USA (AZ, CA, NM, WA) and Mexico (Map 3 C)

- Frontal vitta deep yellow or pale yellow, possibly patchy, without sharply divided darker area around ocellar triangle (Fig. 1 C); dorsal thorax and abdomen patterns of microtomentum not quite as below . . . 9
- 9 Dorsal thorax pattern of microtomentum and maculation (Fig. 18 H) as follows: scutum mainly dull reddish brown to dark brown or nearly black with 2 well-defined, golden stripes of microtomentum; dorsal abdomen black or very dark brown with somewhat bright, grayish-blue, or light blue (cyan) microtomentum

with well-defined edges (especially in males); frontal vitta with darker brown area about the ocellar triangle; legs tend to be brown, golden, or pale

... ***Z. cyanescens* Camras**

Southeastern USA (AL, GA, MS, NC, SC, TN) (Map 3 C)

- Dorsal thorax pattern of microtomentum and maculation as follows: scutum and scutellum black or dark brown; pale or grayish-white microtomentum covers most of dorsum with two thick black medial stripes extending just beyond transscutal suture with one thinner medial stripe between; dorsal abdomen tends to appear wider than thorax, bloated (especially in males), blackish-brown, with golden or grayish-white microtomentum extending laterally to the dorsum, somewhat poorly defined ... ***Z. auricaudatum* Williston**

Western USA (AZ, ID, NM, TX) and Mexico with a single record in Canada (ON) (Map 3 C).

- 10 Abdomen appears somewhat narrow; tergites tend to be narrower toward posterior apex than basal tergites, often with very distinct bandings or dark and light markings (Figs. Z. C-F); always very small (~3.5-5 mm); dorsal thorax is often blue, or blue green but can be brown, or very dark brown (Fig. 19 D)

... 23* (***americanum* group**)

- Abdomen does not appear overly narrow; tergites tend to be broader toward posterior apex with more narrow basal tergites (Fig. 20 G-H); without particular pattern; small to medium (~4+ mm); dorsal thorax is not blue, or green ... 11

- 11 Larger species (~5.5-10 mm); antennae variable ... 15

- Small species (4-5.5 mm); antennae small, rounded and pale orangey-yellow (Fig. 19 H) . . . 12
- 12 Wing with r_{4+5} cell open (Fig. 4 A) . . . 14
- Wing with r_{4+5} cell closed (Fig. 4 B) . . . 13
- 13 Wing with r_{4+5} cell closed (Fig. 4 B); wing usually smoky brownish-yellow hue; antennae bright pale yellow; arista with brownish yellow base followed by pale yellow and a slightly darker brown tip; dorsal thorax usually pale brownish-gray with two bare black stripes of maculation . . . ***Z. abitus* Adams**
Widespread throughout North America: Canada (ON, SK, QC), USA (AZ, CO, CT, GA, IL, IN, IA, KS, KY, MA, MI, MS, MO, NH, NJ, NM, NY, OH, OK, PA, SD, UT, VA, WA, WY) and Mexico (Map 3 A). Also Costa Rica.
- Wing with r_{4+5} cell closed (Fig. 4 B); wing usually clear, or appearing with slight yellowish hue; antennae light brown; arista with brown base and slightly lighter brown tip; dorsal thorax tends to be very dark brownish-gray with four variable bare black stripes of maculation (Fig. 19 C) . . . ***Z. triste* Bigot**
Primarily western USA (CA, CO, ID, NV, WA) with three disjunct eastern records: Canada (ON), USA (MA, NC) (Map 5 C)
- 14 Antennae not reduced (Fig. 19 H) pale brown, yellowish-orange, not paler than yellow frons; abdominal segments reddish-brown, dark brown, with some golden microtomentum; dorsal thorax dusty brownish-gray; abdomen and dorsal thorax only slightly bushy with black setae; generally a smaller species (~4.5-5.5 mm); posterior surstylus double-toothed, lobster-claw-like (Fig. 22 D-G)
. . . ***Z. alexanderi nov. sp.* Burt & Skevington**

Predominantly western and midwestern: Canada (AB, BC, MB, ON) and USA (CA, MO, OH, WY) (Map 3 B)

- Antennae petite, rounded, brown to dark brown, usually darker than pale yellow frons; abdominal segments reddish-brown, or “chocolate” brown, with some golden microtomentum; dorsal thorax usually “chocolate” brown; abdomen and dorsal thorax usually bushy with black setae; a smaller species (~4.5-5.5 mm); posterior surstylus paddle-like, contoured, with strong lateral membrane (Fig. 31

E-G) . . . ***Zodion cinereiventre* Van Duzee**

Widespread; Canada (AB, BC, MB, ON, SA), USA (AZ, CA, GA, IA, ID, MD, MI, MS, MO, NV, NJ, NM, OR, UT, VA, WA, WY) and Mexico (Map 3 A)

- 15 Wing with r_{4+5} cell closed; abdomen reddish-brown; posterior surstyli asymmetrical (Figs. 31 A-D) . . . ***Z. dillahuntyi* nov. sp. Burt & Skevington**

Primarily northwestern; Canada (AB, BC, MB, ON) and the United States (CA, KS) (Map 4 C)

- Wing with r_{4+5} cell open; abdomen reddish-brown (especially tergites 3-4), orange, or pale brown, tan; posterior surstyli symmetrical . . . 16

- 16 Dorsal thorax with brownish-red, brownish-gray, gray, microtomentum with 2-5 bare black maculation stripes, variably-defined (sharp to very faint); central black stripe usually thin if present; abdomen colour variable pale or dull orange, reddish-brown, pale brown; covered in black or golden setae generally large species (~6-10 mm) . . . 18

- Dorsal thorax with dark “chocolate” brown microtomentum with five bare black maculation stripes variably defined (Fig. 18 C); abdomen distinctly “chocolate”

brown with golden brown microtomentum; covered in bushy black setae;
tarsomeres 4-5 are usually blackish-brown, much darker than tm-1-3; large
species (8-10 mm) . . . 17

- 17 Frons and genae pale brown or yellow, with some microtomentum; frontal vitta
dark reddish-brown with few setae; antennae orange, brown, or pale yellow; tarsi
brownish-yellow with black tips . . . ***Z. intermedium* Banks**

Widespread; Canada (AB, BC, MB, NB, NS, ON, PE, QC, SK), USA (AL, AZ,
CA, CO, FL, GA, IA, ID, IN, KS, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ,
NM, NV, NY, LA, OK, OR, PA, SD, TN, TX, UT, VA, WA, WI, WV, WY) and
Mexico (Map 5 B)

- Frons and genae very dark brown, nearly black with very heavy microtomentum;
frontal vitta very dark reddish black with many setae, somewhat bushy, antennae
dark brownish-black; tarsi completely black.

. . . ***Z. hauseri nov. sp.* Burt & Skevington**

Known from a single record from Monterey County, California

- 18 Abdomen dull brown, patchy, with very little golden microtomentum, usually
without medial stripe; tarsomere 5 distinctly darker brown than tm-1 (yellow or
light brown); female tergites 4-5 distinctly elongated compared to tg-3 (Fig. 1 D) .

. . . ***Zodion perlongum* Coquillett**

Widespread; Canada (AB, BC, NS, ON, QC, SA), USA (CA, CO, CT, FL, IA, ID,
KS, MA, ME, MI, MT, ND, NJ, NM, NV, NY, OR, SD, TX, UT, VA) and
Mexico (Map 5 C)

- Abdomen red, reddish-brown, orange, pale yellow with dusting of golden microtomentum, especially laterally, often with a faint medial stripe; tergite-2-3 may be orangey-brown, or paler than following tg-3-4 especially in females; dorsal thorax bare black maculation stripes (2-4) generally poorly defined . . . 19
- 19 Slightly small species (~5.5-6 mm); dorsal thorax very dark brown, brownish-gray, almost black, with two (sometimes four) poorly defined bare black maculation stripes . . . ***Z. oharai nov. sp.* Burt & Skevington**
Widespread in south; USA (AZ, CA, NC, MA, MS, WY) (Map 5 C)
- Generally larger species (~8-10 mm); dorsal thorax not overly dark; with 2-4 variably defined (stark or faint) black stripes of bare maculation . . . 20
- 20 Abdomen orange, very pale brown; dorsal thorax mainly gray, or ash-brown, *light*, with variable (stark to faint) black stripes of bare maculation (Fig. 18 A-B); lateral thorax dusty gray, frosty, ashy, with few darker areas, less patchy . . . 22
- Abdomen red, reddish-brown; dorsal thorax mainly brown, or brownish-gray, *dark*, with variable (stark to faint) black stripes of bare maculation (Fig. 18 E); lateral thorax dusty brown, with dark areas, patchy . . . 21
- 21 Abdomen red, reddish brown, or orange with golden microtomentum forming faint, irregular medial stripe; tergites 2-3 often brighter orange than tg-4-6, which are darker brown (especially in females); abdomen covered in long black setae, somewhat bushy; wing slightly smoky, brownish hue . . . ***Z. fulvifrons* Say**
Widespread; Canada (AB, BC, MB, NB, NS, ON, PE, QC, SK), USA (AL, AZ, CA, CO, CT, FL, GA, IA, ID, IL, IN, KS, MA, MD, MI, MO, MS, MT, NB, ND,

NH, NJ, NM, NV, NY, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WA, WV, WY) and Mexico (Map 5 A)

- Abdomen pale orange, with golden microtomentum forming faint, irregular medial stripe; tergites 2-3 not generally brighter orange than tg-4-6; abdomen covered in long black setae, somewhat bushy; wing clear, or if not, only slightly yellowed . . . ***Z. reclusum* Banks**

Primarily western with scattered records in the east: Canada (ON), USA (AL, AZ, CA, CO, IA, KS, MA, MD, MI, MS, NY, OK, OR, TX, WY) and Mexico (Map 4 A)

- 22 Frontal vitta usually wider than narrow (variable), generally paler orangey-brown, somewhat patchy, reddish brown; wing generally clear; legs tend to be pale brown, yellow; tarsomeres same colour with tm-5 slightly darker brown.

. . . ***Z. bilineata* Van Duzze, 1927**

Western Canada (AB, BC, MB, SK), USA (AZ, CA, CO, ID, KS, NE, NV, ND, NM, OK, TX, UT, WY) and Mexico with four outliers in the east: Canada (ON) and USA (MD, MS, VA) (Map 4 A)

Frontal vitta usually more narrow than wide (variable), generally darker, patchy reddish-brown; wing with very slight smoky brown hue; legs tend to be brown; tarsomeres same colour with tm-5 distinctly darker brown.

. . . ***Z. meigeni* nov. sp. Burt & Skevington**

Primarily western Canada (AB, BC, MB, SK), USA (AZ, CA, CO, IA, KS, NV, NM, TX, UT, WY) and Mexico with eastern outliers in Canada (ON) and USA (ME, MS) (Map 4 A)

- 23*** *Zodion americanum* group: **Note.** *Beyond this section the reliability of identification to species is vastly increased with examination of genitalia (males), and reference to distribution.*
- 23 Abdomen with few black setae, appearing sparsely, though more setae are present on tergites 5-7 than on 1-4 (Fig. 20 C-D) . . . 26
- Abdomen with many long, black setae, appearing quite bushy (Fig. 20 E-F) . . . 24
- 24 - Dorsal thorax distinctly very dark blue with four bare stripes of black maculation; short, black, sparse setae, usually absent from frons and genae; r_{4+5} cell open (Fig. 21 B); **Male Dissection:** posterior surstylus large, bulbous, somewhat elongated, apically rounded with a slight inward curl, without concentrated cluster of long black bristles in line with surstyli, no membranous appendage present, though exaggerated and rounded lateral protrusion present (Figs. 25 D-F) . . . ***Z. harrisi nov. sp.* Burt & Skevington**
- Western Canada (BC, SA) and USA (CA, NM, UT), with a single outlier in Canada (QC) (Map 6 C)
- Dorsal thorax lighter blue, blue-green, brown, or dark brown; short, black, sparse setae, usually present on frons and genae; posterior surstylus not as below . . . 25
- 25 Larger species (~6-7 mm); dorsal thorax bluish-green with coppery-brown tones with four bare stripes of black maculation; Central tarsomere 5 bristle (cb) at apex not as dark and long as marginal bristles; appears same as flanking bristles, also pale and thin (Fig. 20 B); wing r_{4+5} cell open (Fig. 21 C); **Male Dissection:** Posterior surstylus large, bulbous, somewhat elongated, apically somewhat

rounded, paddle-like, with a slight downward-inward curl, without concentrated cluster of long black bristles in line with surstyli, with very slight membranous appendage present, and exaggerated and pointed lateral protrusion present, forming a slight circle with anterior surstylus' forward-facing tooth (Figs. 26 D-F). . . . ***Z. nanellum* Loew**

Widespread in eastern Canada (ON, QC) and USA (GA, IL, IA, KS, ME, MD, MA, MI, MO, NJ, NY, NC, PA, VA, WV, WI) with a western outlier in USA (CO) (Map 6 A)

- Smaller species (~4-4.5 mm); dorsal thorax bluish-green with four bare stripes of black maculation; central tarsomere 5 bristle (cb) at apex as dark and long as marginal bristles (llb, rlb) (Fig. 20 A); appears thicker and darker than flanking bristles, which are pale and thin; wing r_{4+5} cell open (Fig. 21 E); **Male Dissection:** Posterior surstylus large, only slightly bulbous, rather elongated, apically somewhat pointed, with a slight inward curl, without black bristles in line with surstyli; no membranous appendage present, though exaggerated and lateral protrusions present, two knobs, poorly forming an enclosure with anterior surstylus' forward-facing teeth (Figs. 27 A-C)

. . . ***Z. hitchensi nov. sp.* Burt & Skevington**

Widespread; Canada (AB, ON, QC, SK) and USA (AZ, CO, GA, IA, KS, MD, MS, OK, SD) (Map 6 C)

- 26 Dorsal thorax distinctly very dark blue, purple, or dark purplish-blue . . . 28
- Dorsal thorax mix of blue, green and brown . . . 27

- 27 Larger species (~5-7 mm); dorsal thorax mix of blue, green and brown; pedicel of often orange, about the same as base of flagellum; short, black, sparse setae about the genae and frons, usually present; wing r_{4+5} cell open (Fig. 21 A); **Male Dissection:** Posterior surstylus elongated, pointed apically though somewhat rounded, with a slight rounded lateral protrusion forming a slight enclosure with anterior surstylus' forward-facing teeth, with a slight downward-inward curl, without concentrated cluster of long black bristles in line with surstyli, without membranous appendage, and exaggerated and pointed lateral protrusion present (Figs. 25 A-C) . . *Z. pygmaeum* Williston
- Western Canada (BC) and the United States (CA, CO, IA) (Map 6 A)
- Smaller species (~3.5-4.5 mm); dorsal thorax mix of blue, green and brown, though mainly blue; pedicel often brown, darker than base of flagellum; short, black, sparse setae about the genae and frons, usually absent; wing r_{4+5} cell open (Fig. 21 F); **Male Dissection:** Posterior surstylus very large, bulbous, somewhat elongated, apically somewhat pointed, arrow-shaped, with a slight inward curl, without concentrated cluster of long black bristles in line with surstyli, no membranous appendage present, though exaggerated and pointed lateral protrusion present, like a shark-fin, forming a circle with anterior surstylus' forward-facing tooth (Figs. 26 A-C) . . . *Z. albifacies* Van Duzee
- Southern USA (AZ, FL, GA, IN, KS, MO, MS, NC, NM, OK, TN, TX, UT) and Mexico (Map 6 A)
- 28 General size (~3.5-5 mm); dorsal thorax distinctly, very dark blue, nearly black, with a slight greenish hue usually appearing posteriorly; wing r_{4+5} cell open (Fig.

21 D); **Male Dissection:** Posterior surstylus large, only slightly bulbous, rather elongated, apically pointed, with a slight inward curl, with 1-2 very short black bristles; no membranous appendage present, though exaggerated and pointed lateral protrusion, forming a rounded enclosure with anterior surstylus' forward-facing tooth (Fig. 27 D-F) . . . ***Z. kraussi nov. sp.* Burt & Skevington**

Southeastern USA (FL, NC, OK, VA) (Map 6 B)

- General size (~4-4.5); dorsal thorax variably dark blue, dark bluish-purple, dark purple, very dark greenish-brown; collected in south-western USA; surstylus not as described above . . . 29

- 29 Dorsal thorax distinctly dark bluish-purple (variably blue, bluish-green; usually dark); pedicel often brown, darker than base of flagellum; wing r_{4+5} cell open (Fig. 21 G); **Male Dissection:** Posterior surstylus very large, bulbous, somewhat elongated, apically rounded with only a slight inward curl, with a rounded back-facing teeth which forms a circle with the forward-facing bulbous teeth of the anterior surstylus, without concentrated cluster of long black bristles in line with surstylus, no membranous appendage present, though exaggerated and rounded lateral protrusion present (Figs. 28 D-F). Southwestern United States, into northern Mexico (Map 6 C) . . . ***Z. hirsialiae nov. sp.* Burt & Skevington**
- Southwestern USA (AZ, CA, CO, NV, NM) (Map 6 C)

- Dorsal thorax distinctly, very dark blue, nearly black, or blackish-brown; Pedicel of often orange, generally the same as base of flagellum; wing r_{4+5} cell open (Fig. 21 G); **Male Dissection:** Posterior surstylus very large, bulbous, rather elongated, apically somewhat pointed, with a slight inward curl, with 1-2 black bristles in

line with surstyli; no membranous appendage present, though exaggerated and pointed lateral protrusion present, like a thumb, forming a circle with anterior surstylus' forward-facing tooth (Figs. 28 A-C). Southern United States (Arizona and New Mexico (Huachuca Mountains)) (Map 6 B)

... ***Z. dawkinsi nov. sp.* Burt & Skevington**

Southwestern USA (AZ) and Mexico (Huachuca Mountains) at high elevations (Map 6 B)

3.23 General “Group” division of *Zodion*

Zodion is a large and complex genus with a wide range of variability even within species. The genus can be divided into four basic groups based on shared morphological traits, such as general size, common patterns of microtomentum, colouration, wing venation, and in some cases the male genitalia. In his revision of *Myopa* Camras (1953) attempted to arrange species into two groups based on what he deemed “Primitive” or “Specialized” characters that helped make the group more manageable. Camras (1943, 1944) also attempted to divide *Zodion* into groups based on the obviousness of distinctly shared characters, resulting in the *obliquefasciatum* and *fulvifrons* groups. These summaries are incomplete; however, the approach has some value, especially to someone unfamiliar with the family. The present work has been given a similar treatment with the designation of the *americanum* group that is strongly supported by COI data as a distinct lineage (Figs. 40, 41). All other group designations have been abandoned due to lack of COI support and poor distinctive morphological characters. Species within the *Zodion*

americanum group are designated within the key, but all *Zodion* species are listed alphabetically within the description section.

3.24 *Zodion americanum* group

Diagnosis of the group is easily achieved via the examination of the general body shape and size (3.5-4 mm), and colouration. The generally pinched abdomen distinguishes the gestalt posteriorly, along with the striking dark and golden patterns of microtomentum (Figs. 20 C-F). The dorsal thorax is unique also, and highly variable with many intermediates, making species diagnosis difficult. The dorsal thorax can be brown, green, blue, almost black, dark or light, with faint or strikingly defined stripes (4-6) of black bare maculation (Fig. 19 D). Setae are variably long or short, and always black.

3.25 Descriptions

Z. abitus Adams, 1903

Figs. 4 B, 22 A-C, Map 3 A (■).

Synonymy

Zodion abitus Adams, 1903: 33. Type Locality: United States of America, Kansas,

Massachusetts. Type depository: syntype, SEMC.

Zodion bicolor Adams, 1903: 35. Type Locality: United States of America, Kansas. Type

depository: type, (SEMC).

Type material. Awaiting syntype of *Z. abitus* and *Z. bicolor* Adams, 1903 from SEMC.

Tentatively relied on Adams' descriptions of both types.

Material dissected. CNCD199855, CNCD199903, CNCD28515, CNCD199859, CNCD199853, CNCD28514, CNCD199854, CNCD199832, DEBU328757 (9♂).

Additional material examined. CANADA: Ontario: Belfountain, 43.794075°N

80.014302°W, 2.VI.1975, coll. D.J. McComb, DEBU1157122, (1♂ DEBU); Britannia, 45.35°N 75.783333°W, 23.VI.1947, coll. G.E. Shewell, CNCD199910, (1♀ CNC); Constance Bay, 45.483889°N 76.081111°W, 20.VI.1969, coll. P.W. Arntfield, DEBU1157140, (1♀ DEBU); Constance Lake, South March, 45.40273°N 75.976026°W, 20.VI.1966, coll. J.R. Vockeroth, CNCD28515, (1♂ CNC); Constance Lake, South March, 45.408992°N 75.979719°W, 16.VI.1965, 20.VI.1966, coll. J.R. Vockeroth, CNCD199859, CNCD199862, (1♂ 1♀ CNC); Elgin County, Newport Forest, ~3 km SW of Wardsville, 42.631111°N 81.778611°W, 30.VII.2009, coll. S.A. Marshall, DEBU315925, (1♂ DEBU); Grand Bend, 43.312271°N 81.756729°W, 12.VII.1939, coll. G.E. Shewell, CNCD200427, (1♂ CNC); Guelph, 43.544805°N 80.248167°W, pan trap, 1.VIII.1978, 14.VI.1975, 16.VI.1978, 19.VI.1978, 26.V.1977, 26.VII.1978, 3.V.1977, 6.VI.1978, 9.VI.1978, coll. Brenda Warner, G.J. Umphrey, J.M. Heraty, Karen M. Ralph, Kevin Barber, Kevin N. Barber, M.J. Sharkey, M.L.B. Farrell, W.A. Attwater, DEBU1157123, DEBU1157124, DEBU1157125, DEBU1157126, DEBU1157127, DEBU1157128, DEBU1157129, DEBU1157131, DEBU1157132, DEBU1157133, DEBU1157134, DEBU1157135, DEBU1157136, DEBU1157137, DEBU1157138, DEBU1157142, (10♂ 5♀ 1ex DEBU); Jordan, 43.133333°N 79.366667°W, 11.VI.1919, 13.VI.1915, coll. W.A. Ross, CNCD199826, CNCD200424, (2♂ CNC); Lambton County, Port Franks, Watson Property near L-lake, 43.216667°N 81.9°W, 26.VIII.1996, coll. J. Skevington, DEBU1157130, (1ex DEBU); Leamington, 42.083333°N 82.55°W, 1.VI.1937, 9.VI.1929, coll. G.S. Walley, L.J. Milne, CNCD199906, CNCD199909, (2♀ CNC); Low Bush, Lake Abitibi, 48.916667°N 80.133333°W, 20.VII.1925, 21.VII.1925, 23.VII.1925, 25.VII.1925, coll. N.K. Bigelow, CNCD200420, CNCD200425, CNCD200429, CNCD200481, (3♂ 1♀ CNC); Manitoulin Distr., Manitoulin Island., Misery Bay Prov. Nat. Res., 45.5728°N 82.4458°W, alvar, 27.V-3.VI.2010, coll. Marshal et al., genitalia dissected, DEBU328757 (1♂ DEBU); Marmora, 44.48°N 77.68°W, Malaise trap, 12.VI.1952, 25.VII.1952, coll. C. Boyle, J.C. Mitchell,

CNCD199841, CNCD199897, (1♂ 1♀ CNC); Mer Bleu, 5 Miles East of Ottawa, 45.40331°N 75.5083°W, Malaise trap, 21.VI.1966, coll. D.D. Munroe, CNCD199861, (1♀ CNC); Milton, 43.5°N 79.916445°W, 4.VI.1976, coll. E.A. Innes, DEBU1157139, (1♀ DEBU); Ottawa, Fletcher Wildlife Garden, 45.386°N 75.704°W, 14.VI.1997, coll. Fenja Brodo, CNCD200434, (1♀ CNC); Ottawa, 45.42153°N 75.697193°W, 10.VI.1942, 26.VI.1903, 3.VI.1958, coll., J.R. Vockeroth, W. Metcalfe, CNCD199864, CNCD200535, (2♀ CNC); Point Pelee, 41.956157°N 82.514529°W, 27.V.1925, coll. G.S. Walley, CNCD199827, (1ex CNC); Port Hope, 43.9492°N 78.2935°W, 25.VIII.1925, coll. N.K. Bigelow, CNCD200480, (1♀ CNC); River Canard, 42.188354°N 83.092455°W, 10.VII.1977, coll. W.A. Attwater, DEBU1157141, (1♀ DEBU); Sandbanks Park, near Picton, 43.905059°N 77.265953°W, 1.VII.1970, coll. J.F. McAlpine, CNCD199856, CNCD199865, (2♀ CNC); Simcoe, 42.833333°N 80.3°W, 29.V.1939, coll. G.E. Shewell, CNCD199843, (1♀ CNC); Smith's Bay, Near Picton, 44.018826°N 77.124755°W, 4.VII.1970, coll. J.F. McAlpine, CNCD199848, (1♀ CNC); Strathroy, 42.96389°N 81.61806°W, 1.VI.1916, coll. A.L. Melander, USNM.ENT1024284, (1♂ USNM); **Quebec**: Abbotsford, 45.436724°N 72.89035°W, 24.VI.1937, coll. G. Shewell, CNCD199863, (1♀ CNC); Woburn, 45.386361°N 70.864441°W, 19.VI.1923, coll. C.H. Curran, CNCD200419, (1♂ CNC); **Saskatchewan**: Estevan, 49.139167°N 102.986111°W, 23.VII.1958, coll. A. & J. Brooks, CNCD199846, (1ex CNC); Val Marie, 49.25°N 107.733333°W, 11.VI.1955, coll. J.R. Vockeroth, CNCD200924, (1♂ CNC); **COSTA RICA**: JSS18225, (1ex CNC); **MEXICO**: **Durango**: 5 miles West of Durango, 24.033333°N 104.666667°W, 1981m, sweeping, 14.VII.1964, coll. J.F. McAlpine, CNCD199867, CNCD199868, (2♂ CNC); **U.S.A.**: **Arizona**: Kirkland, 34.417525°N 112.712111°W, 19.VIII.1919, coll. Bishopp, USNM.ENT1024301, (1♂ USNM); **Colorado**: 5 miles South of Boulder, 39.942236°N 105.270721°W, 1768m, 21-27.VI.1961, coll. W.R.M. Mason, CNCD89261, (1♂ MZUL); Boulder, 4 miles Northwest, 40.013374°N 105.317523°W, 2103m, mountain meadow in ponderosa pine, 17.VI.1961, coll. C.H. Mann, CNCD199905, (1♂ CNC); Boulder, 4.5 Miles North, 40.015001°N 105.270671°W,

1676m, 12.VI.1961, 13.VI.1961, coll. B.H. Poole, C.H. Mann, CNCN199858, CNCN199907, CNCN199908, (2♂ 1♀ CNC); Boulder, 5 miles South, 39.936516°N 105.678611°W, 1768m, 19.VI.1961, 21-27.VI.1961, coll. W.R.M. Mason, CNCN199844, CNCN199852, CNCN199900, CNCN199901, CNCN199902, CNCN199903, CNCN199904, (6♂ 1♀ CNC); 7.IV.1923, CNCN199855, (1♂ CNC); Boulder, Flagstaff Canyon, 40.°N 105.266667°W, 1768m, 10.VI.1961, coll. C.H. Mann, CNCN199851, (1♂ CNC); Boulder, 40.014986°N 105.270546°W, 1676m, 5.VI.1961, 9.VI.1961, coll. B.H. Poole, CNCN199836, CNCN199839, CNCN199853, (3♂ CNC); Central State Park, 38.8322°N 105.5544°W, 3048m, 22.VI.1961, coll. B. Poole, CNCN199837, (1♂ CNC); Doolittle Ranch, Mount Evans, 39.675739°N 105.601348°W, 2987m, 17.VII.1961, coll. W.R.M. Mason, CNCN200515, (1♀ CNC); **Connecticut**: Stamford, 41.052713°N 73.541039°W, 19.VI.1930, coll. B.T.R. Lab Col., USNM.ENT1024298, (1♂ USNM); **Georgia**: Pine Mountain, Rabun County, 33.675951°N 84.11491°W, 427m, 1.V.1957, coll. W.R.M. Mason, CNCN199832, (1♂ CNC); **Illinois**: Carlinville, 39.27977°N 89.881766°W, coll. A.L. Melander, USNM.ENT1024283, USNM.ENT1024296, (1♂ 1♀ USNM); **Indiana**: La Fayette, 40.418145°N 86.884201°W, 8.VI.1915, coll. J.M. Aldrich, USNM.ENT1024289, (1♀ USNM); **Iowa**: Ames, 42.033333°N 93.616667°W, 15.VII.1923, 7.IV.1923, CNCN199854, CNCN199857, (2♂ CNC); **Kansas**: Pottawatomie County; 12 mi. W Wamengo, 39.196024°N 96.515862°W, 10.VII.1966, coll. F. Hevel, USNM.ENT1024308, (1♀ USNM); Pottawatomie County; 7 mi. W Wamengo, 39.205896°N 96.424186°W, 16.V.1967, 17.V.1967, coll. F. Hevel, USNM.ENT1024309, USNM.ENT1024310, (1♂ 1♀ USNM); **Kentucky**: Ashcamp, 37.266111°N 82.435°W, sweeping, 2.VI.1965, coll. J.G. Chillcott, CNCN199898, (1♀ CNC); **Massachusetts**: Beverly, 42.558426°N 70.880058°W, 10.VI.1969, USNM.ENT1024285, (1ex USNM); Woods Hole, 41.530302°N 70.667905°W, 6.VI.1923, VIII.1923, USNM.ENT1027013, USNM.ENT1027015, (1♂ 1♀ USNM); **Michigan**: Washtenaw Co., 19.VI.1927, coll. N.K. Bigelow, USNM.ENT1024306, (1♂ USNM); **Mississippi**: Agricultural College, 33.455537°N 88.790429°W, 16.IV.1922, coll. Smith, R.H., CNCN199849, (1♂ CNC); Lafayette County,

34.4°N 89.5°W, III-VI.1943, III.1953-VI.1943, coll. F.M. Hull, CNCDD199879, CNCDD199880, CNCDD199881, CNCDD199882, CNCDD199896, (3♂ 2♀ CNC); Oxford, 34.366495°N 89.519248°W, V.1940, coll. F.M. Hull, CNCDD199883, (1♀ CNC); Starkville, 40.131374°N 105.497776°W, 9.VI.1921, coll. H.W. Allen, CNCDD199885, (1♀ CNC); **Missouri**: Agricultural College, 30.8°N 89.683333°W, 24.IV.1922, CNCDD199877, (1♀ CNC); Columbia, 38.951705°N 92.334072°W, Malaise trap, 19.VI.1961, 30.VI.1967, 31.VI.1967, coll. F.D. Parker, USNM.ENT1024292, USNM.ENT1024293, USNM.ENT1024294, USNM.ENT1024295, (2♂ 2♀ USNM); **New Hampshire**: White Mountains, 44.271°N 71.305°W, coll. Morrison, USNM.ENT1024290, (1♂ USNM); **New Jersey**: USNM.ENT1024300, (1♂ USNM); **New Mexico**: Desert Near Cliff, 32.928889°N 108.591944°W, 1365m, 15.VIII.2007, coll. J. Skevington, JSS17352, (1♀ CNC); Lordsburg, 32.348136°N 108.709262°W, 1.V.1942, coll. A.L. Melander, USNM.ENT1024305, (1♂ USNM); Mesilla Park, 32.276067°N 106.766688°W, 17.IX, USNM.ENT1024291, (1♀ USNM); **New York**: Corlear Bay L *Champia*, 44.483961°N 73.418207°W, VI.1989, USNM.ENT1024287, (1♂ USNM); Ithaca, 42.444235°N 76.5°W, coll. R.C. Shannon, USNM.ENT1024286, (1♂ USNM); Keeseville, 44.505046°N 73.480135°W, 2.VI.1918, coll. A.K. Fisher, USNM.ENT1024288, (1♂ USNM); Lake Oeorga George, 43.571739°N 73.605679°W, 26.VII.1929, coll. A.L. Melander, USNM.ENT1024313, (1♂ USNM); Mount Hurricane, Essex County, 44.233601°N 73.708728°W, VI.1939, coll. R.C. Shannon, USNM.ENT1024430, (1♂ USNM); **Ohio**: Columbus, 39.983333°N 82.983333°W, 21.V.1923, 24.V.1923, 27.V.1923, 30.V.1923, CNCDD199847, CNCDD199873, CNCDD199874, CNCDD199875, CNCDD199884, CNCDD199886, CNCDD199888, CNCDD199889, CNCDD199891, CNCDD199892, CNCDD199894, (1♂ 9♀ 1ex CNC); **Oklahoma**: Caddo Co. 5 mi. W. Albert, 35.233115°N 98.500753°W, 31.V.1979, coll. R.J. McGinley, USNM.ENT1024311, (1ex USNM); **Pennsylvania**: Ralston, Lycoming County, 41.506°N 76.954°W, 8.VI.1962, coll. J.G. Chillcott, CNCDD199838, (1♂ CNC); **South Dakota**: Flynn Creek, 8 miles North of Pringle, 43.713915°N 103.578075°W, 1646m, Malaise trap, 8-9.VII.1961, coll. H. & A. Howden,

CNCD199899, (1♀ CNC); **Utah:** Beryl, 37.895869°N 113.661227°W, 24.IX.1957, coll. Knowlton, USNM.ENT1024297, (1♂ USNM); Emery County, 0.5 miles East of Little Gilson Bt., 38.592479°N 110.594188°W, 27.VIII.1985, coll. F.D. Parker, JSS28944, (1♂ LACM); Emery County, 16 miles North of Hanksville, 38.578893°N 110.598201°W, 18.IX.1980, coll. Hanson & Knowlton, JSS28948, (1♂ LACM); Emery County, 2 air miles West Little Gilson Butte, 38.58147°N 110.654849°W, 1554m, 15-17.IX.1980, JSS28929, (1♀ LACM); Emery County, California Cyn Canyon, San Rafael Swell, 38.679243°N 110.673884°W, 1524m, 7.VI.1982, coll. T.L./R.T. Griswold, JSS28923, (1♂ LACM); Emery County, Mollys Castle Trnoff Turnoff, 2 miles South Gilson Bt., 38.583079°N 110.70983°W, on Eriogonum, 28.VIII.1985, JSS28922, (1♀ LACM); **Virginia:** Wardell, Tazewell Co., 37.033199°N 81.797126°W, 20.V.1965, coll. J.G. Chillcott, CNCD28514, (1♂ CNC); **Washington:** Clarkston, 46.416352°N 117.045618°W, 3.IX.1922, 8.V.1924, coll. V. Argo, USNM.ENT1024302, USNM.ENT1024307, (2♂ USNM); Walla Walla, 46.05°N 118.333333°W, 25.VI.1924, coll. Virgil Argo, USNM.ENT1024299, (1♂ USNM); Wawawai, 46.636764°N 117.37699°W, 20.V.1911, USNM.ENT1024312, (1♀ USNM); **Wyoming:** Evanston, 41.263333°N 110.964722°W, 27.VII.1959, CNCD199895, (1♂ CNC); Yellowstone National Park, Thumb Station, 44.415842°N 110.573489°W, 16.VII.1923, 20.VII.1924, coll. A.L. Melander, USNM.ENT1024303, USNM.ENT1024304, (1♂ 1♀ USNM).

Diagnosis. The legs are distinctly two-toned dark and light brown; gena tends to be sparsely covered in short black setae; usually with only a single black bristle about cervical sclerite; r_{4+5} cell closed, often with slight petiole (Fig. 4 B).

Description. Male. Body length (including antennae): ~5-6.5 mm.

Head. Antennae pale yellowish-orange with variable presence of light dusting of silverish-white microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum about half length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina pale yellow with light dusting of silvery

microtomentum; frons and gena pale yellow with sparse black setae; frontal vitta dull yellow above scape; gradually brown about ocellar triangle, with very thin line of silver microtomentum along lateral margins above eyes, with several black setae; ocellar triangle somewhat shiny brown to black with two black forward-facing bristles, surrounded by black setae; occiput and postgena black with faint pale grayish-brown microtomentum with black bristles; sometimes postgena with pale bristles near gena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered in microtomentum; variably gray, grayish-brown, or grayish-blue microtomentum, with presence of bare black stripes of varying lengths; gray, grayish-brown scuta tend to have six short, broken stripes that never extend length of dorsal thorax; grayish-blue scutum tend to have four short, broken stripes which never extend length of dorsal thorax; sometimes two stripes are present at margins though very faint and broken up; dorsal thorax regularly covered with black setae, with longer bristles at lateral margins along notopleuron; scutellum dull, mainly covered in microtomentum with several long black setae; lateral thorax mainly dull black or dark brown with microtomentum dusting same colour as dorsum; katepisternum with long black bristles; usually only one black bristle at cervical sclerite.

Legs. Coxae brown with dusting of microtomentum with black setae; front coxa generally with fewer setae; front femur usually darkest area of all legs; legs covered in a very light dusting of silver microtomentum, patchy; mid and hind femora light brown with darker brown patches dorsally with many black setae; tibia light brown with dark brown patches with many short black setae; posterior distal area of front and hind tibia with short, concentrated patch of black setae; tarsomeres brownish-yellow with short

black setae; posterior area of tarsomere-1 tends to be concentrated with short black setae; tarsi brownish-yellow with black tips with yellow pulvilli.

Wing. Membrane clear with slight yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell closed (Fig. 4 B).

Abdomen. Tergite-1 (tg-1) dull brown, with lateral tufts of short black setae; tergite-2 brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3 dull dark brown with lateral grayish-brown microtomentum; tg-4-6 mainly covered in light grayish-brown microtomentum; tg-2-6 with very thin brown band, slightly glossy, at posterior edge; abdomen sparsely covered in short black setae.

Male Genitalia. (Figs. 22 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, truncate, with slight forward and back-facing tooth or point, with short, fine setae, distally; posterior surstylus somewhat elongated, slightly pointed and narrow with a slight inward curl, with concentrated cluster of long black bristles in line with surstylus, no membranous appendage present; hypandrium Y-shaped, elongate with a rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus somewhat small, generally pointed, arrow-shaped with verticle pattern-lines of tomentum; with medial and some lateral sclerotization; phallapodeme elongated and slightly curled and pointed with

short, faint, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with concentrated bristle field which extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. Unknown.

Distribution. Map 3 A (■). Widespread throughout N. America except the west coast along the western side of the mountains.

Habitat, plant association. Meadows, hilltops and slopes; found on *Eriogonum* Michaux.

Remarks. Emergence March through September, peaking in June. Attempts were made to obtain COI but all have failed. Fresh material is required.

***Z. albifacies* Van Duzee, 1927**

Figs. (26 A-C, Fig. 19 D, Fig. 4 A), Map 6 A (●).

Synonymy

Zodion albifacies Van Duzee, 1927: 588. Type locality: United States of America, Arizona:

Baboquivari Mountains. Type depository: type, CAS.

Note. *Z. albifacies* was synonymized under the South American (Uruguay) species, *Z. americanum* Wiedemann, 1830, but this is surely in error given the type locality of both species. Until the holotype for *Z. americanum* can be obtained from NMW we will not be

able to verify this synonymy, though the original descriptions from Van Duzee and Wiedemann provide some confidence in their division.

Type material. Awaiting Type *Z. albifacies* Van Duzee, 1927; ♀, USA: Arizona: Baboquivari Mountains, (CAS). Relied on type locality and Van Duzee's initial description (1927) to associate specimens with this species.

Material dissected. CNCN199928, CNCN199932, CNCN200053, CNCN200054, CNCN200019 (5♂).

Additional material examined. Mexico: Oaxaca: 12.5 km NE of Oaxaca, Hwy 175, 11-12.VIII.1986, coll. J.E. & W.M. O'Hara, genitalia dissected, CNCN200054 (1♂ CNC); Sinaloa: 15 miles West of El Palmito, elev. 1524m, 20.VII.1964, coll. W.R.M. Mason, genitalia dissected, CNCN200053 (1♂ CNC); **U.S.A.: Arizona:** 4 miles West of Box Canyon, Pima County, 31.786316°N 110.823116°W, *Gossypium thurberi*, 25.VIII.1977, coll. R.W. Brooks, CNCN249413, (1♂ UCDC); Chiricahua Mountains, Hilltop above John Hand Campground, 31.876667°N 109.218056°W, 1870m, open oak forest, grazed hilltop, 11.VIII.2007, coll. J. Skevington, CNCN9842, (1♂ CNC); Highway 366, east side of Graham Mountains, 32.69°N 109.751667°W, 1158m, 28.V.2013, coll. J.E. O'Hara, CNCN224756, CNCN224758, (2♂ CNC); Sierra Vista, Huachuca Mountains, 31.545491°N 110.27291°W, VI.1965, 1-20.X.1965, coll. R.F. Sternitzky, CNCN199928, CNCN199932 (2♂ CNC); SWRS, Portal, Cochise County, 31.883296°N 109.20615°W, 3.VIII.1966, coll. D.R. Miller, CNCN249399, (1♂ UCDC); **Florida:** Seminole Co., 19.VII.1929, coll. C. Nelson, USNM.ENT1024096, (1♂ USNM); **Georgia:** Rabun Bald, Rabun County, 34.964827°N 83.298647°W, 1433m, 16.VII.1957, coll. W.R. Richards, CNCN200002, (1♀ CNC); Rabun Bald, 9.VIII.1957, coll. W.R. Richards, CNCN200001, (1♀ CNC); Warwoman Creek, Rabun County, 34.891552°N 83.292908°W, 457m, 26.VII.1957, coll. J.G. Chillcott, CNCN200006, (1♀ CNC); **Indiana:** La Fayette, 40.418145°N 86.884201°W, 21.VI.1916, 23.X, 24.VIII, coll. J.M. Aldrich, USNM.ENT1024051, USNM.ENT1024053,

USNM.ENT1024055, (3♂ USNM); **Kansas**: Finney County, 19.5 miles West of Kalvesta, 38.055556°N 100.641667°W, 6.VI.2008, coll. G.F. Hevel, USNM.ENT1027158, USNM.ENT1027159, (2♂ USNM); Riley Co., 4.IX.1967, coll. G.F. Hevel, USNM.ENT915755, (1♂ USNM); **Mississippi**: Agricultural College, 33.455537°N 88.790429°W, 23.IV.1922, CNCN199912, (1♂ CNC); Lafayette County, 34.4°N 89.5°W, III-VI.1943, V.1940, coll. F.M. Hull, CNCN199916, CNCN199923, (2♂ CNC); 34.400000°N 89.500000°W, III-VI.1943, coll. F.M. Hull, CNCN199926, (1♂ CNC); Oxford, 34.366495°N 89.519248°W, V.1940, coll. F.M. Hull, CNCN199913, CNCN199919, CNCN199924, CNCN199991, (4♂ CNC); **Missouri**: Williamsville, 36.972491°N 90.548333°W, Malaise trap, 22.VII.1969, X-XI.1968, coll. J.T. Becker, CNCN199940, CNCN199986, (2♀ CNC); **New Mexico**: Guadalupe Mts Mountains, 9 miles Southwest Jct Junction Hwy Highway 285 & 137, Eddy County, 32.452754°N 104.499708°W, Baccharis, 26.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCN249434, (1♂ UCDC); **North Carolina**: Base of Wayah Bald, 35.179761°N 83.56147°W, 10.VIII.1957, coll. W.R. Richards, CNCN200008, (1♀ CNC); Highlands, 35.05°N 83.198859°W, 15.VII.1957, coll. W.R. Richards, CNCN200005, (1♂ CNC); Wayah Bald, Macon County, 35.179761°N 83.56147°W, 1615m, 10.VIII.1957, 6.VII.1957, coll. J.G. Chillcott, W.R.M. Mason, CNCN200000, CNCN200009, (1♂ 1♀ CNC); 1798m, 6.VII.1957, coll. J.R. Vockeroth, CNCN200022, (1♀ CNC); **Oklahoma**: Lake Texoma near Willis, 33.881992°N 96.827409°W, VI.1965, coll. R.M. Bohart, CNCN249384, CNCN249385, (2♂ UCDC); Lake Texoma, 2 miles East of Willis, 33.88245°N 96.809728°W, VII.1965, coll. R.M. Bohart, CNCN249387, (1♂ UCDC); **Tennessee**: Great Smoky Mountain National Park, 35.634444°N 83.7475°W, 2.VII.1957, coll. W.R.M. Mason, CNCN200004, (1♂ CNC); **Texas**: Big Bend National Park, Chisos Mountains Basin, 29.275°N 103.30417°W, 1829m, 11.V.1959, coll. J.F. McAlpine, CNCN199970, (1♀ CNC); Big Bend National Park, Nine Point Draw, 29.612468°N 103.136436°W, 914m, 15.V.1959, coll. J.F. McAlpine, CNCN199955, (1♂ CNC); **Utah**: 24 miles S of Hanksville, Henry Mountains, elev. 2286m, 18.VII.1968, coll. J.E.H. Martin, genitalia

dissected, CNCD200019 (1♂ CNC).

Diagnosis. Distinctly small (3.5-4.5 mm, rarely larger); frontal vitta with brown microtomentum; scutum dark blue with four black stripes; wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~3.5-4.5 mm.

Head. Antennae mainly dark brown with light dusting of silverish-white microtomentum; scape dark brown; flagellum orange with dark brown patch distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and gena yellow with sparse pale or black setae; frontal vitta covered with dull brown microtomentum with very thin line of silver microtomentum along lateral margins above eyes, with several long black setae; ocellar triangle with dull brown microtomentum with many black forward-facing bristles; occiput and postgena brownish-black with grayish-blue microtomentum with black bristles; black patch of microtomentum lining eye when viewed dorsally; palps brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum dark blue with four black stripes that extend just beyond the transscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum dull blue and brown, with four long black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 1-4 long black bristles; one black bristle at cervical sclerite.

Legs. Hind and mid coxae brown with black setae; front coxa brown with variable presence of setae; hind coxa with faint silver microtomentum; legs mainly unicolourous brown, though slightly paler at knees, sparsely covered in black setae; posterior distal area

of hind tibia with short, concentrated patch of black setae; tarsomeres brownish-yellow with short black setae; tarsomere-1 tends to be paler than tm-5; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. (Figs. 20 C-F) Tergite-1 (tg-1) dull brown, with lateral tufts of short black setae; tg-2 brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3 dull brown with lateral golden-brown microtomentum forming obliquely a triangular pattern dorsally; tg-4-5 mainly covered in light golden-brown microtomentum, except for 2 small dull brown triangular spots appearing dorsally, divided by microtomentum; tg-6 covered in golden-brown microtomentum; abdomen sparsely covered in short black setae.

Male Genitalia (Figs. 26 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow and conical, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstyli short, truncate, with very sharp forward and slightly rounded back-facing teeth or points, with short, fine setae, distally; sharp forward-facing tooth forms circle against posterior surstylus back-facing lateral protrusion; posterior surstylus very large, bulbous, somewhat elongated, apically somewhat pointed, arrow-shaped, with a slight inward curl, without concentrated cluster of long black bristles in line with surstyli, no membranous appendage present, though

exaggerated and pointed lateral protrusion present, like a shark-fin, forming a circle with anterior surstylus forward-facing tooth; hypandrium Y-shaped, elongate with a very sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus small, narrow, pointed, dagger-shaped covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply curled and pointed without short, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed and apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. Unknown.

Distribution. Map 6 A (●). Mainly southern USA, and expanding northward along the east coast into southern Canada.

Habitat. Found in a variety of habitats and elevations as high as 570 m, in open oak forests, rock fissures, grassy areas, on *Baccharis* Linnaeus, horehound, *Gossypium thurberi* Todd, *Sphaeralcea angustifolia* (Cavanilles) G. Don, and flowers of *Prunus* sp Linnaeus.

Remarks. Emergence March through October, peaking in May, with a smaller second emergence in July. Intraspecific COI pairwise distance variation: 0.4%. Interspecific

variation with: *Z. hirsaliae*: 16.0-18.0%; *Z. nanellum*: 14-15%; *Z. hitchensi*: 16.0-17.0%;
Z. harrisi: 12.0-13.0%; *Z. pygmaeum*: 15.0%.

***Z. alexanderi* Burt & Skevington, 2015**

Figs. (22 D-G), Map 3 B (●).

Type material. Holotype; ♂, CANADA: Ontario: Ottawa; 10.V.1942., coll. A. Brooks; abdomen dissected; CNCN199834 (CNCN).

Paratype series. CANADA: Alberta: Blackburn, 45.432992°N 75.563443°W, 16.VI.1941, coll. G.A. Hobbs, CNCN199830, (1♂ CNC); **British Columbia:** Lethbridge, 49.7°N 112.816667°W, 4.VII.1928, coll. G.F. Manson, CNCN199828, (1♂ CNC); Lillooet, 50.686751°N 121.937581°W, 21.VI.1917, coll. J.D. Tothill, CNCN200454, (1♂ CNC); **Manitoba:** 3 miles South of Shilo, 49.762488°N 99.639657°W, 30.VI.1958, coll. R.B. Madge, CNCN200654, (1♂ CNC); **Ontario:** Jordan, 43.133333°N 79.366667°W, 27.VI.1920, coll. H. Curran, CNCN199840, (1♂ CNC); **U.S.A.: California:** Sagehen Creek, Nevada County, 39.432117°N 120.241231°W, 8.VII.1968, coll. R.L. Brumley, CNCN249139, (1♂ UCDC); Yuba Pass, Sierra County, 39.323061°N 120.599169°W, 6.VII.1976, coll. M.A. Rabel, CNCN249188, (1♂ UCDC); **Missouri:** Columbia, 38.951706°N 92.334072°W, 15.V.1970, coll. F.D. Parker, CNCN249199, (1♀ UCDC); **Ohio:** Columbus, 39.590°N 82.590°W, 24.V.1923, coll. F.M. Hull, genitalia dissected, CNCN199890 (1♂ CNC); **Wyoming:** 12 miles South of Green River, Sweetwater County, 41.382758°N 109.523122°W, 28.VII.1969, coll. R.M. Bohart, CNCN250050, (1♂ UCDC); Mt Mount View, Utina County, 41.268797°N 110.339633°W, 17.VII.1961, coll. G.F. Knowlton,

CNCD249186, (1♂ UCDC).

Material dissected. CNCD200654, CNCD200454, CNCD199830, CNCD199828, CNCD199890, CNCD199840, CNCD199834 (7♂).

Diagnosis. The legs are nearly unicolourous dark or light brown; gena tends to be sparsely covered in short black setae; tends to have only a single black bristle about cervical sclerite but can have up to three; r_{4+5} cell open (Fig. 4 A).

Description. Male. Body length (including antennae): ~4.5-5.5 mm.

Head. Antennae pale yellowish-orange with variable presence of light dusting of silverish-white microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina pale yellow with light dusting of silvery microtomentum; frons and gena pale yellow with sparse black setae; frontal vitta dull yellow above scape; gradually darker yellow to brownish-yellow about ocellar triangle, with very thin line of silver microtomentum along lateral margins above eyes, with several black setae; ocellar triangle somewhat shiny brown to black with four black forward-facing bristles, surrounded by black setae; occiput and postgena black with faint pale grayish-brown microtomentum with black bristles; sometimes postgena with pale bristles near gena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered in microtomentum; variably gray, grayish-green, grayish-brown or grayish-blue microtomentum; sometimes distinctly bluish, all with presence of bare black stripes of varying lengths; gray, grayish-green, or grayish-brown scuta tend to have six short, broken stripes that never extend length of dorsal thorax;

grayish-blue scutum tend to have four short, broken stripes which never extend length of dorsal thorax; sometimes two stripes are present at margins though very faint and broken up; distinctly blue scutum tends to have two wider black stripes on either side of thinner medial stripe that extends almost full length of dorsum; dorsal thorax regularly covered with black setae, with longer bristles at lateral margins along notopleuron and postalar callus; scutellum dull, mainly covered in microtomentum with several long black setae; lateral thorax mainly dull black or dark brown with microtomentum dusting same colour as dorsum; katepisternum with long black bristles; between 1-3 black bristle at cervical sclerite, though usually only one.

Legs. Coxae brown with dusting of microtomentum with black setae; front coxa generally with fewer setae; legs covered in a very light dusting of silver microtomentum; patchy; legs overall, vary from dark brown, brownish-red, to light brown; femora darker brown with small patches of lighter brown distally, usually at knees, with many black setae; tibia nearly unicolourous brown with variable presence of only slightly lighter brown areas basally with many short black setae; posterior distal area of front and hind tibia with short, concentrated patch of black setae; tarsomeres brownish-yellow with short black setae; posterior area of tarsomere-1 tends to be concentrated with short black setae; tarsi brownish-yellow with black tips with yellow pulvilli.

Wing. Membrane clear with slight yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull “chocolate” brown, with lateral tufts of short black setae; tg-2 brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum

appearing laterally; tg-3 dull brown with lateral golden-brown microtomentum; tg-4-6 mainly covered in light golden-brown microtomentum; tg-2-6 with very thin brown band, slightly glossy, at posterior edge; abdomen sparsely covered in short black setae.

Post-abdomen

Terminalia. Fig. 22 D-G. Epandrium shiny, and variably light or darker brown with sparse long black setae; the posterior surstyli are often exposed, and appear as large flat paddles with a notched or claw-like tooth.

Genitalia. (Fig. 22 D-G) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in very long, thick, black setae; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum, somewhat shortened; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, triangular-shaped, pointed, with short, fine setae, distally; posterior surstylus large, slightly pointed, with a slight inward curl, with concentrated cluster of thick, black bristles in line with and longer than surstylus, with exaggerated membranous appendage present, appearing somewhat like a lobster-claw; hypandrium Y-shaped, elongate with a rounded, protruding, sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum; distiphallus somewhat small, generally pointed, arrow-shaped with verticle pattern-lines of tomentum; with medial and some lateral sclerotization; phallapodeme elongated and slightly curled and truncated at apex, with short, faint, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with bristle field which extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Etymology. Patronym for Alexander Skevington, a burgeoning naturalist and insect collecting enthusiast, and son of Jeffrey (second author, committee supervisor) and Angela Skevington.

Hosts. Unknown.

Distribution. Map 3 B (●). Widespread, with a somewhat disjunct distribution.

Habitat. Unknown

Remarks. Intraspecific COI pairwise distance variation: 0.4%. Interspecific variation with *Z. cinereiventris*: 0.4-2.8%.

***Z. anale* Kröber, 1915**

Figs. (23 D-F, Fig. 19 A), Map 3 B (■).

Synonymy

Zodion anale Kröber, 1915: 113. Type locality: Chile. Concepcion. Type depository: syntype, ZMHU (destroyed).

Zodion peruvianum Kröber, 1915: 115. Type locality: Peru, Sullana. Type depository: type (♂) MCSNM.

Note. The *Zodion anale* syntype have apparently been destroyed. Apparently *Z. anale* and *Z. analis* refer to the same specimen, and *Z. analis* is simply a spelling mistake.

Type material. Syntypes of *Zodion anale* Kröber, 1915 is presumed destroyed (ZMUH).

Jens-Hermann Stuke, a European conopid taxonomist has indicated that the type was

deposited at HNHM and not ZMUH (pers. comm.), and that much of the collection was destroyed during the Second World War including valuable type material. Due to a variety of discrepancies regarding the deposition of syntypes of *Zodion anale* further investigation is required before a Neotype or Lectotype can be designated.

Material dissected. CNC195568, CNC195833 (2♂).

Additional material examined. **BRAZIL:** Nova Teutonia, 27.183333°S 52.383333°W, 300-500m, XI.1968, coll. Fritz Plaumann, CNC195568, (1♂ CNC); **CANADA: Prince Edward Island:** Souris, 46.355004°N, 62.251830°W, VII.1967, coll. N.L.H. Krauss, USNM.ENT1024782, (1♂ USNM); **CHILE:** Angol, 37.8°S 72.7167°W, 28.XI.1927, 5.XI.1928, USNM.ENT1024273, USNM.ENT1024274, (2♂ USNM); **COSTA RICA:** Higuito, San Mateo, 9.946389°N 84.549167°W, coll. Pablo Schild, USNM.ENT1024275, (1♀ USNM); JSS18203, JSS18204, (2ex CNC); **GUATEMALA:** Gualan, 15.11824°N 89.356356°W, coll. W.P. Cockerell, USNM.ENT1024276, (1♂ USNM); Yepocapa, 14.501634°N 90.953289°W, V.1948, coll. H.T. Dalmat, USNM.ENT1024277, (1♀ USNM); **MEXICO: Jalisco:** Teocaltiche, 21.436236°N 102.57493°W, 21.VIII.1970, coll. B. Villegas, CNC195568, (1♂ UCDC); **Morelos:** Jiotepec Jiutepec, Morelos, 18.881013°N 99.175954°W, 2.XI.1969, coll. D. Kritsch, CNC195568, (1♂ CNC); Chiapas Yerba Buena Hwy 195, 17.1807°N 92.9026°W, 24.VI.1969, coll. B.V. Peterson, CNC195833, (1♂ CNC); Oaxaca, 65 miles SE of Oaxaca, 16.644117°N 96.07989°W, 15.VIII.1972, coll. G.F. & S. Hevel, USNM.ENT1024279, (1♀ USNM); Vera Cruz, Alazan, 19.202674°N 96.229048°W, 27.II.1972, coll. F. Parker, D. Miller, USNM.ENT1024278, (1♀ USNM); **U.S.A.: Arizona:** 5 miles West of Portal, Cochise County, 31.884044°N 109.205899°W, *Melilotus alba alba*, 15.VIII.1978, coll. R.W. Brooks, CNC195568, (1♂ UCDC); Oak Creek, Coconino County, 34.961452°N 111.753046°W, 2.IX.1968, coll. D.R. Miller, J.E. Lauck, CNC195568, (1♂ UCDC); Southwestern Research Station, 5 miles West of Portal, Cochise County, 31.883333°N 109.208056°W, 1646m,

1.VIII.1956-14.IX.1960, coll. C. & M. Cazier, CNCN195568, (1♂ CNC); Willcox, 32.252754°N 109.832106°W, 28.VIII.1974, coll. R.M. Bohart, CNCN249064, (1♀ UCDC); **California**: Kelso, San Bdo Bernardino County, 35.012347°N 115.653564°W, 7.V.1977, coll. N.J. Smith, CNCN250042, (1♀ UCDC); 3.IX.1936, coll. Lange de Morretes, USNM.ENT1024272, (1♂ USNM); **Connecticut**: Redding, 41.302716°N 73.383846°W, 19.VI.1932, coll. A.L. Melander, USNM.ENT1024788, (1♀ USNM); **Florida**: Archbald Biological Station, Highland Co., 27.189664°N 81.338133°W, flight interception trap, 21.V.1979, coll. H.V. Weems Jr. & T.A. Webber, CNCN250076, (1♂ UCDC); **Kansas**: Douglas Co., Breidenthal Reserve, 15 miles SE Lawrence, 38.807843°N 95.186599°W, 5-11.VIII.1979, coll. R.J. McGinley, USNM.ENT1024694, (1♀ USNM); Douglas County, 38.866667°N 95.233333°W, 29.V.1952, coll. Kenneth J. Capelle, JSS28942, (1♀ LACM); Oswego, Labette County, 37.167575°N 95.109984°W, 23.V.1970, coll. Gary F. Hevel, USNM.ENT1024281, (1ex USNM); **Massachusetts**: Melrose Highlands, 42.470929°N 71.061441°W, 13.IX.1914, coll. C.H.T. Townsend, USNM.ENT1024512, (1♀ USNM); **Mississippi**: Lafayette County, 34.4°N 89.5°W, coll. F.M. Hull, CNCN200231, (1♂ CNC); **Missouri**: Columbia, 38.951705°N 92.334072°W, Malaise trap, 14.VI.1967, coll. F.D. Parker, USNM.ENT1024271, USNM.ENT1024280, (2♂ USNM); **Nevada**: Fernley, Lyon County, 39.611799°N 119.254985°W, 11.VI.1979, coll. R.M. Bohart, CNCN249052, (1♂ UCDC); **New Mexico**: 20 miles Northwest of Deming, 32.491908°N 107.974111°W, 24.VII.1974, coll. R.M. Bohart, CNCN249068, (1♂ UCDC); Socorro, Williston, 34.0584°N 106.891416°W, 1916, coll. J.M. Aldrich, USNM.ENT1024536, (1♀ USNM); White Sands National Monument, 32.787274°N 106.325684°W, 23.VIII.1974, coll. R.M. Bohart, CNCN249084, (1♂ UCDC); **North Carolina**: Highlands, Shortoff Mountain, 35.05323°N 83.198859°W, 1280-1463m, 23.V.1957, coll. J.R. Vockeroth, CNCN200589, (1♂ CNC); **Texas**: 10 miles Southeast, Van Horn, Culberson County, 31.044247°N 104.913785°W, 28.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCN250029, (1♀ UCDC); Austin, 30.266667°N 97.733333°W, USNM.ENT1024644, USNM.ENT1024645, USNM.ENT1024646, USNM.ENT1024647, (3♂

1♀ USNM); Big Bend National Park, Santa Elena canyon, 29.207204°N 103.510979°W, 26.VIII.1967, coll. R.C. Gardner, C.R. Kovacic, CNC249471, (1♂ UCDC); **Virginia:** Falls Church, 38.883506°N 77.174039°W, 25.VI.1916, coll. C.T. Greene, USNM.ENT1024420, (1♀ USNM); Upton, Ceanothus, 17.VI.1924, 2.VII.1924, coll. C.T. Greene, W.S. Fisher, USNM.ENT1024460, USNM.ENT1024461, USNM.ENT1024804, (3♀ USNM); Wildwood Canyon, 3 miles East of Yucaipa, San Bernardino, 34.014808°N 117.001077°W, 5.VI.1977, coll. T. Grisvold, JSS28945, (1♀).

Diagnosis. Generally small species (5-8 mm); scutum with broad, black stripe against grayish-brown microtomentum (Fig. 19 A); r_{4+5} cell almost always closed (Fig. 4 B).

Description. Male. Body length (including antennae): ~5-8 mm.

Head. Antennae mainly yellow or brownish-yellow with dusting of silverish-white microtomentum; scape brown; flagellum usually unicolourous yellow; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silver microtomentum; frons and gena dull yellow usually without sparse pale or black setae; frontal vitta dull brown, or reddish-brown with line of gold or silver microtomentum along lateral margins above eyes, interrupted with black microtomentum near ocellar triangle; frontal vitta with few black setae; ocellar triangle brownish-green with black, forward-facing bristles; occiput and postgena black and pale brown respectively, covered with brownish-green or brownish-gray microtomentum with black bristles; palps dark brown, slightly clubbed; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum brown or brownish-gray with two thick black stripes that extend just beyond the transscutal suture (Fig. 19 A); a single, variably thin or thick medial stripe is usually present between the thicker stripes; dorsal thorax sparsely covered with black

setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum brown or brownish-gray; sometimes patchy at margins, with many long black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 2-4 long black bristles; cluster of bristles at cervical sclerite.

Legs. Coxae brown with black setae; front coxa with dusting of golden microtomentum and variable presence of setae; legs variably patchy brown, though pale yellow at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres brown with short black setae; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear with slight brownish-yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell almost always closed (Fig. 4 B).

Abdomen. Tergite-1 (tg-1) slightly shiny brown, with lateral tufts of short black setae. tg-2 brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3 dull brown with ill-defined medial and lateral golden-brown microtomentum; tg-4-terminalia mainly covered in light golden-brown microtomentum, slightly spotty; tergites-2 to terminalia with a very thin pale brown band at posterior edge; abdomen sparsely covered in short black setae.

Post-abdomen

Terminalia. Figs. 23 D-F. Epandrium shiny brown with many sparse black setae.

Genitalia. (Figs. 23 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with thick patch of longer bristles near joint of surstylus; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum,

only slightly extended; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, truncated to a small point, very reduced, with short, fine setae distally; posterior surstylus somewhat short, only slightly bulbous, paddle-like with a slight inward curl, with concentrated cluster of black bristles longer and in line with surstylus, without a slight membranous appendage present; hypandrium Y-shaped, elongate with an only a very slightly rounded sheath, almost flat; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus somewhat small, generally pointed, arrow-shaped with verticle pattern-lines of tomentum; with medial and some lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, faint, mid-length, ventral fan of setae; sperm pump rounded, somewhat flat, with conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with concentrated bristle field which extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is only slightly reduced, shorter than broad, as is tg-6 which is shiny pale brown, absent of microtomentum, while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny pale brown.

Hosts. Unknown.

Distribution. Map 3 B (■). Widespread, though mainly concentrated in the southern United States and found in southern South America (See Remarks below). A single record from Prince Edward Island, Canada (USNM.ENT1024782) is suspect. Morphology is in agreement with species concepts but molecular data might indicate a distinctive northern species.

Habitat. Found at a variety of elevations as high as 502 m, on *Melilotus officinalis* Eckardt, and *Ceanothus* Linnaeus.

Remarks. Emergence from February through November, peaking in the summer season. More work is clearly needed to test species concepts in this species. With such a wide distribution it is most likely a species complex. Few molecular data have been collected due to lack of fresh material, and genitalia and morphology have shown little variation.

***Z. auricaudatum* Williston, 1892**

Figs. (34 A-C, 4 A), Map 3 C (●).

Synonymy

Zodion auricaudatum Williston, 1892: 85. Type locality: Mexico, Guerrero: Tepetlapa. Type depository: lectotype, BMNH.

Zodion albonotatum Townsend, 1897: 175. Type locality: United States of America, Texas: Brownsville & Fort Brown. Type depository: syntype, *Zodion albonotatum* Townsend, 1897, (depository unknown).

Freeman, 1968: 276-278: Status of *Z. zebrinum*, *Z. auricaudatum*, and *Z. albonotatum*.

Note: The depository of the *Zodion albonotatum* Townsend, 1897 syntype is currently unknown. *Zodion albonotatum* Townsend syntypes are also reportedly missing from the British Museum, Snow Entomological Collections, and USNM. Parsons (1948) thought this a synonym of *Zodion obliquefasciatum* while Camras (1943) thought it was a valid species. *Z. albonotatum* has since been synonymized with *Zodion auricaudatum* (Freeman, 1966) which is retained here.

Type material. Lectotype (designation: Freeman, 1968); ♂; Mexico: Guerrero: Tepetlapa; BMNH249195 (BMNH). The syntypes of *Zodion albonotatum* Townsend,

1897 cannot be located at the BMNH and have apparently been lost.

Material dissected. CNCN11036 (♂).

Additional material examined. CANADA: Ontario: Chatterton, 44.248799°N

77.487766°W, 2.IX.1949, coll. John C. Martin, CNCN200149, (1♀ CNC); MEXICO: Vera

Cruz, 19.1725°N 96.153333°W, coll. Crawford, USNM.ENT1024315, (1♀ USNM); U.S.A.:

Arizona: Benson, 31.968003°N 110.294431°W, Aster, 27.IX.1960, coll. G.E. Bohart, JSS28930,

(1♂ LACM); Cochise County, Elfrida, 5 mi N, 31.758889°N 109.689167°W, 1285m,

10.VIII.2007, coll. M. Buck, DEBU292177, (1♀ DEBU); Graham County, 3 miles West of

Geronimo, 33.099673°N 110.07888°W, on Pectis papposa, 18.IX.1966, coll. R. Rust, P. Torchio,

G. Wood, N. Yousef, JSS28920, (1♂ LACM); Idaho: Latah Co. Moscow Mt, Tamarck Rd,

46.8027°N 116.825996°W, 1130m, Streamlets, 16.VI.2014, coll. B.J. Sinclair, CNCN195881,

(1♀ CNC); New Mexico: Grant Co., N Silver City, Gomez Peak trail, 32.85°N 108.283333°W,

2012-2103m, hilltop, 24.VIII.2007, 9.VIII.2007, coll. J.E. O'Hara, CNCN11035, CNCN11036,

CNCN11037, CNCN11038, CNCN11040, (4♂ CNC); Summit of Gomez Peak Near Silver City,

hilltop, 13.VIII.2007, coll. J. Skevington, CNCN10589, (1ex CNC).

Diagnosis. Scutum dull brown with two thin gray stripes of microtomentum; abdomen with striking golden-brown microtomentum, especially in females; r_{4+5} cell open (Fig. 4 A).

Description. Male. Body length (including antennae): ~8-10 mm.

Head. Antennae dark reddish-brown; scape dark brown; scape and pedicel with spiky black setae; flagellum less than half length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina pale yellow with light dusting of silvery microtomentum; frons and gena pale yellow, usually without setae; frontal vitta dull deep yellow above scape; abruptly dark brown about ocellar triangle, with very thin line of

silver microtomentum along lateral margins above eyes, and without setae; ocellar triangle dull dark brown to black with two black forward-facing bristles, surrounded by black microtomentum; occiput brown; postgena brown with very faint, whitish-silver microtomentum; occiput and postgena with short black bristles; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Mesoscutum mainly dull brown with two thin gray stripes of microtomentum which extend from prescutum to transscutal suture; two thicker stripes at margins cover and extend from postpronotal lobe to prescutum and extend just beyond the transscutal suture, though these are slightly broken up along sutures; postalar callus with gray microtomentum and few short black setae; dorsal thorax sparsely covered with short black setae, with slightly longer bristles at lateral margins along notopleuron; scutellum dull brown mainly covered in gray microtomentum with few short black setae; lateral thorax mainly dull brown with areas of darker brown; anepisternum and katepisternum with faint silver microtomentum; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Coxae dark brown to black; front and hind coxae with sparse short black setae; mid coxa with many longer black setae; hind coxa with stripe of silver microtomentum; legs covered in a very light dusting of silver microtomentum, patchy; femora dark brown with many black setae, somewhat bushy; tibia covered in golden microtomentum, except inside surface of hind tibia which is dark brown and covered in a thick patch of short black setae; tibia otherwise sparsely covered in short black setae; tarsomeres (tm) dark brown with thick short setae; tarsi pale yellow with black tips with yellow pulvilli.

Wing. Membrane clear with yellow colour, completely microtrichose, without colour patterns; halter dark yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull brown, with lateral tufts of short black setae; tg-2 brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3 dull brown with lateral golden-brown microtomentum; tg-4 mainly covered in light golden-brown microtomentum, except for two small dull brown dorsal spots; tg-5 mainly covered in light golden-brown microtomentum, except for two very faint dorsal spots; tg-6 covered in golden-brown microtomentum except for a very thin brown band at posterior edge; abdomen sparsely covered in short black setae.

Post-abdomen

Terminalia. Figs. 34 A-C. Epandrium, if exposed, is dull brown with few setae.

Genitalia. (Figs. 34 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in long, black setae; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum, somewhat extended; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus truncate, with very sharp forward and back-facing teeth; back-facing tooth pan-like; surstylus with short, fine setae, distally; posterior surstylus somewhat large, slightly pointed, with an inward curl, with sparse black bristles appearing basally, in line with and longer than surstylus, with exaggerated membranous appendage present, appearing as a lateral membranous fin; hypandrium Y-shaped, elongate with a rounded, protruding, sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, rounded, covered in short tomentum; distiphallus somewhat large,

bulbous, generally pointed, arrow-shaped with verticle pattern-lines of tomentum; with medial and some lateral sclerotization; phallapodeme elongated and weakly curled and truncated at apex, with short, faint, mid-length, ventral cluster of setae; sperm pump small, rounded, somewhat flat, with conical, pointed, and elongated ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually dark brown, shiny; tg-4-6 with bright golden microtomentum, as in males.

Hosts. unknown

Distribution. Map 3 C (●). Found mainly in the southeastern United States, extending north to Idaho; not found along the coast beyond the Rocky Mountains.

Habitat. Very often can be found at high elevations and hilltops as high as 677 m, in streamlets, on *Asters* Linnaeus, and *Pectis papposa* Harvey & A.Gray.

Remarks. Emergence from June through September, peaking in August. Intraspecific COI pairwise distance variation: 0.6-2.2%.

***Z. bilineata* Van Duzee, 1927**

Figs. (30 D-F, 18 B), Map 4 A (■).

Synonymy

Zodion bilineata Van Duzee, 1927: 586. Type locality: United States of America, Oregon. Type depository: holotype, CAS.

Note: *Z. bilineata* was synonymized under *Z. fulvifrons* Say, 1823 though this is surely in error based on the descriptions of Van Duzee and Say. Van Duzee's descriptions of *Z. bilineata* (1927) are more detailed than Say's (1823) descriptions of *Z. fulvifrons*. Van Duzee indicates two strong dorsal thoracic black lines against gray microtomentum, while Say's description of *Z. fulvifrons* (1823) indicates two brown stripes against a "fulvous" microtomentum, though the species is noted to be cinereous (ashy gray) overall. Van Duzee also notes a difference between the length of the flagellum in relation to the pedicel and scape (13-20-50) with the flagellum nearly twice as long as the pedicel in *Z. bilineata*, while the flagellum of *Z. fulvifrons* is usually about equal to the pedicel. The syntypes for *Zodion fulvifrons* Say, 1823 at ANSP have apparently been destroyed (see Note on Types above). The holotype of *Z. bilineata* Van Duzee, 1927 was examined.

Type material. Holotype; ♂; USA: Oregon; Wallow Mountains, Baker County; CAS-type# 2411(CAS).

Material dissected. CNCD200507, CNCD200534, CNCD200503, CNCD200297, CNCD200492, CNCD200410, CNCD200408, CNCD200406, CNCD200502, CNCD200139, CNCD200252, CNCD200267, CNCD200238, CNCD200495, CNCD200387, CNCD199835, CNCD199866, CNCD195561, CNCD199868 (17♂, 2♀).

Additional material examined. CANADA: Alberta: Brooks, 50.567619°N 111.894402°W, 13.VI.1957, coll. Brooks, MacNay, CNCD200218, (1♂ CNC); Lethbridge, 49.7°N 112.816667°W, 18.VI.1929, 30.VII.1924, coll. H.L. Seamans, J.H. Pepper, CNCD200524, CNCD200635, (2♂ CNC); Onefour, 49.1°N 110.4°W, 13.VI.1956, coll. E.E. Sterns, CNCD200346, (1♂ CNC); Scandia, 50.280376°N 111.89576°W, 9.VII.1956, coll. E.E. Sterns, CNCD200334, (1♂ CNC); British Columbia: 9.3 miles South of Junction #1 & 8, Spences Bridge, 50.278378°N 121.366051°W, 8.VI.1964, coll. G.C. & D.M. Wood, CNCD200492, (1♂ CNC); Grand Forks, 49.031539°N 118.444733°W, 8.VI.1959, coll. E.E. MacDougall,

CNCD200297 (1♂ CNC); **Manitoba**: Carberry, 49.871229°N 99.360835°W, 31.VII.1953, coll. Brooks - Kelton, CNCD200197, (1♂ CNC); International Peace Gardens, Turtle Mountain Forest Reserve, 49.000579°N 100.058331°W, 7.VIII.1958, coll. J.G. Chillcott, CNCD200127, (1♂ CNC); **Ontario**: Strathroy, 42.96389°N 81.61806°W, 1.VI.1916, coll. J.M. Aldrich, USNM.ENT1024513, (1♂ USNM); **Saskatchewan**: Val Marie, 49.25°N 107.733333°W, 10.VIII.1955, coll. C.D. Miller, CNCD200224, (1♂ CNC); Willows, 49.616667°N 105.866667°W, 21.VI.1955, coll. A.R. Brooks, CNCD200213, (1♂ CNC); Val Marie, 49.25°N 107.733333°W, 10.VIII.1955, coll. C.D. Miller, CNCD200495, (1ex CNC); **MEXICO**: **Chihuahua**: 20 miles South of Ciudad Juárez, 31.446915°N 106.471646°W, 13.IV.1961, coll. H.F. Howden, CNCD200517, (1♂ CNC); Las Animas Bay, Gulf of California, 8.V.1921, coll. E.P. Van Duzee, CNCD200408, CNCD200410, (1♂ 1ex CNC); Majalca Road, 30 miles Northwest of Chihuahua, 28.92°N 106.456°W, 1524m, 17.IV.1961, coll. Howden & Martin, CNCD199866 (1♂ CNC); **Durango**: 5 miles West of Durango, 24.033333°N 104.666667°W, 1981m, 14.VII.1964, coll. J.F. McAlpine, CNCD199868, CNCD200252, (2♂ CNC); **U.S.A.**: **Arizona**: 14 miles West of Tombstone, Cochise County, 31.711601°N 110.309384°W, 16.IV.1965, coll. F.D. Parker, CNCD249029, (1♂ UCDC); Onion Saddle, Chiricahua Mountains, Cochise Co., 31.93333°N 109.26278°W, 3.IX.1959, coll. P.H. Arnaud, USNM.ENT1024720, (1♂ USNM); Picacho Pass, Pinal County, 32.631111°N 111.415556°W, 6.IV.1965, coll. F.D. Parker, CNCD249027, (1♂ UCDC); **California**: Claremont, 34.0967°N 117.7198°W, coll. Baker, USNM.ENT1024719, (1♂ USNM); **Colorado**: Boulder, 40.014986°N 105.270546°W, 1676m, 9.VI.1961, coll. B.H. Poole, CNCD200502, (1♂ CNC); Echo Lake, Mount Evans, 39.658085°N 105.6035°W, 3231m, 8.VIII.1961, 13.VII.1961, coll. C.H. Mann, S.M. Clark, CNCD200503, CNCD200507 (2♂ CNC); **Idaho**: Oakley, 42.243215°N 113.881982°W, on S. altissimum, 15.VI.1927, USNM.ENT1027008, (1♀ USNM); **Kansas**: North Plainville, 41.674543°N 72.858156°W, 18.V.1959, CNCD200238, (1♂ CNC); **Maryland**: Odenton, 39.083998°N 76.700246°W, flowers of *Sericocarpus bifoliatus*, 29.VII.1917, coll. W.L. McAtee,

USNM.ENT1024534, (1♂ USNM); **Mississippi**: Lafayette County, 34.4°N 89.5°W, III-V.1943, coll. F.M. Hull, genitalia dissected, CNCN200387 (1ex CNC); **Nebraska**: Hooker Co. Mullen, 1.5 Miles N. (Middle Loup River), 42.033333°N 101.033333°W, 2-4.VII.1983, coll. Grissel & Menke, USNM.ENT1024696, USNM.ENT1024700, USNM.ENT1024701, (3♂ USNM); **Nevada**: 7 miles West of Ely, 39.303781°N 114.985489°W, 9.VII.1971, coll. R.M. Bohart, CNCN249036, (1♂ UCDC); **New Mexico**: 10 miles West of Elk, Chaves County, 32.910458°N 105.46528°W, 25.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCN249166, (1♂ UCDC); 12 miles North of Las Cruces, Dona Ana County, 32.472417°N 106.888286°W, 11.IV.1965, coll. F.D. Parker, R.M. Bohart, CNCN248986, CNCN248987, CNCN248989, CNCN248990, CNCN248991, CNCN249165, CNCN249221, (2♂ 5♀ UCDC); 20 miles Northwest of Deming, 32.491907°N 107.974109°W, 24.VIII.1974, coll. R.M. Bohart, CNCN249472, (1♂ UCDC); 21 miles Northeast of Lordsburg, Hidalgo County, 32.486367°N 108.572873°W, Euphorbia, 21.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCN249037, (1♂ UCDC); 22 Miles South of Socorro, Socorro County, 33.766504°N 106.983687°W, Guterrezia, 22.IX.1965, coll. R.W. Thorp, CNCN249042, (1♂ UCDC); 5 miles East of Las Cruces, Dona Ana County, 32.302643°N 106.664834°W, Cleomella, Pectis papposa, 23.IX.1965, 7.IV.1965, 8.IV.1965, coll. F.D. Parker, R.M. Bohart, R.W. Thorp, CNCN248972, CNCN248980, CNCN248981, CNCN248983, CNCN248993, (5♂ UCDC); Clovis, 34.403813°N 103.20433°W, 14.VI.1910, coll. F.C. Bishopp, USNM.ENT1024425, (1♂ USNM); Las Cruces, 32.3°N 106.766667°W, VI.1918, VIII.1918, coll. coll. Townsend, USNM.ENT1024384, USNM.ENT1024385, (2♂ USNM); Newcomb, San Juan, 36.284333°N 108.705211°W, Chrysothamnus, 21.IX.1965, coll. R.W. Thorp, CNCN249057, (1♀ UCDC); Pinedale, 35.603893°N 108.447°W, 9.VII.1949, coll. L.C. Wyman, USNM.ENT1024435, (1♂ USNM); Socorro, 34.0584°N 106.891416°W, 1916, coll. Williston, USNM.ENT1024381, USNM.ENT1024382, (2♂ USNM); Tohatchi, McKinley County, 35.851718°N 108.736161°W, Haplopappus spinulosus, 21.IX.1965, coll. R.W. Thorp, CNCN250033, (1♀ UCDC); **North Dakota**: Billings County, Medora, 46.913903°N

103.524353°W, 13-18.VI.1979, coll. C.W. Sabrosky, USNM.ENT1024407, (1♀ USNM); Mott, 46.373611°N 102.325°W, coll. C.N. Ainslie, CNCD200792, (1♂ CNC); **Oklahoma**: Payne County, 36.144999°N 97.006839°W, 14.V.1925, coll. W.J. Brown, CNCD200534, (1♂ CNC); **Texas**: 13 miles East of Snyder, Scurry County, 32.735632°N 101.139091°W, 4.VI.1965, coll. R.M. Bohart, CNCD249049, (1♂ UCDC); 16 miles East of Van Horn, Culberson County, 31.056968°N 104.563295°W, 24.IX.1965, coll. R.W. Thorp, CNCD249047, (1♀ UCDC); 23 miles West, Fort Davis, 30.587179°N 104.280619°W, 1524m, 1.VI.1959, coll. F. McAlpine, CNCD200264, (1♂ CNC); 44 miles North of Van Horn, Culberson County, 31.641845°N 104.862177°W, roadside vegetation, 27.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCD249238, (1♂ UCDC); Big Bend National Park, Boquillas, 29.188819°N 102.945462°W, 564m, light trap, 23.V.1959, coll. Howden & Becker, CNCD200146, (1♂ CNC); Big Bend National Park, Dagger Flats, 29.°N 103.°W, 1067m, 11.V.1959, coll. W.R.M. Mason, CNCD200130, CNCD200132, (2♂ CNC); Big Bend National Park, near Chilcotal Mountain, 29.297627°N 103.229983°W, 914m, 3.V.1959, coll. J.F. McAlpine, CNCD200128, (1♂ CNC); Big Bend National Park, Nine Point Draw, 29.612468°N 103.136436°W, 15.V.1959, coll. W.R.M. Mason, CNCD200131, (1♂ CNC); Big Bend National Park, Santa Elena canyon, 29.207204°N 103.510979°W, 640m, 5.V.1959, 9.V.1959, coll. J.F. McAlpine, W.R.M. Mason, CNCD200129, CNCD200134, CNCD200259, (3♂ CNC); Canyon, Randall County, 34.983645°N 101.919338°W, 21.VI.1969, coll. R.M. Bohart, CNCD249040, (1♂ UCDC); Comstock, 29.68438°N 101.173438°W, 28.IV.1959, coll. J.F. McAlpine, CNCD200257, (1♂ CNC); Denton, 33.214617°N 97.131762°W, on sumach, 19.V.1906, coll. F.C. Bishopp, USNM.ENT1024416, (1♂ USNM); Forestburg, 33.533056°N 97.556608°W, 14.VII.1940, coll. L.H. Bridwell, USNM.ENT1024437, (1♀ USNM); Fort Davis, Limpia Canyon, 30.588211°N 103.894625°W, 1524m, 28.V.1959, coll. J.F. McAlpine, CNCD200151, CNCD200185, (2♂ CNC); Govt Springs, Grapevine Hills, Big Bend National Park, 29.339752°N 103.254777°W, *Sphaeralcea angustifolia*, 1.IX.1971, coll. E.E. Grissell, R.F. Denno, CNCD249193, (1♀

UCDC); Kerrville, 30.047433°N 99.140319°W, 3.IV.1959, coll. W.R.M. Mason, J.F. McAlpine, genitalia dissected, CNCN199835, CNCN200267 (2♂ CNC); Lariat, Parma County, 34.330247°N 102.907958°W, *Helianthus*, 2.X.1965, coll. R.W. Thorp, CNCN250112, (1♂ 1♀ UCDC); Rockpile, 30 miles North West of Fort Davis, 30.873666°N 104.281307°W, 1524m, ex. horehound, sweeping, 28.V.1959, coll. J.F. McAlpine, CNCN200139 (1♂ CNC); **Texas:** Kerrville, 30.047433°N 99.140319°W, 29.III.1959, coll. W.R.M. Mason, CNCN195561, (1♂ CNC); **Utah:** Blanding, 37.623891°N 109.478357°W, 8.VI.1956, coll. G. Knowlton, USNM.ENT1024414, (1♂ USNM); Wayne Co., Fremont River, 27 mi. W.. Hanksville, 27.VIII.1980, coll. A.S. Menke, F.D. Parker, K.A. Menke, USNM.ENT1024718, (1♂ USNM); **Virginia:** Falls Church, 38.883506°N 77.174039°W, 29.VI.1929, coll. C.T. Greene, USNM.ENT1024421, (1♂ USNM); **Wyoming:** 6 mi. NW Newcastle, 43.919454°N 104.181317°W, 1952, coll. F.M. Hull, CNCN200406, (1♂ CNC).

Diagnosis. Abdomen pale orangy-brown, dull, with very short black setae, not bushy; dorsal thorax usually gray with 2-4 variably faint or dark stripes (Fig. 18 B); tarsomeres (tm) are usually unicolourous; r_{4+5} cell open (Fig. 4 A).

Note. The hind tibia is often with a slight lateral groove, very indistinct. In some cases the hind tibia is so malformed at this groove it causes an odd, sharp, L-shaped tibia.

Description. Male. Body length (including antennae): ~8 mm.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum rarely about equal length of pedicel; usually flagellum is much longer than pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina dull yellow with light dusting of silvery microtomentum; frons and gena variably dull yellow or dark yellow, and sometimes with sparse black setae; frontal vitta dull deep brownish-yellow above scape;

and brown around ocellar triangle, with lines of silver microtomentum along lateral margins above eyes, and with black setae; ocellar triangle dull brown with two black forward-facing bristles; occiput and postgena black to dark brown with silverish-white microtomentum with black bristles about occiput and pale bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with dull grayish-brown microtomentum with up to seven thin and prominent black stripes (usually two strong black stripes); the medial stripe extends from below the postpronotal lobe to the transscutal suture with three stripes on either side of varying lengths (Fig. 18 B); marginal stripes somewhat thicker, and broken up by sutures along the notopleuron; dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing bushy; scutellum mainly covered in grayish-brown microtomentum with several long black setae; lateral thorax mainly dull brown, covered in grayish-brown microtomentum, though ventral margin of katepisternum variably bare; katepisternum with long black bristles; few black bristles around cervical sclerite.

Legs. Coxae brown with dusting of grayish-silver microtomentum, especially on anterior front coxa with many long black setae; legs brown, variably light or dark, covered in a very light dusting of silver microtomentum; patchy; femora usually darker brown than tibia with many black setae, very bushy; tibia brown with many shorter black setae; distal posterior surface of front and hind tibia with thick transverse patch of setae; tarsomeres pale brown or yellow with sparse black setae; tarsi brown with black tips with variably brown or yellow pulvilli.

Wing. Membrane clear with brownish-yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull reddish-brown, with lateral tufts of short black setae; tg-2 pale orangy-brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint golden microtomentum appearing laterally; tg-3-5 pale orangy-brown with dusting of golden microtomentum, while tg-4 (and sometimes tg5) is variably darker brown; tg-6 covered in heavier golden microtomentum; tg2-5 with very thin pale yellow band at posterior edge; abdomen covered in very short black setae, not bushy.

Male Genitalia. (Figs. 30 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with concentrated patch of longer bristles near joint of surstylus; hypoproct divided, rounded, bulbous and large, projecting forward, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus large, wide, somewhat truncate, with a rounded forward-facing tooth, with short, fine setae, distally; posterior surstylus large, somewhat bulbous, apically pointed, with a slight inward curl, with a dense cluster of black bristles not longer than and in line with surstylus, with strong lateral membranous appendage present, appearing somewhat like a scoop or lobster claw-like; hypandrium Y-shaped, elongate with a rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus pointed or dagger-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply truncate, without short, mid-length, ventral fan of setae; sperm pump somewhat

large and rounded, flat with long, conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. Unknown.

Distribution. Map 4 A (■). Widely distributed throughout the midwest and western United States, with few specimens collected in the east, or northeast in southern Ontario, Canada, scattered across the prairie provinces.

Habitat. Often found along roadside vegetation where wild flowers grow, including *Sisymbrium altissimum* Linnaeus, *Chrysothamnus* Nuttall, *Gutierrezia* Lagasca, *Sphaeralcea angustifolia* (Cavanilles) G.Don, *Sericocarpus* sp. Nees, *Xanthisma paradoxum* Turner & Hartm., *Helianthus* Linnaeus, *Cleomella* Pyramus de Candolle, *Pectis papposa* Harvey & A.Gray, *Euphorbia* Linnaeus and sumach. This species can also be found in some higher elevations, as high as 1524 m.

Remarks. Emergence April through October, peaking in May through June. Intraspecific COI pairwise distance variation: 0.4-3.3%.

***Z. californicum* Camras, 1954**

Figs (34 D-F; 18 G), Map 3 C (■).

Synonymy

Zodion californicum Camras, 1954: 165. Type locality: United States of America, California:

Riverside Co., Ripley. Type depository: holotype, *Zodion californicum* Camras, 1954, CAS.

Type material. Holotype; ♀; USA: California: Riverside County, Ripley; CAS-Type# 6439 (CAS). Paratype; ♀; USA: California: Ripley, Riverside county; FMNH095513 (FMNH).

Material dissected. CNCD200082 (♂).

Additional material examined. **MEXICO: Baja California Sur:** 27 miles South of Loreto, 25.617417°N 111.374374°W, 14.X.1983, 14.X.1985, coll. D. Faulkner & F. Andrews, CNCD190121, CNCD200083, (1♀ 1ex CNC); La Paz, 24.145104°N 110.310126°W, 3.VI.1921, coll. E.P. Van Duzee, genitalia dissected, CNCD200082, (1♂ CNC); Muleg, 26.891667°N 111.980833°W, 15.V.1921, coll. E.P. Van Duzee, CNCD200084, (1♂ CNC); **U.S.A.: Arizona:** Cochise, Cochise Co., 32.113981°N 109.921165°W, 8.IX.1975, coll. E.G. & J.M. Linsley, USNM.ENT1024314, (1ex USNM); Nogales, 31.340378°N 110.934253°W, 1.VIII.1966, coll. R.L. Brumley, CNCD249227, (1♂ UCDC); Willcox, Cochise County, 32.252754°N 109.832106°W, 28.VIII.1974, 31.VIII.1976, coll. R.M. Bohart, CNCD249216, CNCD249217, (2♀ UCDC); **California:** Imperial Co., 21.VII.1912, coll. J.C. Bridwell, USNM.ENT1024316, (1♂ USNM); Monte Vista Peak, Cochise County, 37.57917°N 106.148084°W, Helenium Hoopesii, 15.VIII.1978, coll. R.W. Brooks, CNCD249235, (1♀ UCDC); Ripley, Riverside Co., 2.VII.1946, coll. W. F. Barr, FMNH95600, (1♀ FMNH); **New Mexico:** Granite Gap, 18 miles North of Rodeo, 32.083333°N 108.951389°W, 7.IX.1976, coll. R.M. Bohart, CNCD249218, (1♀ UCDC); Springer, 17.VIII.1914, coll. W.R. Walton, USNM.ENT1024552, (1♂ USNM); **Washington:** Adams County, 7 miles North of Othello, 46.896433°N 119.143956°W, 8.VIII.1970, coll. D.R. Miller, USNM.ENT1027045, (1♀ USNM).

Diagnosis. Flagellum about equal length of pedicel; scutum dull dark brown with darker medial patches, with two obvious gray stripes of microtomentum (Fig. 18 G); r_{4+5} cell open (Fig. 4 A).

Description. Male. Body length (including antennae): ~8 mm.

Head. Antennae brownish-yellow; scape dark brown; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes black; frons, antennal grooves and facial carina pale yellow with light dusting of silvery microtomentum. Frons and genae pale yellow, usually without setae; if setae present it is sparse; frontal vitta dull yellow above scape to a gradual light patchy brown about ocellar triangle, with very thin line of silver microtomentum along lateral margins above eyes, and without setae; ocellar triangle shiny yellow to light brown with two black forward-facing bristles; occiput and postgena brown with very faint, whitish silver microtomentum, with short black bristles; palps brown, very short; single geniculate proboscis long, shiny, dark brown to black;

Thorax. Scutum mainly dull dark brown with darker medial patches, with two obvious gray stripes of microtomentum which extend from prescutum to transscutal suture; two thicker stripes at margins cover and extend from postpronotal lobe to prescutum and extend just beyond the transscutal suture (Fig. 18 G); postalar callus with gray microtomentum and black setae; dorsal thorax covered with black setulae, with slightly longer bristles at lateral margins along notopleuron and postpronotol lobe; scutellum dull brown with only faint gray microtomentum with black setae; lateral thorax mainly dull brown with areas of darker brown; katepisternum with long black bristles; anepisternum with golden-brown microtomentum; cluster of black bristles around cervical sclerite;

Legs. Front and hind coxae dark brown with long black bristles, with a only a slight dusting of silver microtomentum; mid coxa brown with short black bristles, usually without microtomentum; femora dark brown, covered in a very faint, patchy, dusting of silver and gold microtomentum; tibia dark brown with heavy dusting of golden microtomentum; legs with many black bristles, very bushy; tarsomeres (tm) dark brown with thick short setae; tarsi brown with black tips with yellow pulvilli.

Wing. Membrane clear with yellow colour, completely microtrichose, without colour patterns; halter pale yellow; r_{4+5} cell open (4 A).

Abdomen. Tergite-1 (tg-1) dull brown, with tufts of short black setae; tg-2 brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with golden-brown microtomentum laterally, and fainter dorsally, with two bare brown spots along the posterior edge and the ventral margin; tg-3 with golden-brown microtomentum, with two irregular bare brown spots appearing dorsally and along the ventral margin; tg-4-6 covered in light golden-brown microtomentum except along the ventral margin; abdomen covered in fine, short black setae.

Male Genitalia. (Figs. 34 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in rather short, black setae; hypoproct so reduced as to appear absent, or flattened, covered in tomentum; cerci oval-shaped, protruding with short, fine setae extending distally only; anterior surstyli reduced, short, triangular-shaped, pointed, with short, fine setae, distally; posterior surstylus moderate, slightly pointed, with a weak inward curl, with basal cluster of sparse, short, black bristles, without membranous appendage present; hypandrium Y-shaped, elongate with a weakly

rounded, almost flat, sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum; distiphallus fat, bulbous, bag-like, rounded at apex, with patterned tomentum; with strong, black, medial and some lateral sclerotization; phallapodeme elongated and curled and sharply pointed at apex, with short, faint, mid-length, ventral fan of setae; sperm pump small, rounded, somewhat flat, with short conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually dark brown, shiny; tg-4-6 with bright golden microtomentum, as in males.

Hosts. Unknown.

Distribution. Map 3 C (■). Western. Found mainly along the California coast and some neighboring states, southern Arizona and New Mexico, and down into Mexico and Baja.

Habitat. Can be found on *Helenium hoopesii* (A.Gray) Bierner.

Remarks. Emergence June through October, peaking slightly in August. A single specimen was sequenced for COI (579 bps): CNCD249034 and is available at BOLD under Conopidae of the World (CONW).

***Zodion cinereiventre* Van Duzee, 1927**

Figs. (31 E-G, 4 A), Map 3 A (●).

Synonymy

Zodion cinereiventre Van Duzee, 1927: 58. Type locality: United States of America, California:

Fresno Co., Huntington Lake. Type depository: holotype, *Zodion cinereiventre* Van Duzee, 1927, CAS.

Type material. Holotype; ♀; USA. California: Fresno Co., Huntington Lake. CAS-type# 2408 (CAS).

Material dissected. CNCD200338, CNCD200494, CNCD200208, CNCD200740, CNCD200758, CNCD200853, CNCD200099 (7♂).

Additional material examined. **CANADA: Alberta:** Banff National Park, Eisenhower Junction, 51.266667°N 115.916667°W, 1433m, 19.VII.1955, coll. R. Coyles, CNCD200103, CNCD200105, (2♂ CNC); Banff National Park, 51.178056°N 115.568433°W, 19.VII.1955, CNCD200096, (1♂ CNC); Irvine, 49.954314°N 110.267986°W, 9.VII.1952, coll. A.R. Brooks, CNCD200112, (1ex CNC); Manyberries, 49.401096°N 110.698297°W, 4.VI.1952, coll. A.R. Brooks, CNCD200208 (1ex CNC); South of Vauxhall, 50.068889°N 112.0975°W, 18.VII.1950, CNCD200085, CNCD200086, (2♂ CNC); **British Columbia:** 9.3 miles South of Junction #1 & 8, Spences Bridge, 50.278378°N 121.366051°W, 8.VI.1964, coll. G.C. & D.M. Wood, CNCD200113, (1♂ CNC); Nicola, 50.16654°N 120.66792°W, 3.VIII.1923, coll. E.R. Buckell, CNCD200104, CNCD200106, CNCD200541, (3♂ CNC); Nicola, 50.16654°N 120.66792°W, 27.VIII.1923, coll. E.R. Buckell, CNCD200758, (1♂ CNC); Pavilion Lake, 50.864663°N 121.737564°W, 5.VI.1938, coll. G.S. Walley, CNCD200740, (1♂ CNC); Richter Pass, Osoyoos, 49.073993°N 119.603872°W, 30.V.1959, coll. R.E. Leech, CNCD200087, (1♂ CNC); **Manitoba:** 5 miles North of Minnedosa, 50.317735°N 99.842653°W, 8.VII.1958, coll. C.D.F. Miller, CNCD200338 (1♂ CNC); **Ontario:** Britannia, 45.35°N 75.783333°W, 20.VI.1947, coll. G.E. Shewell, CNCD200114, (1♂ CNC); Delhi, 42.8525°N 80.498889°W, 2.VI.1931, coll. G.S. Walley, CNCD199833, (1♂ CNC); Forks of Credit, 43.823017°N 80.009517°W, 12.VII.1968, coll. Patricia MacKay, CNCD28524, (1♀ CNC); Jordan, 43.133333°N 79.366667°W, 14.VI.1915, 6.VI.1919, coll. W.A. Ross, CNCD200431, CNCD200532, (2♂ CNC); Near Picton,

44.008627°N 77.13918°W, 9.VII.1970, coll. J.F. McAlpine, CNCD200240, (1♂ CNC); Orillia, 44.609505°N 79.42068°W, 9.VI.1925, coll. C.H. Curran, CNCD200109, (1♂ CNC); Ottawa, 45.42153°N 75.697193°W, 24.VI.1943, 25.V.1900, coll. A. Brooks, CNCD199860, CNCD200423, (1♂ 1♀ CNC); Pinewood, 48.713333°N 94.302222°W, 22.VI.1960, coll. Kelton & Whitney, CNCD200098, (1♂ CNC); Sandbanks Park, near Picton, 43.905059°N 77.265953°W, 1.VII.1970, coll. J.F. McAlpine, CNCD200326, (1♂ CNC); Simcoe, 42.833333°N 80.3°W, 1.VII.1939, coll. G.E. Shewell, CNCD199829, (1♂ CNC); Strathroy, 42.95007°N 81.63317°W, 2.VIII.1925, coll. H.D. Hudson, CNCD200422, (1♀ CNC); **Saskatchewan**: Attons Lake, 52.833333°N 108.85°W, 4.IX.1940, coll. A.R. Brooks, CNCD200737, (1♂ CNC); Estevan, 49.139167°N 102.986111°W, 23.VII.1958, coll. A. & J. Brooks, CNCD200111, (1♂ CNC); **MEXICO**: **Durango**: 3 miles East of El Salto, Durango, 23.781254°N 105.310425°W, 2560m, 2.VII.1964, coll. L.A. Kelton, CNCD200095, (1♂ CNC); **Sonora**: 12 miles West of Ciudad Obregón, 27.489689°N 110.138653°W, 15.V.1961, coll. Howden & Martin, CNCD200115, (1♂ CNC); Malaise trap, 2008, JSS19874, (1♂); **U.S.A.**: **Arizona**: Flagstaff, 35.200997°N 111.200997°W, 7-9.VIII.1959, coll. K.V. Krombein, USNM.ENT1024551, (1♂ USNM); Hereford, Cochise County, 31.438524°N 110.097877°W, 17.VIII.1985, coll. R.M. Bohart, CNCD249448, (1♀ UCDC); Pinery Canyon, Cochise County, 31.981367°N 109.371793°W, 1.VIII.1967, coll. C. Beegle, USNM.ENT1027185, (1♂ USNM); Todd's Lodge, Oak Creek Canyon, 34.975338°N 111.74683°W, 29.IX.1948, coll. Grace H. & John L. Sperry, USNM.ENT1024325, (1♂ USNM); **California**: 2 Mi. NW Blue Lake, Lassen Co., 40.896394°N 124.017344°W, 19.VII.1947, coll. J.M. Aldrich, USNM.ENT1024328, (1♂ USNM); Alpine Co., 15.VII.1916, coll. A. C. Browne, JSS28867, (1♂ LACM); Alturas, 7 mi. NE Modoc Co., 1372m, 12.VI.1969, coll. R. R. Snelling, JSS28864, (1♂ LACM); Antelope Springs, Inyo County, 37.331101°N 118.08689°W, 11.VII.1967, coll. R.O. Schuster, CNCD249167, CNCD249168, (2♂ UCDC); Apple Valley, 34.500831°N 117.185876°W, 10.V.1955, 12.V.1955, coll. W.R.M. Mason, CNCD200099, CNCD200100, CNCD200101, CNCD200102, (4♂ CNC); Boca, Nevada

County, 39.383333°N 120.089966°W, 22.VII.1970, 3.VII.1954, coll. A.D. Telford, E.E. Grissell, CNCD249102, FMNH-INS95589, (1♂ 1♀ FMNH, UCDC); Cabazon, 33.917209°N 116.783042°W, 10.IV.1946, coll. A.L. Melander, USNM.ENT1024336, (1♂ USNM); Canada del Medio, Sta Santa Cruz Isl Island, S Santa Barbera County, 33.98917°N 119.68972°W, 11.III.1971, 2.V.1968, 6.V.1968, coll. L. Laughrin, R.O. Schuster, CNCD249072, CNCD249083, CNCD249146, CNCD249149, (3♂ 1♀ UCDC); Cottonwood Canyon, Joshua Tree N.M., 33.846118°N 115.783736°W, Phacelia distans, 12.IV.1978, coll. R.W. Brooks, CNCD250039, (1♂ UCDC); Darwin Falls, Inyo County, 36.320689°N 117.524396°W, 9.IV.1972, coll. G.E. Bohart, CNCD249107, (1♂ UCDC); Hallelujah Jct Junction, Lassen County, 39.775462°N 120.039368°W, 29.VI.1966, coll. R.L. Brumley, CNCD249160, (1♂ UCDC); Inyo County, Sulphur Mine, 44 miles East of Big Pine 9on Big Pine-Death Valley Road), 37.213571°N 117.695565°W, 3.X.1995, coll. A.S. & N. Menke, USNM.ENT1027172, (1♂ USNM); Mt. Tyson, VI.1948, coll. G. H. Ferras, JSS28874, (1♂ LACM); Priest Valley, Monterey Co., 22.IX.1959, coll. R. R. Snelling, JSS28887, (1♂ LACM); Sagehen Creek, Nevada County, 39.432115°N 120.24123°W, 1.VII.1970, 11.VII.1970, 18.VII.1973, 4.VII.1971, coll. B. Villegas, D.S. Horning Jr., R.M. Bohart, CNCD249133, CNCD249135, CNCD249137, CNCD249138, (3♂ 1♀ UCDC); Sagehen Creek, Nevada County, 19.VI.1974, coll. M.K. Sears, DEBU1157174, DEBU1157175, (2♀ DEBU); Salsberry Pass, Inyo County, 35.926037°N 116.428899°W, 6.V.1960, coll. F.D. Parker, UC_BME91912, (1♀ UCDC); Sand Cyn Canyon, 3 miles West of Brown, Kern County, 35.305218°N 118.425949°W, 14.III.1972, coll. R.W. Rust, CNCD250045, (1♂ UCDC); Sierraville, Sierra County, 39.589538°N 120.36698°W, 28.VI.1966, coll. E.E. Grissell, CNCD249117, (1♂ UCDC); South Lk Lake Tahoe, El Dorado County, 39.127256°N 120.020296°W, 22.VI.1975, coll. R.O. Schuster, E.C. Toftner, CNCD249178, CNCD249181, (2♂ UCDC); Thousand Palms, 33.820018°N 116.390289°W, 28.VII.1955, coll. W.R. Richards, CNCD200494, (1♂ CNC); Victorville, 34.536107°N 117.291157°W, 20.V.1955, coll. W.R. Richards, CNCD200097, (1♂ CNC); Westgard Pass, Inyo County, 37.299424°N 118.153235°W,

Encelia, 16.V.1979, coll. R.M. Bohart, CNCD249179, (1♀ UCDC); Westgard Pass, Inyo County, 16.V.1979, coll. R.M. Bohart, CNCD249449, CNCD249450, (2♀ UCDC); **Colorado**: Black Mesa, 10.7mi. W Sapinero, Gunnison Co., 19.VIII.1966, coll. T. C. Emmel, JSS28881, (1♂ LACM); Boulder, 4.5 miles North, 40.015001°N 105.270671°W, 1676m, 20.VI.1961, coll. W.R.M. Mason, CNCD200167, (1♂ CNC); Boulder, 40.014986°N 105.270546°W, 5.VI.1961, coll. B.H. Poole, CNCD190119, (1ex CNC); Central State Park, 38.8322°N 105.5544°W, 3048m, 22.VI.1961, coll. B. Poole, CNCD200166, (1♀ CNC); Doolittle Ranch, Mount Evans, 39.675739°N 105.601348°W, 2987m, 23.VII.1961, 25.VII.1961, coll. B.H. Poole, CNCD200092, CNCD200093, (2♂ CNC); Echo Lake, Mount Evans, 39.658085°N 105.6035°W, 3231m, 25.VII.1961, coll. C.H. Mann, CNCD200107, (1♂ CNC); Frazer Fraser, Grand County, 39.944987°N 105.817232°W, 2896m, 7.VII.1961, coll. B.H. Poole, CNCD200108, (1ex CNC); Jefferson, 39.37561°N 105.798698°W, 2865m, 14.VII.1961, coll. S.M. Clark, CNCD200513, (1♀ CNC); Marshall Pass, 38.395863°N 106.247976°W, 10856m, 28.VII.1908, coll. J.M. Aldrich, USNM.ENT1024326, (1♂ USNM); Mount Evans, 39.59°N 105.64°W, 4267m, 27.VII.1961, coll. S.M. Clark, CNCD200512, (1♀ CNC); Nederland, Science Lodge, 39.95°N 105.5°W, 2896m, 29.VI.1961, 6.VIII.1961, coll. J.R. Stainer, CNCD200088, CNCD200089, (1♂ 1ex CNC); Tennessee Pass, 39.366667°N 106.3°W, 25.VII.1917, coll. J.M. Aldrich, USNM.ENT1024327, (1♀ USNM); **Georgia**: Perry, 32.457482°N 83.730084°W, 5.I.1949, coll. P.W. Fattig, USNM.ENT1024450, (1♀ USNM); **Idaho**: 5 miles West of Idaho Falls, Bonneville County, 43.496814°N 112.136189°W, 14.VI.1966, coll. J.E. Slansky, CNCD249156, CNCD249157, (2♂ UCDC); **Iowa**: Sioux City, 42.499994°N 96.400307°W, coll. C.N. Ainslie, CNCD200430, (1♂ CNC); **Maryland**: Beltsville, 39.034832°N 76.907474°W, 21.V.1916, coll. L.O. Jackson, USNM.ENT1024332, (1♂ USNM); Bethesda, 38.966667°N 77.1°W, 23.IX.1914, coll. R.C. Shannon, USNM.ENT1024479, (1♀ USNM); **Michigan**: Livingston Co., E.S. George Reserve, 42.620795°N 83.847302°W, 24.V.1942, 5-6.VI.1943, coll. C.W. Sabrosky, Geo. Steyskal, USNM.ENT1024324, USNM.ENT1024339, (2♂ USNM); Nottawa, 41.943094°N

85.47507°W, 24.V.1936, coll. C.W. Sabrosky, USNM.ENT1024322, (1♀ USNM); Washtenaw Co., Ann Arbor, 42.280145°N 83.742924°W, 10.VI.1927, coll. N.K. Bigelow, USNM.ENT1024455, (1♀ USNM); **Mississippi**: Agricultural College, 33.455537°N 88.790429°W, 24.IV.1922, CNCD199850, CNCD199872, (2♂ CNC); Lafayette County, 34.4°N 89.5°W, III-V.1943, III-VI.1943, IV-V.1946, V-VI.1955, coll. F.M. Hull, CNCD200853, CNCD199869, CNCD199870, CNCD199876, CNCD200235, CNCD200384, (4♂ 2♀ CNC); **Missouri**: Columbia, 38.951705°N 92.334072°W, Malaise trap, 12.VI.1970, coll. F.D. Parker, CNCD249098, (1♂ UCDC); **Nevada**: 1 mile East of Emigrant Pass, Eureka County, 40.65°N 116.266667°W, 1.VIII.1967, coll. D.R. Miller, CNCD249125, (1♂ UCDC); 5 miles South of Success Summit, White Pine County, 39.216194°N 114.685573°W, 8.VII.1968, coll. R.F. Denno, D.R. Miller, CNCD249170, CNCD250081, (2♂ UCDC); Mount Rose, Storey County, 39.283457°N 119.61118°W, 15.VII.1980, coll. C.D. Paddock, CNCD249182, (1♂ UCDC); Warm Springs, Nye County, 38.190708°N 116.36999°W, 31.VIII.1968, coll. D.R. Miller, J.E. Lauck, CNCD249108, (1♂ UCDC); **New Jersey**: Somerville, 40.574081°N 74.610104°W, 5.VI.1927, coll. A.L. Melander, USNM.ENT1024334, (1♀ USNM); **New Mexico**: Granite Pass, Hidalgo County, 32.083333°N 108.951389°W, 6.IV.1965, coll. F.D. Parker, CNCD249013, (1♂ UCDC); Socorro, 34.0584°N 106.891416°W, 1916, coll. Williston, USNM.ENT1024330, (1♂ USNM); **Ohio**: Columbus, 39.983333°N 82.983333°W, 24.V.1923, 27.V.1923, CNCD199871, CNCD199878, CNCD199887, CNCD199893, CNCD200382, (5♂ CNC); **Oregon**: 10 miles East of Dairy, Klamath County, 42.182386°N 121.344835°W, 2.VIII.1968, coll. R.F. Denno, D.R. Miller, CNCD248994, (1♂ UCDC); Lane Co., Andrew's Experimental Forest, Mack Creek, 44.22°N 122.169167°W, 750m, 10.VIII.2005, coll. J.&A. Skevington, CNCD1347, (1♂ CNC); Lk Lake of the Woods, Klamath County, 42.368634°N 122.208482°W, 1509m, 18.VII.1930, coll. H.A. Scullen, FMNH-INS95520, (1♀ FMNH); **Utah**: Beryl, 37.895869°N 113.661227°W, 24.IX.1959, coll. Knowlton, USNM.ENT1024333, (1♂ USNM); **Virginia**: Barcroft, 38.861869°N 77.109683°W, 24.VI.1917, coll. W.L. McAtee, USNM.ENT1024331, (1♂ USNM);

Washington: Almota, 46.702937°N 117.469352°W, 24.V.1913, coll. W.A. Yethers, USNM.ENT1024335, (1♂ USNM); Blewett Pass, Kittatass County, 47.335518°N 120.579397°W, 28.VI.1924, coll. A.L. Melander, USNM.ENT1024337, (1♂ USNM); Omak, 48.410785°N 119.528515°W, 19.V.1916, coll. A.L. Melander, USNM.ENT1024329, (1♂ USNM); **Wyoming:** Togwotee Pass, Teton County, 39.658085°N 105.6035°W, 17.VII.1961, coll. B.H. Poole, CNC200090, CNC200094, (2♂ CNC); Rio Grande Co. Beaver Creek, 40.6243°N 105.5295°W, 10000m, Malaise trap, 21.VI.1972, coll. W.W. Wirth, USNM.ENT1024340, (1ex USNM); S. Forks Mont., 1.VIII.1916, coll. A.L. Melander, USNM.ENT1024338, (1♂ USNM).

Diagnosis. Wing cell r_{4+5} open (Fig. 4 A); very small species (4-5.5 mm, rarely larger); scutum with 4-6 black stripes against brownish-gray microtomentum.

Description. Male. Body length (including antennae): ~4.5-5.5 mm –rarely larger.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown and encircled by silver microtomentum; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and gena yellow with sparse black setae if present at all; frontal vitta dull yellow or brownish-yellow above scape to brown before ocellar triangle, with lines of golden or silver microtomentum along lateral margins above eyes that do not extend beyond ocellar triangle, with many black setae; ocellar triangle dull brown with many black forward-facing bristles surrounded by many black bristles; occiput and postgena black to dark brown with silverish-white microtomentum with black bristles about occiput and paler bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with dull gray or grayish-brown microtomentum with six bare black stripes; four medial stripes tend to be thin and vary in length; marginal stripes somewhat thicker, and broken up by sutures along the notopleuron; dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing bushy; scutellum mainly covered in gray or grayish-brown microtomentum with several long black setae; lateral thorax mainly dark brown to black, covered in microtomentum the same colour as dorsum, though ventral margin of katepisternum variably bare; katepisternum with long black bristles; black bristles around cervical sclerite.

Legs. Coxae brown to black with grayish-silver microtomentum, especially on anterior front coxa with many long black setae; legs tend to be unicolourous or patchy brown, variably light or dark, covered in a very light dusting of silver microtomentum; patchy, with many black setae, bushy; tibia brown with many shorter black setae; distal posterior surface of hind tibia with thick transverse patch of setae; tarsomeres brown (same as legs) with sparse black setae, though tm-5 often darker than tarsomere-1 (tm-1); tarsi yellow with black tips with pale yellow pulvilli.

Wing. Membrane clear with yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) slightly shiny brown, with lateral tufts of short black setae; tg-2 brown with tufts of longer black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3-terminalia dull brown with dorsal and lateral golden-brown

microtomentum; tergites 2-terminalia with thin paler band at posterior edge; abdomen sparsely covered in short black setae.

Male Genitalia. (Figs. 31 E-G) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with a concentrated patch of longer bristles near joint of surstylus; hypoproct divided, rounded, bulbous, strongly projected, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus short and truncate, with forward-facing tooth, with short, fine setae, distally; posterior surstylus robust and large, convex, appearing scoop or paddle-like, apically rounded, with a slight inward curl, with a cluster of short black bristles not longer than surstylus, with strong lateral membranous appendage present; overall appearing lobster claw-like; hypandrium Y-shaped, elongate with a sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus large, and laterally thin, dagger-like, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and truncate, without short, mid-length, ventral fan of setae; sperm pump rounded, somewhat flat, with conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is only slightly reduced, shorter than broad, as is tg-6 which is bare and shiny orange, while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny orange and also bare of microtomentum.

Hosts. *Panurginus melanocephalus* Cockerell (Freeman, 1966).

Distribution. Map 3 A (●). Widespread through the United States and southern Canada, found in greater numbers in the west and Midwestern United States, and as far south as Mexico.

Habitat. Found in a variety of habitats including gravel pits and hilltops with elevations as high as 677 m, found on *Helenium tenuifolium* Nuttall, *Senecio* sp Linnaeus (Freeman, 1966). *Heterotheca subaxillaris* var. *petiolaris* Benke, *H. grandiflora* Nuttall, *Ericameria paniculatus* (A.Gray) Rydberg.

Remarks. Emergence January through to October peaking May through July.

Intraspecific COI pairwise distance variation: 0-2.4%. Interspecific variation with: *Z. alexanderi*: 0.4-2.8%.

***Z. cyanescens* Camras, 1943**

Figs (35 A-C; 18 H.), Map 3 C (▲).

Synonymy

Zodion cyanescens Camras, 1943: 188. Type locality: United States of America, North Carolina:

Smokemont. Holotype depository: *Zodion cyanescens* Camras, 1943, FMNH.

Type material. *Z. cyanescens* Camras, 1943: Holotype; ♀; USA: North Carolina:

Smokemont; FMNH095679 (FMNH). Allotype; ♂; USA: North Carolina: Smokemont;

FMNH095644 (FMNH). Paratypes; ♂; USA: North Carolina: Willard; FMNH095621

(FMNH); ♀; USA: North Carolina: Newton; FMNH095629 (FMNH); ♀; USA: Georgia:

Atlanta; USNM1024344 (USNM); ♂; USA: Mississippi: Westpoint; USNM1024349

(USNM); ♀; USA: South Carolina: Florence; USNM1024346 (USNM); ♀; USA:

Mississippi: Utica, Augustus County; USNM1024345 (USNM); ♂; USA: North

Carolina: Morrison; USNM024350 (USNM).

Material dissected. CNC200120, FMNH095621 (Paratype), CNC200120

Additional material examined. U.S.A.: **Alabama:** Decatur, 34.604054°N 86.979881°W, 1.VIII.1944, coll. G.E. Bohart, USNM.ENT1024341, (1♂ USNM); **Georgia:** Atlanta, 33.75°N 84.383333°W, 8.IX.1938, coll. P.W. Fattig, USNM.ENT1024344, (1ex USNM); **Mississippi:** Lafayette County, 34.4°N 89.5°W, 15.VI.1949, coll. F.M. Hull, CNC200120, (1ex CNC); Utica, 32.109521°N 90.623395°W, VIII, USNM.ENT1024345, (1ex USNM); West Point, 33.606718°N 88.649387°W, 16.IX.1904, coll. F.C. Bishopp, USNM.ENT1024349, (1ex USNM); **North Carolina:** Newton, 25.VIII.1921, coll. T. B. Mitchell, FMNH95629, (1♀ FMNH); Smokemont, 35.55°N 83.3°W, 20.VII.1923, coll. J. C. Crawford, T. B. Mitchell, FMNH95644, FMNH95679, (1♂ 1♀ FMNH); Willard, 6.VII.1922, coll. T. B. Mitchell, FMNH95621, (1♂ FMNH); coll. Morrison, USNM.ENT1024350, (1ex USNM); **South Carolina:** Clemson College, 34.677049°N 82.838754°W, 12.VIII.1926, USNM.ENT1024347, USNM.ENT1024348, (1♂ 1♀ USNM); Florence, 34.183333°N 79.75°W, 19.VII.1935, USNM.ENT1024346, (1ex USNM); **Tennessee:** Memphis, 35.15°N 90.05°W, 15.IX.1921, 20.V.1921, CNC200119, CNC200120, CNC200121, CNC200122, (2♂ 1♀ 1ex CNC); Riverton, 28.VII.1927, coll. C.H. Baldu, CR, USNM.ENT1024343, (1♀ USNM); 15.X.1937, coll. Weidemann, USNM.ENT1024342, (1♀ USNM).

Diagnosis. Cyan (blue-gray) patterned microtomentum of the abdomen and dorsal thorax striking (Fig. 18 H); wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~9-10 mm.

Head. Antennae orangy-yellow; scape orange; antennae with patchy dusting of silver microtomentum; scape and pedicel with spiky black setae; flagellum about half length of pedicel, rounded; eyes dark brown to black; frons, antennal grooves and facial carina pale yellow with silver microtomentum within antennal grooves and lining eyes; frons and genae pale yellow, without setae; frontal vitta dull yellow; brown about ocellar triangle,

with very thin line of silver microtomentum along lateral margins above eyes, without setae; ocellar triangle dull black to brown with two black forward-facing bristles; occiput dull brown with black bristles; postgena pale yellow with patches of whitish silver microtomentum and pale yellow bristles; palps brown, somewhat long; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly dull reddish brown to dark brown with 2 well-defined, golden stripes of microtomentum which extend from prescutum to transscutal suture; two thicker stripes at margins cover and extend from postpronotal lobe to prescutum and extend just beyond the transscutal suture, and are usually unbroken by sutures (Fig. 18 H); postalar callus with golden microtomentum and row of black setae; dorsal thorax covered with short black setulae, with longer bristles at lateral margins along notopleuron and postpronotal lobe; scutellum dull brown and covered with golden microtomentum and few long black setae; lateral thorax somewhat shiny, dark brown, with gold microtomentum extending across anepisternum and katepisternum; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Hind and mid coxae brown with long black bristles, slightly bushy; front coxa brown with shorter black bristles, less bushy; coxae with light dusting of golden microtomentum, most prominent on hind coxa; legs unicolourous brown, irregularly covered in golden microtomentum with many black bristles, somewhat bushy, especially the femora; tibia almost entirely covered in golden microtomentum; hind tibia with dorsal, longitudinal strip bare of black setae; tarsomeres brown with shiny microtomentum, thick short setae; tarsi pale yellow with black tips with yellow pulvilli.

Wing. Membrane clear with yellow colour, completely microtrichose, without colour patterns; halter pale yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull dark brown with tufts of short black setae and slight dusting of silver-blue (cyan) microtomentum; tg-2 dark brown with with dorso-lateral tufts of longer black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally, followed with gold microtomentum appearing more uniform laterally, while slightly fainter dorsally, with two bare areas along the dorsal posterior margin; laterally, golden microtomentum stripe is diagonal, with latero-ventral margin bare; tg-3 dull dark brown with thin band of golden microtomentum near posterior margin, widening at lateral margin, bare along latero-ventral margin; tg-4 dull dark brown with golden microtomentum medial stripe flanked by two large bare spots, with microtomentum extending laterally, though bare at latero-ventral margin; tg-5-6 covered in golden microtomentum except at latero-ventral margins; bare brown spot is variably present dorsally; abdomen sparsely covered in fine, short black setae.

Male Genitalia. (Figs. 35 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in rather short, black setae; hypoproct so reduced as to appear absent, or flattened, covered in tomentum; cerci oval-shaped, protruding with short, fine setae extending distally only; anterior surstylus reduced, short, triangular-shaped, pointed, with short, fine setae, distally; posterior surstylus moderate, slightly pointed, with a weak inward curl, with basal cluster of sparse, short, black bristles, without membranous appendage present; hypandrium Y-shaped, elongate with a weakly rounded, almost flat, sheath; postgonite skinny, reduced and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum;

distiphallus fat, bulbous, bag-like, rounded at apex, with patterned tomentum; with strong, black, medial and lateral sclerotization; phallapodeme elongated and curled and sharply pointed at apex, with long, faint, mid-length, ventral fan of setae; sperm pump small, rounded, somewhat flat, with short conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually dark brown or black, shiny; tg-4-6 with muted cyan, blue-gray microtomentum, as in males.

Hosts. unknown

Distribution. Map 3 C (▲). Southeastern United States, mainly along the coast, and possibly as far west as Texas.

Habitat. Has been associated with *Helenium tenuifolium* Nuttall.

Remarks. Emergence June through October, steady throughout summer season. No COI sequences are available at this time.

***Z. dawkinsi* Burt & Skevington, 2015**

Figs. (28 A-C, 19 D, 20 C-F), Map 6 B (●).

Type material. Holotype; ♂; USA: Arizona: Sierra Vista, Huachuca Mountains; 31.324377°N 110.162248°W; IV.1966, coll. R.F. Sternitzky; genitalia dissected; CNCN199944 (CNCN).

Paratype series. U.S.A.: Arizona: Cochise County, 14.8 km East on Guadalupe Cyn Canyon Road, 31.335000°N 109.087700°W, 1285m, 12.IX.1910, coll. G.W. Forister, CNCD249429, (1♂ UCDC); Santa Rita Mountains, Madera Canyon, 31.726019°N 110.880478°W, 12-13.VI.1968, coll. Menke & Flint, USNM.ENT1024140, (1ex USNM); Sierra Vista, 31.544228°N 110.292928°W, 12.II.1966, coll. R.F. Sternitzky, CNCD199943, (1♂ CNC); SWRS near Portal, Cochise County, 31.883297°N 109.206150°W, 20.VIII.1979, coll. R.M. Bohart, CNCD249410, (1♂ UCDC); Turkey Creek 6 miles W. Portal, 31.863542°N 109.357881°W, 6400m, sweeping, 21-25.IX.1965, coll. C. Sabrosky, USNM.ENT915884, (1♂ USNM); **MEXICO: Durango:** 11 miles West of Durango, 24.030669°N 104.836717°W, 2134m, 13.VII.1964, coll. J.F. McAlpine, CNCD195879, (1♂ CNC).

Material dissected. CNCD199944 (♂)

Diagnosis. Scutum very dark blue, or brownish-blue, very dark, with four black stripes; abdomen dark blackish-brown with grayish-blue microtomentum appearing obliquely; wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~4-4.5 mm.

Head. Antennae usually very dark brown with light dusting of silverish-white microtomentum; scape dark brown; flagellum almost black, with dark brown patch distally. Scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and gena yellow with sparse pale or black setae; frontal vitta covered with dull dark brown microtomentum with very thin line of silver microtomentum along lateral margins above eyes, with several long black setae; ocellar

triangle with dull brown, nearly black, microtomentum with many black forward-facing bristles; occiput and postgena brownish-black with grayish-blue microtomentum with black bristles; black patch of microtomentum lining eye when viewed dorsally; palps brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum dark blue, variably very dark blueish-brown with four black stripes that extend just beyond the trasscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 20 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum same colour as scutum, dull, with four long black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 1-4 long black bristles; one black bristle at cervical sclerite.

Legs. Hind and mid coxae brown with black setae; front coxa brown with variable presence of setae; hind coxa with faint silver microtomentum; legs mainly unicolourous dark brown, though slightly paler at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres dark brown with short black setae; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; wing cell r_{4+5} open (Fig. 4 A).

Abdomen. (Figs. 20 C-F) Tergites dull very dark brown, or grayish-brown, often appearing blackish-purple; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint grayish-blue microtomentum appearing laterally; tg-3 dull brown with lateral grayish-blue microtomentum forming obliquely a

triangular pattern dorsally; tg-4-5 mainly covered in light grayish-blue microtomentum, except for 2 small dull brown triangular spots appearing dorsally, divided by microtomentum; tg-6 covered in grayish-blue microtomentum; abdomen sparsely covered in short black setae.

Male Genitalia (Figs. 28 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow and conical, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus short, truncate, with very sharp forward and slightly rounded back-facing teeth or points, with short, fine setae, distally; sharp forward-facing tooth forms circle against posterior surstylus back-facing lateral protrusion; posterior surstylus very large, bulbous, rather elongated, apically somewhat pointed, with a slight inward curl, with 1-2 black bristles in line with surstylus; no membranous appendage present, though exaggerated and pointed lateral protrusion present, like a thumb, forming a circle with anterior surstylus forward-facing tooth; hypandrium Y-shaped, elongate with a very sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus small, narrow, pointed, dagger-shaped covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply curled and pointed without short, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed and apically curled ejaculatory apodem , with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth. tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Etymology. Patronym for Dr. Richard Dawkins, a world renowned biologist (ethologist) and educator, author of many high impact books, out-spoken defender of the theory of evolution by natural selection, free speech, science education, female and homosexual equality, atheism and secularism.

Hosts. Unknown.

Distribution. Map 6 B (●). Found mainly at high elevations in Arizona, New Mexico, and into Mexico along the peaks of the Huachuca Mountains.

Habitat. High elevations, hilltops, mountains as high as 1951 m.

Remarks. No COI sequences are available at this time due to lack of fresh material.

***Z. dillahuntyi nov. sp.* Burt & Skevington, 2015**

Figs. (31 A-D, 4 B), Map 4 C (●).

Type material. Holotype; ♂; CANADA: Ontario: Grand Bend; 22.VII.1939; coll. G.E. Shewell; abdomen dissected; CNCN200421 (CNCN).

Paratype series. CANADA: Alberta: 15 miles East of Morley, 51.169228°N 114.505481°W, 19.VII.1962, coll. K.C. Herrmann, CNCN200496, (1♂ CNC); **British Columbia:** 9.3 miles South of Junction #1 & 8, Spences Bridge, 50.278378°N 121.366053°W, 8.VI.1964, coll. G.C. & D.M. Wood, CNCN200498, (1♂ CNC); Nicola,

50.166542°N 120.667922°W, 3.VIII.1923, coll. E.R. Buckell, CNCD200414, (1♂ CNC); **Manitoba**: Pilot Mound, 49.202272°N 98.893064°W, 31.IV.1958, coll. A. & J. Brooks, CNCD200206, (1♂ CNC); **U.S.A.: California**: 18 miles West of Blythe, Riverside County, 33.607658°N 114.900692°W, 22.IV.1978, coll. N.J. Smith, CNCD249051, (1♂ UCDC); Baker, San Bernardino County, 35.266947°N 116.075033°W, 5.IV.1966, coll. R.O. Schuster, CNCD249062, (1♂ UCDC); Red Mountain, 35.358297°N 117.61672°W, 4.IV.1968, coll. R.O. Schuster, CNCD250048 (1♂ UCDC); **Kansas**: 3 miles Northeast of Lawrence, 38.998975°N 95.177972°W, *Heterotheca grandiflora*, IX.1979, coll. R.W. Brooks, CNCD249205 (1♂ UCDC).

Material dissected. CNCD200421 (♂).

Diagnosis. Abdomen usually reddish-brown with dusting of golden microtomentum; wing cell r_{4+5} almost always closed (Fig. 4 B); posterior surstyli asymmetrical (Figs. 31 A-D).

Description. Male. Body length (including antennae): ~8-10 mm.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape yellowish-orange; scape and pedicel with very short spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina yellow with dusting of silvery microtomentum; frons and gena yellow with sparse black setae; frontal vitta somewhat short and wide, dull yellow above scape to brown about ocellar triangle, with lines of golden microtomentum along lateral margins above eyes that do not extend beyond ocellar triangle, with black setae; ocellar triangle shiny black with 2-4 black forward-facing bristles surrounded by black bristles; occiput and postgena black with silverish-white microtomentum with black bristles about occiput and

paler bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with dull grayish-brown (somewhat brassy) microtomentum with four prominent bare black stripes; stripes thin and vary in length with two inner submedial stripes short beginning after postpronotal lobe and ending well before transscutal suture; outer pair of stripes longer, beginning about where submedial-1 stripes end, ending well beyond transscutal suture; dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron where two very large bristles are present, appearing somewhat bushy overall; scutellum mainly covered in grayish-brown microtomentum with several long black setae. Lateral thorax mainly dark brown to black, covered in microtomentum the same colour as dorsum, though ventral margin of katepisternum variably bare; katepisternum with cluster of long black bristles; black bristles around cervical sclerite.

Legs. Coxae brown with silver microtomentum, less prevalent on front coxa; mid and hind coxa with many long black setae, while front coxa with only sparse black setae; legs with very light dusting of silver microtomentum with many black setae, somewhat bushy; front and mid femora light brown with prominent darker brown dorsal maculation; hind femur light brown with faintly darker brown maculation appearing distally only; tibia mainly dark brown with paler areas basally (about knees) with long black setae; distal posterior surface of front and hind tibia with thick transverse patch of setae; tarsomeres light brown (same as legs) with sparse black setae; tarsomere-5 (tm-5) always darker than tm-1; tarsi yellow with black tips with pale yellow pulvilli.

Wing. Membrane clear with slight yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell closed (Fig. 4 B).

Abdomen. Tergite-1 (tg-1) dull, dusty brown, with lateral tufts of short black setae; tg-2 slightly paler reddish-brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with strong golden-brown microtomentum appearing laterally and obliquely; tg-3 dull reddish-brown with golden-brown microtomentum; tg-4-5 mainly covered in light golden-brown microtomentum, though irregular; tg-6 covered in golden-brown microtomentum; microtomentum irregular, though a poorly defined medial line is usually apparent from tg3-5; tg2-6 with very thin brown band at posterior edge; abdomen sparsely covered in short black setae, moderately bushy.

Male Genitalia. (Figs. 31 A-D) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus short, truncate, with rounded, forward-facing point, with short, fine setae, distally; posterior surstylus somewhat flat, elongated, apically slightly rounded, with a slight inward-downward curl, with concentrated basal cluster of black bristles as long as and in line with surstylus, with lateral membranous appendage present, appearing somewhat like a scoop; hypandrium Y-shaped, elongate with a very sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus small, narrow, with slight ribbing, pointed or dagger-shaped, covered with tomentum; with medial and

very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, mid-length, ventral setae; sperm pump rounded, somewhat flat, with conical, pointed and slightly apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Etymology. Patronym for Matt Dillahunty, an American self-made public intellectual, soughtafter lecturer, longtime host of the Atheist Experience public access television program based in Austin, Texas, and outspoken advocate for free speech, critical rationalism, defender of science and reason, and secular values, and the American Constitution.

Hosts. Unknown.

Distribution. Map 4 C (●). Mainly found in the western United States, and southern Canada, around the Rocky Mountains and east to at least Missouri.

Habitat. Found on *Heterotheca grandiflora*.

Remarks. There are no COI sequence data available at this time.

***Zodion fulvifrons* Say, 1823**

Figs. (32 A-C, 18 D), Map 5 A (●).

Synonymy

Zodion fulvifrons Say, 1823: 74. Type locality: United States of America, Maryland and Pennsylvania. Type depository: syntype, ANSP (Destroyed).

Zodion abdominalis Say, 1823: 84. Type locality: United States of America, Nebraska: “near Rocky Mountain” & “Engineer Contonment.” Type depository: syntype, *Zodion abdominalis* Say, 1823, ANSP (Destroyed).

Myopa rubifrons Desvoidy, 1830: 247. Type locality: United States of America, Pennsylvania: Philadelphia. Type depository: syntype, MNHNP.

Zodion flavipenne Bigot, 1887: 204. Type locality: (unknown). Type depository: (unknown).

Note: The syntypes for *Zodion fulvifrons* Say, 1823 and, *Zodion abdominalis* Say, 1823 at ANSP have apparently been destroyed. *Zodion reclusum* Banks, 1916 has been examined and resurrected. *Zodion bistria* Walker, 1849, *Zodion lativentre* Graenicher 1910, *Zodion sayi* Banks, 1916, *Zodion obscurum* Banks, 1916, have now been synonymized under *Zodion intermedium*, Banks 1916 based on examination of dorsum and by comparing the genitalia (combination of examination of dissected genitalia and intact terminalia (see *Zodion intermedium* below)).

Type material. The Syntypes of *Z. fulvifrons* Say, 1823, and *Z. abdominalis* Say, 1823 (ANSP) have been destroyed (see note on Conopid Type Material).

Material dissected. CNCN200332, CNCN200428, CNCN200455, CNCN200446 (4♂).

Additional material examined. CANADA: Alberta: 25 miles East of Milk River, Aden, 49.024567°N 111.298373°W, 28.VI.1956, coll. O. Peck, CNCN200342, (1♂ CNC); Delburne, 52.197629°N 113.234232°W, 12.VII.1959, 16.VII.1959, coll. D.H. Pengelly, debu1157176, debu1157179, (1♂ 1♀ DEBU); Grassy Lake, 54.809809°N 117.506676°W, 24.VI.1974, coll. J.F. McAlpine, CNCN28527, (1♀ CNC); Lethbridge, 49.7°N 112.816667°W, 9.VIII.1923, coll. H.E. Gray, CNCN200413, (1♀ CNC); Medicine Hat, 50.040483°N 110.673523°W, 18.VIII.1924, coll. F.S. Carr, CNCN200808, (1♂ CNC); Scandia, 10 km East, 50.280376°N 111.89576°W, 20.VII.1989, coll. D.B. McCorquodale, JSS19756, (1♀ CBU); Scandia, 9.VII.1956, coll. E.E. Sterns, CNCN200332, (1ex CNC); **British Columbia:** Bear Lake, 49.63°N 124.07°W,

20.VII.1903, coll. R.P. Currie, USNM.ENT1024496, (1ex USNM); Grand Forks, 49.031539°N 118.444733°W, 17.VII.1951, coll. E.E. MacDougall, CNCD200360, (1♂ CNC); Hell's Gate, 49.780665°N 121.451615°W, 26.VI.1971, coll. D.H. Pengelly, debu1157177, debu1157180, (1♂ 1♀ DEBU); Kamloops, 50.666667°N 120.316667°W, 1.VI.1938, 12.VI.1943, coll. E.R. Buckell, J.K. Jacob, CNCD200283, CNCD200364, (2♀ CNC); Kaslo, 49.913333°N 116.911389°W, VI.1920, coll. A.N. Caudell, USNM.ENT1024544, (1ex USNM); Nelson, 49.492856°N 117.294766°W, 17.VII.1910, USNM.ENT1024640, (1ex USNM); Nicola, 50.16654°N 120.66792°W, 3.VIII.1923, coll. E.R. Buckell, CNCD200618, (1♂ CNC); Okanagan Falls, 49.34467°N 119.571493°W, 10.VI.1913, coll. E.M. Anderson, USNM.ENT1024740, (1ex USNM); Oliver, 49.18333°N 119.55°W, 26.V.1923, 6.VI.1923, coll. C.B. Garrett, CNCD200537, CNCD200538, (1♂ 1♀ CNC); Salmon Arm, 50.700103°N 119.283844°W, 16.VI.1925, coll. A.A. Dennys, CNCD200656, (1♀ CNC); Summerland, 49.59988°N 119.66787°W, 4.VI.1919, coll. E.R. Buckell, CNCD200540, (1♂ CNC); **Manitoba**: 5 miles Southwest of Shilo, 49.753932°N 99.720027°W, floodplain community near Tamarack Bog, road cut in stabilized sand dunes, 13.VIII.1958, 9.VIII.1958, coll. J.G. Chillcott, CNCD200312, CNCD200313, (1♂, 1ex CNC); Brandon, 49.843355°N 99.950444°W, 7.VIII.1958, coll. N.B. Chillcott, CNCD200242, (1♂ CNC); Carberry, 49.871229°N 99.360835°W, 20.VII.1953, coll. Brooks - Kelton, CNCD200202, (1♀ CNC); Ninette, 49.4°N 99.6°W, Powerline scrub, 5.VIII.1958, coll. J.G. Chillcott, CNCD200269, CNCD200271, (2♂ CNC); Virden, 49.850833°N 100.931667°W, 12.VII.1953, coll. Brooks - Kelton, CNCD200210, (1ex CNC); **New Brunswick**: Douglas, 45.97832°N 66.731078°W, 17.VIII.1913, coll. J.D. Tothill, CNCD200455, (1ex CNC); St. Andrews, 45.079914°N 67.058441°W, 10.VII.1978, 5.VIII.1957, coll. G.E. Shewell, S.A. Marshall, CNCD195563, CNCD200497, debu1157182, (2♂ 1ex CNC, DEBU); **Nova Scotia**: Inverness Co., Chimney Corner, 46.4°N 61.15°W, 5.VIII.1996, coll. DBMcCorquodale, JSS18161, (1♂ CBU); Kenloch, 46.186611°N 61.273502°W, 31.VII.1991, coll. D.B. McCorquodale, JSS19758, (1♀ CBU); Strathlorne, 46.183333°N 61.283333°W, 13.VIII.1991,

coll. D.B. McCorquodale, JSS19762, (1♂ CBU); **Ontario**: Brockville, 44.583333°N 75.683333°W, 16.VIII.1903, coll. W. Metcalfe, debu1157178, (1♀ DEBU); Chatterton, 44.248799°N 77.487766°W, 17.VII.1940, 19.VI.1945, coll. C.W. Smith, R.W. Smith, CNCD200518, CNCD200519, CNCD200824, (2♂ 1♀ CNC); Hald.-Norfolk Reg., Turkey Point Prov. Pk., site 2, 42.707778°N 80.341389°W, savannah, 15.VI.2011, coll. S.M. Paiero, debu1151660, (1♀ DEBU); Hald.-Norfolk Reg., Turkey Point Prov. Pk., 42.711667°N 80.342222°W, open sandy field, Malaise trap, 3-28.VIII.2009, 6-22.VII.2009, coll. S.M. Paiero, debu1146360, debu1146394, debu336043, (2♂ 1♀ DEBU); Hastings County, 44.7681°N 77.630069°W, 4.VI.1903, coll. Evans, CNCD200531, (1♂ CNC); Hilton Township, 46.264811°N 83.940057°W, edge of hardwood forest & field, Malaise trap, 7.VII.1992, coll. J.E. Swann, debu1157183, (1ex DEBU); Jordan, 43.133333°N 79.366667°W, 16.VI.1919, 18.X.1919, coll. W.A. Ross, CNCD200486, debu1157186, debu1157187, debu1157188, (1♂ 3ex CNC, DEBU); Lambton County, Port Franks, Richmond Subdivision, 43.216667°N 81.9°W, wet meadow, 1.IX.1994, coll. J. Skevington, debu1157185, (1ex DEBU); Lambton County, Port Franks, Watson Property near L-lake, 28.VII.1996, coll. J. Skevington, debu1157184, (1ex DEBU); Low Bush, Lake Abitibi, 48.916667°N 80.133333°W, 2.VIII.1925, coll. N.K. Bigelow, CNCD200428, (1ex CNC); Northumberland County, Barr property, ~7 km NE Centreton, site 2, 44.13°N 77.984167°W, field, Malaise trap, 27.VI-12.VII.2011, coll. Brunke & Paiero, debu1152343, (1♀ DEBU); Ottawa, Uplands sand pit, 45.307615°N 75.637283°W, 3.VII.1962, coll. G.E. Shewell, CNCD200294, (1♂ CNC); Ottawa, 45.42153°N 75.697193°W, 21.VII.1938, 29.VII.1946, 6.VIII.1914, coll. A. Brooks, A.R. Brooks, J.I. Beaulne, CNCD200353, CNCD200415, CNCD200466, CNCD200478, (4♂ CNC); Point Pelee, 41.956157°N 82.514529°W, 21.VI.1927, 24.VI.1927, coll. F.P. Ide, CNCD200472, CNCD200487, (1♂ 1♀ CNC); Port Sydney, 45.213191°N 79.275791°W, 18.VII.1919, coll. N.K. Bigelow, CNCD200460, (1♂ CNC); Simcoe, 42.833333°N 80.3°W, 19.VI.1939, coll. G.E. Shewell, CNCD200464, CNCD200471, (1♂ 1♀ CNC); Spencerville, 44.843305°N 75.546362°W, 14.VIII.1939, coll. G.H. Hammond,

CNCD200522, CNCD200523, (1♂ 1ex CNC); **Prince Edward Island**: Brackley Beach, Prince Edward Island National Park, 46.431111°N 63.216111°W, 12.VIII.1940, coll. G.S. Walley, CNCD200446, (1ex CNC); **Quebec**: Co. Vaudreuil, Summit of Mount Rigaud, 45.466389°N 74.326389°W, hilltop, 28.V.2008, 5.VI.2008, coll. J. Cumming, J. Gibson, J. King, H. Cumming, A. Sugarman, J. Gibson, S. Kelso, M. Jackson, C. Vincent, CNCD12798, CNCD12799, CNCD12800, CNCD12809, (4♂ CNC); Cte. Vaudreuil, summit Mt. Rigaud, 220m, hilltop, 13.V.1987, 2.VI.1981, 9.VII.1985, coll. D. Bell, D.M. Wood, D.M. Wood, JSS17598, JSS17602, JSS17603, JSS17605, (4♂ CNC, MZUL); Gasp, 48.833333°N 64.483333°W, 26.VI.1954, coll. W.J. Brown, CNCD200351, (1ex CNC); Island of Montreal, 45.555464°N 73.60253°W, 29.V.1904, USNM.ENT1024648, USNM.ENT1024649, (2ex USNM); Mount Rigaud, Summit, 45.466389°N 74.326389°W, hilltop, 17.VII.1985, coll. B.E. Cooper, JSS17604, (1♂ CNC); **Saskatchewan**: Pheasant Creek, 50.583246°N 103.467217°W, 21.VII.1937, coll. A.R. Brooks, CNCD200447, CNCD200469, (2♂ CNC); Rutland, 52.515736°N 109.528654°W, 26.VII.1940, coll. A.R. Brooks, CNCD200474, (1♂ CNC); Saskatoon, 52.13437°N 106.647656°W, 6.VI.1957, coll. A.R. Brooks, CNCD200207, (1♂ CNC); St. Victor, 49.333333°N 105.9°W, 28.VI.1955, coll. A.R. Brooks, CNCD200215, CNCD200217, (1♂ 1♀ CNC); Swift Current, 50.285072°N 107.79717°W, 13.VI.1937, coll. A.R. Brooks, CNCD200465, (1♂ CNC); **MEXICO: Durango**: 5 miles West of Durango, 24.033333°N 104.666667°W, 1981m, 14.VII.1964, coll. J.F. McAlpine, CNCD200219, (1♀ CNC); Durango, 24.033333°N 104.666667°W, 25.V.1964, coll. H.F. Howden, CNCD200370, (1♂ CNC); **Hidalgo**: Pachuca, 20.097942°N 98.709606°W, 518m, 29.VII.1954, coll. J.G. Chillcott, CNCD200253, (1♀ CNC); **San Luis Potosi**: 10 miles Northeast of San Luis Potosí, 22.247356°N 100.88297°W, 1890m, 22.VIII.1954, coll. J.G. Chillcott, CNCD200251, (1♂ CNC); Puebla, 2 km S.W. Zapotitlan Salinas, 18.962132°N 98.180083°W, 1410m, 3.XI.1991, coll. T. Griswold, USNM.ENT1024764, USNM.ENT1024765, (2ex USNM); San Jose de Guayanas, IV.1910, coll. L.O. Howard, USNM.ENT1024532, (1ex USNM); Sierra Madre Mountains, Piedras Verdes, Chih., 30.30087°N 108.224401°W, 2225m, VIII.1932, coll.

Townsend, USNM.ENT1024443, (1ex USNM); Sonora, 9.3 mi. N.E. Puerto Penasco, Rt. 8, 7.IV.1988, coll. K. Krombein & B. Norden, USNM.ENT1024761, (1ex USNM); **U.S.A.:**

Alabama: Kushla, 30.816786°N 88.161163°W, coll. A.H. Sturtevant, USNM.ENT1024422, (1♀ USNM); **Arizona:** 14 miles West of Tombstone, Cochise County, 31.711601°N 110.309384°W, 16.IV.1965, coll. F.D. Parker, R.M. Bohart, CNC249030, CNC249031, (2♀ UCDC); Canelo Bog, 1 mile West of Canelo, Huachuca Mountains, 31.542871°N 110.53127°W, 1494m, 8.V.1964, coll. Sternitzky, CNC200277, (1♀ CNC); Chiricahua Mtns, Snake Gulch, 36.643874°N 112.623673°W, 8.VI.1968, coll. Menke & Flint, USNM.ENT1024561, (1ex USNM); Rustler Park, W. Portal, 31.90556°N 109.27917°W, 2560-2689m, 20-25.IX.1965, coll. C.W. Sabrosky, USNM.ENT1024574, (1ex USNM); S.W. Research Station, 5 mi W. Portal, Cochise Co., 31.883333°N 109.208056°W, 3.IX.1959, coll. G.I. Stage, USNM.ENT1024438, USNM.ENT1024620, (2ex USNM); **California:** 20 mi. W of Blythe, 33.614217°N 114.923868°W, 27.IV.1939, coll. F.H. Parker, USNM.ENT1024605, (1ex USNM); 5 mi. W Indio, 33.77783°N 116.340365°W, 17.III.1949, coll. A.L. Melander, USNM.ENT1024590, (1ex USNM); Canada del Medio, Sta Santa Cruz Isl Island, S Santa Barbara County, 33.98917°N 119.68972°W, *Calochortus catalinae*, 18.VI.1967, coll. A.S. Menke, CNC249150, (1♂ UCDC); Claremont, 34.0967°N 117.7198°W, coll. Baker, Metz, USNM.ENT1024630, USNM.ENT1024726, USNM.ENT1024727, USNM.ENT1024741, USNM.ENT1024742, (5ex USNM); Del Mar, 32.959302°N 117.265036°W, 2.IX.1952, coll. A.L. Melander, USNM.ENT1024598, (1ex USNM); E. Fork Santa Ana River, 34.17721°N 116.843419°W, 18.IX.1945, coll. A.L. Melander, USNM.ENT1024579, (1ex USNM); Hot Creek, Mono County, 37.618064°N 119.007811°W, 29.VIII.1969, coll. R.M. Bohart, CNC249460, (1♂ UCDC); Imperial County, IV.1911, coll. J.C. Bridwell, USNM.ENT1024526, (1ex USNM); Los Angeles Co., 34.052233°N 118.243685°W, IV, coll. Coquillett Collection, USNM.ENT1024502, USNM.ENT1024509, USNM.ENT1024548, (3ex USNM); Morongo Valley, 34.047214°N 116.581161°W, 28.IX.1944, coll. A.L. Melander, USNM.ENT1024592, (1ex USNM); Mountains

near Claremont, 34.185442°N 117.702977°W, V, coll. Baker, USNM.ENT1024669, USNM.ENT1024728, (2ex USNM); Pasadena, 34.147785°N 118.144516°W, coll. J.M. Aldrich, USNM.ENT1024517, (1ex USNM); Redlands, 34.055569°N 117.182538°W, XI.1913, coll. F.R. Cole, USNM.ENT1024436, (1♂ USNM); S. Berdino Co., V, USNM.ENT1024668, (1ex USNM); S. Fork Santa Ana, 9.VIII.1942, coll. A.L. Melander, USNM.ENT1024577, (1ex USNM); San Diego, 32.715329°N 117.157255°W, coll. van Blacker, USNM.ENT1024510, (1ex USNM); Santa Clara Co., coll. Baker, USNM.ENT1024528, (1ex USNM); Upper Santa Ana River, 34.091253°N 117.120741°W, 1.IX.1946, 17.VIII.1946, coll. J.L. Sperry, USNM.ENT1024597, USNM.ENT1024602, (2ex USNM); Verdemont, 23.IV.1946, 24.IV.1946, coll. A.L. Melander, USNM.ENT1024580, USNM.ENT1024584, (2ex USNM); Whitewater, 27.X.1934, coll. A.L. Melander, USNM.ENT1024623, USNM.ENT1024624, (2ex USNM); Yucca Valley, 5.X.1934, coll. A.L. Melander, USNM.ENT1024663, (1ex USNM); **Colorado**: 15 miles South of Steamboat spring, Routt County, 40.301791°N 106.870379°W, 15.VIII.1964, coll. J.S. Buckett, CNCD249196, (1♂ UCDC); Boulder, 4 miles Northwest, 40.013374°N 105.317523°W, 2103m, 8.VI.1961, coll. B.H. Poole, CNCD200520, (1ex CNC); Boulder, 5 miles South, 39.936516°N 105.678611°W, 1768m, 12.VI.1961, coll. B.H. Poole, CNCD200165, (1♀ CNC); 40.01552°N 105.271103°W, grindelia, 20.VII.1908, 7.VIII.1906, coll. S.A. Rohwer, T.D.A. Cockerell, USNM.ENT1024456, USNM.ENT1024501, (2ex USNM); Denver, 39.739154°N 104.984703°W, 18.VI.1918, coll. L.O. Jackson, USNM.ENT1024506, (1ex USNM); Doolittle Ranch, Mount Evans, 39.675739°N 105.601348°W, 2713m, 12.VII.1961, coll. C.H. Mann, CNCD200279, (1♀ CNC); 2987m, 10.VIII.1961, coll. S.M. Clark, CNCD200504, (1ex CNC); Echo Lake, Mount Evans, 39.658085°N 105.6035°W, 11.VIII.1961, coll. C.H. Mann, CNCD200306, CNCD200505, (1♂ 1♀ 1ex CNC); Emery County, 30 km North Northeast of Hanksville, 38.916667°N 110.583333°W, 1660m, 4.IX.1991, coll. W. Steiner & J. Hill, USNM.ENT1027133, (1♂ USNM); Estes Park, 40.376877°N 105.519167°W, 13.VII.1934, coll. A.L. Melander, USNM.ENT1024625, (1ex USNM); Florissant, 38.946209°N 105.289346°W,

2.VII.1907, coll. S.A. Rohwer, USNM.ENT1024497, (1ex USNM); Huerfano Co., Cordova Pass, 32.35°N 105.016667°W, 3354m, 29.VIII.1991, coll. G.F. & J.F. Hevel, USNM.ENT1024713, (1ex USNM); Milner Pass, 40.420064°N 105.811665°W, 3353m, 10.VII.1964, coll. H.H. Knight, USNM.ENT1024724, (1ex USNM); Nederland, Science Lodge, 39.95°N 105.5°W, 2896m, 4.VII.1961, coll. B.H. Poole, CNCD200304, (1♀ CNC); Nederland, 39.961376°N 105.510831°W, 4.VII.1961, coll. B.H. Poole, CNCD200216, (1♀ CNC); Pikes Peak, Glen Cove, 38.834209°N 104.860284°W, 3597m, VIII.1932, coll. V.M. Tanner, USNM.ENT1024442, (1ex USNM); Pingree Park, 40.567018°N 105.593372°W, 19-24.VIII.1935, 5.I.1949, coll. C.L. Hayward, D.A. Wilbur, V.M. Tanner, USNM.ENT1024451, USNM.ENT1024616, USNM.ENT1024631, (3ex USNM); 40.567018°N 105.597778°W, 26.VIII.1936, coll. C.B. Philip, CNCD200272, (1♀ CNC); Poncha Springs, 7 miles North, 38.614575°N 106.078801°W, 2286m, 22.VI.1961, coll. W.R.M. Mason, CNCD200199, (1♀ CNC); Rio, Grande County, South Fork, 37.6°N 106.716667°W, Malaise trap, 20.VI.1972, coll. W.W. Wirth, USNM.ENT1024562, (1ex USNM); coll. Coquiliet Collection, USNM.ENT1024537, (1ex USNM); **Connecticut:** Lyme, 41.4°N 72.35°W, 10.VI.1918, 21.VI.1918, 29.VI.1918, coll. C.T. Greene, Champlain, W.S. Fisher, USNM.ENT1024428, USNM.ENT1024531, USNM.ENT1024540, (1♂ 2ex USNM); Norwichtown, 41.553574°N 72.10439°W, coll. A. Latham, USNM.ENT1024622, (1ex USNM); Redding, 41.302716°N 73.383846°W, 10.VI.1929, coll. A.L. Melander, USNM.ENT1024581, (1ex USNM); Stanford, 15.IX.1942, USNM.ENT1024454, (1ex USNM); Williston, 8.VII, USNM.ENT1024490, (1ex USNM); **Florida:** Arcadia, 27.215883°N 81.858416°W, 2.VII.1962, coll. K.V. Krombien, USNM.ENT1027007, (1♂ USNM); Archer, 29.53036°N 82.51897°W, III.1882, coll. G.F. Knowlton, USNM.ENT1024515, (1ex USNM); Hialeah, Sjogren's Farm, 25.847624°N 80.270186°W, 18.VI.1971, coll. C. Stegmaier, USNM.ENT1024565, (1ex USNM); Marion Co., Silver Springs Woods Ocala Nt. For., 6-15.VI.1984, coll. S.A. Marshall, JSS18173, (1♂ DEBU); White Springs, 30.32967°N 82.759017°W, 18.X, X.1917, coll. C.H.T. Townsend, Mrs. C.H.T. Townsend,

USNM.ENT1024380, USNM.ENT1024520, (1♂ 1ex USNM); **Georgia**: South Georgia, coll. Morrison, USNM.ENT1024530, (1ex USNM); **Idaho**: 10 miles West of Idaho Falls, Bonneville County, 43.521776°N 112.228457°W, 14.VI.1966, coll. J.E. Slansky, CNC249039, (1♂ UCDC); Boise, 43.6°N 116.2°W, 13.VI.1915, coll. A.K. Fisher, USNM.ENT1024546, (1ex USNM); Lava Hot Springs, 42.619234°N 112.010858°W, 3.IX.1959, coll. D.E. Johnson, USNM.ENT1024439, USNM.ENT1024619, (2ex USNM); Moscow Mountains, 46.800972°N 116.866093°W, 1.VI.1910, VII.1910, coll. R.C. Shannon, USNM.ENT1024549, USNM.ENT1024748, (2ex USNM); Moscow Mountain, 12.VI.1910, 2.VII.1911, USNM.ENT1024657, USNM.ENT1024658, (2ex USNM); Potlatch, 46.92149°N 116.898215°W, USNM.ENT1024660, (1ex USNM); West Chicago Creek, Idaho Springs, 39.741855°N 105.512629°W, 2987m, 11.VIII.1961, coll. J.E.R. Stainer, CNC200148, (1♂ CNC); **Illinois**: Champaign County, 40.13487°N 88.142796°W, 15.VI.1926, coll. M. Shackleford, CNC200411, (1♀ CNC); McHenry, 42.333333°N 88.266667°W, 3.VI.1900, USNM.ENT1024642, (1ex USNM); **Indiana**: La Fayette, 40.418145°N 86.884201°W, 17.VI.1915, VI.1901, VIII.1921, coll. J.M. Aldrich, USNM.ENT1024476, USNM.ENT1024504, USNM.ENT1024538, (1♂ 2ex USNM); Lafayette, 40.416702°N 86.875287°W, 15.VI.1915, coll. J.M. Aldrich coll., USNM.ENT1024404, (1♂ USNM); Minrl. Mineral Sprgs. Springs, 31.VIII.1925, USNM.ENT1024387, (1♂ USNM); **Iowa**: 3 mi. S.E. Ogden, Boone Co., 42.029754°N 93.982816°W, black-eyed susan, 21.VI.1970, coll. R.R. Pinger, Jr., USNM.ENT1024731, (1ex USNM); Ames, 42.023793°N 93.625687°W, 2.VI.1925, coll. H.H. Knight, USNM.ENT1024541, USNM.ENT1024735, (2ex USNM); 42.033333°N 93.616667°W, 17.VI.1923, 28.VI.1923, CNC200237, CNC200361 (2♀ CNC); Woodbury Co., 3 mi. ESE Holly Springs, Loess Hill, 42.25°N 96.033333°W, 13.VI.1970, coll. R.R. Pinger, Jr., USNM.ENT1024715, USNM.ENT1024736, (1♂ 1♀ USNM); **Kansas**: 3 miles Northeast of Lawrence, 38.998974°N 95.177971°W, *Heterotheca grandiflora*, IX.1979, coll. R.W. Brooks, CNC250049, (1♀ UCDC); Lawrence, 38.971669°N 95.23525°W, 6.VI.1922, coll. C.H. Curran,

CNCD200352, (1♀ CNC); Manhattan, 39.18361°N 96.57167°W, 24.X.1938, coll. C.W. Sabrosky, USNM.ENT1024743, (1ex USNM); Medora, 38.148899°N 97.845605°W, V, coll. W. Knaus, USNM.ENT1024618, (1ex USNM); Onaga, 39.493365°N 96.169955°W, coll. Crevecoeur, USNM.ENT1024505, (1ex USNM); **Maryland**: Beltsville, 39.035014°N 76.907286°W, 22-30.IX.1952, coll. D.G. Shappirio, USNM.ENT1024564, (1ex USNM); Bethesda, 38.966667°N 77.1°W, 25.IX.1913, coll. J.C. Crawford, USNM.ENT1024468, (1ex USNM); Cabin John, 38.973653°N 77.158582°W, *Elephantopus carolinanus*, 6.IX.1914, coll. J.C. Crawford, USNM.ENT1024576, (1ex USNM); Camp Meade, 39.101329°N 76.76472°W, 5.VI.1919, coll. R.C. Shannon, USNM.ENT1024553, USNM.ENT1024626, (2ex USNM); Chain Bridge, D.C., 38.930317°N 77.111983°W, flowers of *Ceanothus ovatus*, 28.V.1922, coll. W.L. McAtee, USNM.ENT1024500, (1ex USNM); Colesville, 39.066667°N 77.°W, 28.V.1977, coll. W.W. Wirth, USNM.ENT1024734, (1ex USNM); Montgomery Co., Bethesda, 38.966667°N 77.1°W, 30.V.1971, coll. G. Steyskal, USNM.ENT1024571, (1ex USNM); Plum Point, 38.614219°N 76.512133°W, 28.V.1922, coll. L.L. Buchanan, USNM.ENT1024511, (1ex USNM); Rock Creek, Washington D.C., 38.901077°N 77.045393°W, *Chrysanthemum*, 3.VI.1917, coll. C.H.T. Townsend, USNM.ENT1024482, (1ex USNM); Washington D.C., 38.9°N 77.033333°W, 3.VIII.1907, coll. W.L. McAtee, USNM.ENT1024467, (1ex USNM); **Massachusetts**: Melrose Highlands, 42.470929°N 71.061441°W, *Solidago*, 13.IX.1914, coll. C.H.T. Townsend, USNM.ENT1024458, (1ex USNM); Mount Holyoke Gap, 42.20502°N 72.619381°W, *Aster*, *Solidago*, 17.IX.1914, coll. C.H.T. Townsend, USNM.ENT1024486, USNM.ENT1024492, USNM.ENT1024493, USNM.ENT1024494, (4ex USNM); Nantucket Island, 41.283333°N 70.083333°W, *grindelia*, 29.VIII.1867, coll. C.V. Riley, USNM.ENT1024457, (1ex USNM); Petersham, 42.48761°N 72.186927°W, 1.VII.1926, coll. A.L. Melander, USNM.ENT1024587, (1ex USNM); Woods Hole, 41.530302°N 70.667905°W, 7.IX.1915, 7.VII.1919, VII.1920, VIII.1920, coll. A.H. Sturtevant, E.G. Anderson, L. Wood, USNM.ENT1024554, USNM.ENT1024555, USNM.ENT1024556, USNM.ENT1024617, (4ex

USNM); **Michigan**: Ann Arbor, 42.280145°N 83.742924°W, *Rhus typhina*, on *Crataegus*, 13.VII.1917, 27.VI.1917, coll. E.G. Anderson, USNM.ENT1024470, USNM.ENT1024607, USNM.ENT1024608, USNM.ENT1024609, (4ex USNM); Constantine, St. Joseph Co., 41.84116°N 85.668603°W, 14.IX.1959, coll. G.C. Eickwort, USNM.ENT1024732, (1ex USNM); Detroit, 42.342543°N 83.053849°W, 1.IX.1933, 3.VII.1934, coll. G. Steyskal, USNM.ENT1024440, USNM.ENT1024665, (2ex USNM); Emmett County, 45.58°N 84.98°W, 14.VIII.1943, coll. R.R. Dreisbach, CNCD200327, (1♂ CNC); Livingston Co., E.S. George Reserve, 42.620795°N 83.847302°W, 24.VII.1943, coll. Geo. Steyskal, USNM.ENT1024434, (1♂ USNM); Nottawa, 41.943094°N 85.47507°W, 18.VIII.1957, coll. G. Steyskal, USNM.ENT1024710, USNM.ENT1024717, (2♂ USNM); Pierport, Manistee County, 44.426668°N 86.24009°W, 4.IX.1964, coll. R. & J. Matthews, USNM.ENT1024621, USNM.ENT1024865, (1♀ 1ex USNM); Presque Isle Co., Ocqueoc Lake, 45.474772°N 84.114°W, 18-23.VII.1987, coll. R.W. & E.R. Hodges, USNM.ENT1024733, (1ex USNM); Traverse City, 17.VI.1943, coll. C. Sabrosky, USNM.ENT1024712, (1♀ USNM); Turin, 8.VIII.1936, coll. C.W. Sabrosky, USNM.ENT1024751, (1ex USNM); Yankee Springs Game Area, Barry Co., 17.VIII.1960, coll. G.C. Eickwort, USNM.ENT1024702, (1♂ USNM);

Mississippi: Lafayette County, 34.4°N 89.5°W, III-V.1943, IV-V.1946, VI.1934, coll. F.M. Hull, CNCD200229, CNCD200377, CNCD200381, CNCD200385, CNCD200386, CNCD200396, CNCD200399, CNCD200440, CNCD200442, (8♂ 1ex CNC); Sardis Lake, 34.475319°N 89.670682°W, 15.VIII.1960, coll. F.M. Hull, CNCD200400, (1♂ CNC); **Missouri**: Columbia, Boone County, 38.951705°N 92.334072°W, Malaise trap, 14.VIII.1967, coll. F.D. Parker, USNM.ENT1024714, (1♂ USNM); Columbia, Malaise trap, 14.VI.1967, 15.VI.1968, 21.VIII.1967, 26.VIII.1967, 9.VI.1967, coll. F.D. Parker, USNM.ENT1024567, USNM.ENT1024568, USNM.ENT1024569, USNM.ENT1024737, USNM.ENT1024793, (1♂ 1♀ 3ex USNM); **Montana**: Bozeman, 45.666667°N 111.033333°W, 1463m, 3.VII.1902, USNM.ENT1024659, (1ex USNM); Gardiner Valley, 45.031678°N 110.704946°W,

20.VIII.1918, coll. A.L. Melander, USNM.ENT1024589, (1ex USNM); Helena, 39.912796°N 94.649536°W, 6.VIII.1909, 9.VIII.1909, USNM.ENT1024522, USNM.ENT1024525, (2ex USNM); Madison Co., Ruby River Res. Reserve, 9 miles S Alder, 45.213152°N 112.12496°W, 30.VI.1964, coll. C.&B. Durden, USNM.ENT1024409, (1♂ USNM); Roosevelt Co., Bainville, 9.VI.1969, coll. W.W. Wirth, USNM.ENT1024572, (1ex USNM); Yellowstone National Park, near Gardiner, 45.032025°N 110.705363°W, 16.VIII.1962, coll. Phyl & Paul Spangler, USNM.ENT1024990, (1♂ USNM); **Nebraska**: Hooker Co. Mullen, 1.5 Miles N. (Middle Loup River), 42.033333°N 101.033333°W, 2-4.VII.1983, coll. Grissel & Menke, USNM.ENT1024695, USNM.ENT1024697, USNM.ENT1024698, USNM.ENT1024699, (3♂ 1ex USNM); Pyramid Lake, Washoe County, 39.958639°N 119.593503°W, 20.VI.1974, coll. B. Villegas, debu1157181, (1♀ DEBU); **Nevada**: Mercury, 36.66063°N 115.994496°W, 12.VI.1964, coll. H. Stapin, USNM.ENT1024614, (1ex USNM); Ormsby Co., 6.VII, coll. Baker, USNM.ENT1024527, (1ex USNM); **New Hampshire**: White Mountains, Dolly Copp, 44.271°N 71.305°W, 27.VIII.1937, coll. A.L. Melander, USNM.ENT1024629, (1ex USNM); **New Jersey**: Atco, 39.769722°N 74.887778°W, 13.VI.1947, coll. J.C. Crawford, USNM.ENT1024469, (1ex USNM); Clementon, 39.806194°N 74.982944°W, 11.IX.1909, 11.V.1902, USNM.ENT1024762, USNM.ENT1024763, (2ex USNM); Riverton, 40.011501°N 75.014893°W, 20.VI.1909, 30.V.1910, 7.IX.1908, coll. G.M. Greene, USNM.ENT1024516, USNM.ENT1024745, USNM.ENT1024756, (3ex USNM); **New Mexico**: 10 miles North of Santa Rosa, 34.93867°N 104.682489°W, VIII.1950, coll. F.M. Hull, CNCD200369, (1♀ CNC); 12 miles North of Las Cruces, Dona Ana County, 32.472417°N 106.888286°W, 9.IV.1965, coll. F.D. Parker, CNCD249016, (1♀ UCDC); Beulah, 35.774687°N 105.153639°W, 16.VIII, USNM.ENT1024495, (1ex USNM); City of Rocks St. Pk., 32.566389°N 107.96°W, 17.VII.1959, coll. K.V. Krombein, USNM.ENT1024611, USNM.ENT1024612, USNM.ENT1024613, (1♀ 2ex USNM); Hidalgo Co. 15 mi S of Animas, 31.737249°N 108.822028°W, 24.VIII.1986, coll. R.J. McGinley & B.M. Norden, USNM.ENT1024711, (1ex USNM); Highway 766, 26 miles West of

Santa Rosa, 34.935777°N 105.144155°W, 7.IX.1964, coll. F.M. & M.C. Hull, CNCN79806, (1♀ CNC); Koehler, 36.740863°N 104.618325°W, 30.VII.1915, coll. W.R. Walton, USNM.ENT1024444, (1ex USNM); Las Cruces, 32.3°N 106.766667°W, on Populus, USNM.ENT1024499, (1ex USNM); Las Vegas, 35.592589°N 105.215008°W, malvastrum corci., 19.VI, USNM.ENT1024491, (1ex USNM); Lordsburg, 32.348136°N 108.709262°W, 1.V.1942, coll. A.L. Melander, USNM.ENT1024601, (1ex USNM); Maxwell, 36.540114°N 104.542017°W, 6.VIII.1914, coll. W.R. Walton, USNM.ENT1024606, (1ex USNM); Pecos, 35.571341°N 105.674334°W, 1.VII, 4.IX, 8.VII, coll. W.L. McAtee, USNM.ENT1024489, USNM.ENT1024535, USNM.ENT1024739, (3ex USNM); Socorro, Williston, 34.0584°N 106.891416°W, 1916, coll. J.M. Aldrich, USNM.ENT1024518, (1ex USNM); Taos Co., 17 mi. NW Taos, 3.VII.1970, coll. D.R. Miller, USNM.ENT1024585, (1ex USNM); coll. F.M. Hull, CNCN200371, (1♀ CNC); **New York:** Cold Spring Harbor, Long Island, 40.871487°N 73.456788°W, 24.VI.1921, VIII, coll. S.H. Emerson, V. Argo, USNM.ENT1024485, USNM.ENT1024638, (2ex USNM); Ithaca, 42.444235°N 76.5°W, 30.V.1918, coll. S.H. Emerson, USNM.ENT1024448, USNM.ENT1024610, (2ex USNM); Keeseville, 44.505046°N 73.480135°W, 2.VI.1918, 3.VI.1918, coll. A.K. Fisher, USNM.ENT1024507, USNM.ENT1024529, USNM.ENT1024533, (3ex USNM); West Nyack, 11.VI.1939, coll. A.L. Melander, USNM.ENT1024594, (1ex USNM); West Point, 41.391483°N 73.955972°W, 10.IX.1923, coll. W. Robinson, USNM.ENT1024426, (1♂ USNM); Whiteface Mountain, Adirondacks, 44.39726°N 73.899556°W, 1158m, 4.VII, coll. J.M. Aldrich, USNM.ENT1024449, (1ex USNM); **North Dakota:** Billings County, Medora, 46.913903°N 103.524353°W, 13-18.VI.1979, coll. C.W. Sabrosky, USNM.ENT1024408, (1♀ USNM); Bismarck, 46.805904°N 100.780959°W, 21.VII.1918, coll. I.N. Gabrielson, USNM.ENT1024521, (1ex USNM); Burgan, 8.VIII.1935, coll. A.L. Melander, USNM.ENT1024583, (1ex USNM); Martin, 47.827463°N 100.115181°W, 8.VIII.1935, coll. A.L. Melander, USNM.ENT1024632, (1ex USNM); Minot, 48.23251°N 101.296273°W, 18.VI.1918, coll. J.M. Aldrich, J.M. Aldrich coll.,

USNM.ENT1024379, USNM.ENT1024406, (2♂ USNM); **Oklahoma:** Ardmore, Indian Territory, 34.174261°N 97.143625°W, 16.V, coll. C.R. Jones, USNM.ENT1024403, (1♂ USNM); Beaver Co., Elmwood, 36.616406°N 100.522629°W, 4.IV.1979, coll. R.J. McGinley, USNM.ENT1024721, USNM.ENT1024722, USNM.ENT1024723, (3ex USNM); **Oregon:** Baker County, Pleasant Valley, 44.67718°N 117.629933°W, 5.VIII.1970, coll. D.R. Miller, USNM.ENT1024563, (1ex USNM); Corvallis, 44.56454°N 123.262192°W, 17.VII.1910, coll. J.C. Bridwell, USNM.ENT1024445, (1ex USNM); Deep Creek, 1 mile East of Adel, Lake County, 42.05512°N 119.48427°W, 13.IX.1969, coll. R.F. Denno, E.E. Grissell, CNCD249048, (1♂ UCDC); Imnaha, 45.559367°N 116.833228°W, 18.VII.1950, USNM.ENT1024570, (1ex USNM); Juntura, 43.744555°N 118.079582°W, 16.VIII.1974, 16.VIII.1979, coll. R.M. Bohart, CNCD249069, CNCD249185, (1♂ 1♀ UCDC); Lake of Woods, Klamath Co., 42.368634°N 122.208482°W, 13.VIII.1935, coll. G. Ferguson, USNM.ENT1024744, (1ex USNM); Mt. Hood, 45.368614°N 121.696776°W, 914m, 29.VII.1921, coll. A.L. Melander, USNM.ENT1024603, (1ex USNM); JSS19857, (1ex ; **Pennsylvania:** Pocono Lake, 41.105644°N 75.474999°W, 9.VII.1911, USNM.ENT1024746, (1ex USNM); **South Carolina:** Clemson College, 34.677049°N 82.838754°W, 12.X.1908, coll. C.H.T. Townsend, USNM.ENT1024545, (1ex USNM); **South Dakota:** Brookings, 44.311357°N 96.798388°W, coll. J.M. Aldrich coll., USNM.ENT1024393, (1♀ USNM); Custer, 43.766651°N 103.598806°W, coll. J.M. Aldrich coll., USNM.ENT1024383, USNM.ENT1024386, USNM.ENT1024388, USNM.ENT1024389, USNM.ENT1024397, (5♂ USNM); Sisseton, 45.664944°N 97.050087°W, 24.X.1936, coll. H.C. Severin, USNM.ENT1024431, USNM.ENT1024432, USNM.ENT1024433, (3♀ USNM); **Tennessee:** La Follette, 36.382649°N 84.121037°W, 15.VIII.1916, USNM.ENT1024628, (1ex USNM); **Texas:** 44 miles North, Van Horn, Culberson County, 31.641845°N 104.862177°W, roadside vegetation, 27.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCD249063, (1♂ UCDC); Austin, 30.266667°N 97.733333°W, USNM.ENT1024643, USNM.ENT1027037, (1♀ 1ex USNM); Bangs, 31.716772°N 99.132885°W, 8.VI.1938, coll. Christenson, USNM.ENT1024478,

(1ex USNM); Big Bend National Park, Dagger Flats, 29.°N 103.°W, 1067m, 11.V.1959, 25.V.1959, coll. J.F. McAlpine, W.R.M. Mason, CNCD200133, CNCD200157, (2♀ CNC); Big Bend National Park, Panther Junction, 29.32833°N 103.20472°W, 1067-1219m, 8.V.1959, coll. W.R.M. Mason, CNCD200296, (1♂ CNC); Big Bend National Park, Pine Canyon, 29.265892°N 103.242965°W, 1524-1829m, 4.V.1959, coll. J.F. McAlpine, CNCD200258, (1♀ CNC); 29.78°N 103.48°W, 4.V.1959, coll. J.F. McAlpine, CNCD89255, (1♀ MZUL); Big Bend National Park, Santa Elena canyon, 29.207204°N 103.510979°W, 640m, 5.V.1959, coll. J.F. McAlpine, CNCD200183, (1♀ CNC); Canyon, Randall County, 34.983645°N 101.919338°W, 21.VI.1969, coll. R.M. Bohart, CNCD249000, (1♀ UCDC); Comstock, 29.68438°N 101.173438°W, 29.IV.1959, coll. J.F. McAlpine, CNCD200142, (1♀ CNC); Devil's River, 34.174261°N 97.143625°W, on Sumach, 5.V.1907, coll. F.C. Bishopp, USNM.ENT1024396, (1♂ USNM); Devils Riv., on sumach, 5.V.1907, USNM.ENT1024415, (1♂ USNM); Dumas Moore County, 35.865234°N 101.973004°W, 1.VII.1970, coll. D.R. Miller, USNM.ENT1024615, (1ex USNM); Fort Davis, Limpia Canyon, 30.588211°N 103.894625°W, 1524m, 28.V.1959, coll. J.F. McAlpine, CNCD200287, CNCD200292, (2♂ CNC); Horse Canyon, Black Gap Refuge, Southeast of Brewster County, 15.V.1959, coll. Howden & Becker, CNCD200143, (1♂ CNC); Hudspeth Co., McNary, 31.247723°N 105.796633°W, 18.V.1973, coll. Menke & Miller, USNM.ENT1024729, (1ex USNM); Kerrville, 30.046264°N 99.135349°W, 12.IV.1907, coll. F.C. Pratt, USNM.ENT1024391, USNM.ENT1024398, (1♂ 1♀ USNM); 30.047433°N 99.140319°W, sweeping, 2.IV.1959, 29.III.1959, 3.IV.1959, 30.III.1959, 31.III.1959, 4.IV.1959, coll. J.F. McAlpine, W.R.M. Mason, CNCD200144, CNCD200147, CNCD200152, CNCD200153, CNCD200154, CNCD200155, CNCD200156, CNCD200160, CNCD200161, CNCD200162, CNCD200168, CNCD200169, CNCD200170, CNCD200172, CNCD200174, CNCD200175, CNCD200181, CNCD200182, CNCD200191, CNCD200262, CNCD200266, CNCD200286, CNCD200298, CNCD200299, CNCD200303, CNCD200305, CNCD200309, CNCD79801, CNCD79802, (20♂ 11♀ CNC); Lajitas, Southwest of Brewster County,

29.261667°N 103.776667°W, 19.V.1959, coll. Howden & Becker, CNCN200158, CNCN200159, (2♀ CNC); Near Point of Rocks, 10 miles West of Fort Davis, 30.588665°N 104.062105°W, 1524m, 29.V.1959, coll. J.F. McAlpine, CNCN200260, (1♀ CNC); Paris, 33.660939°N 95.555513°W, 23.III.1904, coll. F.C. Bishopp, USNM.ENT1024666, (1ex USNM); Rockpile, 30 miles North West of Fort Davis, 30.873666°N 104.281307°W, 1524m, ex. horehound, sweeping, 28.V.1959, coll. J.F. McAlpine, CNCN200140, CNCN200141, CNCN200255, (1♂ 2♀ CNC); Sanderson, 9.V.1912, coll. J.D. Mitchell, USNM.ENT1024503, (1ex USNM); Uvalde, 29.214444°N 99.789722°W, V.1964, coll. F.M. Hull, CNCN200372, (1♀ CNC); Wilbarger Co., 17 mi. N. Vernon, 2.IV.1979, coll. R.J. McGinley, USNM.ENT1024708, USNM.ENT1024709, (1♂ 1♀ USNM); 27.V.1906, coll. F.C. Pratt, USNM.ENT1024441, (1ex USNM); **Utah**: 24 mi. S Hanksville Henry Mts., 38.028415°N 110.712679°W, 2286m, 17.VII.1968, coll. B.E. Martin, CNCN28526, (1♀ CNC); Kanab, Kane County, 37.043416°N 112.526131°W, 31.V.1965, coll. R.M. Bohart, CNCN249071, (1♀ UCDC); Logan, 41.733333°N 111.833333°W, 4.VII.1907, coll. E.G. Titus, USNM.ENT1024627, (1ex USNM); Moab, 20 metres N, 38.573316°N 109.549839°W, 14.IX.1917, coll. A.K. Fisher, USNM.ENT1024488, (1ex USNM); Oak City, 39.375068°N 112.336035°W, 27.V.1958, coll. G.F. Knowlton, USNM.ENT1024514, (1ex USNM); Plain City, Utah Experimental Station, 41.297998°N 112.086054°W, 3.VII.1937, coll. D.E. Hardy, CNCN200412, (1♂ CNC); **Vermont**: Lyndon, 44.515529°N 72.011733°W, 22.VIII.1900, USNM.ENT1024639, (1ex USNM); Tunbridge, 31.VIII.1966, coll. C. Sabrosky, USNM.ENT1024730, (1ex USNM); **Virginia**: 4-mile Run trail, 38.857254°N 77.089125°W, 11.X.1930, coll. Bridwell, USNM.ENT1024477, (1♂ USNM); Cowden, on *Ceanothus americanus*, 5.VI.1918, coll. W.L. McAtee, USNM.ENT1024738, (1♀ USNM); Dead Run, 38.9°N 77.45°W, Flowers of *Ceanothus americanus*, 10.VI.1922, coll. W.L. McAtee, USNM.ENT1024750, (1ex USNM); Duke, 28.VI.1910, coll. F.C. Bishopp, USNM.ENT1024417, (1♂ USNM); Falls Church, 38.883506°N 77.174039°W, *Ceanothus*, 2.VII.1912, 20.VI, 22.VI, 4.IX, 7.IX, 9.V.1919, coll. C.T. Greene, CNCN1024524, USNM.ENT1024452,

USNM.ENT1024480, USNM.ENT1024487, USNM.ENT1024752, USNM.ENT1024753, (6ex USNM); Lewinsville, Scott's Run, 38.929004°N 77.197764°W, 25.VII.1915, coll. J. Silver, USNM.ENT1024483, (1ex USNM); Peaks of Otter, 37.433476°N 79.604858°W, 26.VII.1906, coll. W.M. Palmer, USNM.ENT1024484, (1ex USNM); Potomac Cr., 38.371932°N 77.431203°W, 22.V.1996, 23.V.1996, USNM.ENT1024759, USNM.ENT1024760, (2ex USNM); Upton, Ceanothus, 14.VI.1924, 17.VI.1924, 2.VII.1924, coll. C.T. Greene, W.S. Fisher, USNM.ENT1024459, USNM.ENT1024462, USNM.ENT1024463, USNM.ENT1024464, USNM.ENT1024465, USNM.ENT1024466, (6ex USNM); Wiehlie, 22.VI.1913, coll. R.C. Shannon, USNM.ENT1024481, (1ex USNM); **Washington**: Almota, 46.702937°N 117.469352°W, 26.V.1907, USNM.ENT1024656, (1ex USNM); Asotin Creek, 46.338176°N 117.047326°W, 27.VIII.1924, coll. A.L. Melander, USNM.ENT1024633, (1ex USNM); Asotin, 46.07725°N 117.047326°W, 13.VI.1930, 16.V.1923, 20.V.1923, 5.VI.1930, coll. A.L. Melander, J.M. Aldrich, V. Argo, USNM.ENT1024472, USNM.ENT1024474, USNM.ENT1024604, USNM.ENT1024636, (4ex USNM); Benton City, 46.263065°N 119.487679°W, 6.V.1966, coll. C.W. Sabrosky, USNM.ENT1024558, USNM.ENT1024559, (2ex USNM); Blue Mountains, Dry Creek, 46.089754°N 118.148288°W, 27.VI.1924, coll. V. Argo, USNM.ENT1024588, USNM.ENT1024593, (2ex USNM); Buena, 46.428738°N 120.313391°W, 24.VI.1923, coll. V. Argo, USNM.ENT1024634, USNM.ENT1024635, USNM.ENT1024637, (3ex USNM); Creston, 47.758652°N 118.520371°W, 27.VI.1924, coll. A.L. Melander, USNM.ENT1024591, (1ex USNM); Dartford, 47.782522°N 117.415363°W, 28.VI.1930, coll. J.M. Aldrich, USNM.ENT1024473, (1ex USNM); Ewan, 47.116874°N 117.734651°W, 13.VI.1920, coll. R.C. Shannon, USNM.ENT1024749, (1ex USNM); Lake Paha, 20.VII.1920, coll. R.C. Shannon, USNM.ENT1024595, (1ex USNM); Lind, 46.972089°N 118.615265°W, 12.VI.1919, coll. F.W. Carlson, USNM.ENT1024596, (1ex USNM); Pullman, Lyle Grove, 46.716667°N 117.166667°W, 30.VI.1918, coll. A.L. Melander, USNM.ENT1024582, (1ex USNM); Pullman, Saints Rest, 11.VI.1921, coll. A.L. Melander, USNM.ENT1024600, (1ex USNM); Pullman,

10.VII.1908, 13.IX.1908, 17.V.1906, 23.V.1918, coll. A.L. Melander, USNM.ENT1024539, USNM.ENT1024575, USNM.ENT1024652, USNM.ENT1024653, (4ex USNM); Rattlesnake Ridge, Hanford A.E.C. Res., Benton County, 47.445767°N 121.794994°W, 914m, foliage of *Chrysothamnus viscidifloris*, 12.IX.1966, 14.VIII.1967, coll. W.W. Cone, USNM.ENT1024566, USNM.ENT1024586, (2ex USNM); Ritzville, 47.12728°N 118.379975°W, 12.VI.1920, 16.VI.1920, 22.VIII.1923, coll. R.C. Shannon, V. Argo, USNM.ENT1024471, USNM.ENT1024550, USNM.ENT1024578, USNM.ENT1024747, (4ex USNM); Skagit Co., 13 km NE Marblemount at Damnation Creek, 2.VII.1988, coll. W.E. Steiner, USNM.ENT1024705, USNM.ENT1024706, (2ex USNM); Wawawai, 46.636764°N 117.37699°W, 2.VII.1920, 20.V.1911, 30.V.1923, 7.V.1966, 9.VI.1908, coll. C.W. Sabrosky, V. argo, W.M. Mann, CNCD1024523, USNM.ENT1024453, USNM.ENT1024508, USNM.ENT1024573, USNM.ENT1024599, USNM.ENT1024641, USNM.ENT1024650, USNM.ENT1024651, (8ex USNM); Wenatchee, 26.VII.1908, USNM.ENT1024661, (1ex USNM); **West Virginia**: Bluefield, 37.266667°N 81.216667°W, 17.VI.1970, coll. G. Steyskal, USNM.ENT1024560, (1ex USNM); **Wyoming**: 6 mi. NW Newcastle, 43.919454°N 104.181317°W, 21.VI.1965, coll. R.W. Hodges, USNM.ENT1024543, (1ex USNM); Baby head, 27.V.1906, coll. F.C. Pratt, USNM.ENT1024390, (1♀ USNM); 16.VI, 16.VII.1913, coll. Coquillett Collection, J.M. Aldrich, USNM.ENT1024446, USNM.ENT1024447, USNM.ENT1024542, USNM.ENT1024547, (1♂ 3ex USNM); North Fork, coll. E. Hardy, USNM.ENT1024667, (1ex USNM); 30.V.1899, CNCD200461, CNCD200528, CNCD200529, CNCD200530, USNM.ENT1024654, USNM.ENT1024655, (4♂ 2ex CNC, USNM);

Diagnosis. Often tg-2-3 are distinctly orangy-brown, while tergite-4-6 are darker brown; abdomen in particular appears rather bushy with long black setae; wing cell r_{4+5} open (Fig. 4 A); dorsal thorax with faint bare black stripes against grayish-brown microtomentum (Fig. 18 D).

Description. Male. Body length (including antennae): ~8-10 mm.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape yellowish-orange; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and gena yellow with sparse black setae; frontal vitta dull yellow or brownish-yellow above scape to brown before ocellar triangle, somewhat patchy, with lines of golden microtomentum along lateral margins above eyes that do not extend beyond ocellar triangle, with many black setae; ocellar triangle dull brown to black with many black forward-facing bristles surrounded by many black bristles; occiput and postgena black to dark brown with silverish-white microtomentum with black bristles about occiput and paler bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with dull gray or grayish-brown microtomentum with up to five bare black stripes of varying width and length (Fig. 18 D); central medial stripe often very faint, if present at all; stripes tend to be thin and vary in length with submedial-1 stripes short beginning after postpronotal lobe; submedial-2 stripes longer, beginning about where submedial-1 stripes end, ending just beyond transscutal suture; additional marginal stripes somewhat thicker, and distinctly broken by sutures along the notopleuron; dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing bushy; scutellum mainly covered in gray or grayish-brown microtomentum with several long black setae; lateral thorax mainly dark brown to black, covered in microtomentum the same colour as dorsum,

though ventral margin of katepisternum variably bare; katepisternum with long black bristles; black bristles around cervical sclerite.

Legs. Coxae brown to black with grayish-silver microtomentum, especially on anterior front coxa with black setae; legs tend to be unicolourous brown, usually lighter brown but can be variably light or dark, covered in a very light dusting of silver microtomentum; patchy, with many black setae, somewhat bushy; tibia brown with slightly shorter black setae; distal posterior surface of front and hind tibia with thick transverse patch of setae; tarsomeres brown (same as legs) with sparse black setae, though tarsomere-5 (tm-5) often darker than tm-1; tarsi yellow with black tips with pale yellow pulvilli.

Wing. Membrane clear with yellow colour, completely microtrichose, without colour patterns; halter yellow; wing cell r_{4+5} open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull, dusty brown, with lateral tufts of short black setae; tg-2 slightly paler reddish-brown, or orange with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with strong golden-brown microtomentum appearing laterally and obliquely; tg-3 often pale reddish-brown with golden-brown microtomentum; tg-4-5 usually darker than tg2-3, mainly covered in light golden-brown microtomentum, though irregular; tg-6 covered in golden-brown microtomentum; microtomentum irregular, though a poorly defined medial line is usually apparent from tg3-5; tg2-6 with very thin brown band at posterior edge; abdomen covered in long black setae, rather bushy.

Male Genitalia. (Figs. 32 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, without concentrated patch of longer bristles near joint of surstylus; hypoproct divided, rounded, bulbous,

covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus large, wide, somewhat truncate, with forward-facing tooth or point and back-facing scoop-like or pan-shaped tooth, with short, fine setae, distally; posterior surstylus large, somewhat flat and elongated, slightly apically pointed, with a slight inward curl, with a sparse cluster of black bristles (2-3) longer than and in line with surstylus, with thin lateral membranous appendage present, appearing somewhat like a scoop; hypandrium Y-shaped, elongate with a weakly rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus large, bag-like, slightly pointed or arrow-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply truncate, with short, mid-length, ventral fan of setae; sperm pump rounded, somewhat flat, with long, conical, pointed and slightly apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. *Apis mellifera* Linnaeus (Severin, 1937; Freeman, 1966).

Distribution. Map 5 A (●). Widespread, all over North America.

Habitat. Found in a variety of habitats, including hilltops and elevations as high as 774 m, found on *Achillea millefolium* Linnaeus, *Asclepias* sp. Linnaeus, *Aster* sp. Linnaeus, *Brassica* sp., *Chaenactis* sp. de Condolle, *Chrysothamnus* sp., *Eriogonum* Michaux, *Trifolium repens* Linnaeus (Freeman, 1966), *Helianthus annuus* Linnaeus, *Melilotus*

albus Mediks, *Sphaeralcea angustifolia*, *Haplopappus* Cassini, *Verbesina encelioides* (Cav.) Benth. & Hook f. ex A.Gray, *Lepidium* Linnaeus, *Coreopsis cardaminefolia* Nuttall, *Gaillardia pulchella* Fougereux de Bondaroy, *Opuntia* Miller, *Tetraneuris linearifolia* (Hook.) Greene.

Remarks. Emergence year round, peaking between May and August with winter (November through March) emergences restricted to the Southern USA (TX, AZ, NM, MS).

***Z. harrisi* Burt & Skevington, 2015**

Figs. (25 D-F), Map 6 C (■).

Type material. Holotype; ♂, USA: California: Inyo County, 6 miles west Westgard Pass; 6000' Elevation; 24. VII. 1982, coll. N.J. Smith; genitalia dissected; COI sequenced; CP-dried; CNCN249404 (CNCN).

Paratype series. **CANADA: British Columbia:** Robson, 49.33000°N 117.68000°W, 30.VIII.1948, coll. H.R. Foxlee, CNCN200046, (1♂ CNC); **Quebec:** Knowlton, 45.21671°N 72.51476°W, 5.VII.1927, coll. W.J. Brown, CNCN200029, (1♂ CNC); **Saskatchewan:** Christopher Lake, 53.539969°N 105.789258°W, 15.VII.1959, coll. A. & J. Brooks, CNCN200039, (1♂ CNC); **U.S.A.: California:** 2 miles East of Solvang, Sta Santa Barbara County, 34.606661°N 120.106733°W, 28.VI.1965, coll. J.S. Buckett, CNCN249424, CNCN249426, (1♂ 1♀ UCDC); 4 miles East of Garberville, Humboldt County, 40.110000°N 123.752303°W, 31.VIII.1979, coll. R.W. Brooks, CNCN249427, (1♂ UCDC); Alameda County, 22 miles South of Livermore, Mines Road, 37.458525°N 121.516497°W, 22.V.1976, coll. R.B. & L.S. Kimsey, CNCN249425, (1♂ UCDC);

Barton Flat So Fork Camp, 34.169367°N 116.826208°W, 1.IX.1944, 11.IX.1944,
 2.IX.1944, 21.IX.1944, 9.IX.1944, coll. A.L. Melander, USNM.ENT1024029,
 USNM.ENT1024036, USNM.ENT1024047, USNM.ENT1024048, USNM.ENT915776,
 USNM.ENT915786, (3♂ 3♀ USNM); Camp Angelus, 34.145842°N 116.982447°W,
 23.IX.1954, coll. A.L. Melander, USNM.ENT915929, (1♀ USNM); Davis, Yolo County,
 38.544906°N 121.740514°W, 23.X.1969, coll. I.A. Boussy, CNCD249415, (1♂ UCDC);
 Forest Home, 34.088625°N 116.931342°W, 26.VIII.1944, coll. A.L. Melander,
 USNM.ENT1024114, (1♂ USNM); Lost Creek, San Berdo Mts., 34.169075°N
 116.824792°W, 27.VII.1953, coll. A.L. Melander, USNM.ENT1024115, (1♂ USNM);
 Ortega Highway El Cariso, 33.650278°N 117.415267°W, 19.X.1944, coll. A.L.
 Melander, USNM.ENT1024037, (1♂ USNM); Ortega Highway, El Cariso, 19.X.1944,
 coll. A.L. Melander, USNM.ENT915783, (1♂ USNM); Phelan, 34.425847°N
 117.572639°W, 23.V.1945, coll. A.L. Melander, USNM.ENT1024039, (1♂ USNM); S.
 Fork Sta Ana, 34.171678°N 116.830306°W, 31.VII.1942, coll. A.L. Melander,
 USNM.ENT915777, (1♂ USNM); San Benito County, Clear Creek, 36.380539°N
 120.724378°W, 21.V.1984, 31.V.1984, coll. N.J. Smith, CNCD249403, CNCD249407,
 (2♂ UCDC); San Bernadino Co., San Bernadino Mountains, Mount Home Canyon,
 34.130139°N 116.880172°W, 1219m, 27.IX.1955, 9.IX.1958, coll. Melander,
 USNM.ENT1024163, USNM.ENT1024164, USNM.ENT1024165,
 USNM.ENT1024166, USNM.ENT1024167, USNM.ENT1024168,
 USNM.ENT1024169, (7♂ USNM); Stanford University, Santa Clara County,
 37.427983°N 122.170389°W, 30.IX.1953, coll. P.H. Arnaud, USNM.ENT1024238,
 USNM.ENT1024239, USNM.ENT1024240, (2♂ 1♀ USNM); Stanford University,

20.X.1953, 30.X.1957, coll. P.H. Arnaud, P.H. Arnaud, Jr., USNM.ENT1024120, USNM.ENT1024225, (2♂ USNM); Up Sta Riv Upper Santa Ana River, 34.091253°N 117.120742°W, 2.VIII.1953, coll. A.L. Melander, USNM.ENT1024024, (1♂ USNM); **New Mexico:** Grant County, 13.5 miles North of Silver City, Cherry Creek Campground, 32.910000°N 108.228333°W, 2088m, 25.V.2013, coll. J.E. O'Hara, CNCD224747, (1♂ CNC); **Utah:** 24 miles South of Hanksville, Henry Mountains, 38.028417°N 110.712681°W, 2286m, 18.VII.1968, coll. J.E.H. Martin, CNCD200019, (1♂ CNC).

Material dissected. CNCD200046, CNCD224747 (COI-sequence), CNCD200029 (COI-sequence), CNCD200019, CNCD200039, CNCD199944 (6♂).

Diagnosis. Scutum usually blue, powder blue, green, or bluish-brown, sometimes dark with 4-6 black stripes (Fig. 19 D); r_{4+5} cell open (4 A).

Description. Male. Body length (including antennae): ~4-4.5 mm.

Head. Antennae mainly light brown with light dusting of silverish-white microtomentum; scape brown; flagellum orangy-brown with darker brown patch distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and gena yellow with mix of sparse pale and black setae; frontal vitta yellow about the ptilium fissure and distinctly darker reddish-brown about ocellar triangle, covered with light brown microtomentum without thin line of silver microtomentum along lateral margins above eyes, with black setae; ocellar triangle with dull brown microtomentum with two short, black, forward-facing bristles; occiput and postgena brown with dusting of faint grayish microtomentum with black bristles; black

microtomentum lining eye when viewed dorsally absent; palps brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum variably blue, green, dark brown or very dark blueish-brown with four black stripes that extend just beyond the transscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum same colour as scutum, dull, with four long black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 1-3 long black bristles; one black bristle at cervical sclerite.

Legs. Hind and mid coxae dusty, light brown with black setae; front coxa light brown with setae; hind coxa with faint silver microtomentum; legs mainly unicolourous brown, though slightly paler at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres brownish-yellow with short black setae; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (4 A).

Abdomen. (Figs. 20 C-F) Tergites dull, dark brown; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint grayish-brown microtomentum appearing laterally; tg-3 dull brown with lateral grayish-brown microtomentum forming obliquely a triangular pattern dorsally; tg-4-5 mainly covered in light grayish-brown microtomentum, except for 2 small dull brown triangular spots

appearing dorsally, divided by microtomentum; tg-6 covered in grayish-brown microtomentum; abdomen sparsely covered in short black setae.

Male Genitalia (Figs. 25 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow, covered in fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, truncate, with slight forward and sharp back-facing teeth or points, with short, fine setae, distally; posterior surstylus large, bulbous, somewhat elongated, apically rounded with a slight inward curl, without concentrated cluster of long black bristles in line with surstylus, no membranous appendage present, though exaggerated and rounded lateral protrusion present; hypandrium Y-shaped, elongate with a sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus somewhat small, generally pointed, arrow-shaped with usually three pinched ribs or horizontal invaginations, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, faint, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, and apically curled, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Etymology. Patronym for Dr. Sam Harris, an American neuroscientist, author, atheist activist and outspoken advocate for science and reason.

Hosts. unknown

Distribution. Map 6 C (■). Widespread, though found mainly in the southwest United States, especially along the California coast. There is a single conspicuous record from Quebec, Canada. Genitalic dissection and COI molecular data indicate that it is *Z. harrisi*. However, full sequences of COI might indicate a subtle species complex represented by this northeastern record.

Habitat. Unknown.

Remarks. Intraspecific COI pairwise distance variation: 0-1.4%. Interspecific variation with: *Z. albifacies*: 12.0-13.0% *Z. hirsialiae*: 13.6-15.7%; *Z. nanellum*: 12.6-13.8%; *Z. hitchensi*: 18.3-19.6%; *Z. pygmaeum*: 11.5-12.5%.

***Z. hauseri* Burt & Skevington, 2015**

Figs. (29 A-C, 4 A, 18 C).

Type material designation. Holotype; ♂; USA: California: Monterey County, Arroyo Seco Campground; 25.IV.1998; coll. Madeline & Paul H. Arnaud, Jr. (Field Note #01913); USNM.ENT1027122 (USNM).

Additional material examined. None. Described from a single male specimen.

Diagnosis. Larger species (~9-10 mm); frontal vitta dark reddish-brown, almost black; frons, facial carina, parafacial and genae dark brown, with thick brown microtomentum; tarsomeres-1-3 (tm-1-3) brown (same colour as tibia) with sparse black setae, though tm-4-5 are darker brown, almost black; antennae brownish-black; wing cell r_{4+5} open (Fig. 4

A); abdomen distinctly “chocolate” brown with golden microtomentum; thorax with distinct bare black maculation pattern (Fig. 18 C) (as in *Z. intermedium*).

Description. Male. Body length (including antennae): ~8 mm.

Head. Antennae blackish-brown with faint dusting of silverish-white microtomentum; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; arista, black; eyes dark brown; frons, antennal grooves and facial carina dark brown with light dusting of brown microtomentum; frons and gena dark brown with few black setae and many pale setae; frontal vitta dark reddish-brown, nearly black especially about ocellar triangle, with lines of silver microtomentum along lateral margins above eyes with a dark interruption about the oc tr, with many black setae, slightly bushy; ocellar triangle shiny black with four black forward-facing bristles surrounded by many black bristles; occiput and postgena black to dark brown with brownish-gray microtomentum with black bristles about occiput and slightly paler bristles about postgena; palps dark brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum covered with dark brown microtomentum with 6-7 thin and prominent bare black stripes; as in *Z. intermedium* (Fig. 18 C); medial stripe extends from below the postpronotal lobe to the transscutal suture with three submedial stripes on either side of varying lengths; sometimes medial stripe is very faint, or absent; submedial stripes-3 somewhat thicker, and broken up by sutures along the notopleuron; dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing bushy; scutellum same colour as scutum with several long black setae; lateral thorax mainly dark brown to black, covered in microtomentum the same

colour as dorsum, though ventral margin of katepisternum bare; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Coxae patchy dark brown and brown with dusting of brownish-gray microtomentum, especially on anterior front coxa with many long black setae, slightly bushy; tibia brown with many shorter black setae; distal posterior surface of hind tibia with thick transverse patch of black setae; tarsomeres 1-3 brown (tm-1-3) (same as legs) with sparse black setae, though tm-4-5 almost always darker; tarsi brownish-black with yellow pulvilli.

Wing. Membrane clear with slight brownish-yellow colour, darkened, cloudy, completely microtrichose, without colour patterns; halter yellow; *wing cell* r_{4+5} open in Holotype (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull dark brown, with lateral tufts of short black setae; tg-2 dark brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3-5 dull dark brown with lateral and oblique golden-brown microtomentum; tg-6 covered in golden-brown microtomentum; tg-2-5 with very thin brown band at posterior edge; microtomentum irregular, dusty, with only a faint medial stripe apparent on tg-2-5; abdomen sparsely covered in short black setae.

Terminalia. Figs. 29 A-C. Epandrium exposed in the Holotype, very shiny and very dark brown with many setae; ventrally, the sternal membrane above the opening of the epandrium appears darkened, sclerotized nodules or dull teeth that somewhat flank the posterior surstyli; visible features suggest a very close relationship to *Z. intermedium* Banks, 1916.

Genitalia. (see Terminalia above) Not dissected as most of the genitalia is exposed on the single male specimen, the holotype, and appears close to *Z. intermedium* Banks, 1916.

Female. none.

Etymology. Patronym for Dr. Martin Hauser, a Germany born, American entomologist at the California Department of Food and Agriculture (CDFA), whose enthusiasm for science and nature are only rivaled by his helpful and kind character. His assistance in this revision is beyond measure.

Hosts. Unknown.

Distribution. Found in coastal California, USA.

Remarks. No COI sequence data are available at this time. This species is based on a single specimen unique in morphology.

***Z. hirsialiae* Burt & Skevington, 2015**

Figs. (28 D-F), Map 6 C (▲).

Type material. Holotype; ♂; USA: California: Palm Springs; Andreas Canyon; 26-III-1982, coll. N.J. Smith; COI sequenced, CP-dried; CNCN249383 (UCDC).

Paratype series. U.S.A.: Arizona: Cochise County, Chiricahua Mountains, Onion Saddle, 31.933331°N 109.262781°W, 15.VIII.1986, coll. McGinley & Norden, USNM.ENT1027107, (1♂ USNM); Congress, Yavapai County, 34.162528°N 112.850739°W, 23-26.IV.1967, coll. D.M. Wood, CNCN199951, CNCN199983, CNCN199984, (2♂ 1♀ CNC); Ramsey Canyon, 15 Miles South of Sierra Vista, Huachuca Mountains, 31.337025°N 110.302647°W, 1585m, 1-15.VII.1966, coll. R.F. Sternitzky, CNCN200020, (1♂ CNC); **California: California:** 3 miles East of Tuolumne

City, Tuolumne County, 37.961947°N 120.182964°W, 25.VI.1979, coll. N.J. Smith, CNCD249420, (1♂ UCDC); Arroyo Seco Camp, Monterey County, 34.118483°N 118.191733°W, 1000m, 15.V.1976, coll. R.W. Brooks, CNCD249428, (1♂ UCDC); Barton Flats, 34.172511°N 116.863083°W, 20.IX.1956, coll. A.L. Melander, USNM.ENT915710, (1♂ USNM); Riverside County, Palm Springs, Andreas Canyon, 33.763325°N 116.555000°W, 26.III.1982, coll. N.J. Smith, CNCD249381, CNCD249382, (1♂ 1♀ UCDC); San Benito County, Clear Creek, 36.380539°N 120.724378°W, 31.V.1984, coll. N.J. Smith, CNCD249397, (1♂ UCDC); San Diego, 32.715331°N 117.157256°W, 3.IX.1958, coll. P.H. Arnaud, Jr., USNM.ENT1024229, (1♂ USNM); Seigler Springs Lake Co., 38.874150°N 122.690494°W, 7.IX.1957, coll. P.H. Arnaud Jr., USNM.ENT1024121, (1♀ USNM); Stanford University, 37.427983°N 122.170389°W, 28.IX.1953, coll. P.H. Arnaud, USNM.ENT1024230, (1♂ USNM); Tulare County, Mineral King Road, 36.450086°N 118.594283°W, 1524m, 18.VIII.1982, coll. R.F. Gill, N.J. Smith, CNCD249405, (1♂ UCDC); **Colorado**: Boulder, Flagstaff Canyon, 40.000000°N 105.266667°W, 1768m, 8.VIII.1961, coll. J.R. Stainer, CNCD199936, (1♂ CNC); **Nevada**: Lander County, summit just above Austin, 39.483333°N 117.033333°W, 8.VIII.1999, coll. S.L. & S.M.L. Heydon, CNCD249436, (1♂ UCDC); **New Mexico**: Grant County, 13.5 miles North of Silver City, Cherry Creek Campground, 32.910000°N 108.228333°W, 2088m, 25.V.2013, coll. J.E. O'Hara, CNCD224749, (1♂ CNC); Sierra County, Rt 152 E. Emory Pass, 32.910111°N 107.766197°W, 13.VIII.2007, coll. B.J. & F.C. Thompson, USNM.ENT1027116, (1♂ USNM).

Material dissected. USNM.ENT1027107 (♂).

Diagnosis. Scutum bluish or purple with four bare black stripes (Fig. 19 D); wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~4-4.5 mm.

Head. Antennae mainly light brown with light dusting of silverish-white microtomentum; scape brown; flagellum orangy-brown with darker brown patch distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and gena yellow with mix of sparse pale and black setae. Frontal vitta patchy yellow and darker reddish-brown about ocellar triangle, covered with light brown microtomentum without thin line of silver microtomentum along lateral margins above eyes, with black setae; ocellar triangle with dull brown microtomentum with two short, black, forward-facing bristles; occiput and postgena brownish-blue with dusting of faint grayish microtomentum with black bristles; black microtomentum lining eye when viewed dorsally absent; palps brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum variably dark blue, or purple with four black stripes that extend just beyond the transscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum same colour as scutum, dull, with four long black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of one long black bristles; one black bristle at cervical sclerite.

Legs. Hind and mid coxae dusty, light brown with black setae; front coxa light brown with setae; hind coxa with faint silver microtomentum; legs mainly unicolourous brown, though slightly paler at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres brownish-yellow with short black setae, though tm-5 is often slightly darker brown than tm-1; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; wing cell r_{4+5} open (Fig. 4 A)

Abdomen. (Figs. 20 C-F) Tergites dull, dark brown; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorily along the lateral margins, though visible dorsally with faint grayish-brown microtomentum appearing laterally; tg-3 dull brown with very little lateral grayish-brown microtomentum poorly forming an irregular triangular pattern dorsally; tg-4-5 very sparsely covered in grayish-brown microtomentum, except for 2 small dull brown ill-defined triangular spots dorsally; tg-6 covered in grayish-brown microtomentum; abdomen sparsely covered in short black setae.

Male Genitalia (Figs. 28 D-F) Epandrium pale brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow, covered in fuzzy tomentum; cerci oval-shaped, strongly protruding with long, fine setae extending distally only; anterior surstylus short and bulbous, truncate, with slight forward-facing, rounded, dull teeth, and sharp back-facing teeth or points, with short, fine setae, distally; posterior surstylus very large, bulbous, somewhat elongated, apically

rounded with only a slight inward curl, with a rounded back-facing teeth which forms a circle with the forward-facing bulbous teeth of the anterior surstylus, without concentrated cluster of long black bristles in line with surstylus, no membranous appendage present, though exaggerated and rounded lateral protrusion present; hypandrium Y-shaped, elongate with a sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus somewhat small, generally pointed, arrow-shaped with usually three pinched ribs or horizontal invaginations, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, faint, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, and apically curled, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny; genitalia appear overall like a clasping apparatus.

Etymology. Matronym for Ayaan Hirsi Ali, a Sudanese born, former Dutch politician, noted author and public speaker on the subject of religious extremism, and an unrelenting defender of science and reason, and a great voice for women living under religious patriarchal tyranny.

Hosts. Unknown.

Distribution. Map 6 C (▲). Southwestern United States, south into Mexico.

Habitat. Found at a variety of hilltops with elevations as high as 637 m.

Remarks. Intraspecific COI pairwise distance variation: 0-2.8%. Interspecific variation with: *Z. albifacies*: 16-18% *Z. harrisi*: 13.6-15.7%; *Z. nanellum*: 9.7-10.6%; *Z. hitchensi*: 13.5-16.0%; *Z. pygmaeum*: 14.4-15.5%.

***Z. hitchensi* Burt & Skevington, 2015**

Figs. (27 A-C), Map 6 C (●).

Type material. Holotype; ♂; **Saskatchewan**: Attons Lake, 52.833333°N 108.850000°W, 22.VIII.1940, coll. A.R. Brooks; abdomen dissected; CNCN200032 (CNC).

Paratype series. CANADA: Alberta: Peace River, 56.249972°N 117.284650°W, 10.VII.1961, coll. A.R. Brooks, CNCN199959, (1♂ CNC); **Ontario:** Maynooth, 45.233333°N 77.938375°W, 9.VII.1965, coll. J.F. McAlpine, CNCN199964, (1♂ CNC); **Quebec:** Abbotsford, 45.436725°N 72.890350°W, 2.VII.1936, coll. Shewell, CNCN200078, (1♂ CNC); **Saskatchewan:** Great Deer, 8.IX.1950, coll. J.R. Vockeroth, CNCN199961, (1♂ CNC); Prince Albert, 53.216208°N 105.714808°W, 23.VII.1959, coll. A. & J. Brooks, CNCN200040, (1♂ CNC); **U.S.A.: Arizona:** Morse Canyon, Cochise County, 31.835753°N 109.298333°W, 2652m, *Draba aurea*, 15.VIII.1978, coll. R.W. Brooks, CNCN249430, (1♂ UCDC); SWRS, Portal, Cochise County, 31.883297°N 109.206150°W, 3.VIII.1966, coll. R.L. Brumley, CNCN249398, (1♂ UCDC); Sycamore Cyn Canyon, Sta Santa Cruz County, 31.400000°N 111.250000°W, 16.VII.1966, coll. H.K. Court, CNCN249389, CNCN249390, (2♂ UCDC); **Colorado:** Fremont Co. Phantom Canyon, near Canon City, 38.495964°N 105.110278°W, Malaise trap, 29-31.V.1987, coll. G.F. & J.F. Hevel, USNM.ENT915740, (1♂ USNM); **Georgia:** Rocky

Ford, near Millen, 32.664167°N 81.828333°W, 25.VIII.1957, coll. J.G. Chillcott, CNCDD199954, (1♂ CNC); **Iowa**: Ames State Nursery, Ames, 42.033333°N 93.616667°W, Malaise trap, 25.VI.1972, 30.VI.1972, 6.X.1972, coll. R. R. Pinger, Jr., R.R. Pinger, Jr., USNM.ENT915722, USNM.ENT915732, USNM.ENT915733, USNM.ENT915735, (4♂ USNM); Ames, 17.VI.1923, 25.VI.1947, coll. A.R. Brooks, CNCDD199922, CNCDD199997, (2♂ CNC); **Kansas**: Cherokee County, 12 mi. W, 5 mi. S. of Columbus, 37.169969°N 94.843914°W, 3.IX.1980, coll. G.F. & J.F. Hevel, USNM.ENT915719, (1♂ USNM); Douglas Co. Lawrence, 38.971669°N 95.235250°W, Malaise trap, 17-28.VIII.1979, coll. R.J. McGinley, USNM.ENT915726, (1♂ USNM); Manhattan, 39.183611°N 96.571672°W, 21.IX.1933, coll. C.W. Sabrosky, USNM.ENT1024162, (1♂ USNM); **Maryland**: Garrett; Savage River, 39.501667°S 79.115000°W, 23.VIII.2005, coll. D. & W.N. Mathis, USNM.ENT1027177, (1♀ USNM); Montgomery County Colesville, 39.066667°N 77.000000°W, Malaise trap, 26.VII.1979, coll. W.W. Wirth, USNM.ENT1027111, (1♀ USNM); Sheppard Pratt, Baltimore County, 39.388267°N 76.624989°W, Woods, Malaise trap, 10.VI.1972, coll. A.G. Scarbrough, USNM.ENT1027209, (1♀ USNM); **Mississippi**: Oxford, 34.366497°N 89.519250°W, V.1940, coll. F.M. Hull, CNCDD200036, (1♂ CNC); **Oklahoma**: Lake Texoma near Willis, 33.881992°N 96.827411°W, VI.1965, coll. R.M. Bohart, CNCDD249118, (1♀ UCDC); Lake Texoma, 2 miles East of Willis, 33.882450°N 96.809728°W, VI.1965, VII.1965, coll. R.M. Bohart, CNCDD249386, CNCDD249388, (2♀ UCDC); **South Dakota**: Brookings, 44.311358°N 96.798389°W, coll. J.M. Aldrich coll., USNM.ENT1024105, (1♀ USNM).

Material dissected. CNCDD199961 (♂), CNCDD199959 (♀).

Diagnosis. Smaller species (3.5-4.5); scutum blue, or bluish-green with four black stripes (Fig. 19 D); abdomen slightly bushy (Figs. 20 E-F); r_{4+5} cell open (4 A).

Description. Male. Body length (including antennae): ~4-4.5 mm.

Head. Antennae mainly brown with dusting of silverish-white microtomentum; scape dark brown; flagellum dark orange with black patch distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silver microtomentum; frons and gena yellow with sparse pale or black setae; frontal vitta dull yellow just above scape and then dull, patchy brown with line of gold or silver microtomentum along lateral margins above eyes, with several black setae; somewhat bushy; ocellar triangle somewhat shiny brownish-green with many black forward-facing bristles; occiput and postgena black and pale brown respectively, covered with brownish-green or brownish-gray microtomentum with bushy black bristles; often occiput is covered in lighter brownish-green microtomentum; palps pale brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum blue, or bluish-green with four black stripes that extend just beyond the trasscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum dull blue and bluish-green; patchy, with black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 1-3 long black bristles; one (rarely two) black bristle(s) at cervical sclerite.

Legs. Coxae brown with black setae; front coxa with golden microtomentum and variable presence of setae; legs mainly unicolourous brown, though pale yellow at knees, sparsely

covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres pale brownish-yellow with short black setae; tarsomere-1 tends to be paler than tm-5; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; wing cell r_{4+5} open (Fig. 4 A).

Abdomen. (Figs. 20 C-F) Tergites dull brown; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint grayish-brown microtomentum appearing laterally; tg-3 dull brown with lateral grayish-brown microtomentum forming obliquely a triangular pattern dorsally; tg-4-5 mainly covered in light grayish-brown microtomentum, except for 2 small dull brown triangular spots appearing dorsally, divided by microtomentum; tg-6 covered in grayish-brown microtomentum; abdomen variably covered in long black setae, usually appearing somewhat bushy (Figs. 20 E-F).

Male Genitalia (Figs. 27 A-C) Epandrium variably pale or dark brown, rounded and bulbous, shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow and bulbous, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstyli short, truncate, with very rounded, bulbous forward-facing teeth, and sharp back-facing teeth or points, with short, fine setae, distally; forward-facing teeth form an enclosure against posterior surstyli back-facing lateral protrusion; posterior surstylus large, only slightly bulbous, rather elongated, apically somewhat pointed, with a slight inward curl, without black

bristles in line with surstylus; no membranous appendage present, though exaggerated and lateral protrusions (2) present, two knobs, poorly forming an enclosure with asur forward-facing teeth; hypandrium Y-shaped, elongate with a very sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus small, narrow, pointed, dagger-shaped covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply curled and pointed with short, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed and apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Etymology. Patronym for the late, great Christopher Hitchens, a brilliant journalist, biographer, philosopher, and writer who spent his life tackling a host of social issues and was widely known as a staunch defender of free speech, open inquiry, atheism, rational skepticism and science.

Hosts. Unknown.

Distribution. Map 6 C (●). Fairly widespread, though rare. Appears across the prairies to eastern Canada, throughout the midwest and southern states.

Habitat. Has been found in wooded areas, or elevations as high as 808 m, on *Draba aurea* Vahl ex Homen.

Remarks. Intraspecific COI pairwise distance variation: 0.9%. Interspecific variation with: *Z. albifacies*: 16.0-17.0%; *Z. harrisi*: 18.3-19.6%; *Z. hirsialiae*: 13.5-16.0%; *Z. nanellum*: 8.7-9.7%; *Z. pygmaeum*: 11.5-12.5%.

***Z. intermedium* Banks, 1916**

Figs. (29 A-C, 4 A), Map 5 B (●).

Synonymy

Zodion intermedium Banks, 1916: 193. Type locality: United States of America, Pennsylvania:

Pocono Lake & New Jersey: Clementon. Type depository: syntype, MCZ, USNM.

Zodion occidentale Banks, 1916: 194. Type locality: United States of America, Oregon:

Montaville; Mary's River & Corvallis. Type depository: syntype, MCZ, ORSU.

Zodion abdominalis Say, 1823: 84. Type locality: United States of America, Nebraska: "near

Rocky Mountain" & "Engineer Contonment." Type depository: syntype, *Zodion abdominalis* Say, 1823, ANSP (Destroyed).

New synonymy

Myopa bistris Walker, 1849: 679. Type locality: North America. Type depository: syntype, BMNH

Zodion lativentre Graenicher, 1910: 26. Type locality: United States of America, Wisconsin.

Type depository: holotype, MCPM.

Zodion obscurum Banks, 1916: 194. Type locality: San Bernadino C., Bear Valley, 6700' & Santa Monica. Type depository: syntype, MCZ.

Zodion sayi Banks, 1916: 194. Type locality: United States of America, Virginia: Falls Church & Oregon: Mount Jefferson & Horse Lake. Type depository: syntype, MCZ, CAS.

Note: The syntype for *Zodion abdominalis* Say, 1823 at ANSP has apparently been destroyed. *Zodion reclusum* Banks, 1916 has been examined and resurrected. *Zodion*

bistria Walker, 1849, *Zodion lativentre* Graenicher, 1910, *Zodion sayi* Banks, 1916, *Zodion obscurum* Banks, 1916, had been previously synonymized under *Zodion intermedium*, Banks 1916 based on examination of dorsum and comparison of the genitalia (combination of examination of dissected genitalia and intact terminalia).

Lectotype designation. *Zodion intermedium* Banks, 1916; ♂, USA. Pennsylvania: Pocono Lake & New Jersey: Clementon; MCZ-ENT304076 (MCZ). This type was selected from a syntype series from MCZ that possesses the characters that typify the species. The syntype is a male with genitalia distended and exposed without dissection, with the whole body intact, wings and legs splayed. Therefore, this specimen is here designated as the lectotype to fix and ensure the universal and consistent interpretation of the name.

Type material. *Z. intermedium* Banks, 1916: syntypes; 2♀; USA. Pennsylvania: Pocono Lake & New Jersey: Clementon; MCZ-ENT13540, MCZ-ENT304077 (MCZ). *Z. obscurum* Banks, 1916: syntypes; ♂; USA: California: Bear Valley, San Bernadino Mountains; MCZ-ENT304073 (MCZ); ♀; USA: California: Bear Valley, San Bernadino Mountains; MCZ-ENT13543 (MCZ); ♂; USA: California: Santa Monica; MCZ-ENT04074 (MCZ). *Z. sayi* Banks, 1916: syntypes; ♀; USA: Virginia: Falls Church, & Oregon: Mt. Jefferson & Horse Lake; MCZ-ENT13541(MCZ); ♀; USA: Virginia: Falls Church, & Oregon: Mt. Jefferson & Horse Lake; MCZ-ENT304070 (MCZ); ♀; USA: Oregon: Horse Lake; MCZ-ENT304071 (MCZ); ♀; USA: Oregon: Mount Jefferson; MCZ-ENT304072 (MCZ). *Z. occidentale* Bank, 1916: Syntype; ♂, ♀; USA. Oregon: Montaville; Mary's River & Corvalis; MCZ-ENT304075, MCZ-ENT13542 (MCZ). *Myopa bistria* Walker, 1849: Holotype; ♂; North America; BMNH249190 (BMNH).

Neotypes have not yet been designated. *Z. lativentre* Graenicher, 1910: Holotype;

♂; USA: Wisconsin: Yellow River, Burnett Count; type# 29257 (MCPM)

Notes on Types: The syntypes of *Z. obscurum* Banks, 1916, appear somewhat blueish on the abdomens and the dorsum is darker, almost black in areas. I attribute this discolouration to the greasiness of the specimens.

Material dissected. CNCD200533, CNCD200164, CNCD200374, CNCD200438, CNCD200448, CNCD200488, JSS17585, JSS17586, CNCD200553, CNCD200633, CNCD200831, CNCD200609, CNCD200622, CNCD200855, CNCD200617, CNCD200662 (16♂).

Additional material examined. CANADA: Alberta: 15 miles East of Morley, 51.169227°N 114.505479°W, 10.VIII.1962, coll. K.C. Herrmann, CNCD200625, (1♀ CNC); 25 miles East of Milk River, Aden, 49.024567°N 111.298373°W, 28.VI.1956, coll. E.E. Sterns, CNCD200665, (1ex CNC); Aden, 28.VI.1956, coll. E.E. Sterns, CNCD200683, (1♀ CNC); Banff, 51.18°N 115.57°W, 4.VII.1924, coll. Eric Hearle, CNCD200620, (1ex CNC); Bilby, 53.69912°N 114.109675°W, 22.VI.1924, coll. O. Bryant, USNM.ENT1024799, (1ex USNM); Calgary, 51.04994°N 114.08439°W, 9.VI.1923, coll. R.W. Salt, CNCD200592, (1♀ CNC); Chin, 49.76261°N 112.444505°W, 7.VII.1956, coll. E.E. Sterns, CNCD200684, (1♀ CNC); Empress, 50.954515°N 110.010012°W, 7.VI.1957, coll. Brooks, MacNay, CNCD200222, (1♀ CNC); Gleichen, 50.866111°N 113.054722°W, 30.VII.1929, coll. H.L. Seamans, CNCD200602, (1ex CNC); High Prairie, 55.432861°N 116.488643°W, 26.VII.1961, coll. A.R. Brooks, CNCD200619, (1♀ CNC); Jumping Pound Creek, 20 miles West of Calgary, 51.183°N 114.5°W, 3.VII.1962, coll. K.C. Herrmann, CNCD200164, (1♂ CNC); Lethbridge, 49.7°N 112.816667°W, Beach, 25.VI.1922, 25.VI.1956, 26.VI.1923, 5.VI.1980, coll. E.E. Sterns, H.L. Seamans, R.W. Salt, Walter Carter, CNCD200307, CNCD200344, CNCD200459, CNCD200722, (2♂ 2♀ CNC); 49.700000°N 112.816667°W, 29.VII.1922, coll. H.L. Seamans, CNCD200439, (1♂ 1♀ CNC);

Manyberries, 49.401096°N 110.698297°W, 14.VII.1949, coll. G.A. Hobbs, CNCD200356, (1♀ CNC); Morrin, 51.659016°N 112.762933°W, 4.VI.1928, coll. G.F. Manson, CNCD200561, (1♀ CNC); Scandia, 50.280376°N 111.89576°W, 26.VI.1956, 9.VII.1956, coll. E.E. Sterns, O. Peck, CNCD200345, CNCD200584, CNCD200587, (3♀ CNC); South of Vauxhall, 50.068889°N 112.0975°W, 18.VII.1950, CNCD200278, (1♀ CNC); Writing-on-Stone Provincial Park, 49.083343°N 111.616738°W, Sedges, 26.V-6.VI.1990, coll. D. McCorquadale, debu1157224, (1♀ DEBU); **British Columbia**: 3 miles Northeast of Telegraph Creek, 57.933°N 131.101°W, 1.VII.1960, coll. W.W. Moss, CNCD200571, (1♀ CNC); 5 miles East of Fife, 49.060278°N 118.101745°W, 8.VI.1959, coll. R. Madge, CNCD200627, (1♂ CNC); Fort Steele, 49.61659°N 115.6344°W, 15.VIII.1921, 16.VIII.1921, coll. W.B. Anderson, CNCD200701, CNCD200760, (1♂ 1♀ CNC); Gagnon Road, 6 miles West of Terrace, 54.499294°N 128.716143°W, 29.VI.1960, coll. J.G. Chillcott, CNCD200614, (1♀ CNC); McIntyre Creek, Oliver, 49.249986°N 119.282841°W, 27.V.1959, coll. L.A. Kelton, CNCD200723, (1♀ CNC); McIntyre Road, Oliver, 49.230106°N 119.544522°W, 29.V.1958, coll. H. & A. Howden, CNCD200333, (1♂ CNC); Nicola, 50.16654°N 120.66792°W, 17.V.1923, coll. P.N. Vroom, CNCD200732, debu1157229, (2♂ CNC, DEBU); Robson, 49.33°N 117.68°W, 1.VI.1941, 12.VI.1950, 20.VI.1948, coll. H.R. Foxlee, CNCD200355, CNCD200682, CNCD200724, (3♀ CNC); Rock Creek, 49.051652°N 118.999089°W, Potentilla meadow, 7.VI.1959, coll. L.A. Kelton, R. Madge, R.E. Leech, CNCD200145, CNCD200331, CNCD200591, (3♀ CNC); Seton Lake, Lillooet, 50.683812°N 122.137717°W, 30.V.1926, coll. J. McDunnough, CNCD200809, (1♀ CNC); Sorrento, 5 miles West, 50.876608°N 119.584948°W, 5.VII.1979, coll. J.M. & S.H. Cumming, CNCD28528, (1♀ CNC); Terrace, 54.52°N 128.59°W, 67m, in field, 22.VI.1960, coll. B. Heming, CNCD200289, (1♀ CNC); 13.VII.1960, coll. W.R. Richards, CNCD200284, (1♀ CNC); Vaseaux Lake, Oliver, 49.283333°N 119.533333°W, 23.V.1959, coll. R.E. Leech, CNCD200644, (1♂ CNC); Vernon, 50.255069°N 119.292145°W, 22.V.1936, coll. G.R. Hopping, CNCD200717, (1♀ CNC);

Manitoba: 2 Miles East of Douglas, 49.901042°N 99.660306°W, Prairie community, along

stream, 27.VII.1958, coll. J.G. Chillcott, CNCD200275, (1♀ CNC); Aweme, 49.70864°N 99.60328°W, 22.VI.1953, 28.VI.1923, coll. Brooks - Kelton, R.M. White, CNCD200209, CNCD200473, (1♂ 1♀ CNC); Beulah, 50.260013°N 101.035451°W, 13.VII.1927, coll. E. & S. Criddle, CNCD200443, CNCD200484, (1♂ 1♀ CNC); Boissevain, 49.230556°N 100.055°W, 16.VII.1953, 20.VII.1953, coll. Brooks - Kelton, CNCD200196, CNCD200203, (2♀ CNC); Brandon, 49.843355°N 99.950444°W, 7.VIII.1958, coll. N.B. Chillcott, CNCD200241, (1♀ CNC); Carberry, 49.871229°N 99.360835°W, 19.VI.1953, coll. Brooks - Kelton, CNCD200700, (1♀ CNC); Gillam, 56.348028°N 94.709121°W, 1.VII.1950, coll. J.F. McAlpine, CNCD200650, (1♀ CNC); Horton, 49.133333°N 100.066667°W, 22.VII.1953, coll. Brooks - Kelton, CNCD200221, (1♀ CNC); International Peace Gardens, Turtle Mountain Forest Reserve, 49.000579°N 100.058331°W, 17.VII.1958, 7.VIII.1958, coll. J.G. Chillcott, R.L. Hurley, CNCD200123, CNCD200631, (1♂ 1♀ CNC); Morris, 49.35096°N 97.368057°W, 4.VIII.1958, coll. A. & J. Brooks, CNCD200223, (1♀ CNC); Ninette, 49.4°N 99.6°W, Maple, elm, floodplain community along stream, Power line scrub, Powerline scrub, 20.VI.1958, 28.VII.1958, 5.VIII.1958, coll. J.G. Chillcott, R.B. Madge, CNCD200124, CNCD200276, CNCD200339, CNCD200628, CNCD200629, CNCD200632, (2♂ 4♀ CNC); Onah, 49.805973°N 99.524133°W, 6.VIII.1927, coll. N. Criddle, CNCD200311, CNCD200448, CNCD200470, (2♂ 1♀ CNC); Pilot Mound, 49.202272°N 98.893064°W, 31.VII.1958, coll. A. & J. Brooks, CNCD200322, CNCD200612, (2♀ CNC); Roblin, 51.2284°N 101.3574°W, 15.VII.1954, coll. Brooks - Wallis, CNCD200320, (1♀ CNC); Russell, 50.780833°N 101.283889°W, 18.VIII.1954, coll. Brooks - Wallis, CNCD200708, (1♀ CNC); Virden, 49.850833°N 100.931667°W, 12.VII.1953, 8.VII.1953, coll. Brooks - Kelton, Brooks, MacNay, CNCD200220, CNCD200697, (2♀ CNC); Whitewater Lake, 4 Miles North of Whitewater, 49.250624°N 100.227926°W, 22.VI.1958, coll. J.F. McAlpine, CNCD200579, (1♀ CNC); Winnipeg, 49.883333°N 97.133333°W, Beach, 2.VII.1923, coll. A.J. Hunter, CNCD200458, (1♀ CNC); **New Brunswick:** Barber, 45.490523°N 67.239538°W, 23.VI.1914, coll. J.D. Tothill, CNCD200453, (1♂ CNC); Douglas, 45.97832°N

66.731078°W, 7.VIII.1913, coll. J.D. Tothill, CNCN200562, (1♀ CNC); Fredericton, 45.963561°N 66.644554°W, 5.VI.1918, 5.VIII.1913, 8.VII.1913, coll. G.P.W., CNCN200736, CNCN200746, CNCN200822, (2♂ 1♀ CNC); Ottawa, 45.42153°N 75.697193°W, 11.VI.1968, coll. J.R. Vockeroth, CNCN200823, (1♂ CNC); Saint Andrews, 45.079914°N 67.058441°W, 11.VIII.1957, coll. G.E. Shewell, CNCN200328, (1♂ CNC); Tower Hill, Charlotte County, 45.285521°N 67.182516°W, 1946, 26.VI.1946, coll. James V. Clark, CNCN200553, CNCN200754, (1♂ 1♀ CNC); **Nova Scotia**: Cheticamp, Cape Breton Island, 46.621002°N 61.023964°W, 1.VIII.1917, coll. F. Johansen, CNCN200918, (1♀ CNC); Digby County, 44.162302°N 66.367495°W, 29.VI.1932, coll. C.E. Atwood, CNCN200706, (1♀ CNC); Hants County, 45.144217°N 63.958031°W, 22.VI.1931, coll. C.E. Atwood, CNCN200613, (1♀ CNC); King's County, 45.017428°N 64.610757°W, 18.VI.1931, 27.V.1931, 30.V.1931, coll. C.E. Atwood, CNCN200748, CNCN200749, CNCN200762, (3♂ CNC); Kings County, 18.VI.1931, 22.VI.1931, 24.VI.1931, 24.VII.1931, coll. C.E. Atwood, CNCN200703, CNCN200704, CNCN200705, CNCN200751, (3♀ 1ex CNC); Portapique, 45.405278°N 63.703611°W, 16.VI.1975, coll. A.T. Finnamore, M.E. Neary, CNCN200648, CNCN200651, (1♂ 1♀ CNC); Truro, 45.35°N 63.266667°W, 11.X.1913, CNCN200731, (1ex CNC); Victoria Co., Cape North Village, 46.884555°N 60.506046°W, gravel pit, 29.VI.1996, coll. D.B. McCorquodale, JSS18159, (1♀ CBU); **Ontario**: 2 Miles North of Metcalfe, 45.265406°N 75.488737°W, 16.VII.1982, 28.VI.1982, 9.VI.1982, coll. B.E. Cooper, CNCN200435, CNCN200436, CNCN200550, (1♂ 2♀ CNC); 7 miles East of Griffith, 45.243279°N 77.031193°W, 1.VIII.1983, 2.VII.1983, 28.VII.1984, 8.VI.1985, coll. B.E. Cooper, CNCN200546, CNCN200548, CNCN200549, CNCN79800, (4♀ CNC); 964 Sheridan Ave., Ottawa, 45.382206°N 75.726992°W, 10.VIII.2009, coll. J.F. Gibson, JSS19847, (1♂ CNC); Arkell, 43.537298°N 80.167829°W, 11.VI.1958, 15.VII.1964, 17.VI.1966, 20.VI.1956, coll. D.H. Pengelly, debu1157205, debu1157237, debu1157238, debu1157245, (3♂ 1♀ DEBU); Belwood, 43.794143°N 80.322452°W, 16.VII.1972, 19.VI.1972, 30.V.1975, 5.VII.1973, 8.VI.1973,

9.VI.1973, coll. D.H. Pengelly, R.P. Macfarlane, debu1157209, debu1157210, debu1157217, debu1157218, debu1157219, debu1157220, debu1157222, debu1157249, (1♂ 7♀ DEBU); Blackburn, 45.432992°N 75.563443°W, 17.VIII.1961, coll. C.D. Miller, CNCD200295, (1♀ CNC); Bobcaygeon, 44.533°N 78.55°W, 31.V.1931, coll. J. McDunnough, CNCD200489, CNCD200720, CNCD200721, CNCD200725, CNCD200726, (5♂ CNC); Brighton, 44.04226°N 77.736883°W, Malaise trap, 24.VII.1956, CNCD200779, (1♀ CNC); Britannia, 45.35°N 75.783333°W, 1.VI.1948, 23.VI.1947, coll. G.E. Shewell, CNCD200610, CNCD200638, (1♂ 1♀ CNC); Bruce County, Dyers Bay, 45.163611°N 81.296111°W, 24.VI.1953, coll. D.H. Pengelly, debu80390, (1ex DEBU); Bruce/Gray County, Hepworth, 44.616667°N 81.15°W, 8.VI.1976, coll. E.A. Innes, M.J. Sharkey, debu80388, debu80389, (2ex DEBU); Chatham, 42.412001°N 82.185001°W, 19.V.1925, coll. G.S. Walley, CNCD200735, CNCD200757, (2♂ CNC); Constance Bay, 45.48°N 76.08°W, 10.VII.1933, coll. G.S. Walley, CNCD200702, CNCD200712, (1♂ 1♀ CNC); 45.483889°N 76.081111°W, Oak savannah, Malaise trap, 31.V-8.VI.2006, coll. J. Skevington, CNCD79807, (1♀ CNC); Constance Lake, South March, 45.408992°N 75.979719°W, 16.VI.1965, 17.VI.1971, 20.VI.1966, coll. J.R. Vockeroth, CNCD200395, CNCD200569, CNCD200811, CNCD200812, CNCD200813, CNCD200815, CNCD200816, CNCD200817, CNCD200818, CNCD200819, CNCD200820, (4♂ 7♀ CNC); Delhi, 42.8525°N 80.498889°W, 10.VI.1960, 12.VI.1960, 9.VI.1960, coll. N.N. Leblanc, debu1157202, debu1157203, debu1157204, debu1157240, (1♂ 3♀ DEBU); Dorset P.S., 45.244235°N 78.89389°W, 16.VIII.1961, coll. G.K. Morris, debu1157242, (1♂ DEBU); Dorset, 45.244235°N 78.893889°W, 2.IX.1974, coll. D.H. Pengelly, debu1157253, (1♂ DEBU); Durham, 44.17616°N 80.818386°W, 11.VI.1955, 17.VI.1955, coll. D.H. Pengelly, debu1157190, debu1157230, (1♂ 1♀ DEBU); Fergus, 43.7°N 80.366667°W, 25.VII.1992, coll. S.A. Marshall, debu1157223, debu1157225, (2♀ DEBU); Forks of Credit, 43.823017°N 80.009517°W, 2.VII.1968, 28.VI.1965, coll. G. Knerer, Patricia MacKay, CNCD200552, CNCD200557, CNCD200563, CNCD200564, (4♀ CNC); Fort Frances, 48.611273°N 93.392468°W, 28-

29.VI.1960, coll. Kelton & Whitney, CNCN200282, (1♂ CNC); Grand Bend, 43.312271°N 81.756729°W, 6.IX.1954, coll. C.D. Miller, CNCN200348, (1♀ CNC); Guelph, 43.544805°N 80.248167°W, 1.VII.1974, 10.VI.1964, 10.VI.1973, 12.VI.1971, 14.VI.1973, 15.VII.1965, 16.VI.1972, 16.VI.1978, 2.VI.1913, 20.VII.1976, 21.VI.1956, 22.VI.1956, 23.VII.1976, 26.VI.1956, 3.VII.1974, 4.VII.1956, 7.VI.1956, 9.VII.1974, coll. D.H. Pengelly, David Levin, Donna J. McComb, G.J. Umphrey, H. Curran, Jack A. Neary, Kevin N. Barber, Paul R. Heels, R.P. Macfarlane, CNCN200456, CNCN200574, debu1157191, debu1157192, debu1157193, debu1157194, debu1157195, debu1157196, debu1157197, debu1157198, debu1157199, debu1157200, debu1157206, debu1157208, debu1157213, debu1157214, debu1157215, debu1157216, debu1157221, debu1157231, debu1157232, debu1157233, debu1157234, debu1157235, debu1157236, debu1157247, debu1157248, debu1157254, debu1157255, (11♂ 17♀ 1ex CNC, DEBU); Horning's Mills, 44.153731°N 80.20487°W, 15.VI.1961, coll. L.A. Kelton, CNCN200590, (1♂ CNC); Howe Island, 44.258874°N 76.31395°W, 21.VI.1975, coll. Nancy Wilcox, debu1157252, (1♂ DEBU); Jordan, 43.133333°N 79.366667°W, 10.VI.1919, 11.VI.1919, 11.VII.1920, 14.VIII.1914, 27.VI.1920, 6.VI.1919, coll. H. Curran, W.A. Ross, CNCN200310, CNCN200432, CNCN200433, CNCN200533, CNCN200598, CNCN200715, CNCN200821, CNCN200913, (3♂ 5♀ CNC); Mer Bleu, 5 Miles East of Ottawa, 45.40331°N 75.5083°W, Malaise trap, 23.VI.1966, coll. D.D. Munroe, CNCN200374, (1♂ CNC); Lambton County, Pinery Provincial Park, behind Park Store, 43.247443°N 81.844336°W, oak savannah, 20.VIII.1994, coll. J. Skevington, debu1157228, (1♀ DEBU); Lambton County, Pinery Provincial Park, Riverside Campground, 43.245441°N 81.847049°W, on New Jersey Tea at roadside, 13.VI.1994, coll. J. Skevington, debu1157227, (1♀ DEBU); Lambton County, Port Franks, Karner Blue Sanctuary, 43.216667°N 81.9°W, 20.VI.1996, coll. J. Skevington, debu1157226, (1♀ DEBU); Low Bush, Lake Abitibi, 48.916667°N 80.133333°W, 21.VII.1925, coll. N.K. Bigelow, CNCN200727, (1♂ CNC); Marmora, 44.48°N 77.68°W, 15.VIII.1952, 20.VI.1952, coll. C. Boyle, J.R. McGillis, CNCN200604, CNCN200667, (2♀ CNC); Mer Bleu, 5

Miles East of Ottawa, 45.40331°N 75.5083°W, Malaise trap, 15.VI.1966, 19.VI.1966, 20.VI.1973, 21.VI.1966, 23.VI.1966, 25.VI.1966, 29.VI.1966, 7.VI.1966, coll. D.D. Munroe, D.D. Munroe, E. Small, CNC200125, CNC200567, CNC200573, CNC200624, CNC200637, CNC200639, CNC200640, CNC200641, CNC200642, CNC200711, CNC200794, CNC200795, CNC200796, CNC200798, CNC200799, CNC200800, CNC200801, CNC200802, CNC200803, CNC200804, CNC200805, CNC200806, CNC200807, CNC200814, (2♂ 2♀ CNC); Mer Bleue, 5 miles East of Ottawa, Malaise trap, 25.VI.1966, 5.VII.1966, 8.VI.1973, coll. D.D. Munroe, E. Small, CNC200556, CNC200565, CNC20089246, (1♂ 2♀ CNC, MZUL); Midland, 44.75°N 79.89°W, 10.VIII.1974, 14.VII.1974, coll. John T. Huber, debu1157212, debu1157251, (1♂ 1♀ DEBU); Muldrew Lake, 44.878401°N 79.405723°W, 25.V.1951, coll. D.H. Pengelly, debu1157189, (1♀ DEBU); Norland, 44.727445°N 78.811733°W, 18.VII.1961, coll. G.K. Morris, debu1157241, (1♂ DEBU); North Burgess Township, Lanark County, 44.806964°N 76.312633°W, 23.VI.1968, coll. D.M. Wood, CNC200699, (1♀ CNC); Orillia, 44.609505°N 79.42068°W, 14.VI.1921, 14.VI.1927, 21.V.1921, 3.VI.1914, 30.V.1997, 4.VI.1921, 6.VI.1925, 9.V.1925, 9.VI.1925, coll. C.H. Curran, H. Curran, CNC200452, CNC200457, CNC200543, CNC200599, CNC200600, CNC200653, CNC200734, CNC200743, CNC200755, CNC200759, (6♂ 4♀ CNC); Orono, 44.866667°N 68.671941°W, 5.IX.1925, coll. N.K. Bigelow, CNC200468, (1♀ CNC); Osgoode, 45.144769°N 75.605322°W, 28.V.1965, coll. J.R. Vockeroth, CNC200790, (1♀ CNC); Ottawa, Fletcher Wildlife Garden, 45.386°N 75.704°W, 14.VI.1997, coll. Fenja Brodo, CNC200542, (1♀ CNC); Ottawa, Mer Bleue, bog, 45.392222°N 75.511111°W, 23.V.2015, coll. O. Lonsdale, CNC395956, CNC395957, (2♂ CNC); Orillia, 44.609505°N 79.42068°W, 22.V.1921, coll. H. Curran, CNC200438, (1♂ CNC); Ottawa, 45.42153°N 75.697193°W, 1.VII.1969, 10.VI.1942, 10.VI.1961, 19.VI.1901, 21.VI.1947, 21.VII.1938, 24.VI.1943, 26.VI.1911, 28.VI.1942, 3.VII.1955, 3.VII.1965, 7.VI.1923, coll. A. Brooks, C.H. Curran, G.S. Walley, J.R. Vockeroth, Merrill H. Prime, W. Metcalfe, CNC200366, CNC200392,

CNCD200477, CNCD200491, CNCD200526, CNCD200527, CNCD200555, CNCD200630,
 CNCD200636, CNCD200676, CNCD200728, CNCD200750, CNCD200752, CNCD200778,
 CNCD200793, debu1157207, (9♂ 8♀ CNC, DEBU); Pelee Island, 41.783333°N 82.666667°W,
 18.VI.1974, coll. D.M. Wood, CNCD200825, (1♀ CNC); Perth County, Stratford, 43.343889°N
 80.939167°W, 27.VI.2009, coll. S.A. Marshall, debu315947, (1♂ DEBU); Picton, 44.00862°N
 77.139223°W, 7.VII.1970, coll. J.F. McAlpine, CNCD200677, CNCD200678, CNCD200680,
 CNCD200685, CNCD200686, CNCD200687, CNCD200688, CNCD200689, (1♂ 7♀ CNC);
 Port Hope, 43.94919°N 78.293475°W, 22.VIII.1963, coll. J.D. Van Loon, debu1157244, (1♂
 DEBU); 43.9492°N 78.2935°W, 24.V.1925, coll. N.K. Bigelow, CNCD200601, (1♀ CNC); Port
 Sydney, 45.213191°N 79.275791°W, 16.VII.1919, 18.VII.1919, 8.VIII.1919, coll. N.K. Bigelow,
 CNCD200488, CNCD200566, CNCD200575, CNCD200707, CNCD200744, CNCD200745,
 CNCD200747, (3♂ 1ex 3♀ CNC); Priceville, 46.50736°N 66.282718°W, 16.VI.1958,
 21.VI.1961, coll. D.H. Pengelly, debu1157201, debu1157239, (1♂ 1♀ DEBU); Rainy River,
 48.721846°N 94.568208°W, 14.VII.1960, coll. S.M. Clark, CNCD200280, (1♀ CNC); S.S.
 Marie, 7.VII.1963, coll. D.B. Stoltz, debu1157243, (1♂ DEBU); Sandbanks Park, near Picton,
 43.905059°N 77.265953°W, 1.VII.1970, coll. J.F. McAlpine, CNCD200672, (1♀ CNC); Simcoe,
 42.833333°N 80.3°W, 13.VI.1931, 25.VI.1939, 27.VI.1939, 29.V.1939, coll. G.E. Shewell, G.S.
 Walley, CNCD200318, CNCD200365, CNCD200482, CNCD200568, CNCD200719, (1♂ 4♀
 CNC); Smith's Bay, Near Picton, 44.018826°N 77.124755°W, 1.VII.1970, 2.VII.1970,
 3.VII.1970, 4.VII.1970, coll. J.F. McAlpine, CNCD200671, CNCD200690, CNCD200691,
 CNCD200692, CNCD200693, CNCD200694, CNCD200695, (2♂ 4♀ 1ex CNC); Spencerville,
 44.843305°N 75.546362°W, 14.VIII.1939, coll. G.H. Hammond, CNCD200244, (1♂ CNC);
 Strathroy, 42.95007°N 81.63317°W, 2.VI.1924, 2.VII.1925, coll. H.F. Hudson, CNCD200479,
 CNCD200572, CNCD200659, (1♂ 2♀ CNC); Sudbury, 46.49°N 81.01°W, CNCD200716, (1♀
 CNC); Sydney Field Station, Near Foxboro, 44.250134°N 77.436758°W, 8.VII.1970, coll. J.F.
 McAlpine, CNCD200698, (1♀ CNC); **Prince Edward Island:** Souris, VII.1967, coll. N.L.H.

Krauss, USNM.ENT1024848, (1ex USNM); **Quebec**: Abbotsford, 45.436724°N 72.89035°W, 3.VI.1936, 4.VI.1936, VII.1935, coll. G.E. Shewell, Shewell, CNCD200595, CNCD200596, CNCD200603, CNCD200658, CNCD200661, CNCD200662, (2♂ 3♀ 1ex CNC); Aylmer, 45.400002°N 75.849998°W, 18.VI.1924, coll. H.L. Viereck, CNCD200718, (1♀ CNC); Beechgrove, 45.65°N 76.133333°W, 23.VIII.1951, coll. J.F. McAlpine, CNCD200330, (1♀ CNC); Cascades, 45.588059°N 75.869336°W, 20.VI.1929, coll. A. Richardson, CNCD200597, (1♀ CNC); Co. Vaudreuil, Summit of Mount Rigaud, 45.466389°N 74.326389°W, hilltop, 13.VI.2001, 26.VI.2001, 9.VI.2002, coll. J. Skevington, JSS17593, JSS17594, JSS17595, JSS17596, JSS17597, JSS17599, (5♂ 1♀ CNC); Comt, Äö Gatineau, Masham, Duncan Lake, 45.681389°N 76.050278°W, 260m, hilltop, 1-7.VII.2001, coll. D.M. Wood, JSS17591, (1♂ CNC); Covey Hill, 45.019681°N 73.745746°W, 15.VI.1927, 17.VI.1927, coll. W.J. Brown, CNCD200657, CNCD200756, (1♂ 1♀ CNC); Cte. Vaudreuil, summit Mt. Rigaud, 45.466389°N 74.326389°W, 220m, hilltop, 10.VI.1994, 13.VI.2001, 2.VI.1981, 22.VII.1997, 24.VII.1985, 9.VII.1985, coll. D.M. Wood, JSS17581, JSS17582, JSS17583, JSS17584, JSS17585, JSS17587, JSS17588, JSS17590, JSS17601, JSS17606, (10♂ 2♀ CNC); Ct, Äö. Aylwin, 5 km West of Kazabazua, 45.945289°N 76.090551°W, 28.VII.1991, coll. D.M. Wood, JSS17592, (1♂ CNC); Duncan Lake, near Rupert, 45.681389°N 76.050278°W, 10.VI.1971, coll. J.F. McAlpine, CNCD200626, (1♀ CNC); Gasp, Äö, 48.833333°N 64.483333°W, 26.VI.1954, coll. W.J. Brown, CNCD200350, CNCD200588, (1♂ 1♀ CNC); Gatineau Park, 45.594868°N 76.002392°W, 4.VI.1964, coll. J.W. Boyes, CNCD200551, (1♀ CNC); Harrington Lake, Gatineau Park Lac Mousseau, 45.568°N 75.954°W, 3.VII.1963, coll. J.R. Vockeroth, CNCD200791, (1♀ CNC); Hemmingford, 45.04571°N 73.588046°W, 26.VI.1923, 30.V.1934, coll. C.H. Curran, J.B. Maltais, CNCD200585, CNCD200660, (2♀ CNC); Hull, 45.4°N 75.7°W, Malaise trap, 10.VI.1923, 13.VI.1923, 13.VI.1965, 14.VI.1950, coll. C.H. Curran, J.R. Vockeroth, CNCD200570, CNCD200649, CNCD200670, CNCD200733, (4♀ CNC); Kazabazua, 45.952028°N 76.021718°W, 7.VI.1927, coll. F.P. Ide, CNCD200714, CNCD200739, (1♂ 1♀

CNC); Lennoxville, 45.366667°N 71.866667°W, 18.VII.1935, coll. G.E. Shewell, CNCD200357, (1♂ CNC); Mount Rigaud, Summit, 45.466389°N 74.326389°W, hilltop, 17.IX.1985, 3.VII.1987, coll. B.E. Cooper, JSS17580, JSS17586, JSS17600, (2♂ 1♀ CNC); Mont Joli, 48.58721°N 68.192412°W, 13.VIII.1954, coll. J.R. McGillis, CNCD200347, CNCD200349, (2♂ CNC); Montreal, 45.466389°N 74.326389°W, 21.VII.1906, coll. Beaulieu, CNCD200536, (1♀ CNC); M, Äögantig, 45.583333°N 70.883333°W, 20.VI.1923, 22.VI.1923, coll. C.H. Curran, CNCD200559, CNCD200729, CNCD200730, (2♂ 1♀ CNC); Old Chelsea, summit of King Mountain, 45.48°N 75.87°W, 351m, hilltop, 1.VI.1965, 12.VI.1965, 14.VI.1963, 18.VII.1961, 2.VI.1964, 21.VI.1965, 21.VI.1966, 26.V.1964, 31.V.1965, coll. J.R. Vockeroth, JSS17627, JSS17628, JSS17629, JSS17630, JSS17631, JSS17632, JSS17633, JSS17634, JSS17635, JSS17636, (7♂ 3♀ CNC, MZUL); St. Chrysostome, 45.101444°N 73.762152°W, 28.VI.1927, coll. W.J. Brown, CNCD200713, (1♀ CNC); Summit of King Mountain, Old Chelsea, 45.48°N 75.87°W, 14.VI.1972, coll. D.M. Wood, CNCD200547, (1♂ 1♀ CNC); Vaudreuil Co., Summit of Mount Rigaud, 45.466389°N 74.326389°W, 177m, hilltop, hand collected, 9.VI.2002, coll. J. Skevington, JSS17589, (1♂ CNC); Wakefield, 45.635861°N 75.929874°W, 22.VI.1946, coll. G.S. Walley, CNCD79805, (1♀ CNC); **Saskatchewan**: Assiniboia, 49.62895°N 105.988339°W, 25.VI.1955, coll. J.R. Vockeroth, CNCD200669, CNCD200674, CNCD200675, (1♂ 2♀ CNC); Christopher Lake, 53.539968°N 105.789257°W, 11.VII.1959, 15.VII.1959, coll. A. & J. Brooks, CNCD200173, CNCD200204, (2♀ CNC); Cut knife, 52.747469°N 109.015892°W, 7.VI.1940, coll. A.R. Brooks, CNCD200560, (1♀ CNC); Dundurn, 51.806462°N 106.502109°W, 29.VIII, coll. N. Criddle, CNCD200485, (1♀ CNC); Earl Gray, 50.935556°N 104.711111°W, 4.VIII.1924, coll. J.J. de Gryse, CNCD200308, (1♀ CNC); Elbow, 51.119503°N 106.598332°W, 17.VI.1960, 18.VII.1960, coll. A.R. Brooks, CNCD200205, CNCD200696, (1♂ 1♀ CNC); Estevan, 49.139167°N 102.986111°W, 23.VII.1958, coll. A. & J. Brooks, CNCD200179, CNCD200180, CNCD200615, (3♂ CNC); Kandahar, 51.75869°N 104.361067°W, 29.VII.1954, coll. Brooks - Wallis, CNCD200323, (1♀ CNC); Katepwa, 50.700014°N 103.633932°W,

11.VIII.1954, coll. Brooks - Wallis, CNCD200195, (1♀ CNC); Kelso, 49.970367°N 101.951257°W, 14.VIII.1925, coll. Kenneth M. King, CNCD200291, (1♀ CNC); Kenosee, 49.83502°N 102.290234°W, 15.V.1959, 15.VI.1958, coll. A.R. Brooks, CNCD200178, CNCD200211, (2♂ CNC); Mossbank, 49.939867°N 105.964409°W, 23.VI.1955, coll. A.R. Brooks, CNCD200622, (1♂ CNC); Pheasant Creek, 50.583246°N 103.467217°W, 21.VII.1937, coll. A.R. Brooks, CNCD200444, CNCD200449, CNCD200741, (2♂ 1♀ CNC); Pike Lake, 51.910886°N 106.819433°W, 12.VI.1948, coll. J.R. Vockeroth, CNCD200753, (1♀ CNC); Prince Albert, 53.216206°N 105.714806°W, 23.VII.1959, 28.VII.1959, 7.VI.1948, coll. A. & J. Brooks, J.R. Vockeroth, CNCD200177, CNCD200198, CNCD200200, CNCD200445, CNCD200643, CNCD200646, (4♂ 2♀ CNC); Rockglen, 49.183333°N 105.933333°W, 21.VI.1955, coll. A.R. Brooks, J.R. Vockeroth, CNCD200214, CNCD200343, (1♂ 1♀ CNC); Rutland, 52.515736°N 109.528654°W, 2.VIII.1940, coll. A.R. Brooks, CNCD200490, (1♀ CNC); Saskatoon, 52.13437°N 106.647656°W, 1.VIII.1960, 13.VI.1949, 18.VII.1923, coll. A.R. Brooks, Kenneth M. King, L. Konotopetz, CNCD200354, CNCD200476, CNCD200616, (3♀ CNC); St. Victor, 49.333333°N 105.9°W, 21.VI.1955, 23.VI.1955, 27.VI.1955, 28.VI.1955, coll. A.R. Brooks, J.R. Vockeroth, CNCD200335, CNCD200621, CNCD200623, CNCD200666, CNCD200709, (4♂ 1♀ CNC); Swift Current, 50.285072°N 107.79717°W, 13.VI.1937, 20.VI.1937, coll. A.R. Brooks, Dom. Ent. Lab., CNCD200363, CNCD200742, (2♀ CNC); Tangleflags (2), 53.483064°N 109.63754°W, 11.VII.1926, coll. N.J. Atkinson, CNCD200340, (1♂ CNC); Val Marie, 49.25°N 107.733333°W, 11.VIII.1957, 12.VI.1955, 5.VI.1955, coll. J.R. Vockeroth, CNCD200329, CNCD200679, CNCD200681, (3♂ CNC); White Fox, 53.449297°N 104.08571°W, 10.VIII.1944, 6.VII.1954, coll. Brooks - Wallis, O. Peck, CNCD200358, CNCD200663, (1♂ 1ex CNC); Willows, 49.616667°N 105.866667°W, 21.VI.1955, 24.VI.1955, coll. A.R. Brooks, CNCD200212, CNCD200710, (1♂ 1♀ CNC); **MEXICO: Durango:** 11 miles West of Durango, 24.030668°N 104.836716°W, 2134m, 13.VII.1964, coll. J.F. McAlpine, CNCD200516, (1♀ CNC); 5 miles West of Durango, 24.033333°N 104.666667°W, 1981m,

sweeping, 14.VII.1964, coll. J.F. McAlpine, CNC200250, (1♀ CNC); 7 miles West of Durango, 24.028146°N 104.762833°W, 2134m, 3.VII.1964, coll. W.R.M. Mason, CNC200247, (1♀ CNC); Navajos, 20 miles East of El Salto, 2438m, 27.VII.1964, coll. L.A. Kelton, CNC200245, (1♂ CNC); **Mexico**: Texcoco, 19.52°N 98.88°W, 2134m, 12.VIII.1954, coll. J.G. Chillcott, CNC200558, (1♂ CNC); **U.S.A.**: **Alabama**: Kushla, 30.816786°N 88.161163°W, 4.V.1920, 5-8.V.1920, coll. A.H. Sturtevant, USNM.ENT1027022, USNM.ENT1027023, (2♀ USNM); **Arizona**: 15 miles South of Quartzsite, Yuma County, 33.460483°N 114.216922°W, 23.III.1967, coll. R.O. Schuster, CNC249469, (1♀ UCDC); Globe, 33.394222°N 110.786498°W, 30.IV.1934, coll. Parker, USNM.ENT1024784, (1ex USNM); Highway 92, 5-7 miles West of Palominas, 31.380599°N 110.20087°W, 12.VIII.1959, CNC200373, (1♀ CNC); Pinal Mountains, 33.281428°N 110.819506°W, 9.V.1937, coll. Parker, USNM.ENT1024789, (1ex USNM); Sierra Ancha Mountains, 33.9575°N 111.186667°W, 31.V.1949, coll. Parker, USNM.ENT1024405, USNM.ENT1024869, (1♀ 1ex USNM); Stronghold Canyon, Cochise County, 1417m, 30.III.1968, coll. R.F. Sternitzky, CNC200521, (1♀ CNC); White Mountains, 33.813691°N 109.303261°W, 10.VII.1936, coll. Parker, USNM.ENT1027092, (1♂ USNM); **California**: 1 mile North of Cedarville, Modoc County, 41.544062°N 120.171776°W, 11.IX.1969, coll. R.F. Denno, E.E. Grissell, CNC249001, (1♀ UCDC); 1000 Springs, San Berdo Mountains, 41.118°N 121.554°W, 16.IX.1946, coll. John L. Sperry, USNM.ENT1027028, (1♂ USNM); 12 miles West of Canby, Modoc County, 41.32083°N 120.902955°W, Brodea spp., 28.VI.1967, coll. L.L. Dunning, CNC249183, (1♀ UCDC); 14 miles West of Johnsville, Plumas County, 39.738256°N 120.820522°W, 15.VII.1967, coll. M.R. Gardner, CNC249457, (1♀ UCDC); 18 miles West of Blythe, Riverside County, 33.607658°N 114.900692°W, 22.IV.1978, coll. R.M. Bohart, CNC249050, (1♀ UCDC); 25 miles East of Baker, 35.388844°N 115.844983°W, 22.IV.1984, coll. R.M. Bohart, CNC249055, (1♀ UCDC); 3.9 miles North on Bear Vly Valley Rd Road, Colusa County, from Hwy Highway 20, 39.04189°N 122.408715°W, Collecting nectare from Tamarix tetrandra, 19.IV.1976, coll. R.W.

Brooks, CNCD249058, (1♂ UCDC); 39 miles West of Needles, San Bernardino, 34.835318°N 115.008361°W, *Chrysothamnus paniculatus*, 22.X.1978, coll. R.W. Brooks, CNCD249232, (1♂ UCDC); 4 miles East of Garberville, Humboldt County, 40.110000°N 123.752303°W, 9.VIII.1974, coll. R.W. Brooks, CNCD249461, (1♀ UCDC); 5 miles North Pope Valley, Napa County, 38.663819°N 122.448249°W, 11.III.1972, coll. C. Goodpasture, CNCD249189, (1♀ UCDC); 5 miles West of Kernville, Tulare County, 35.755142°N 118.513287°W, 11.V.1979, coll. L.D. French, N.J. Smith, CNCD249229, (1♀ UCDC); 6 miles South of Mojave, Kern County, 34.966717°N 118.159637°W, 7.V.1979, coll. R.W. Brooks, CNCD250078, (1♂ UCDC); Antioch, C. Costa County, 38.004921°N 121.805789°W, 11.X.1974, coll. R.M. Bohart, CNCD249209, (1♀ UCDC); Arroyo Seco Camp, Monterey County, 34.118482°N 118.191732°W, 1000m, 22.V.1976, coll. R.M. Brooks, CNCD249466, (1♀ UCDC); 19.V.1964, coll. F.D. Baker, CNCD249123, (1♂ UCDC); Beach at Water Cyn Canyon, Sta Santa Cruz Island, 33.962251°N 120.096771°W, 2.V.1969, coll. D.S. Horning Jr., CNCD249173, (1♂ UCDC); Boca, Nevada County, 39.387272°N 120.089966°W, 12.VII.1974, 25.VII.1974, 31.VII.1967, coll. B. Villegas, M.K. Sears, R.M. Bohart, CNCD250044, debu1157250, debu1157256, (3♂ DEBU, UCDC); Borrego Vly Valley, San Diego County, 33.212245°N 116.233533°W, 6.IV.1964, coll. F.D. Parker, CNCD249180, (1♀ UCDC); Campo Raton, Santa Cruz Island, S. Santa Barb. Barbara County, 21.VI.1967, coll. D.S. Horning Jr., CNCD250054, (1♂ UCDC); Canada del Puerto, Santa Cruz Island, Santa Barbara County, 33.98917°N 119.68972°W, 9.III.1971, coll. R.W. Thorp, CNCD249017, (1♀ UCDC); Canada del Medio, Sta Santa Cruz Isl Island, S Santa Barbera County, 10.V.1968, 11.III.1971, 12.V.1968, 16-23.VI.1967, 18.VI.1967, 2.V.1968, 22.VI.1967, 26.IV.1969, 28.IV.1969, 29.IV.1969, 4.V.1968, 5.V.1968, 6.V.1968, 7.V.1968, 8.V.1968, 9.V.1968, coll. D.R. Miller, D.S. Horning Jr., L. Laughrin, R.L. Brumley, R.O. Schuster, CNCD249002, CNCD249003, CNCD249004, CNCD249005, CNCD249006, CNCD249007, CNCD249008, CNCD249009, CNCD249010, CNCD249011, CNCD249012, CNCD249073, CNCD249074, CNCD249075, CNCD249076,

CNCD249077, CNCD249078, CNCD249079, CNCD249080, CNCD249081, CNCD249082,
 CNCD249140, CNCD249142, CNCD249143, CNCD249144, CNCD249145, CNCD249147,
 CNCD249148, CNCD249151, CNCD249152, CNCD249210, CNCD249211, CNCD249212,
 CNCD249213, CNCD249214, CNCD249215, CNCD249439, CNCD249440, CNCD249441,
 CNCD250028, CNCD250055, CNCD250056, CNCD250057, CNCD250058, CNCD250059,
 CNCD250060, CNCD250061, (28♂ 19♀ UCDC); Cascada, Santa Cruz Island, Santa Barbara
 County, 34.01667°N 119.75°W, 6.V.1968, 8.V.1968, coll. D.R. Miller, D.S. Horning Jr.,
 CNCD249060, CNCD250036, CNCD250075, (3♂ UCDC); Cascada, Sta Santa Cruz Isl Island, S
 Santa Barbera County, 4.V.1968, 8.V.1968, coll. D.R. Miller, R.W. Rust, CNCD249153,
 CNCD249154, CNCD249155, (3♂ UCDC); Christi Beach, Santa Cruz Island, Santa Barbara
 County, 34.027207°N 119.875448°W, 19.VI.1967, 27.IV.1969, coll. A.A. Grigarick, A.S.
 Menke, D.S. Horning Jr., CNCD249162, CNCD249163, CNCD249465, (1♂ 2♀ UCDC);
 Claremont, 34.0967°N 117.7198°W, coll. Baker, USNM.ENT1024423, USNM.ENT1024909,
 USNM.ENT1024910, USNM.ENT1024911, (4♂ USNM); Coches Prietos, Sta Santa Cruz Island,
 Santa Barbera County, 33.966944°N 119.7125°W, 10.V.1968, coll. D.R. Miller, CNCD249175,
 (1♂ UCDC); Daggett, 34.863319°N 116.888092°W, 13.IV.1955, coll. J.E.H. Martin,
 CNCD200583, (1♂ CNC); Deep SprIngs Lk Lake, 37.273649°N 118.044579°W, 11.VII.1967,
 coll. R.O. Schuster, CNCD249187, (1♀ UCDC); Deep Springs, Deep Springs Lake, Inyo County,
 11.VII.1967, coll. R.M. Bohart, CNCD250077, (1♂ UCDC); 37.273650°N 118.044581°W,
 25.VI.1971, coll. R.M. Bohart, CNCD249454, (1♀ UCDC); Fallen Leaf, 38.881122°N
 120.072067°W, 1981m, 16.VII.1917, coll. J.M. Aldrich, USNM.ENT1024858, (1ex USNM); Fan
 Hill Can., 10 miles North East of Thousand Palms, 33.923338°N 116.26849°W, 6.IV.1955, coll.
 W.R.M. Mason, CNCD200337, (1♀ CNC); Fresno County, on Parksfield Grade, 16 miles North
 of Parkfield (Monterey County), 36.063331°N 120.475831°W, 9.V.1994, coll. A.S. & N. Menke,
 USNM.ENT1027174, (1♂ USNM); Griffith Cyn Canyon, Sta Santa Cruz Islands, Sta Santa
 Barbera County, 33.98917°N 119.68972°W, 457m, 22.VI.1967, coll. D.R. Miller, CNCD249464,

(1♂ UCDC); Hallelujah Jet Junction, Lassen County, 39.775462°N 120.039368°W, 13.VII.1972, 18.VII.1964, 22.VI.1964, 29.VI.1966, 6.VII.1976, coll. C.R. Kovacic, I.A. Boussy, J.E. Slansky, R.M. Bohart, S.K. Ault, CNCND249067, CNCND249158, CNCND249159, CNCND249161, CNCND249231, (5♀ UCDC); Hallelujah Jet Junction, Plumas County, 17.VII.1973, coll. B. Villegas, CNCND249101, (1♂ UCDC); Hope Vly Valley, Alpine County, 38.766667°N 119.916667°W, 11.VII.1972, coll. R.A. Belmont, S.F. Casey, CNCND249093, CNCND249094, (1♂ 1♀ UCDC); Keeler, Inyo County, 36.488297°N 117.873348°W, 23.IV.1984, coll. R.M. Bohart, CNCND249447, (1♀ UCDC); Klamath R.River PO, Siskiyou County, 41.947388°N 122.799582°W, Eriogonum, 25.VI.1968, coll. R.W. Thorp, CNCND250041, (1♀ UCDC); Lake Tahoe, Pope Beach, 39.127256°N 120.020296°W, 19.IX.1975, coll. E.C. Toftner, R.O. Schuster, CNCND250052, (1♂ UCDC); Little Lake, Inyo County, 35.937°N 117.907°W, 15.X.1967, coll. R.M. Bohart, CNCND249028, (1♂ UCDC); Little Sand Flat, Hwy Highway 120, Mono County, 37.825729°N 118.942299°W, 16.VII.1981, coll. C. Paddock, CNCND249177, (1♂ UCDC); Lone Pine Lake, Inyo County, 36.576632°N 118.248429°W, 15.X.1967, coll. R.M. Bohart, CNCND249233, (1♀ UCDC); Los Angeles Co., 34.052233°N 118.243685°W, IV, coll. Coquillett Collection, USNM.ENT1024876, USNM.ENT1024877, (2ex USNM); Marin Co., San Geronimo, 38.013352°N 122.663782°W, 23.IV.1913, coll. J.C. Bridwell, USNM.ENT1024418, USNM.ENT1024856, USNM.ENT1024857, (1♀ 2ex USNM); Morongo Valley, 34.047214°N 116.581161°W, 4.X.1949, coll. A.L. Melander, USNM.ENT1024775, (1♀ USNM); Pasadena, 34.147785°N 118.144516°W, coll. Baker, USNM.ENT1024912, (1♀ USNM); Portezuela, Sta Santa Cruz Isl Island, S Santa Barbera County, 34.023206°N 119.765766°W, 20.VI.1967, coll. D.R. Miller, CNCND250043, (1♀ UCDC); Riverside, 33.953349°N 117.396156°W, 22.II.1935, coll. A.L. Melander, USNM.ENT1024785, USNM.ENT1024786, USNM.ENT1024787, (3ex USNM); Russel Vly Valley, Nevada County, 39.427929°N 120.101289°W, 26.VI.1964, coll. P. Richerson, CNCND248996, (1♀ UCDC); S. Berdino Co., V, coll. Coquillett Collection, USNM.ENT1024879, (1ex USNM); Sagehen CkCreek, Nevada County, 39.432115°N

120.24123°W, 14.VII.1978, coll. L.S. Kimsey, CNCD249219, CNCD249220, (1♂ 1♀ UCDC); Sagehen Creek, Nevada County, 12.VII.1978, 22.VI.1972, 30.VI.1976, coll. B. Villegas, M.A. Roese, R.M. Bohart, CNCD249442, CNCD249444, CNCD249445, (3♂ UCDC); Sagehen Creek, Nevada County, *Perideridia*, *Sidalcea Sidalcea spicata*, 18.VII.1968, 18.VII.1973, 19.VII.1972, 2.VII.1978, 22.VII.1970, 23.VI.1976, 24.VI.1970, 25.VI.1968, 27.VI.1972, 3.VII.1968, 30.VI.1976, 4.VII.1971, 5.VII.1966, coll. B. Villegas, C. Goodpasture, Carol J. Horning, D.S. Horning Jr., E.A. Sugden, E.E. Grissell, M.E. Irwin, R.L. Brumley, R.M. Bohart, S.K. Ault, CNCD249019, CNCD249020, CNCD249021, CNCD249022, CNCD249023, CNCD249024, CNCD249025, CNCD249026, CNCD249086, CNCD249087, CNCD249088, CNCD249089, CNCD249090, CNCD249091, CNCD249092, CNCD249127, CNCD249128, CNCD249129, CNCD249130, CNCD249131, CNCD249132, CNCD249134, CNCD249136, CNCD250084, (15♂ 9♀ UCDC); Sagehen Creek, Nevada County, 10.VII.1974, coll. R.L. Bugg, debu1157211, (1♀ DEBU); San Diego, 32.715329°N 117.157255°W, 549m, Collected at firs *Baccharis sarothroides*, 5.XI.1955, coll. Paul H. Arnaud, USNM.ENT1024900, (1♂ USNM); Sand Canyon, 3 miles West of Brown, Kern County, 35.77553°N 117.902092°W, *Baccharis*, 25.III.1970, 29.III.1971, coll. E.E. Grissell, E.E. Grissell, R.F. Denno, CNCD249038, CNCD249463, (1♂ 1♀ UCDC); Santa Barbara County, Santa Cruz Island, Christy Beach, 34.027207°N 119.875448°W, 20.V.1979, 27.IV.1969, coll. B. Villegas, D.R. Miller, CNCD249065, CNCD249066, (1♂ 1♀ UCDC); Santa Cruz County, Sta Santa Cruz Island, 33.98917°N 119.68972°W, 22.VII.1988, coll. E.A. Sugden, CNCD249174, (1♀ UCDC); Short Cyn Canyon, Kern County, 35.706567°N 117.883938°W, 5.IV.1968, coll. R.O. Schuster, CNCD249176, (1♂ UCDC); Stanford University, 37.427982°N 122.170387°W, 19.III.1906, coll. J.M. Aldrich, USNM.ENT1024872, (1ex USNM); Stanislaus County, Frank Raines Park, Del Puerto Cyn Canyon, 18 miles West of Patterson, 37.419636°N 121.35938°W, 23.IV.1983, coll. R.W. Thorp, CNCD249115, (1♂ UCDC); Strawberry, Tuolumne County, 38.199053°N 120.008565°W, 21.VI.1951, 24.VI.1951, coll. C.E. Reiner, CNCD250053, CNCD250062, (2♀ UCDC); Thousand Palms, 33.820018°N

116.390289°W, 16.III.1955, coll. W.R. Richards, CNCD200336, (1♀ CNC); Upper Santa Ana River, 34.091253°N 117.120741°W, 29.IX.1949, 9.IX.1947, coll. A.L. Melander, USNM.ENT1024773, USNM.ENT1024777, (2ex USNM); Yuba Pass, Sierra County, 39.323059°N 120.599169°W, 5.VII.1966, coll. R.M. Bohart, CNCD250037, (1♂ UCDC);

Colorado: Boulder, 5 miles South, 39.936516°N 105.678611°W, 1768m, 9.VI.1961, coll. C.H. Mann, CNCD200826, (1♀ CNC); Doolittle Ranch, Mount Evans, 39.675739°N 105.601348°W, 2987m, 23.VII.1961, coll. B.H. Poole, CNCD200319, (1♀ CNC); Estes Park, 40.376877°N 105.52137°W, 2286m, 19.VI.1961, coll. C.H. Mann, CNCD200645, (1♀ CNC); 40.376877°N 105.519167°W, 13.VII.1934, coll. A.L. Melander, USNM.ENT1024783, (1ex USNM); Gould, Jackson County, 40.527342°N 106.0298°W, 29.VIII.1962, coll. R.M. Bohart, CNCD249114, (1♂ UCDC); Korinant', Malaise trap, 19.VII, USNM.ENT1024827, (1♀ USNM); Los Pinos, 36.820833°N 107.601667°W, on Prunus, 31.V.1899, coll. C.F. Baker, USNM.ENT1024844, (1ex USNM); Loveland Pass, Western Slope, 39.65°N 105.866667°W, 3002m, 8.VIII.1961, coll. B.H. Poole, CNCD200655, (1♀ CNC); Nederland, Science Lodge, 39.95°N 105.5°W, 2896m, 29.VI.1961, coll. W.R.M. Mason, CNCD200582, (1♀ CNC); Rio Grande Co., Beaver Creek, 40.6243°N 105.5295°W, 3048m, 21.VI.1972, coll. W.W. Wirth, USNM.ENT1024829, (1ex USNM); Tennessee Pass, 39.366667°N 106.3°W, 24.VII.1917, coll. J.M. Aldrich, USNM.ENT1024870, (1ex USNM); Valmont Butte, Boulder, 40.030834°N 105.211654°W, 1615m, 7.VII.1961, coll. B.H. Poole, CNCD200285, (1♀ CNC);

Connecticut: Colebrook, 42.001389°N 73.084444°W, IX.1918, coll. W.M. Wheeler, USNM.ENT1024850, (1ex USNM); Hartford, 41.763711°N 72.685093°W, 23.V.1897, CNCD200863, (1♂ CNC); Lyme, 41.4°N 72.35°W, 16.V.1918, coll. W.S. Fisher, USNM.ENT1024816, (1♀ USNM); Norwichtown, 41.553574°N 72.10439°W, IV.1920, coll. A. Latham, USNM.ENT1024824, USNM.ENT1024825, USNM.ENT1024826, (3ex USNM); Redding, 41.302716°N 73.383846°W, 9.IX.1960, coll. A.L. Melander, USNM.ENT1024778, (1♀ USNM); Williston, USNM.ENT1024875, (1ex USNM);

Florida: Mount Pleasant, 30.65722°N 84.69111°W,

1.V.1952, coll. G.S. Walley, CNCD200668, (1ex CNC); **Georgia**: Liberty County, Saint Catherines Island, South Beach; Liberty, 31.659732°N 81.151488°W, 27.VI.1974, coll. R.O. Schuster, E.C. Toftner, CNCD250034, (1♀ UCDC); Morrison, USNM.ENT1024863, (1ex USNM); **Idaho**: Blaine County, Sun Valley, 43.795°N 114.258°W, 3.VII.1972, coll. K.E. Gibson, USNM.ENT1024898, (1♀ USNM); Cassia County, 8 km Northwest of Black Pine, 42.179814°N 113.192284°W, 17.VI.1982, coll. Steiner, Gordon, & Whitehead, USNM.ENT1024894, USNM.ENT1024895, (1♂ 1♀ USNM); Holbrook, Oneida County, 42.161926°N 112.653696°W, Chrsyothamnus, 14.V.1972, coll. G.F. Knowlton, CNCD249197, (1♂ UCDC); Lewiston, 46.400409°N 117.001189°W, coll. J.M. Aldrich, USNM.ENT1024861, (1♂ USNM); Montpelier, 42.322139°N 111.297903°W, 2.IX.1982, coll. R.M. Bohart, CNCD249456, (1♀ UCDC); Moscow, 46.732802°N 117.°W, 22.VIII.1910, 4.IX.1908, coll. J.M. Aldrich coll., USNM.ENT1024392, USNM.ENT1024400, (2♀ USNM); **Indiana**: La Fayette, 40.418145°N 86.884201°W, 21.VI.1916, coll. J.M. Aldrich, USNM.ENT1024880, (1ex USNM); **Iowa**: Ames, 42.033333°N 93.616667°W, 10.V.1947, coll. A.R. Brooks, CNCD200594, (1♀ CNC); Iowa City, 41.65°N 91.516667°W, 25.VI, coll. Stoner, USNM.ENT1024413, (1♀ USNM); **Kansas**: 3 miles Northeast of Lawrence, 38.998974°N 95.177971°W, *Heterotheca grandiflora*, *Heterotheca petiolaris*, IX.1979, coll. R.W. Brooks, CNCD249200, CNCD249206, (1♂ 1♀ UCDC); Douglas Co., Lawrence, 38.971669°N 95.23525°W, 17-28.VIII.1979, coll. R.J. McGinley, USNM.ENT1024672, (1♀ USNM); **Louisiana**: Kisatchie National Forest, Summerfield, 32.92364°N 92.800027°W, 13-14.III.1972, coll. H.J. Teskey, CNCD200593, (1♀ CNC); **Maine**: 10 miles Northeast of Millinocket, 45.759647°N 68.562209°W, bog, 7.VII.1968, coll. D.M. Wood, CNCD200673, (1♂ CNC); Deblois, 44.733333°N 68.016667°W, 6-27.VI.1966, coll. G. Steyskal, USNM.ENT1024833, (1ex USNM); Orono, 44.88385°N 68.671814°W, 10.VI.1958, USNM.ENT1024849, (1ex USNM); **Maryland**: Beltsville, 39.034832°N 76.907474°W, 4.VII.1916, coll. W.R. Walton, USNM.ENT1024412, (1♀ USNM); 39.035014°N 76.907286°W, flowers of *Xolisma ligustrina*, 23.VI.1917, coll. L.O. Jackson,

USNM.ENT1024867, (1ex USNM); Bladensburg, 38.939278°N 76.933863°W, 23.IX.1915, coll. R.C. Shannon, USNM.ENT1024801, (1ex USNM); Chesapeake Beach, 38.683333°N 76.533333°W, 4.IX, coll. J.M. Aldrich, USNM.ENT1024475, (1♂ USNM); Colesville, 39.066667°N 77.°W, 28.V.1977, coll. W.W. Wirth, USNM.ENT1024906, (1♀ USNM); Mg. County, 4 miles Southwest of Ashton, 39.102766°N 77.054403°W, Malaise trap, 15.VI.1986, coll. G.F. & J.F. Hevel, USNM.ENT1024896, (1♀ USNM); Odenton, 39.083998°N 76.700246°W, flowers of *Vaccinium corymbosum*, 5.V.1918, coll. W.L. McAtee, USNM.ENT1024860, (1ex USNM); Rockville, Montgomery Co., 30.V.1969, coll. G. Steyskal, USNM.ENT1024843, (1ex USNM); Sheppard Pratt, Baltimore County, 39.388266°N 76.624988°W, Woods, Malaise trap, 10.VI.1972, 27.V.1972, coll. A.G. Scarbrough, USNM.ENT1027204, USNM.ENT1027205, (1♂ 1♀ USNM); **Massachusetts**: Barnstable Co., Dennis, 41.697738°N 70.152979°W, 16.IX.1979, coll. R.J. McGinley, USNM.ENT1024725, (1♀ USNM); Beverly, 42.558426°N 70.880058°W, 24.VI.1966, coll. Burgess, USNM.ENT1024853, (1ex USNM); Cambridge, Middlesex County, 42.37264°N 71.109653°W, 29.V.1981, coll. N.E. Woodley, USNM.ENT1027175, (1♀ USNM); Forest Hills, 42.294811°N 71.111832°W, 2.VI.1915, coll. F.X. Williams, USNM.ENT1024815, (1ex USNM); Lowell, 42.633425°N 71.316172°W, 14.VIII.1910, coll. J.D. Tothill, CNCD200761, (1♂ CNC); Mashpee, 41.675946°N 70.48681°W, 24.VII.1924, coll. C.C. Sperry, USNM.ENT1024800, (1ex USNM); Melrose Highlands, 42.470929°N 71.061441°W, 17.VI.1911, coll. J.D. Tothill, CNCD200302, CNCD200462, (1♂ 1♀ CNC); Middlesex County Belmont, Rock Mdw Meadow, 42.401823°N 71.199064°W, 7.VIII.1981, coll. N.E. Woodley, USNM.ENT1027091, (1♀ USNM); Pocasset, 41.683333°N 70.6°W, 22.VIII.1925, USNM.ENT1027024, (1♀ USNM); Woods Hole, 41.530302°N 70.667905°W, on *S. altissimum*, 6.VI.1923, IX.1919, USNM.ENT1027010, USNM.ENT1027014, (2♀ USNM); **Michigan**: 2 miles Southwest of Holt Ingham County, 42.620207°N 84.543798°W, 30.V.1964, coll. R.W. Matthews, USNM.ENT1024908, (1♂ USNM); Alger County, 31.V.1964, coll. R.W. Husband, USNM.ENT1024864, (1ex USNM);

Cheboygan County, 3.VIII.1941, coll. T.W. Porter, USNM.ENT1027115, (1♂ USNM); Chippewa County, 46.3°N 84.483333°W, 31.V.1965, coll. J.P. Donahue, USNM.ENT1024881, USNM.ENT1024882, USNM.ENT1024883, (3♀ USNM); Detroit, 42.342543°N 83.053849°W, 30.V.1930, coll. G. Steyskal, USNM.ENT1024834, (1ex USNM); Douglas Lake, 45.576°N 84.693°W, USNM.ENT1024828, (1ex USNM); Gull Lake Bio. Sta., Kalamazoo County, 42.393464°N 85.386419°W, 24.VI.1965, coll. Roland L. Fischer, USNM.ENT1024891, (1♂ USNM); Isabella County, 43.598799°N 84.856793°W, 20.VIII.1944, coll. R.R. Dreisbach, CNCD200273, (1♂ CNC); Lake County, 39.207391°N 106.32953°W, 30.V.1945, coll. R.R. Dreisbach, CNCD200608, (1♀ CNC); Lapeer Co., Deerfield twp., 43.051102°N 83.293434°W, 30.V.1937, coll. G. Steyskal, USNM.ENT1024845, (1ex USNM); Livingston Co., E.S. George Reserve, 42.620795°N 83.847302°W, 28.V.1944, coll. G. Steyskal, USNM.ENT1024836, (1ex USNM); Livingston Co., Hamburg, 42.448661°N 83.801395°W, 3.VI.1934, 8.VI.1934, coll. G. Steyskal, USNM.ENT1024830, USNM.ENT1024831, USNM.ENT1024832, (3ex USNM); Livingston County Gee. George' Reserve, 42.620795°N 83.847302°W, 5-6.VI.1943, coll. C.W. Sabrosky, USNM.ENT1024902, USNM.ENT1024903, USNM.ENT1024904, USNM.ENT1024905, (2♂ 2♀ USNM); Livingston County, 24.VII.1943, coll. R.R. Dreisbach, CNCD200388, (1♀ CNC); Luce County, 46.28°N 85.33°W, 16.VII.1946, coll. R.R. Dreisbach, CNCD200605, (1♀ CNC); Melstrand, 46.462997°N 86.415195°W, 17.VI.1940, coll. C.B. Dibble, USNM.ENT1024897, (1♂ 1♀ USNM); Michigamme, 46.536388°N 88.107876°W, 8.VIII.1936, coll. C. Sabrosky, USNM.ENT1024901, (1♂ USNM); Midland County, 43.574974°N 84.352846°W, 22.VI.1945, 29.VIII.1945, coll. R.R. Dreisbach, CNCD200389, CNCD200391, (2♀ CNC); Midland, 43.65°N 84.4°W, 27.V.1945, coll. R.R. Dreisbach, CNCD200401, (1♂ CNC); Missaukie County, 44.333333°N 85.1°W, 29.VII.1948, coll. R.R. Dreisbach, CNCD200274, (1♂ CNC); Presque Isle County, Ocqueoc Lake, 45.474772°N 84.114°W, 18-23.VII.1987, 18.VI.1978, 22.VI.1978, coll. R.W. & E.R. Hodges, USNM.ENT1024884, USNM.ENT1024885, USNM.ENT1024886, USNM.ENT1024887,

USNM.ENT1024888, USNM.ENT1024889, USNM.ENT1024890, USNM.ENT1024892, USNM.ENT1024893, USNM.ENT1024899, (5♂ 5♀ USNM); Roscommon County, 44.33°N 84.61°W, 15.VIII.1943, coll. R.R. Dreisbach, CNCD200652, (1♂ CNC); Saginaw County, 43.333333°N 84.033333°W, 6.VI.1943, coll. R.R. Dreisbach, CNCD200606, CNCD200810, (2♀ CNC); Shiawassee County, 42.95°N 84.14°W, 13.VI.1943, coll. R.R. Dreisbach, CNCD200607, (1♀ CNC); **Minnesota**: St. Anthony Park, coll. Lugger, USNM.ENT1024862, (1ex USNM); **Mississippi**: Agricultural College, 33.455537°N 88.790429°W, 24.III.1922, 3.IV.1922, 6.IV.1922, V.1940, coll. F.M. Hull, CNCD200765, CNCD200766, CNCD200773, CNCD200777, CNCD200780, CNCD200781, CNCD200782, CNCD200789, CNCD200841, CNCD200842, CNCD200862, (8♂ 1♀ 2ex CNC); Lafayette County, 34.4°N 89.5°W, 1-15.IV.1949, III-V.1943, IV-V.1946, V-VI.1960, VII.1945, coll. F.M. Hull, CNCD200228, CNCD200230, CNCD200232, CNCD200234, CNCD200236, CNCD200239, CNCD200362, CNCD200368, CNCD200375, CNCD200378, CNCD200441, CNCD200609, CNCD200768, CNCD200769, CNCD200787, CNCD200797, CNCD200840, CNCD200843, CNCD200852, CNCD200859, CNCD200860, (11♂ 10♀ CNC); Oxford, 34.366495°N 89.519248°W, 1-15.IV.1948, V.1940, VI.1941, coll. F.M. Hull, CNCD200763, CNCD200764, CNCD200767, CNCD200770, CNCD200771, CNCD200772, CNCD200774, CNCD200775, CNCD200776, CNCD200783, CNCD200784, CNCD200785, CNCD200786, CNCD200788, CNCD200827, CNCD200828, CNCD200829, CNCD200830, CNCD200831, CNCD200832, CNCD200833, CNCD200834, CNCD200835, CNCD200836, CNCD200837, CNCD200838, CNCD200839, CNCD200844, CNCD200845, CNCD200846, CNCD200847, CNCD200848, CNCD200849, CNCD200850, CNCD200851, CNCD200854, CNCD200856, CNCD200857, CNCD200858, CNCD200861, CNCD79803, CNCD79804, (20♂ 20♀ 2ex CNC); **Nevada**: Kecaeville, 2.VI.1918, coll. A.K. Fisher, USNM.ENT1024913, (1♀ USNM); Lake Mead, Clarke County, 36.173559°N 114.416484°W, 23.IV.1978, coll. N.J. Smith, CNCD249451, (1♀ UCDC); Nixon, Washoe County, 39.831882°N 119.358005°W, 26.VI.1980, coll. L.S. Kimsey, CNCD249223,

(1♂ UCDC); Verdi, Washoe County, 39.51764°N 119.989527°W, 18.VI.1964, coll. E.A. Kane, CNCD249191, (1♀ UCDC); **New Hampshire**: Mount Monadnock, 42.866667°N 72.116667°W, 11.VI.1932, coll. A.L. Melander, USNM.ENT1024779, (1ex USNM); Mount Washington, 44.270481°N 71.30255°W, coll. S.W. Cassino, CNCD200738, (1♂ CNC); **New Jersey**: Clementon, 39.806194°N 74.982944°W, 10.V.1896, 14.V.1896, coll. G.M. Greene, USNM.ENT1024820, USNM.ENT1024821, USNM.ENT1024822, USNM.ENT1024823, (1♂ 3ex USNM); Iona, 39.601843°N 75.067595°W, 12.IX.1909, USNM.ENT1024757, (1♀ USNM); Malaga, 39.57°N 75.05°W, 1.V.1910, 15.IX.1907, USNM.ENT1024818, USNM.ENT1024819, (1♂ 1ex USNM); Ramsey, 41.057414°N 74.140899°W, 15.IX.1917, coll. J. Bequaert, USNM.ENT1024835, (1ex USNM); Riverton, 40.011501°N 75.014893°W, 30.V.1910, 7.IX.1908, USNM.ENT1024755, USNM.ENT1024758, (2♀ USNM); Trenton, Ceanothus, 23.V.1914, coll. W.S. Fisher, USNM.ENT1024805, (1ex USNM); coll. F.H. Chittenden, USNM.ENT1024429, (1♀ USNM); **New Mexico**: 12 miles North of Las Cruces, Dona Ana County, 32.472417°N 106.888286°W, 11.IV.1965, coll. F.D. Parker, CNCD248985, CNCD248988, (2♀ UCDC); 5 miles East of Las Cruces, Dona Ana County, 32.302643°N 106.664834°W, 7.IV.1965, 8.IV.1965, coll. F.D. Parker, R.M. Bohart, CNCD248971, CNCD248973, CNCD248974, CNCD248975, CNCD248976, CNCD248977, CNCD248978, CNCD248979, CNCD248982, CNCD248984, CNCD248992, (8♂ 3♀ UCDC); Beulah, 35.774687°N 105.153639°W, 8.VII, USNM.ENT1024842, (1ex USNM); Granite Pass, Hidalgo County, 32.083333°N 108.951389°W, 6.IV.1965, coll. F.D. Parker, R.M. Bohart, CNCD248997, CNCD248998, CNCD248999, CNCD249014, CNCD249015, CNCD250040, (4♂ 2♀ UCDC); Pecos, 35.571341°N 105.674334°W, 9.VI, coll. Graham, USNM.ENT1024873, (1ex USNM); Rio Ruidoso, Lincoln National Forest, 33.331655°N 105.67321°W, 2134m, 30.IX.1916, coll. C.H.T. Townsend, USNM.ENT1024874, (1ex USNM); Summit of Gomez Peak Near Silver City, 32.843611°N 108.283889°W, 2221m, hilltop, 13.VIII.2007, coll. J. Skevington, JSS17345, (1♂ CNC); **New York**: Corlear Bay, Lake Champlain, 44.483961°N 73.418207°W, VI.1939, coll.

R.C. Shannon, USNM.ENT1024812, USNM.ENT1024813, (1♀ 1ex USNM); Geneva, 42.868955°N 76.977744°W, 28.V.1914, USNM.ENT1024780, (1ex USNM); Ithaca, 42.444235°N 76.5°W, V, VI, coll. R.C. Shannon, USNM.ENT1024419, USNM.ENT1024424, USNM.ENT1024809, USNM.ENT1024810, USNM.ENT1024811, (2♂ 3ex USNM); Mount Hurricane, Essex County, 44.233601°N 73.708728°W, VI.1939, coll. R.C. Shannon, USNM.ENT1024806, USNM.ENT1024807, USNM.ENT1024868, (3ex USNM); **North Carolina**: Cherokee, 35.516667°N 83.3°W, 610m, 24.V.1957, coll. W.R.M. Mason, CNCD200664, (1♀ CNC); Highlands, Whiteside Mountain, 35.080925°N 83.138203°W, 1494m, 13.V.1957, coll. W.R.M. Mason, CNCD200586, (1♂ CNC); Highlands, 35.054167°N 83.202222°W, 914-1524m, IV.1936, V.1936, coll. R.C. Shannon, USNM.ENT1024794, USNM.ENT1024795, USNM.ENT1024796, (3ex USNM); Moore County, 35.367449°N 79.470388°W, 8.X.1964, coll. U.F. Cornell, debu1157246, (1♂ DEBU); Smokemont, 35.55°N 83.3°W, 17.VII.1941, coll. A.L. Melander, USNM.ENT1024776, (1ex USNM); **Ohio**: Athens Co., 1.VI.1955, USNM.ENT1024716, (1♀ USNM); Columbus, 39.983333°N 82.983333°W, 23.V.1925, 30.V.1923, coll. F.C. Bishopp, CNCD200376, USNM.ENT1024791, (1♀ 1ex CNC, USNM); **Oklahoma**: Payne County, 36.144999°N 97.006839°W, 12.IV.1925, coll. W.J. Brown, CNCD200545, CNCD200554, (1♂ 1♀ CNC); **Oregon**: 6 miles East of Warner Pass, Lake County, 42.234369°N 120.291332°W, 3.VIII.1968, coll. D.R. Miller, R.F. Denno, CNCD249237, (1♂ UCDC); Alkali Lake, Lake County, 42.977222°N 120.028056°W, 26.VIII.1986, coll. R.M. Bohart, CNCD249764, (1♀ UCDC); Corvallis, 44.56454°N 123.262192°W, 21.VI.1925, coll. A.L. Melander, USNM.ENT1024781, (1ex USNM); Forest Grove, 45.519836°N 123.110663°W, on wild flowers of wheat field, 13.V.1919, coll. A.C. Barrill, USNM.ENT1024817, (1ex USNM); Imnaha, 45.559367°N 116.833228°W, 18.VII.1950, coll. G.H. & J.L. Sperry, USNM.ENT1024797, (1♀ USNM); Malin, 42.013938°N 121.409309°W, on Alsike Clover, 9.VII.1940, coll. H.A. Scullen, USNM.ENT1024790, (1ex USNM); **Pennsylvania**: Allegheny, coll. J.M. Aldrich coll., USNM.ENT1024410, (1♀ USNM); Pocono Lake, 41.105644°N

75.474999°W, 11.VII.1911, 13.VII.1911, 9.VII.1911, coll. N. Banks, CNC200544, USNM.ENT1024837, USNM.ENT1024838, USNM.ENT1024839, USNM.ENT1024840, (5ex CNC, USNM); Ralston, Lycoming County, 41.506°N 76.954°W, 8.VI.1962, coll. J.G. Chillcott, CNC200633, CNC200634, (2♂ CNC); **South Dakota**: Big Stone Cy City, 45.291632°N 96.462834°W, coll. J.M. Aldrich, USNM.ENT1024402, (1♀ USNM); Brookings, 44.311357°N 96.798388°W, 11.VI.1891, 8.VI.1891, coll. J.M. Aldrich, J.M. Aldrich coll., USNM.ENT1024394, USNM.ENT1024854, (1♀ 1ex USNM); Custer, 43.766651°N 103.598806°W, coll. J.M. Aldrich, USNM.ENT1024846, (1ex USNM); **Tennessee**: Clarksville, 36.531206°N 87.362587°W, 20.IV.1936, coll. E.W. Howe, USNM.ENT1024814, (1ex USNM); Fall Creek, Falls State Forest Park, Van Buren County, 35.66211°N 85.349779°W, 518m, 25.V.1965, coll. J.G. Chillcott, CNC200126, (1♀ CNC); **Texas**: Kerrville, 30.047433°N 99.140319°W, sweeping, 31.III.1959, coll. J.F. McAlpine, CNC200270, (1♂ CNC); Toyahvale, Jeff Davis County, 30.944313°N 103.789349°W, 22.III.1967, coll. D.M. Wood, CNC200617, (1♂ CNC); **Utah**: Lonesome Beaver, Henry Mountains, 38.111886°N 110.774663°W, 2286m, 30-31.VII.1968, coll. H.F. Howden, CNC200493, (1♀ CNC); Wellsville Mountains, 41.635624°N 112.014561°W, 20.V.1956, coll. G.E. Bohart, USNM.ENT1027000, USNM.ENT1027001, USNM.ENT1027002, USNM.ENT1027003, USNM.ENT1027004, USNM.ENT1027006, (5♂ 1♀ USNM); **Virginia**: 4-mile Run trail, 38.857254°N 77.089125°W, flowers of Aster, 8.X.1916, coll. W.L. McAtee, USNM.ENT1024878, (1ex USNM); Dead Run, Fairfax Co., 38.9°N 77.45°W, Ceanothus, 22.VI.1915, coll. R.C. Shannon, USNM.ENT1024859, (1ex USNM); Falls Church, 38.883506°N 77.174039°W, USNM.ENT1024855, (1ex USNM); Upton, Ceanothus, 14.VI.1924, 2.VII.1924, coll. C.T. Greene, W.S. Fisher, USNM.ENT1024802, USNM.ENT1024803, (2ex USNM); Vienna, 38.901222°N 77.26526°W, Ceanothus flowers, 18.VI.1936, 3.VI.1936, coll. J.C. Bridwell, R.C. Shannon, USNM.ENT1024411, USNM.ENT1024841, (1♂ 2♀ USNM); **Washington**: Almota, 46.702937°N 117.469352°W, 20.V.1923, coll. A.L. Melander, USNM.ENT1024774, (1ex USNM); Benton City, 46.263065°N

119.487679°W, 6.V.1966, coll. C.W. Sabrosky, USNM.ENT1024792, USNM.ENT1024851, USNM.ENT1024852, (3ex USNM); Kalmia, D.C., 38.985591°N 77.040441°W, flowers of *Chrysopsis mariana*, 9.IX.1916, coll. W.L. McAtee, USNM.ENT1024798, (1ex USNM); Paterson, 45.938919°N 119.602583°W, 26.IV.1939, USNM.ENT1024847, (1ex USNM); Pullman, 46.716667°N 117.166667°W, 16.VI.1918, 4.VI.1922, 6.VI.1918, V, VI.1921, coll. A. Ramstad, A.L. Melander, USNM.ENT1024767, USNM.ENT1024768, USNM.ENT1024769, USNM.ENT1024770, USNM.ENT1024771, (1♂ 4ex USNM); Skagit Co., 13 km NE Marblemount at Damnation Creek, 2.VII.1988, coll. W.E. Steiner, USNM.ENT1024703, USNM.ENT1024704, USNM.ENT1024707, (2♂ 1♀ USNM); Walla Walla, 46.05°N 118.333333°W, 18.VIII.1925, coll. A.L. Melander, USNM.ENT1024871, (1ex USNM); Wawawai, 46.636764°N 117.37699°W, 732m, 28.V.1922, coll. A.L. Melander, USNM.ENT1024772, (1♂ USNM); 1.V.1909, 30.VIII.1908, 7.V.1915, coll. A.L. Melander, W.M. Mann, USNM.ENT1024519, USNM.ENT1024766, USNM.ENT1024808, (1♀ 2ex USNM); **West Virginia**: 5 miles East of Moorefield, 39.061675°N 78.879172°W, 20.VI.1965, coll. J.G. Chillcott, CNCDC200576, CNCDC200577, (1♂ 1♀ CNC); Lost River State Park, Hardy County, 38.902981°N 78.904661°W, 5-6.VII.1980, coll. A.S. Menke, CNCDC250051, (1♀ UCDC); So. Charleston, Kanawha County, 38.368086°N 81.701169°W, 24.V.1980, coll. P.H. Adler, USNM.ENT1024907, (1♂ USNM); **Wyoming**: Lafayette County, 34.4°N 89.5°W, coll. F.M. Hull, CNCDC200407, (1♂ CNC); 1952, coll. F.M. Hull, CNCDC200855, (1♂ CNC); 4 miles South Cottonwood Spgs Springs. JTNM, *Phacelia distans*, 12.IV.1978, coll. R.W. Brooks, CNCDC250074, (1♂ UCDC); Island Beach, 19.IX.1926, coll. H.W. Allen, USNM.ENT1024427, (1♂ 1♀ USNM); Valley, Cole County, 12.VI.1974, coll. M.E.N., CNCDC200647, (1♀ CNC); CNCDC200243, CNCDC200475, USNM.ENT1024866, (2♀ 1ex CNC, USNM).

Diagnosis. Larger species (~8-10 mm); tarsomeres 1-3 (tm-1-3) brown (same as legs) with sparse black setae, though tm-4-5 are always darker brown; arista, black base,

orange, black tipped; r_{4+5} usually open (Fig. 4 A), but in rare cases can be closed or nearly so; abdomen distinctly “chocolate” brown with golden microtomentum; thorax with usually distinct bare black maculation pattern (Fig. 18 C) though slightly variable.

Note. A single male specimen (CNCD200780) collected 6.IV.1922 in Mississippi, USA, shows a remarkable aberration in the wings. The r_{4+5} cell is reduced and invaginated with the costal vein complete. This feature is symmetrical in the left and right wings.

Description. Male. Body length (including antennae): ~8-10 mm.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; arista, black base, orange, black tipped; eyes dark brown; frons, antennal grooves and facial carina yellow with light dusting of silvery microtomentum; frons and genae yellow with sparse black setae; frontal vitta dull yellow or brownish-yellow from scape to ocellar triangle, with lines of golden or silver microtomentum along lateral margins above eyes with a dark interruption about the ocellar triangle, with many black setae; ocellar triangle dull brown with two black forward-facing bristles surrounded by many black bristles; occiput and postgena black to dark brown with silverish-white microtomentum with black bristles about occiput and paler bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with either dull grayish-brown, or grayish-blue microtomentum with 6-7 thin and prominent bare black stripes; the medial stripe extends from below the postpronotal lobe to the transscutal suture with three submedial stripes on either side of varying lengths; sometimes medial stripe is very faint, or absent; submedial

stripes-3 somewhat thicker, and broken up by sutures along the notopleuron (Fig. 18 C); dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing bushy; scutellum mainly covered in grayish-brown or grayish-blue microtomentum with several long black setae; lateral thorax mainly dark brown to black, covered in microtomentum the same colour as dorsum, though ventral margin of katepisternum variably bare; katepisternum with long black bristles; black bristles around cervical sclerite.

Legs. Coxae brown to black with dusting of grayish-silver microtomentum, especially on anterior front coxa with many long black setae; legs tend to be unicolourous or patchy brown, variably light or dark, covered in a very light dusting of silver microtomentum; patchy, with many black setae, very bushy; tibia brown with many shorter black setae; distal posterior surface of hind tibia with thick transverse patch of setae; tarsomeres 1-3 (tm-1-3) brown (same as legs) with sparse black setae, though tm-4-5 almost always darker; tarsi brown with black tips with variably brown or yellow pulvilli.

Wing. Membrane clear with brownish-yellow colour, darkened, cloudy, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open, though vary rarely closed (Figs. 4 A, B).

Abdomen. Tergite-1 (tg-1) dull dark brown, with lateral tufts of short black setae; tg-2 dark brown with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3-5 dull dark brown with lateral and oblique golden-brown microtomentum; tg-6 covered in golden-brown microtomentum; tg-2-5

with very thin brown band at posterior edge; microtomentum irregular, dusty, with only a faint medial stripe apparent on tg-2-5; abdomen sparsely covered in short black setae.

Male Genitalia. (Figs. 29 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, without concentrated patch of longer bristles near joint of surstylus; hypoproct divided, rounded, bulbous, curled and projecting forward, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus large, narrow and elongate, rounded apically, with a back-facing tooth or point and a strong inner-facing tooth, with short, fine setae, distally; posterior surstylus large, somewhat flat and very elongate, apically pointed, with a strong inward curl, with a sparse cluster of black bristles (2-4) not in line with surstyli, but about as long; thin lateral membranous appendage present, appearing as a rounded fin; hypandrium Y-shaped, elongate with a sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus ribbed, slightly pointed or arrow-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply truncate, without short, mid-length, ventral fan of setae; sperm pump rounded, somewhat large and flat, with conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth. tg-5 is reduced, much shorter than broad, orangy-red, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny orange or pale yellow.

Hosts. *Podalonia atriceps* Smith (Freeman, 1966).

Distribution. Map 5 B (●). Widespread, all over North America.

Habitat. Can be found on hilltops with elevations, as high as 677 m, or gravel pits; generally lower elevations. Found in a variety of habitats and on many plants including *Chrysothamnus sp.* (*Erica paniculata*) (A.Gray) Rydberg, *Brassica rapa* Linnaeus, *Conyza Canadensis* (Linnaeus) Cronquist, *Erigeron linearis* (Hooker) Piper, *Lupinus sp.* Linnaeus, *Solidago sp.* Linnaeus (Freeman, 1966), *Helianthus petiolaris* Nuttall, and *H. grandiflora*.

Remarks. Emergence as early as February through to November, peaking in June. Intraspecific COI pairwise distance variation: 0.9-6.3%. The wide genetic variation combined with the expansive range is suggestive of a complex of several subtle species. Full COI sequences and more extensive sampling will be needed to teasing out the species within this complex.

***Z. kraussi* Burt & Skevington, 2015**

Figs. (27 D-F), Map 6 B (■).

Type material. Holotype; ♂; USA: Florida: Archbold Biological Station, Highlands County, 27.189664°N 81.338133°W; 24-IV-1967, coll. B.V. Peterson, genitalia dissected; COI sequenced (leg missing for analysis); CNCD28517 (CNCD).

Paratype series. U.S.A.: Florida: Dade Co. Miami, 25.790000°N 80.230000°W, 28.XI.1967, coll. C.E. Stegmaier, USNM.ENT1024068, (1♀ USNM); **North Carolina:** Highlands, Whitesides Cove, 35.059586°N 83.134039°W, 792m, 18.VII.1957, coll. J.G. Chillcott, CNCD200007, (1♀ CNC); Looking Glass Falls, Transylvania County,

35.296339°N 82.768400°W, 762m, 5.VI.1962, coll. J.R. Vockeroth, CNC199989, (1♀ CNC); Smokemont, 35.550000°N 83.300000°W, 17.VII.1941, coll. A.L. Melander, USNM.ENT915991, (1♂ USNM); **Oklahoma**: Ardmore, Indian Territory, 34.174261°N 97.143625°W, 6.I.1909, coll. F.C. Bishopp, USNM.ENT1024099, (1♂ USNM); **Virginia**: Potomac Run, 38.826953°N 77.056694°W, 30.V.1916, coll. W.L. McAtee, USNM.ENT915829, (1♂ USNM).

Material dissected. CNC128517 (♂).

Diagnosis. Smaller species (3.5-5 mm); scutum blue, or bluish-green; sometimes dull brown with four black stripes (Fig. 19 D); wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~3.5-5 mm.

Head. Antennae mainly brown with dusting of silverish-white microtomentum; scape dark brown; flagellum dark orange with black patch distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silver microtomentum; frons and gena yellow with sparse pale or black setae; frontal vitta variably dull yellow just above scape and then dull, patchy brown or entirely patchy reddish-brown to dark brown, with line of gold or silver microtomentum along lateral margins above eyes, with several black setae; somewhat bushy; ocellar triangle somewhat shiny brownish-green with many black forward-facing bristles; occiput and postgena black and pale bluish-brown respectively, covered with brownish-green or bluish-gray microtomentum with bushy black bristles; often occiput is covered in lighter brownish-green microtomentum; palps pale brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum generally bluish-green, or dull brown with four black stripes that extend just beyond the trasscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum same colour as scutum, with four long black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 1-2 thin, pale bristles positioned more posteriorly than anteriorly; 1-2 black or pale bristles present at cervical sclerite.

Legs. Coxae brown with black setae; front coxa with golden microtomentum and variable presence of setae; legs mainly unicolourous brown, though pale yellow at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres pale brownish-yellow with short black setae; tm-1 variably paler than tm-5; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; wing cell r_{4+5} open (Fig. 4 A).

Abdomen. (Figs. 20 C-F) Tergites dull brown; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint grayish-brown microtomentum appearing laterally; tg-3 dull brown with lateral grayish-brown microtomentum forming obliquely a triangular pattern dorsally; tg-4-5 mainly covered in light grayish-brown microtomentum, except for 2 small dull brown triangular spots appearing dorsally, divided by microtomentum; tg-6 covered in grayish-brown

microtomentum; abdomen variably covered in long black setae, usually appearing somewhat bushy (Figs. 20 E-F).

Male Genitalia. (Fig. 27 D-F) Epandrium variably pale or dark brown, rounded and bulbous, shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow and conical, covered in fuzzy tomentum; cerci oval-shaped and elongated, fan-like laterally, protruding with long, fine setae extending distally only; anterior surstylus short, slightly bulbous, truncate, with very sharp, forward-facing teeth, and sharp back-facing teeth or points, with short, fine setae, distally; forward-facing teeth form an enclosure against posterior surstylus back-facing lateral protrusion; posterior surstylus large, only slightly bulbous, rather elongated, apically pointed, with a slight inward curl, with 1-2 very short black bristles; no membranous appendage present, though exaggerated and pointed lateral protrusion, forming a rounded enclosure with asur forward-facing teeth; hypandrium Y-shaped, elongate with a very sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus small, narrow, pointed, dagger-shaped covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and sharply curled and pointed without short, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed and apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter

than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny; genitalia appear overall like a clasping apparatus.

Etymology. Patronym for Dr. Lawrence Krauss, an American theoretical physicist, cosmologist, science author, educator, public speaker, and a noted champion of science and educational freedom.

Hosts. unknown

Distribution. Map 6 B (■). Found mainly in the southeastern and midwestern United States, extending southwest to Arizona.

Habitat. Can be found at elevations as high as 241 m.

Remarks. There are no known COI sequence data at this time.

***Z. lisafyrea* nov. sp. Burt & Skevington, 2015**

Figs (36 A-C; 20 G-H), Map 4 B (●).

Type material. *Z. lisafyrea* Burt & Skevington, 2015: Holotype; ♀; CANADA: Saskatchewan: Rock Glen, 49.183333°N 105.95000°W, 3.VII.1955; coll. C.D. Miller; CNCN200885 (CNC).

Paratype series. CANADA: Alberta: Lethbridge, 49.700000°N 112.816667°W, 9.VIII.1923, coll. H.E. Gray, E.R. Tinkham, CNCN200418, CNCN200897 (1♂ 1ex CNC); Medicine Hat, 50.040483°N 110.673525°W, 31.VII.1925, coll. F.S. Carr, CNCN200902, (1♀ CNC); **British Columbia:** Penticton, 49.499138°N 119.593708°W, 24.VII.1924, coll. W. Downes, CNCN200878, (1♂ CNC); **Saskatchewan:** Beaver Creek, 51.976303°N 106.664694°W, 29.VII.1925, coll. N.J. Atkinson, CNCN200904, (1♂ UCDC); Torquay, 49.140431°N 103.488000°W, 14.VIII.1955, coll. C.D. Miller, CNCN200874, (1♀ CNC); **U.S.A.: California:** Imperial County, Experiment Farm, 32.701717°N 115.116919°W, 31.V.1912, coll. J.C. Bridwell,

USNM.ENT1024976, (1♀ USNM); **Montana**: 7 miles Northeast of St. Regis, Mineral County, 47.344233°N 114.982236°W, *Sphaeralcea angustifolia*, 19.VII.1971, coll. E.E. Grissell, CNCN250103, (1♂ UCDC); Helena, 39.912797°N 94.649536°W, 6.VIII.1904, USNM.ENT1024971, (1♀ USNM); **Nebraska**: Lincoln, Lancaster County, 40.813408°N 96.702469°W, on Solidago (m), 5.VIII.1904, coll. M.H. Swenk, USNM.ENT1024983, (1♂ USNM); **Nevada**: Indian School, Pyramid Lake, 39.959061°N 119.592986°W, VII.1911, coll. J.M. Aldrich, USNM.ENT1024947, (1♀ USNM); **North Dakota**: Krumen, 21.VII.1923, coll. N. Criddle, CNCN200875, (1♂ UCDC); **Oregon**: Lake County, Warner Mountains, 24.VII.1992, coll. R.M. Bohart, CNCN250094, (1♂ UCDC); **South Dakota**: 2 miles South of Blue Bell, Custer State Park, 43.690964°N 103.482167°W, 10.VII.1961, coll. H. & A. Howden, CNCN200876, (1♂ UCDC); **Utah**: Logan, 41.733333°N 111.833333°W, 4.VII.1907, coll. E.S.G. Titus, USNM.ENT1027047, (1♀ USNM); St. George, 37.095389°N 113.570192°W, 29.V.1919, USNM.ENT1027042, (1♂ USNM); Sunglow Camp, Bicknell, 38.340814°N 111.544072°W, 11.VIII.1968, coll. H.F. Howden, CNCN200899, (1♂ CNC); **Wyoming**: Carbon County Int. 80, Wagonhound Rest Area 22, 41.628356°N 106.283225°W, 22.VIII.1995, coll. Paul H. Arnaud Jr., USNM.ENT1027096, (1♂ USNM); Glenrock, 42.861289°N 105.872478°W, Working blossoms *Grindelia squarrosa*, 27.VII.1974, coll. R. Lavigne, USNM.ENT1027130, (1♂ USNM); Tower Falls Continental Divide, Yellowstone Park, 44.587719°N 110.537673°W, VII.1928, coll. J. McDunnough, CNCN200905, (1ex CNC).

Material dissected. CNCN200903, CNCN200886, CNCN200905, CNCN200878, CNCN200897 (4♂, 1♀).

Diagnosis. A large species (~8-10 mm); reddish-orange body, pale, especially the abdomen, with bright golden microtomentum distinctly patterned; dorsal thorax with two strong median stripes which extend over a dark dorsum which usually gradually changes to a brownish-red posteriorly, just before the scutellum, though variable (*like* Fig. 18 I).

Description. Male. Body length (including antennae): ~10-12 mm.

Head. Antennae yellowish-orange; scape and pedicel with short black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina pale yellow with microtomentum within grooves and lining inner eye edge; frons and genae pale yellow, without setae; frontal vitta dull yellowish-orange; ocellar triangle dull dark brown with two black forward-facing bristles; occiput dull brown with two pale golden stripes of microtomentum and postgena with pale yellow microtomentum (paler than frons); occiput with black bristles; postgena with pale yellow bristles; palps dark brown, slightly elongate; single geniculate proboscis long, shiny, dark brown.

Thorax. Scutum variably orange or dark brown; pale microtomentum covers and extends from postpronotol lobe along scutum margin to transscutal suture, shifts medially and continues to scutellar suture; scutum with two thin medial stripes extending just beyond transscutal suture (*as in* Fig. 18 I); short black bristles on postpronotol lobe and along margins of scutum; scutellum dull brown with variable presence of pale microtomentum and short posterior-facing black bristles; upper lateral thorax brown and dark brown toward coxae; katepisternum dark brown; pale microtomentum extends from anepisternum (anepst) to katepisternum, broken only by sutures; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Mid and hind coxae brown with fan-like, thick black bristles, with little microtomentum; front coxa with sparse, pale yellow microtomentum and black bristles. Femora unicolourous light brown with paler microtomentum distally; front femur with variable presence of pale microtomentum strip of variable length posteriorly; tibia unicolourous light brown with small patches of pale microtomentum; legs with

moderately long black bristles evenly distributed, with longer bristles distally, appearing slightly bushy; tarsomeres (tm) brown, with thick short setae; tm-5 often darker than tm-1; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, with slight smokey brown colouration, completely microtrichose, without colour patterns; wing cell r_{4+5} is open (Fig. 4 A); halter pale yellow to brown.

Abdomen. Tergite-1 (tg-1) (tg-1) dull pale brown, without microtomentum, with only short, thin lateral tufts of setae tg-2 dark brown with with dorso-lateral tufts of longer black bristles appearing 1/5th posteriorly, though visible dorsally; very faint dusting of pale microtomentum variably present; tg-3 with variably faint golden microtomentum at lateral margins appearing obliquely, joining along posterior edge; microtomentum breaks up ventrolaterally; tg-4 covered in microtomentum except for two brown posterodorsal spots, and breaks up ventrolaterally; tg-5 as tg-4 except brown spots reduced; tg-6 short with pale golden microtomentum dorsally and laterally, breaking away ventrolaterally; tg-4-6 with thin pale yellow or darker brown band along posterior edge and extending laterally (*like* Figs. 20 G-H).

Male Genitalia. (Figs. 36 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in rather short, black setae with a small patch of short bristles about seam of inner surstylus; hypoproct so reduced as to appear absent, or flattened, covered in tomentum; cerci oval-shaped, strongly reduced, with very short, fine setae extending distally only; anterior surstylus strongly reduced, short, triangular-shaped, without teeth or strong points, with short, fine setae, distally; posterior surstylus somewhat long, wide and paddle-like, rounded, with basal patch of sparse, short, black bristles, without membranous appendage present; hypandrium Y-

shaped, elongate with a weakly rounded, almost flat, sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum; distiphallus fat, bulbous, bag-like, rounded at apex, with patterned tomentum; with black, medial and some lateral sclerotization; phallapodeme elongated and curled and slightly pointed at apex, with short, faint, mid-length, ventral fan of setae; sperm pump small, rounded, and somewhat flat, with long, conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually orange, or brown, shiny; tg-6-7 usually shiny orange, with little or no microtomentum.

Etymology. Matronym for Lisa Marie Carroll, the senior author's spouse who assisted throughout this revision with field collecting, databasing, and providing immeasurable moral support. "lisafyrea" referring to "Lisa" and "fyr" (AS. fyr, or fire) referring to the fact that LM Carroll has reddish-orange hair, a strong trait shared with the species which bares her name.

Hosts. Unknown

Distribution. Map 4 B (●). Mainly concentrated in the north and midwestern United States and southwestern Canada and the Prairie Provinces.

Habitat. Found on *Heterotheca grandiflora*.

Remarks. Emergence as early as February through November, peaking in August. A single short sequence of COI (215 bps) was analysed against *Z. obliquefasciatum* for interspecific pairwise distance variation: 9.1-10.6.

***Z. meigeni* Burt & Skevington, 2015**

Figs. (30 A-C), Map 4 A (●).

Type material. *Zodion meigeni* Burt & Skevington, 2015: Holotype designation; ♂; USA: Colorado: Echo Lake, Mount Evans; 600'; 17.VII.1961; coll., W.R.M. Mason; CNC200293 (CNC2).

Paratype series. **CANADA: Alberta:** Countess, 50.781512°N 112.284968°W, 25.VII.1927, coll. H.E. Gray, CNC200426, (1♂ CNC); Gleichen, 50.866111°N 113.054722°W, 30.VII.1929, coll. H.L. Seamans, CNC200463, (1♂ CNC); **British Columbia:** Grand Forks, 49.031539°N 118.444733°W, 18.VII.1951, coll. D.A. Arnott, CNC200359 (1♂ CNC); Oliver, 49.18333°N 119.55°W, 14.IX.1923, 16.V.1938, 26.V.1923, coll. C.B. Garrett, J.K. Jacob, CNC200483, CNC200539, CNC200578, (3♂ CNC); Rock Creek, 49.051652°N 118.999089°W, 7.VI.1959, coll. R.E. Leech, CNC200290, (1♂ CNC); **Manitoba:** Boissevain, 49.230556°N 100.055°W, 20.VII.1953, coll. Brooks - Kelton, CNC200324 (1ex CNC); Ninette, 49.4°N 99.6°W, Powerline scrub, 5.VIII.1958, coll. J.G. Chillcott, CNC200268 (1♂ CNC); Oak Lake, 49.766389°N 100.628056°W, 26.VIII.1953, coll. Brooks - Kelton, CNC200176, (1♂ CNC); **Ontario:** Forks of Credit, 43.823017°N 80.009517°W, 12.VIII.1968, coll. Patricia MacKay, CNC200417, (1♂ CNC); Jordan, 43.133333°N 79.366667°W, 12.VIII.1920, 13.VI.1920, coll. H. Curran, CNC200450, CNC200525, (2♂ CNC); Picton, 44.00862°N 77.139223°W, 7.VII.1970, coll. J.F. McAlpine, CNC199845, (1♂ CNC); Strathroy, 42.95007°N 81.63317°W, 20.VI.1920, 27.VI.1924, coll. H.F. Hudson, CNC200451, CNC200581, (2♂ CNC); **Saskatchewan:** Lumsden, 50.647083°N 104.870353°W, 7.VIII.1954, coll. Brooks - Wallis,

CNCD200201, (1♀ CNC); **MEXICO: Baja California Sur:** Loreto, 26.011741°N 111.34773°W, 1981m, 20.V.1921, coll. E.P. Van Duzee, CNCD200249, (1♂ CNC); **California:** Las Animas Bay, Gulf of California, 8.V.1921, coll. E.P. Van Duzee, CNCD200226, CNCD200227, (2♂ CNC); 8.V.1921, coll. E.P. Van Duzee, CNCD200225, CNCD200409, (2♂ CNC); **U.S.A.: Arizona:** 1 mile South of Wilcox, Cochise County, 32.239089°N 109.839725°W, *Wislizenia refracta*, 19.VIII.1978, coll. R.W. Brooks, CNCD250031, (1♂ UCDC); 1 miles South of Willcox, Cochise County, 32.239088°N 109.839723°W, *Wislizenia refracta*, 19.VIII.1978, coll. R.W. Brooks, CNCD249198, (1♂ UCDC); **California:** Claremont, 34.0967°N 117.7198°W, USNM.ENT1024401, (1♀ USNM); Sagehen Creek, Nevada County, 39.432115°N 120.24123°W, 19.VII.1972, 25.VI.1968, coll. D.S. Horning Jr., S.K. Ault, CNCD249443, CNCD249446, (2♂ UCDC); Sierra Vly Valley, Sierra County, 39.643236°N 120.390947°W, 16.VII.1970, coll. E.E. Grissell, CNCD249054, (1♂ UCDC); Tehachapi, Kern County, 41.065902°N 114.606481°W, V.1983, coll. R.P. Meyer, CNCD250083, (1♂ UCDC); Thousand Palms, 33.820018°N 116.390289°W, 7.IV.1955, coll. W.R.M. Mason, CNCD200341, (1♀ CNC); **Colorado:** Boulder, 4 miles Northwest, 40.013374°N 105.317523°W, 2103m, 8.VI.1961, coll. B.H. Poole, W.R.M. Mason, CNCD200163, CNCD200501, (2♂ CNC); Boulder, 5 miles South, 39.936516°N 105.678611°W, 1768m, 9.VI.1961, coll. C.H. Mann, CNCD200510, (1♂ CNC); Boulder, 40.014986°N 105.270546°W, 1676m, 9.VI.1961, coll. B.H. Poole, CNCD200499, CNCD200500, (2♂ CNC); 9.VI.1961, coll. B.H. Poole, CNCD200511, (1♂ CNC); Chicago Creek, Clear Creek County, 39.69415°N 105.616756°W, 2682m, 5.VIII.1961, coll. S.M. Clark, CNCD200514, (1♂ CNC); Doolittle Ranch, Mount Evans, 39.675739°N 105.601348°W, 2987m, 24.VII.1961, 6.VIII.1961, 9.VII.1961, coll. C.H. Mann, J.G. Chillcott, W.R.M. Mason, CNCD200150, CNCD200325, CNCD200379, (3♂ CNC); Echo Lake, Mount Evans, 39.658085°N 105.6035°W, 3231m, 17.VII.1961, 18.VII.1961, 20.VII.1961, coll. B.H. Poole, S.M. Clark, W.R.M. Mason, CNCD200288, CNCD200293, CNCD200315, CNCD200316, CNCD200506, (5♂ CNC); Mount Evans, 39.59°N 105.64°W, 3658m, 7.VIII.1961, coll. S.M.

Clark, CNCD200509, (1♂ CNC); Nederland, Science Lodge, 39.95°N 105.5°W, 2896m, 4.VII.1961, coll. B.H. Poole, CNCD200300, (1♂ CNC); **Iowa**: Ames, 42.033333°N 93.616667°W, 17.VI.1923, CNCD200404, (1♂ CNC); **Kansas**: 3 miles Northeast of Lawrence, 38.998974°N 95.177971°W, *Heterotheca grandiflora*, IX.1979, coll. R.W. Brooks, CNCD250035, (1♂ UCDC); **Maine**: Wesley, 44.952297°N 67.660831°W, 16.VIII.1961, coll. G.S. Walley, CNCD200301, (1ex CNC); **Mississippi**: Sardis Lake, 34.475319°N 89.670682°W, 15.VIII.1960, coll. F.M. Hull, CNCD200397, CNCD200398, (2♂ CNC); **Nevada**: 8 miles West of Oasis, Elko County, 41.065902°N 114.606481°W, 2.VIII.1967, coll. D.S. Horning Jr., CNCD250082, (1♂ UCDC); **New Mexico**: Desert Near City of Rocks, 32.566389°N 107.96°W, 1559m, 16.VIII.2007, coll. J. Skevington, JSS17354, (1♂ CNC); coll. F.M. Hull, CNCD200367, (1♂ CNC); **Texas**: 23 miles West, Fort Davis, 30.587179°N 104.280619°W, 1524m, 1.VI.1959, coll. F. McAlpine, CNCD200263, (1♂ CNC); Big Bend National Park, Boquillas, 29.188819°N 102.945462°W, 564m, 25.V.1959, coll. Howden & Becker, CNCD200265, (1♂ CNC); Big Bend National Park, Santa Elena canyon, 29.207204°N 103.510979°W, 640m, 9.V.1959, coll. J.F. McAlpine, CNCD200256, (1♂ CNC); Horse Canyon, Black Gap Refuge, Southeast of Brewster County, 15.V.1959, coll. Howden & Becker, CNCD200135, (1♂ CNC); Kerrville, 30.047433°N 99.140319°W, 29.III.1959, 3.IV.1959, coll. J.F. McAlpine, CNCD200171, CNCD200192, (2♂ CNC); Near Point of Rocks, 10 miles West of Fort Davis, 30.588665°N 104.062105°W, 1524m, 2.VI.1959, 29.V.1959, 30.V.1959, coll. J.F. McAlpine, CNCD200184, CNCD200193, CNCD200194, CNCD200254, (4♂ CNC); Rockpile, 30 miles North West of Fort Davis, 30.873666°N 104.281307°W, ex. horehound, sweeping, 28.V.1959, coll. J.F. McAlpine, CNCD200136, CNCD200137, CNCD200138, CNCD200186, CNCD200187, CNCD200188, CNCD200189, CNCD200190, (8♂ CNC); **Utah**: Ogden, 41.223°N 111.97383°W, 14.VIII.1937, coll. D.E. Hardy, CNCD200416, (1♂ CNC); **Wyoming**: 1952, coll. F.M. Hull, CNCD200405, (1♂ CNC).

Genitalic dissections. CNCD200359, CNCD200324, CNCD200417, CNCD200176, CNCD200301, CNCD199845 (6♂).

Diagnosis. Abdomen dull or pale orangy-brown with many long black setae, appearing somewhat bushy; dorsal thorax tends to be light gray, or grayish-brown with 2-4 very faint stripes (Fig. 18 A); tm-1 is usually much paler than tm-5; wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~8 mm.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina dull yellow with light dusting of silvery microtomentum; frons and gena variably dull yellow or dark yellow, and sometimes with sparse black setae; frontal vitta dull deep brownish-yellow above scape; and brown around ocellar triangle, with lines of silver microtomentum along lateral margins above eyes, and with black setae; ocellar triangle dull brown with two black forward-facing bristles; occiput and postgena black to dark brown with silverish-white microtomentum with black bristles about occiput and pale bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with dull grayish-brown microtomentum with seven thin and prominent black stripes (Fig. 18 A); the medial stripe extends from below the postpronotal lobe to the transscutal suture with three stripes on either side of varying lengths; marginal stripes somewhat thicker, and broken up by sutures along the notopleuron; dorsal thorax regularly covered with black setae, with slightly longer

bristles at lateral margins along notopleuron, appearing bushy; scutellum mainly covered in grayish-brown microtomentum with several long black setae; lateral thorax mainly dull brown, covered in grayish-brown microtomentum, though ventral margin of katepisternum variably bare; katepisternum with long black bristles; few black bristles around cervical sclerite.

Legs. Coxae brown with dusting of grayish-silver microtomentum, especially on anterior front coxa with many long black setae; legs brown, variably light or dark, covered in a very light dusting of silver microtomentum; patchy; femora usually darker brown than tibia with many black setae, very bushy; tibia brown with many shorter black setae; distal posterior surface of hind tibia with thick transverse patch of setae; tarsomeres 1-4 pale yellow or brown with sparse black setae; tm-1 is usually much paler than tm-5 which is dark brown; tarsi brown with black tips with variably brown or yellow pulvilli.

Wing. Membrane clear with brownish-yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull reddish-brown, with lateral tufts of short black setae; tg-2 pale orangy-brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint golden microtomentum appearing laterally; tg-3-5 pale orangy-brown with dusting of golden microtomentum; tg-6 covered in heavier golden microtomentum; t2-5 with very thin pale yellow band at posterior edge; abdomen covered in medium to long black setae, slightly bushy.

Male Genitalia. (Figs. 30 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, without concentrated

patch of longer bristles near joint of surstylus; hypoproct divided, rounded and conical, projecting forward, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus somewhat large and truncate, with vert sharp forward-facing tooth and back-facing pan or scoop-like tooth, with short, fine setae, distally; posterior surstylus large, somewhat flat and elongated, slightly apically pointed, with an inward curl, with a sparse cluster of black bristles (2-6) about as long as, and in line with surstylus, with thin lateral membranous appendage present, appearing somewhat like a scoop with strong grooves; hypandrium Y-shaped, elongate with a rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus large, ribbed, slightly pointed or arrow-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated, wide and sharply pointed, with short, mid-length, ventral fan of short setae; sperm pump rounded, somewhat flat, with long, conical, pointed and slightly apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male, although the abdomen tends to be darker brown, and except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Etymology. Patronym for the great German entomologist, Johann Wilhelm Meigen, widely considered the father of Dipterology and more importantly, the multi-character approach to modern classification and systematics.

Hosts. Unknown.

Distribution. Map 4 A (●). Very widespread, concentrated in the southern United States, and reaching as far north as southern Ontario, British Columbia and prairie provinces, down throughout the midwest and as far west as California, and south into Baja and Mexico.

Habitat. Collected in a variety of scrub and other plants including horehound, *Wislizenia refracta* Engelm. in Wisl., and *Heterotheca grandiflora* Nuttall. Additionally this species seems to have an affinity for high elevations, as high as 3658 m.

Remarks. Emergence April through September, peaking in May. Intraspecific COI pairwise distance variation: 2.8-9.1%. This wide variation suggests there may still exist a subtle complex of species.

***Z. nanellum* Loew, 1866**

Figs. (26 D-F), Map 6 A (■).

Synonymy

Zodion nanellum Loew, 1866:42. Type Locality: United States of America: District of Columbia.

Type depository: type, MCZ.

Note. *Z. nanellum* was synonymized under the South American (Uruguay) species, *Z. americanum* Wiedemann, 1830, but this is surely in error given the type locality of both types. Until the holotype for *Z. americanum* can be obtained from NMW we will not be able to verify this synonymy, though the original descriptions from Loew and Wiedemann provide some confidence in their division, in addition to examination of the holotype of *Z. nanellum* (MCZ)

Lectotype designation: *Zodion nanellum* Loew, 1866: Syntype; ♂, USA: Washington, District of Columbia; type#438 (MCZ). This specimen is here designated as the lectotype to fix and ensure the universal and consistent interpretation of the name.

Type material. *Z. nanellum* Loew, 1866: Syntype; ♂, USA: Washington, District of Columbia; type#438 (MCZ).

Material dissected. CNCN199925, CNCN199952, CNCN199941, CNCN199745, CNCN199994, CNCN199963, CNCN199985, CNCN199993, CNCN199911, CNCN199945, CNCN200017, CNCN199938, CNCN200081, CNCN199917, CNCN200003 (15♂).

Additional material examined. CANADA: Ontario: 2 Miles North of Metcalfe, 45.265406°N 75.488737°W, 14.VIII.1984, 21.IX.1982, 5.IX.1984, 9.IX.1982, coll. B.E. Cooper, CNCN200072, CNCN200073, CNCN200075, CNCN200076, CNCN200080, (5♂ CNC); 7 miles East of Griffith, 45.243279°N 77.031193°W, Malaise trap, 1.IX.1984, coll. B.E. Cooper, CNCN200070, (1♂ CNC); Brockville, 44.583333°N 75.683333°W, 13.IX.1903, 27.VIII.1903, coll. W. Metcalfe, CNCN200023, CNCN200035, (2♂ CNC); Hepworth, 44.616667°N 81.15°W, 30.VI.1962, coll. G. Thorpe, CNCN199950, (1♂ CNC); Jordan, 43.133333°N 79.366667°W, 1.VII.1920, 12.VIII.1920, coll. H. Curran, CNCN199956, CNCN200024, (2♂ CNC); Maynooth, 45.233333°N 77.938373°W, 10.VI.1965, 9.VII.1965, coll. J.F. McAlpine, CNCN199957, CNCN199963, CNCN200021, (3♂ CNC); Metcalfe, 45.235826°N 75.472712°W, 31.VII.1984, coll. B.E. Cooper, CNCN200071, (1♂ CNC); Perth Road, Frontenac County, 44.466045°N 76.491977°W, 12.VIII.1971, 21.VIII.1971, coll. P. Ward, CNCN199929, CNCN199930, (2♂ CNC); Picton, 44.00862°N 77.139223°W, 7.VII.1970, coll. J.F. McAlpine, CNCN200042, CNCN200044, (2♂ CNC); Rondeau Park, 42.328932°N 81.845165°W, 22.VI.1962, coll. S.M. Clark, CNCN199939, (1♂ CNC); Spencerville, 44.843305°N 75.546362°W, 8.IX.1939, coll. G.H. Hammond, CNCN200017, CNCN200018 (2♂ CNC); St. Lawrence Islands National Park,

McDonald Island, 44.313741°N 76.171094°W, 1.X.1976, 24.VII.1976, coll. W. Reid, CNCD200048, CNCD200049, (2♂ CNC); Stittsville, 45.263479°N 75.925163°W, 14.VIII.1963, 27.VIII.1963, coll. W.R.M. Mason, CNCD200013, CNCD200014, (2♂ CNC); **Quebec**: Abbotsford, 45.436724°N 72.89035°W, 17.VIII.1935, coll. G.E. Shewell, CNCD200077, (1♂ CNC); Aylmer, 45.400002°N 75.849998°W, 21.VII.1924, 18.VII.1924, coll. C.H. Curran, CNCD200079, CNCD200081 (2♂ CNC); Fort Coulonge, 45.841513°N 76.738267°W, 27.VII.1919, coll. Jos. I. Beaulne, CNCD200043, (1♂ CNC); Knowlton, 45.216716°N 72.514769°W, 9.VII.1927, coll. W.J. Brown, CNCD200027, (1♀ CNC); Laniel, 47.033333°N 79.266667°W, 4.VII.1914, coll. A.R. Brooks, CNCD199992, (1♂ CNC); **U.S.A.: Colorado**: Schoolcraft County, 4 miles South of Germfask, 46.216667°N 85.916667°W, 17.VIII.1992, coll. S. Geohegan, USNM.ENT1027132, (1♂ USNM); **Georgia**: Pine Mountain, Rabun County, elev. 427m, 27.VI.1957, coll. J.R. Vockeroth, CNCD199952 (1♂ CNC); Rabun Bald, Rabun County, 1433m, 16.VII.1957, coll. W.R. Richards, CNCD200003 (1♂ CNC); **Illinois**: Champaign County, 40.13487°N 88.142796°W, 21.VI.1925, coll. M.W. Shackleford, CNCD200034, (1♂ CNC); **Iowa**: Ames, 42.033333°N 93.616667°W, 25.VI.1947, coll. A.R. Brooks, CNCD199994, (1♂ CNC); **Kansas**: Riley Co., 4.IX.1967, coll. G.F. Hevel, USNM.ENT915756, (1♂ USNM); **Maine**: Dryden, 1.VII.1959, coll. G.H. Heinrich, CNCD199938 (1♂ CNC); **Maryland**: Carroll Co. Eldersburg, 39.403814°N 76.951105°W, 9.VI.1985, coll. W.E. Steiner & J.E. Lowry, USNM.ENT1024074, (1♀ USNM); Colesville, Montgomery County, 39.066667°N 77.°W, 18.IX.1974, coll. A.S. Menke, CNCD249396, (1♂ UCDC); Colesville, 4.VII.1976, coll. W.W. Wirth, USNM.ENT915718, (1♂ USNM); **Massachusetts**: Petersham, 42.48761°N 72.186927°W, 26.VIII, coll. A.L. Melander, USNM.ENT915916, (1♂ USNM); **Michigan**: Allegan St. Forest Allegan Co., 42.53361°N 85.966055°W, 28.VII.1964, coll. R.L. Fischer, USNM.ENT915864, (1♀ USNM); Drummond Isl., 46.020229°N 83.731114°W, 30.VIII.1954, coll. R.L. Fischer, USNM.ENT915856, (1♂ USNM); Roscommon County, 44.33°N 84.61°W, 18.VII.1945, coll. R.R. Dreisbach, CNCD199995, (1♂ CNC); **Mississippi**: Agricultural College,

23.IV.1922, coll. F.M. Hull, CNCN199917 (1♂ CNC); Greenville, 33.410116°N 91.061774°W, 11.IX.1922, coll. F.M. Hull, CNCN199925, (1♂ CNC); **Missouri**: Columbia, Boone County, 38.951705°N 92.334072°W, 10.VI.1964, 10.VI.1969, 20.VII.1966, coll. F.D. Parker, CNCN249100, CNCN249391, CNCN249392, (2♂ 1♀ UCDC); Columbia, Malaise trap, 2.VIII.1967, 20.VII.1970, 24.VI.1970, 3.VII.1970, coll. F.D. Parker, CNCN249097, CNCN249099, CNCN249393, CNCN249394, CNCN249395 (4♂ 1♀ UCDC); Williamsville, 14.VII.1969, Malaise trap, genitalia dissected, CNCN199941 (1♂ CNC); **New Jersey**: Riverton, 40.011501°N 75.014893°W, 23.VIII.1920, 24.VIII.1920, CNCN199911, CNCN199990, (2♂ CNC); **New York**: Jefferson Co. Wellesley Island, 44.311447°N 75.99837°W, 25.VIII.1976, coll. S.R. Alm, USNM.ENT915760, (1♀ USNM); **North Carolina**: Jocassee, Pickens County, 3.VI.1965, coll. J.G. Chillcott, sweeping, CNCN199745 (1♂ CNC); Ramseytown, Yancey County, 12.VI.1965, coll. J.G. Chillcott, CNCN199945 (1♂ CNC); **Pennsylvania**: ex. Roadside Scotia Barrens, Centre County, 40.779046°N 77.953594°W, 12.VIII.1980, coll. P.H. Adler, USNM.ENT1024112, (1♂ USNM); **Virginia**: Arlington Co.; 4 Mile Run, 38.857254°N 77.089125°W, Malaise trap, 17.IX.1977, coll. H.B. Williams, USNM.ENT915736, (1♀ USNM); Great Falls, 38.98333°N 77.28333°W, 6.VI.1938, coll. C.T. Greene, USNM.ENT1024058, (1♂ USNM); Brush Mountain, Blacksburg, elev. 853m, 27.V.1962, coll. J.G. Chillcott, CNCN199985 (1♂ CNC); **West Virginia**: 5 miles East of Moorefield, 39.061675°N 78.879172°W, 20.VI.1965, coll. J.G. Chillcott, CNCN199949, (1♂ CNC); Harper Ferry, 39.313848°N 77.742307°W, 6.VII.1914, coll. R.C. Shannon, USNM.ENT915892, (1♂ USNM); **Wisconsin**: Salmo, Bayfield Co., 46.779439°N 90.86559°W, 12.VIII.1919, coll. W.L. McAtee, USNM.ENT1024064, (1♀ USNM); Bull Run Knob Outlook mile 135, 37.147093°N 80.103336°W, 881m, 18.V.1965, coll. J.G. Chillcott, CNCN200045, (1♂ CNC).

Diagnosis. Slightly larger than other species of this Group (6-7 mm); scutum generally bluish-green, with coppery-brown tones, and four strong black stripes (19 D); wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~6-7 mm.

Head. Antennae mainly yellowish-orange with light dusting of silverish-white microtomentum; scape dark brown; flagellum orange with variably presence of dark brown patch distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina yellow with light dusting of silver microtomentum; frons and gena yellow with sparse pale or black setae; frontal vitta dull yellow above scape and dull, patchy brown about ocellar triangle with line of gold or silver microtomentum along lateral margins above eyes, with several black setae; ocellar triangle with shiny brownish-green or blue microtomentum with many black forward-facing bristles; occiput and postgena black and pale brown respectively, covered with greenish-blue or bluish-gray microtomentum with black bristles; often occiput is covered in bluish-green microtomentum; palps pale brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum bluish-green, blue with copper-brown and green tones, with four black stripes that extend just beyond the transscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum same colour as scutum, with four black setae; lateral thorax mainly dull, dusty brown; katepisternum with variable presence of 1-4 long black bristles; one (rarely two) black bristle(s) at cervical sclerite.

Legs. Coxae pale brown with black setae; front coxa with variable presence of setae; legs mainly unicolourous dark brown, though slightly paler at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres pale brownish-yellow with short black setae; tarsomere-1 tends to be paler than tm-5; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow wing cell r_{4+5} open (Fig. 4 A).

Abdomen. (Figs. 20 C-F) Tergites dull brown; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint gray microtomentum appearing laterally and forming a medial divide; tg-3-5 dull, dark brown, mainly covered in light gray microtomentum laterally, except for 2 small dull brown triangular spots appearing dorsally, divided by slight dusting of gray microtomentum; tg-6 covered in gray microtomentum; abdomen variably covered in long black setae, usually appearing somewhat bushy (Figs. 20 E-F).

Male Genitalia. (Figs. 26 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow and conical, covered in fuzzy tomentum; cerci oval-shaped with long, fine setae extending distally only; anterior surstylus short, truncate, with very sharp forward and back-facing teeth or points, with short, fine setae, distally; posterior surstylus large, bulbous, somewhat elongated, apically somewhat rounded, paddle-like, with a slight downward-inward curl, without concentrated cluster of long black bristles in line with

surstylus, with very slight membranous appendage present, and exaggerated and pointed lateral protrusion present, forming a slight circle with anterior surstylus forward-facing tooth; hypandrium Y-shaped, elongate with a very sharply pointed sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus small, narrow, pointed, dagger-shaped covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, mid-length, ventral cluster of setae; sperm pump rounded, somewhat flat, with conical, pointed and apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny; genitalia appear overall like a clasping apparatus.

Hosts. Unknown.

Distribution. Map 6 A (■). Eastern. Generally costal; north eastern Canada, through the midwest and southern United States.

Habitat. Can be found at elevations and hilltops as high as 269 m.

Remarks. Emergence May through October, peaking July and August. Intraspecific COI pairwise distance variation: 0%. Interspecific variation with: *Z. albifacies*: 14-15% *Z. harrisi*: 12.6-13.8%; *Z. hirsialiae*: 9.7-10.6%; *Z. hitchensi*: 8.7-9.7%; *Z. pygmaeum*: 13.5-14.1%.

***Z. nigrifrons* Kröber, 1915**

Fig.s (4 C), Map 3 B (▲).

Synonymy

Zodion nigrifrons Kröber, 1915: 97. Type locality: United States of America, California. Type depository: type, (Unknown).

Zodion hirtipes Van Duzee 1927: 587. Type locality: United States of America, California: Alameda Co., Melrose. Type depository: type, CAS.

Note. The depository for the type of *Zodion nigrifrons* Kröber, 1915, is currently unknown, but was believed to be deposited at the CAS. Communication with CAS has been inconsistent and confirming the location of the type difficult. All Nearctic *Zodion* type material was requested from CAS. CAS curatorial staff have indicated that much of the Kröber type material has been deposited in European museums and collections. Further investigation is required before Neotype designation can be considered.

Type material. The whereabouts of the holotype for *Z. nigrifrons* Kröber, 1915 is currently unknown (see Note above). *Z. hirtipes* Van Duzee, 1927: Holotype; ♂; USA: California, Melrose; type# 2412 (CAS).

Material dissected. CNCD200865, CNCD200866 (2♂).

Additional material examined. U.S.A.: California: Berkeley Hills, Fish Ranch, 37.875149°N 122.243713°W, 22.III.1913, coll. J.C. Bridwell, USNM.ENT1024928, USNM.ENT1024929, (1♂ 1♀ USNM); Berkeley, 13.III.1954, 15.III.1913, 17.III.1958, coll. J.C. Bridwell, J.W. MacSwain, CNCD190118, CNCD200868, CNCD200869, USNM.ENT1024919, USNM.ENT1024920, USNM.ENT1024921, USNM.ENT1024922, USNM.ENT1024923, USNM.ENT1024924, USNM.ENT1024925, USNM.ENT1024926, USNM.ENT1024927, USNM.ENT1024930, (8♂ 4♀ 1ex CNC, USNM); Dutch Flat, Placer County, 39.206982°N 120.836182°W, 20.V.1952, coll. A.T. McClay, E.I. Schilinger, CNCD200864, CNCD200865,

CNCD200866, CNCD200867, (2♂ 2ex CNC); Lk Lake Cuyamaca, 32.988158°N 116.581037°W, 5.V.1945, coll. A.L. Melander, USNM.ENT1024931, (2♂ USNM); Siskiyou County, Happy Camp, on road from Happy Camp to Waldo, 41.7925°N 123.375833°W, 5.VI.2009, coll. S.A. Marshall, debu316710, (1♂ DEBU).

Diagnosis. *Z. nigrifrons* is small for the genus (~4 mm), comparable to *Z. americanum*, *abitus*, and *anale*; wing cell r_{4+5} is open and the M_1 vein is always incomplete (Fig. 4 C); body black and frontal vitta usually very dark if not completely black, and the gena is generally very dark.

Description. Male. Body length (including antennae): ~4 mm.

Head. Antennae dark brown with dusting of silver microtomentum; scape dark brown to black; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina yellow with heavy dusting of silvery microtomentum; frons and gena yellow usually with sparse black setae; frontal vitta dull deep brownish-black with line of golden-brown microtomentum along lateral margins above eyes, and several black setae; ocellar triangle shiny dark brown to black with two black forward-facing bristles; occiput and postgena brown with very faint, pale brown microtomentum with black bristles; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly dull black with four to seven grayish brown stripes of microtomentum which extend medially as follows (Fig. 19 B): two center stripes extend from prescutum just beyond transscutal suture; two outermost stripes near margin extend from postpronotal lobe and beyond the transscutal suture, along the notopleuron, and to the postalar callus; dorsal thorax regularly covered with short black setae, with slightly longer bristles at lateral margins along notopleuron; scutellum dull black mainly covered

in grayish brown microtomentum with several long black setae; lateral thorax mainly dull brown with grayish brown microtomentum dusting; katepisternum with long black bristles; few black bristles around cervical sclerite.

Legs. Coxae dark brown or brown with light dusting of grayish brown microtomentum with long black setae; legs brown or dark brown, unicolourous, with many short black setae and light dusting of grayish-silver microtomentum; tarsomeres dark brown with thick short setae; tarsi pale yellow with black tips with yellow pulvilli.

Wing. Membrane clear with slight yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell is open as the M_1 vein is incomplete (Fig. 4 C).

Abdomen. Tergite-1 (tg-1) somewhat shiny, light or dark brown, with short black setae; tg-2 somewhat shiny, light or dark brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3 somewhat shiny, light or dark brown with lateral golden-brown microtomentum; tg-4 mainly covered in light golden-brown microtomentum, with only a faint medial stripe pattern, though highly variable; tg-5 and 6 mainly covered in light golden-brown microtomentum; abdomen covered in black setae.

Male Genitalia. (Figs. 24 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, weakly covered black setae; hypoproct divided, rounded, narrow, and projecting forward, covered in fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, elongate and truncated, with slight forward and back-facing teeth, or points, with short, fine setae, distally; posterior surstylus moderate, only slightly pointed overall, but rounded, paddle-

like, with an inward curl, with a small basal cluster of black bristles in line with and usually longer than surstylus, with weakly exaggerated membranous appendage present, appearing somewhat like fin; hypandrium Y-shaped, elongate with a weakly rounded, almost flat, sheath; postgonite skinny, elongated and pointed, nearly projecting as much as hypoproct; epiphallus bulbous; covered in short tomentum; distiphallus somewhat small, generally pointed, with verticle pattern-lines of tomentum; with medial and only some lateral sclerotization; phallapodeme elongated and slightly curled and truncated at apex, with short, faint, mid-length, ventral fan of setae; sperm pump rounded, somewhat flat, with elongated, conical, curled and pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field which extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. *Panurginus melanocephalus* Cockerell (Macswain & Bohart, 1947; Camras & Hurd, 1957).

Distribution. Map 3 B (▲). Mainly found in California.

Habitat. Found on *Ranunculus sp.* Linnaeus.

Remarks. Strong emergence in March, tapering off in June. A few attempts have been made to obtain COI but all have failed. Fresh material is required.

***Zodion obliquefasciatum* Macquart, 1846**

Figs (36 D-F; 18 I, K, 4 A), Map 4 B (■).

Synonymy

Myopa obliquefasciata Macquart, 1846: 269. Type locality: United States of America, Texas.

Type depository: syntype, Private Collection (Coll. Pilate).

Zodion splendens Jaennicke 1867: 406. Type locality: Mexico. Type depository: syntype, SMF.

Zodion leucostoma Williston, 1885: 330. Type locality: United States of America, Kansas:

western; Arizona & Montana. Type depository: syntype, SEMC.

Myopa tectura Adams, 1903: 35. Type locality: Unknown. Type depository: holotype, SEMC.

Note. The type specimen of *Myopa obliquefasciatum* Macquart, 1846, is currently held in an unknown private collection in southern California and may be lost.

Type material. The holotype (♂) of *Z. obliquefasciatum* Macquart, 1846, is believed deposited in a private collection in southern California and attempts to verify and obtain it have been fruitless. I have not been able to obtain the following syntype from SMF: (A) of *Zodion splendens* Jaennicke, 1867 (SMF); I am expecting the following syntypes from SEMC (♂, 2♀) *Zodion leucostoma* Williston, 1885 (SEMC); (♂) *Myopa tectura* Adams, 1903 (SEMC).

Material dissected. CNCD200886, CNCD200871 (2♂)

Additional material examined. **CANADA: Manitoba:** Teulon, 50.387058°N 97.259644°W, 17.VIII.1923, coll. A.J. Hunter, CNCD200898, (1♀ CNC); **MEXICO: Chihuahua:** 17 km South of Samalayuca, 31.0065°N 106.853609°W, 31.VIII.1992, coll. B.N. Danforth, USNM.ENT1027183, (1♀ USNM); Majalca Road, 30 miles Northwest of Chihuahua, 28.92°N 106.456°W, 1524m, 17.IV.1961, coll. Howden & Martin, CNCD200896, (1♂ CNC); **Durango:** 5 miles West of Durango, 24.033333°N 104.666667°W, 1981m, 23.VII.1964, coll. J.F. McAlpine, CNCD200895, (1♂ CNC); 6 miles East of Durango, 24.027503°N 104.558088°W, 31.VII.1964, coll. L.A. Kelton, CNCD190115, (1ex CNC); **U.S.A.: Arizona:** 11 miles South of Pearce, Cochise County, 31.756091°N 109.802062°W, 26.VIII.1981, coll. R.M. Bohart, CNCD249111,

(1♀ UCDC); 4 miles South of Apache, Cochise County, 31.64374°N 109.171617°W,
 18.VIII.1982, coll. R.M. Bohart, CNCN249112, CNCN250088, CNCN250089, (1♂ 2♀ UCDC);
 4 miles West of Box Canyon, Pima County, 31.786316°N 110.823116°W, *Helianthus annuus*,
 25.VIII.1977, coll. R.W. Brooks, CNCN249113, CNCN250095, (1♂ 1♀ UCDC); 5 miles
 Northeast of Douglas, Cochise County, 31.404813°N 109.501507°W, 2.VIII.1966, coll. C.R.
 Kovacic, CNCN250105, (1♀ UCDC); 5 miles West of Portal, Cochise County, 31.884044°N
 109.205899°W, *Melilotus alba alba*, 15.VIII.1978, coll. R.W. Brooks, CNCN250099, (1♂
 UCDC); Cochise County, 4 miles East of Willcox, 32.213483°N 109.78126°W, 11-18.VIII.1987,
 coll. K.V. Kormbein, USNM.ENT1027036, (1♀ USNM); Douglas, 1 mile East of Cochise
 County, 31.34443°N 109.54674°W, *Verbesina encelioides*, 7.VIII.1962, coll. M.A. Cazier,
 USNM.ENT1027182, (1♂ 1♀ USNM); Florence, 34.183333°N 79.75°W, 21.IV.1935, coll. F.H.
 Parker, USNM.ENT1027044, (1♀ USNM); Grand Canyon, 36.355164°N 112.661209°W,
 VIII.1971, coll. F.M. Hull, CNCN200887, (1♀ CNC); Hoteville, 35.924464°N 110.662045°W,
 27.IX.1977, coll. R.M. Bohart, CNCN250111, (1♀ UCDC); Navajo County, Winslow,
 35.023517°N 110.697649°W, *Sphaeralicea*, 1.IX.1978, coll. R.J. McGinley,
 USNM.ENT1027051, (1♀ USNM); Phoenix, 33.448377°N 112.074037°W, 22.IX.1996,
 29.IX.1996, coll. Parker, USNM.ENT1024997, USNM.ENT1027009, (1♂ 1♀ USNM); Pinery
 Cyn Canyon, 10 miles Northwest of Onion Saddle, Chiricahua Mountains, Cochise County,
 31.981061°N 109.372071°W, 16.VIII.1965, coll. G.W. Forister, CNCN250097, (1♀ UCDC);
 Rimmy Jims, Coconino County, 32.910458°N 105.46528°W, 9.VIII.1966, coll. R.L. Brumley,
 CNCN250108, (1♀ UCDC); S.W. Research Station, 5 miles West of Portal, Cochise County,
 31.883333°N 109.208056°W, 5.XI.1959, coll. P.H. Arnaud, USNM.ENT1027027, (1♀ USNM);
 San Bernardino Ranch, Cochise County, 31.336212°N 109.293939°W, 1143m, VIII, coll. F.H.
 Snow, USNM.ENT1024963, (1♀ USNM); San Simon, Cochise County, 32.267627°N
 109.226883°W, 1.IX.1976, coll. R.M. Bohart, CNCN250100, (1♂ UCDC); Wilcox, Cochise
 County, 14.VIII.1958, coll. R.E. Rice, CNCN250091, (1♂ UCDC); Williams Lake, 35.249897°N

112.190439°W, 30.VI, coll. H. Barber, USNM.ENT1024970, (1♀ USNM); **California**: 1 mile North of Columbia, Tuolumne County, 38.047963°N 120.411536°W, *Chrysothamnus*, 8.X.1967, coll. R.W. Thorp, CNCD250098, (1♀ UCDC); 2 miles West of Oasis, Inyo County, 38.968634°N 123.026534°W, 14.V.1979, coll. L.D. French, N.J. Smith, CNCD249230, (1♂ UCDC); 3 miles West of Woodland, Yolo County, 38.678004°N 121.830056°W, 30.VI.1972, coll. W.R. Cothran, S.R. Sims, CNCD249234, (1♀ UCDC); 4 miles Southeast Woodland, Yolo County, 38.61935°N 121.760962°W, 28.VII.1970, CNCD249467, (1♀ UCDC); Barton Flat, So Fork Camp, 34.169366°N 116.826207°W, 10.IX.1944, coll. A.L. Melander, USNM.ENT1027060, (1♀ USNM); Barton Flats, 34.172509°N 116.863083°W, 7.IX.1946, coll. John L. Sperry, USNM.ENT1024996, (1♂ USNM); Claremont, 34.0967°N 117.7198°W, coll. Baker, USNM.ENT1024991, (1♀ USNM); Escalon, 37.797187°N 120.99682°W, *Helanthus annuus*, 22.VII.1977, coll. E.G. & J.M. Linsley, A.E. & M.M. Michelbacher, USNM.ENT1027059, (1♀ USNM); Eureka Vly Valley Dunes, Inyo County, 15.V.1979, coll. N.J. Smith, L.D. French, CNCD250073, (1♀ UCDC); Jacolitos Cyn Canyon, Fresno County, 36.0667°N 120.3833°W, 12.IV.1970, coll. R.M. Bohart, CNCD249116, CNCD250110, (1♂ 1♀ UCDC); Los Angeles Co., 34.052233°N 118.243685°W, coll. Coquillett Collection, USNM.ENT1024960, (1♂ USNM); Los Angeles, coll. R.J. McGinley, USNM.ENT1027053, (1♀ USNM); Madera, Madera County, 36.961618°N 120.06113°W, 5.X.1975, coll. E.G. & J.M. Linsley, A.E. & M.M. Michelbacher, USNM.ENT1027061, (1♀ USNM); Red Bluff, Tehama County, 40.178639°N 122.236312°W, 11.X.1970, coll. T.R. Haig, CNCD250090, (1♂ UCDC); Rush Ranch; Solano County, 38.213883°N 122.0282°W, sweeping, 18.VII.2007, coll. K. Bayless, JSS19860, (1ex CNC); San Bernardino, 34.107668°N 117.300996°W, on *Opuntia*, USNM.ENT1024980, (1♂ USNM); San Diego, 32.715329°N 117.157255°W, on *Opuntia*, 24.IV.1906, coll. J.D. Mitchell, USNM.ENT1024977, (1♂ USNM); Upper Santa Ana River, 34.091253°N 117.120741°W, 1.XI.1946, coll. John L. Sperry, USNM.ENT1027043, (1♂ USNM); **Colorado**: Mesa Verde, 37.25438°N 108.44879°W, 29.VIII.1950, coll. F.M. Hull, CNCD200884, (1♀ CNC); Pueblo,

38.25°N 104.6°W, 21.V.1918, coll. A. Wetmore, USNM.ENT1024952, (1♂ USNM); **Illinois:** Bath, 40.191051°N 90.143253°W, 8.VII.1999, coll. A.L. Melander, CNCD23678, (1♀ CNC); **Iowa:** Ames, 42.033333°N 93.616667°W, 14.VII.1923, 26.VI.1923, coll. Philip Spong, CNCD200890, CNCD200893, (2ex CNC); Sioux City, 42.499994°N 96.400307°W, 15.VII.1920, coll. C.N. Ainslie, CNCD200901, (1ex CNC); **Kansas:** Douglas County, Lone Star Lake, 38.833336°N 95.381653°W, 22.VII.1979, coll. R.J. McGinley, USNM.ENT1027052, (1♀ USNM); Oswego, Labette County, 37.167575°N 95.109984°W, 19.IV.1965, 3.VII.1966, 4.VI.1965, coll. Gary F. Hevel, USNM.ENT1027030, USNM.ENT1027031, USNM.ENT1027032, (2♂ 1♀ USNM); Ottawa County, 39.149375°N 97.698218°W, 24.VI.1934, coll. C.W. Sabrosky, USNM.ENT1024945, (1♀ USNM); USNM.ENT1024973, (1♂ USNM); **Louisiana:** N.O. New Orleans, 29.951066°N 90.071532°W, coll. Shufeldt, USNM.ENT1024948, (1♀ USNM); **Maryland:** Popes Creek, 38.395556°N 76.989444°W, In abdomen of bee, 2.IV.1939, coll. H.S. Barber, USNM.ENT1027062, USNM.ENT1027063, (2♀ USNM); **Missouri:** Columbia, 38.951705°N 92.334072°W, 16.VIII.1966, coll. F.D. Parker, USNM.ENT1027034, (1♂ USNM); **Montana:** Charleston, Fish Lake, 15.IV.1917, coll. Satterthwait, USNM.ENT1024994, (1♂ USNM); Meramec HlndsHighlands, 38.566249°N 90.436126°W, 30.IV.1921, coll. Satterthwait, USNM.ENT1027058, (1♂ USNM); **Nebraska:** Andrews, 42.631259°N 103.733692°W, 22.VII.1960, coll. F.C. Harmston, USNM.ENT1027026, (1♂ USNM); Hooker County Mullen, 1.5 miles North (Middle Loup River), 42.033333°N 101.033333°W, 2-4.VII.1983, coll. Grissell & Menke, USNM.ENT1027050, (1♀ USNM); Lincoln, Lancaster County, 40.813408°N 96.702468°W, VIII, USNM.ENT1024986, (1♀ USNM); **Nevada:** Patrick, Washoe County, 39.547222°N 119.578333°W, 16.VI.1964, coll. C.R. Kovacic, CNCD249224, CNCD249225, (2♂ UCDC); Patrick, Washoe County, 16.VI.1964, coll. C.R. Kovacic, CNCD249105, (1♀ UCDC); Searchlight, Clark County, 35.465413°N 114.920277°W, 19.IV.1986, coll. R.M. Bohart, CNCD249032, CNCD249033, CNCD250027, CNCD250104, (2♂ 2♀ UCDC); Tonopah, Nye County, 38.068625°N 117.231024°W,

26.V.1988, coll. R.M. Bohart, CNCND249226, (1♀ UCDC); **New Mexico**: 10 miles West of Elk, Chaves County, 32.910458°N 105.46528°W, 25.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCND250107, (1♂ UCDC); 16 miles Northeast of Lordsburg, Hidalgo County, 32.461839°N 108.617216°W, 21.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCND250086, (1♂ UCDC); 2 miles West of Rodeo, Hidalgo County, 31.845251°N 109.050525°W, 26.VIII.1982, coll. R.M. Bohart, CNCND250106, (1♀ UCDC); 2-10 miles East of La Mesa, 32.737916°N 102.121523°W, 13.IX.1965, coll. F.M. & M.C. Hull, CNCND200889, (1♀ CNC); 5 miles North of Rodeo, Hidalgo County, 31.905347°N 109.035976°W, 10.IX.1971, coll. B. Villegas, CNCND250113, (1♂ UCDC); 5 miles Northeast of Lordsburg, Hidalgo County, 32.39334°N 108.699485°W, 21.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCND250087, (1♂ UCDC); 8 miles East of Silver City, Grant County, 32.782403°N 108.14164°W, 22.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCND250114, (1♀ UCDC); 8 miles Northeast of Lordsburg, Hidalgo County, 32.445175°N 108.644631°W, 21.VIII.1971, coll. E.E. Grissell, R.F. Denno, CNCND250085, (1♂ UCDC); Alamogordo, Otero County, 32.88333°N 105.95°W, 12.IV.1965, coll. F.D. Parker, CNCND249018, (1♂ UCDC); Animas, Hidalgo County, 31.950262°N 108.806707°W, 4-5.VIII.1974, coll. E.G. & J.M. Linsley, USNM.ENT1024995, (1♀ USNM); Dona Ana Co.unt, Radium So. Leasburg Dam State Pk.Park, 32.495598°N 106.922429°W, Malaise trap, 15.VIII.1995, coll. Madeline & Paul H. Arnaud Jr., USNM.ENT1027120, (1♀ USNM); Granite Gap, 18 miles North of Rodeo, 32.083333°N 108.951389°W, 7.IX.1976, coll. D.R. Miller, J.E. Lauck, R.M. Bohart, CNCND249109, CNCND250092, CNCND250093, (2♂ 1♀ UCDC); Grant Co., Gila National Forest, Cherry Creek campground, 21km N Silver City, 32.913333°N 108.226667°W, 2250m, 3-4.VIII.1980, coll. J.E. & W.M. O'Hara, CNCND28529, (1♂ CNC); Grant County 8.4 km Southwest of Silver City, 32.711766°N 108.29635°W, Aplopappus, 25.VIII.1992, coll. B.N. Danforth, USNM.ENT1027178, (1♀ USNM); Grant County, Gila National Forest, Cherry Creek Campground, 21 km North of Silver City, 32.914167°N 108.225°W, 2250m, 3-4.VIII.1980, coll. J.E. & W.M. O'Hara, CNCND200894, (1♂ CNC); Grant County, Gila Natl. For., Emory Pass,

32.913611°N 107.765556°W, 2540m, 16.VIII.2007, coll. J.H. Kits, debu293032, (1♀ DEBU); Grant County, Mimbres River, 4 mi S San Juan, 32.716667°N 107.85°W, 1660m, 5.VIII.2007, coll. J.H. Kits, debu293125, (1♂ DEBU); Grant County, Silver City area, 0.°N 0.°E, 14.VIII.2007, coll. Kits & Buck, debu293650, (1♀ DEBU); Hidalgo County, 14 km Northwest Lordsburg, 32.444741°N 108.787797°W, *Lepidium*, 9.VIII.1992, coll. B.N. Danforth, USNM.ENT1027179, (1♀ USNM); Hidalgo County, 38 miles Southwest of Rodeo, 31.56414°N 109.264938°W, 17.VIII.1986, coll. R.J. McGinley & B.M. Norden, USNM.ENT1027049, (1♀ USNM); Hidalgo County, Cotton City, 32.088511°N 108.879245°W, 27.VIII.1995, coll. R. McGinley, USNM.ENT1027184, (1♂ USNM); Hidalgo County, Rodeo, 31.835372°N 109.03117°W, *Helianthus annuus*, 2-4.IX.1973, coll. E.G. & J.M. Linsley, USNM.ENT1027054, USNM.ENT1027055, (1♂ 1♀ USNM); Hidalgo County, 1 miles East of Douglas, 31.350938°N 109.524897°W, 20.VIII.1975, coll. R.J. McGinley, USNM.ENT1027033, (1♂ USNM); Koehler, 36.740863°N 104.618325°W, 30.VII.1915, coll. W.R. Walton, USNM.ENT1024984, (1♀ USNM); Las Cruces, 32.3°N 106.766667°W, V.1911, V.1915, coll. Townsend, USNM.ENT1024953, USNM.ENT1024964, (2♀ USNM); Mesilla Park, 32.276067°N 106.766688°W, 7.V, VII.1922, coll. C.M. Barber, USNM.ENT1024974, USNM.ENT1024987, (1♂ 1♀ USNM); Rodeo, 31.835372°N 109.03117°W, 13.VIII.1959, coll. F.M. & M.C. Hull, CNCD200879, CNCD200882, (1♂ 1♀ CNC); Socorro, 34.0584°N 106.891416°W, 1916, coll. S.W. Williston, USNM.ENT1024965, USNM.ENT1024966, USNM.ENT1024967, (2♂ 1♀ USNM); Tesuque, 35.762847°N 105.93282°W, 26.VIII.1932, USNM.ENT1027040, (1♂ USNM); Therma Eagle Nest, 36.554486°N 105.258915°W, 25.VII.1932, USNM.ENT1027041, (1♂ USNM); White Sands National Monument, 32.787274°N 106.325684°W, 2.VIII.1966, 9.X.1965, coll. F.M. & M.C. Hull, R.L. Brumley, CNCD200881, CNCD200883, CNCD200888, CNCD250109, (3♂ 1ex CNC, UCDC); coll. F.M. Hull, CNCD200906, (1♂ CNC); **Oklahoma:** Ardmore, Indian Territory, 34.174261°N 97.143625°W, 11.VII, coll. C.R. Jones, USNM.ENT1024978, (1♂ USNM); Beaver County, Elmwood, 36.616406°N 100.522629°W,

4.IV.1979, coll. R.J. McGinley, USNM.ENT1027035, (1♂ USNM); Lake Texoma, 2 miles East of Willis, 33.88245°N 96.809728°W, VII.1965, coll. R.M. Bohart, CNCD250101, (1♀ UCDC); **South Dakota**: Custer, 43.766651°N 103.598806°W, coll. J.M. Aldrich, USNM.ENT1024972, (1♀ USNM); **Texas**: Armstrong County, Palo Duro Canyon State Park, 34.897671°N 101.611331°W, 7.VI.1991, coll. B.J. Sinclair, CNCD195999, (1♀ CNC); Austin, 30.266667°N 97.733333°W, 5.V.1901, USNM.ENT1027057, (1♂ USNM); Barstow, 31.461392°N 103.394125°W, X.1912, coll. J.C. Crawford, USNM.ENT1024985, (1♀ USNM); Belfrage, USNM.ENT1024949, (1♂ USNM); Big Bend National Park, Panther Junction, 29.32833°N 103.20472°W, 1067-1219m, 7.V.1959, coll. J.F. McAlpine, CNCD200873, (1♂ CNC); 1067m, 16.V.1959, coll. J.F. McAlpine, CNCD200872, (1♂ CNC); Big Bend National Park, Santa Elena canyon, 29.207204°N 103.510979°W, 640m, 5.V.1959, coll. W.R.M. Mason, CNCD200877, (1♂ CNC); Brownsville, 25.901747°N 97.497484°W, V, coll. C.W. Sabrosky, USNM.ENT1024946, (1♀ USNM); Cotulla, 28.436981°N 99.235101°W, on *Coreopsis cardaminefolia*, on *Verbesina encelioides*, on *Verbesina encelioides*, 10.V.1906, 11.V.1906, coll. F.C. Pratt, J.C. Crawford, USNM.ENT1024954, USNM.ENT1024955, USNM.ENT1024956, USNM.ENT1024957, (3♂ 1♀ USNM); Dallas, 32.802955°N 96.769923°W, on *Gaillardia pulchella*, 26.VI.1907, coll. C.M. Barber, USNM.ENT1024975, (1♂ USNM); Del Rio, 29.362095°N 100.896669°W, 27.IV.1959, coll. W.R.M. Mason, CNCD200908, (1♀ CNC); Devils River, 29.685219°N 101.003671°W, on *Gaillardia pulchella*, 6.V.1901, coll. F.C. Pratt, USNM.ENT1024959, (1♂ USNM); Fort Davis, Limpia Canyon, 30.588211°N 103.894625°W, 1524m, 28.V.1959, coll. J.F. McAlpine, CNCD200907, (1♂ CNC); Fort Davis, 30.592778°N 103.891944°W, 31.V.1959, coll. Howden & Becker, CNCD200900, (1♀ CNC); Govt Government Springs, Grapevine Hills, Big Bend National Park, 29.339752°N 103.254777°W, *Sphaeralcea angustifolia*, 1.IX.1971, coll. E.E. Grissell, R.F. Denno, CNCD250102, (1♂ UCDC); Govt Springs, Grapevine Hills, Big Bend National Park, *Sphaeralcea angustifolia*, 1.IX.1971, coll. E.E. Grissell, R.F. Denno, CNCD249110, (1♂ UCDC); Kerrville, 30.046264°N 99.135349°W, on *Tetraneuris linearifolia*,

11.IV.1907, coll. F.C. Pratt, USNM.ENT1024958, (1♂ USNM); Kingsville, 37.515869°N 97.856109°W, 17.VII.1921, CNC200891, (1♀ CNC); Liadonia' Ladonia, 33.42466°N 95.945981°W, 26.VI.1904, coll. F.C. Bishopp, USNM.ENT1024951, (1♀ USNM); Near Point of Rocks, 10 miles West of Fort Davis, 30.588665°N 104.062105°W, 1524m, 30.V.1959, coll. J.F. McAlpine, genitalia dissected, CNC200871, (1♂ CNC); Rockpile, 30 miles North West of Fort Davis, 30.873666°N 104.281307°W, sweeping, 28.V.1959, coll. J.F. McAlpine, CNC200870, CNC200909, (1♂ 1♀ CNC); Sabinal, 29.3178°N 99.466849°W, on Coreopsis, 28.V.1910, coll. F.C. Pratt, USNM.ENT1024962, (1♂ USNM); Starr County, 26.558968°N 98.788251°W, 27.V.1947, coll. George B. Vogt, USNM.ENT1027039, (1♂ USNM); Trinity, 29.464291°N 98.481889°W, 30.VIII.1906, coll. F.C. Bishopp, USNM.ENT1024979, (1♂ USNM); Waco, 31.549333°N 97.14667°W, coll. Belfrage, USNM.ENT1024981, USNM.ENT1024982, (1♂ 1♀ USNM); VI.1910, coll. J.M. Aldrich coll., USNM.ENT1024950, USNM.ENT1024968, USNM.ENT1024969, (2♂ 1♀ USNM); **Utah**: Emery County, San Rafael Desert, near Little Gilson Butte, 38.581168°N 110.617641°W, 1524-1554m, 19-27.VIII.1980, coll. a.S. Menke, F.D. Parker, Kurt A. Menke, USNM.ENT1027038, (1♂ USNM); Green River, 38.99525°N 110.161804°W, 20.VIII.1974, coll. R.M. Bohart, CNC250096, (1♀ UCDC); **Virginia**: E. Falls CkCreek, 37.037651°N 78.1275°W, II.1918, coll. S.A. Rohwer, USNM.ENT1027056, (1♂ USNM); **Washington**: Adams County, 7 miles North of Othello, 46.896433°N 119.143956°W, 8.VIII.1970, coll. D.R. Miller, USNM.ENT1027046, (1♂ USNM); **Wyoming**: Austin, USNM.ENT1027048, (1♂ USNM); Colo, coll. Baker, USNM.ENT1024961, (1♂ USNM).

Diagnosis. A very large species (6-12 mm); usually very bright orange, or rusty-reddish brown, with striking golden microtomentum distinctly patterned on the abdomen; dorsal thorax bares two variably bright golden or silver microtomentous stripes over a black or brown scutum (Fig. 18 I).

Description. Male. Body length (including antennae): 6-12 mm.

Head. Antennae yellowish-orange to light brown; scape and pedicel with short black setae; flagellum about equal length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina pale yellow with microtomentum within grooves and lining inner eye edge. Frons and genae pale yellow, without setae; frontal vitta dull yellowish-orange; ocellar triangle dull dark brown with two black forward-facing bristles; occiput dull brown with two pale golden stripes of microtomentum and postgena with light yellow microtomentum (paler than frons); occiput with black bristles; postgena with pale yellow bristles; palps dark brown; single geniculate proboscis long, shiny, dark brown.

Thorax. Scutum variable light or dark brown; pale microtomentum covers and extends from postpronotol lobe along scutum margin to transscutal suture, shifts medially and continues to scutellar suture; scutum with two thin medial stripes extending just beyond transscutal suture (Fig. 18 I); short black bristles on postpronotol lobe and along margins of scutum; scutellum dull brown with variable presence of pale microtomentum and short posterior-facing black bristles; upper lateral thorax brown and dark brown toward coxae; katepisternum dark brown; pale microtomentum extends from anepisternum (anepst) to katepisternum, broken only by sutures; katepisternum with long black bristles; cluster of black bristles around cervical sclerite (Fig. 18 K).

Legs. Mid and hind coxa brown with thick black bristles, without microtomentum; front coxa with sparse, pale yellow microtomentum and black bristles; femora unicolourous light brown with paler microtomentum distally; front femur with variable presence of pale microtomentum strip of variable length posteriorily; tibia unicolourous light brown with small patches of pale microtomentum; legs with short black bristles evenly distributed;

hind tibia with thick patch of thick black bristles slightly longer than rest of leg bristles; tarsomeres brown, with thick short setae; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear, though slightly cloudy brown, completely microtrichose, without colour patterns; r_{4+5} cell open (Fig. 4 A); halter pale yellow to brown.

Abdomen. Tergite-1 (tg-1) shiny brown, without microtomentum, with only short, thin lateral patches of setae; tg-2 shiny brown with rows of short black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally; pale microtomentum pattern emerges halfway across tg-2 and is divided toward the lateral margins when viewed ventrally, microtomentum breaks up ventrolaterally; tg-3 with thin medial strip of pale microtomentum and with microtomentum at lateral margins, but joining along posterior edge; microtomentum breaks up ventrolaterally; tg-4 covered in microtomentum except for two posterodorsal spots, and breaks up ventrolaterally; tg-5 as tg-4 except spots half the size; tg-6 short with pale microtomentum dorsally and laterally, breaking away ventrolaterally.

Male Genitalia. (Figs. 36 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in rather short, black setae with a small patch of short bristles about seam of inner surstylus; hypoproct so reduced as to appear absent, or flattened, covered in tomentum; cerci oval-shaped, strongly reduced, with very short, fine setae extending distally only; anterior surstylus strongly reduced, short, triangular-shaped, with rounded teeth or strong nodule, with short, fine setae, distally; posterior surstylus long, very narrow and slightly pointed, with a very weak inward curl, with basal patch of sparse, short, black bristles, with membranous appendage absent; hypandrium Y-shaped, elongate with a weakly rounded, almost flat, sheath; postgonite

skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum; distiphallus fat, bulbous, bag-like, rounded at apex, with patterned tomentum; with black, medial and some lateral sclerotization; phallapodeme elongated and curled and slightly pointed at apex, with short, faint, mid-length, ventral fan of setae; sperm pump small, rounded, somewhat flat, with long, conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually orange, or brown, shiny; tg-6-7 usually shiny orange, with little or no microtomentum.

Hosts. *Nomia melanderi* Cockerell.

Distribution. Map 4 B (■). Fairly widespread throughout North America, concentrated mainly in the southern United States and into Mexico, and likely reaching as far north as southern Canada's prairie provinces, its range overlapping slightly with *Zodion lisafyrea*.

Habitat. Found in a variety of habitats and elevations as high as 774 m on a number of different plants including, *Asclepias* sp. Linnaeus, *Bahia absinthifolia* Benth, *Baileya pleniradiata* Harvey & A.Gray, *Besseya* sp Linnaeus, *Centaurea repens* (Linnaeus) Hidalgo, *Chrysothamnus* sp., *Cirsium arvense* (Linnaeus) Scopoli, *C. vulgare* (Savi) Tenore, *Eriogonum* sp., *Gaillardia pulchella* Fougereux de Bondaroy, *Grindelia* sp. Willdenow, *Gutierrezia microcephala* (Pyramus de Candolle) A. Gray, *Helianthus* sp. Linnaeus, *Helianthus annuus* Linnaeus, *Helianthus petiolaris* Nuttall, *Hemizonia fasciculate* Pyramus de Candolle, *Heterotheca subaxillarias* Camphorweed, *Medicago*

sativa Linnaeus, *Melilotus alba* Medkikus, *M. officinalis* (Linnaeus) Lam., *Solidago* sp., *Sorbus occidentalis* (S.Watson) Greene, *Sphaeralcea augustifolia* (Cav.) G.Don var. *lobota*, *Verbesina enceliodes* (Cav.) Bentham & Hook. f. ex A.Gray (Freeman, 1966), *Melilotus albus*, *Aplopappus* sp., *Coreopsis cardaminefolia* Nuttall, *Opuntia* sp. Miller and *Tetranneuris linearifolia* (Hooker) Greene.

Remarks. Emergence as early as February through November, peaking in August.

Intraspecific COI pairwise distance variation: 1.4-1.9%. Interspecific variation with: *Z. lisafrea* 9.1-10.6%.

***Z. oharai* Burt & Skevington, 2015**

Fig.s. (23 A-C), Map 5 C (●)

Type material. Holotype; ♂; USA: North Carolina: Great Smoky Mountain National Park; 29.V.1957., coll. J.R. Vockeroth; abdomen dissected; CNCN199842 (CNCN).

Paratype series. U.S.A.: Arizona: Huachuca Mountains, Carr Peak, 31.413333°N 110.305000°W, 2804m, hilltop, 20.IX.2008, coll. J.E. O'Hara, CNCN200437, (1♂ CNCN); **California:** Antioch, C. Costa County, 38.004922°N 121.805789°W, 4.IX.1976, coll. B. Villegas, CNCN250072, (1♂ UCDC); Canada Laguna, Santa Cruz Island, Santa Barbara County, 33.989172°N 119.689722°W, Brassica sp., 18.VII.1988, coll. E.A. Sugden, CNCN250080, (1♂ UCDC); Coches Prietos, Sta Santa Cruz Island, Santa Barbara County, 33.966944°N 119.712500°W, 17.VI.1967, coll. D.S. Horning Jr., CNCN250079, (1♂ UCDC); **North Carolina:** Franklin, 35.18111°N 83.38167°W, 8.V.1957, coll. W.R.M. Mason, elev. 610m, genitalia dissected, CNCN199842 (1♂ CNCN); **Massachusetts:** Dedham, 42.241767°N 71.166164°W, 3.IX, coll. C.W. Johnson,

CNCD200383, (1♂ CNC); **Mississippi**: Agricultural College, 33.455539°N 88.790431°W, 14.V.1920, coll. Hull, F.M., CNCD200402, (1♂ CNC); Lafayette County, 34.400000°N 89.500000°W, III-V.1943, IV-V.1946, coll. F.M. Hull, CNCD200233, CNCD200394, CNCD200403, (3♂ CNC); **Wyoming**: Lonetree, Uinta County, 41.035069°N 110.154211°W, 17.VII.1961, coll. G.F. Knowlton, CNCD250038, (1♂ UCDC).

Material dissected. CNCD199831, CNCD199842 (2♂).

Diagnosis. Generally a small species (5.5-6 mm); legs are nearly unicolourous pale yellow or brownish-yellow; gena tends to be sparsely covered in short black setae; pale bristles near gena and a thin line of silver microtomentum along lateral margins of eyes; wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~5-6.5 mm.

Head. Antennae pale yellowish-orange with variable presence of light dusting of silverish-white microtomentum; scape slightly darker orange; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown. Frons, antennal grooves and facial carina dull yellow with extremely light dusting (if at all) of silvery microtomentum; frons and gena dull yellow with sparse black setae; frontal vitta dull yellow and somewhat darker yellow to brownish-yellow about ocellar triangle, with very thin line of silver microtomentum along lateral margins above eyes, with several black setae, somewhat bushy; ocellar triangle somewhat shiny brown to black with four long, black forward-facing bristles, surrounded by black setae; occiput blackish brown with faint pale grayish-brown microtomentum with black bristles and postgena pale yellow with pale bristles near gena and a thin line of silver microtomentum along

lateral margins of eyes; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered in grayish-brown microtomentum with presence of 2-3 bare black medial stripes that extend almost 3/4 length of dorsum; variably present is a thin stripe between two consistently present stripes that are slightly wider and longer; dorsal thorax regularly covered with black setae, with longer bristles at lateral margins along notopleuron and postalar callus; scutellum dull, mainly covered in microtomentum with several long black setae; lateral thorax mainly dull black or dark brown with microtomentum dusting same colour as dorsum; katepisternum with long black bristles (4-5); between 2-4 black bristle at cervical sclerite.

Legs. Coxae yellow to brownish-yellow with dusting of microtomentum with black setae; front coxa generally with fewer setae; legs covered in a very light dusting of silver microtomentum, patchy; legs yellow to brownish-yellow overall with regular black setae; posterior distal area of front and hind tibia with short, concentrated patch of black setae; tarsomeres yellow (same colour as legs) with short black setae; posterior area of tarsomere-1 tends to be concentrated with short black setae; tarsi brownish-yellow with black tips with yellow pulvilli.

Wing. Membrane clear with slight brownish-yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull pale brown, with lateral tufts of short black setae; tg-2 pale brown with tufts of longer black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint golden-brown microtomentum appearing laterally; tg-3 pale dull brownish-orange with lateral golden-brown microtomentum; tg-4-

terminalia mainly covered in light golden-brown microtomentum; tg-3-4 with very thin pale brown band at posterior edge; abdomen sparsely covered in medium black setae.

Male Genitalia (Figs. 23 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with longer bristles near joint of surstylus; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum, strongly narrow and extended. Cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus short, truncate, with slight forward-facing tooth or point, with short, fine setae distally; posterior surstylus somewhat bulbous, slightly pointed and arrow-shaped with a slight inward curl, with concentrated cluster of black bristles only slightly longer and in line with surstylus, with a slight membranous appendage present; hypandrium Y-shaped, elongate with an only slightly rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus somewhat small, generally pointed, arrow-shaped with verticle pattern-lines of tomentum; with medial and some lateral sclerotization; phallapodeme elongated and slightly curled and pointed with short, faint, mid-length, ventral fan of setae; sperm pump rounded, somewhat flat, with conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia that includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field which extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny brown.

Etymology. Patronym for Dr. James O'Hara, a dipterist and systematist whose collecting enthusiasm in the southern United States has provided an incredible number of conopid specimens over an illustrious career.

Hosts. Unknown

Distribution. Map 5 C (●). Mainly western but can be rarely found in the eastern United States, and as north as Massachusetts; few intermediate records available.

Habitat. Can be found on hilltops, occasionally on *Brassica sp.* Linnaeus.

Remarks. Emerges as early as March through to September. At this time no attempts have yet been made to obtain COI.

***Z. perlongum* Coquillett, 1902**

Figs. (33 A-C), Map 5 C (▲).

Synonymy

Zodion perlongum Coquillett, 1902: 199. Type locality: United States of America, New Mexico:

White Mountains; Type depository: holotype, USNM.

Type material. *Z. perlongum* Coquillett, 1902: Holotype; ♀; USA: New Mexico: White Mountains; USNM915703 (USNM).

Material dissected. CNC200920 (1♂).

Additional material examined. **CANADA: Alberta:** Bowden, 51.933087°N 114.032226°W, 15.VIII.1962, coll. D.H. Pengelly, debu1157257, (1♀ DEBU); Stettler, 52.32276°N 112.709752°W, 3.VIII.1957, coll. A.R. & J.E. Brooks, CNC200922, (1♀ CNC); **British Columbia:** Lillooet, 50.686751°N 121.937581°W, 26.VII.1925, coll. W.B. Anderson, CNC200467, (1♀ CNC); Royal Oak, 48.483333°N 123.383333°W, 27.VI.1921, coll. W. Downes, CNC200321, (1♀ CNC); **Nova Scotia:** Bridgewater, 44.378159°N 64.521477°W,

2.IX.1912, coll. G.E.S., CNCND200117, (1♂ CNC); Kings County, 45.017428°N 64.610757°W, 11.VIII.1931, coll. C.E. Atwood, CNCND200919, (1♀ CNC); **Ontario**: Damascus, Wylde Lake Bog, 43.95°N 80.433333°W, 1.VIII.1982, coll. S.A. Marshall, debu1157260, (1ex DEBU); Fergus, 43.7°N 80.366667°W, 25.VII.1992, coll. S.A. Marshall, debu1157261, (1ex DEBU); Forks of Credit, 43.823017°N 80.009517°W, 6.VIII.1968, coll. Patricia MacKay, CNCND28530, (1♀ CNC); Gananoque, 44.330318°N 76.16391°W, 18.VIII.1963, coll. C.J. Edwards, debu1157258, (1♀ DEBU); Guelph, 43.544805°N 80.248167°W, 30.VIII.1978, coll. Brenda Warner, debu1157259, (1♀ DEBU); Marmora, 44.48°N 77.68°W, 24.VII.1952, coll. J.R. Vockeroth, CNCND200916, (1♀ CNC); Severn, 44.805077°N 79.716902°W, 30.VII.1913, coll. H. Curran, CNCND200923, (1♀ CNC); **Quebec**: Fort Coulonge, 45.841513°N 76.738267°W, 21.VIII.1917, coll. J.I. Beaulne, CNCND200910, (1ex CNC); **Saskatchewan**: Saskatoon, 52.13437°N 106.647656°W, 18.VIII, coll. N. Criddle, CNCND200915, (1♀ CNC); **MEXICO**: **Chihuahua**: Sierra madre, HdR Piedras Verdes, 30.30087°N 108.224401°W, 2225m, VIII.1926, coll. Townsend, USNM.ENT1027065, (1♀ USNM); **Coahuila**: near Jame, 33 miles Southeast of Saltillo, 2286m, 25.VII.1963, coll. H. Howden, CNCND200920, (1♂ CNC); **U.S.A.**: **California**: 2 miles East of Lone Pine, Inyo County, 36.575979°N 118.023063°W, 12.X.1971, coll. R.M. Bohart, CNCND250032, (1♀ UCDC); Cedar Pass, Modoc County, 41.562407°N 120.272343°W, 11.X.1952, coll. E.I. Schilinger, UC_BME91908, (1♀ UCDC); Lassen Co., 3.VI.1913, coll. F. W. Nunenmacher, JSS28883, (1♂ LACM); **Colorado**: Kim, 32,1 mi. SW Las Animas Co., 22.VIII.1967, coll. R. R. Snelling, JSS28870, (1♀ LACM); **Connecticut**: Colebrook, 42.001389°N 73.084444°W, 26.III.1902, coll. W.M. Wheeler, CNCND200914, (1♀ CNC); **Florida**: Lutz, 28.151587°N 82.461687°W, 17.III.1926, coll. Krautwurm, FMNH-INS95531, FMNH95531, (2♂ FMNH); **Idaho**: 10 mi W Massacre Rocks, Power Co., 42.610553°N 113.157809°W, 9.VIII.1954, coll. A. R. Gittens, FMNH95572, (1♀ FMNH); 10 miles West of Massacre Rocks, Power County, 9.VIII.1954, coll. A.R. Gittens, FMNH-INS95572, (1♀ FMNH); Lava Hot Springs, 42.619234°N 112.010858°W, 4.VIII, coll. D.E. Johnson,

USNM.ENT1027067, (1♂ USNM); **Iowa**: Sioux City, 42.499994°N 96.400307°W, 8.IX.1920, coll. C.N. Ainslie, CNCN200911, (1ex CNC); **Kansas**: 4 miles Northwest of Lawrence, 39.039425°N 95.261794°W, *Aster simplex*, 4.X.1979, coll. R.W. Brooks, CNCN250046, (1♀ UCDC); **Maine**: Desert of Maine, 43.858995°N 70.157246°W, 17.VIII.1951, coll. Freeberr, USNM.ENT1027070, (1♀ USNM); **Maryland**: Glen Echo, 38.966667°N 77.133333°W, 12.VIII.1926, coll. N.K. Bigelow, CNCN200912, (1ex CNC); **Massachusetts**: Melrose Highlands, 42.470929°N 71.061441°W, *Flowers of Solidago*, 13.IX.1914, coll. C.H.T. Townsend, CNCN1027077, (1♀ CNC); Northborough, 42.319347°N 71.642182°W, coll. C.A. Frost, USNM.ENT1027064, (1♀ USNM); Woods Hole, 41.530302°N 70.667905°W, IX.1919, USNM.ENT1024662, (1♀ USNM); **Michigan**: Gladwin County, 43.99°N 84.39°W, 24.VIII.1942, coll. R.R. Dreisbach, CNCN200917, (1♀ CNC); Midland County, 43.574974°N 84.352846°W, 6.IX.1942, coll. R.R. Dreisbach, CNCN200921, (1♀ CNC); **Montana**: 12 miles West of Dillon, Beaverhead County, 45.22992°N 112.876133°W, 6.VIII.1967, coll. D.S. Horning Jr., CNCN249195, (1♂ UCDC); **Nevada**: 15 miles Southwest of Winnemucca, 40.84917°N 117.959963°W, 9.IX.1959, coll. T.R. Haig, UC_BME91895, (1♀ UCDC); 5 miles South of Success Summit, White Pine County, 39.216194°N 114.685573°W, 8.VII.1968, coll. R.F. Denno, D.R. Miller, CNCN249169, (1♂ UCDC); Dayton, Ormsby County, 39.236873°N 119.589177°W, 19.VI.1964, coll. F.D. Baker, CNCN249119, (1♀ UCDC); **New Jersey**: Malaga, 39.57°N 75.05°W, 15.IX.1907, USNM.ENT1024754, (1♀ USNM); Riverton, 40.011501°N 75.014893°W, 14.IX, coll. D.E. Johnson, USNM.ENT1027068, USNM.ENT1027069, (2♂ USNM); **New York**: Long Island, Greenport, 41.103433°N 72.35925°W, 14.VIII.1952, coll. Roy Latham, USNM.ENT1027076, (1♀ USNM); Long Island, Orient, 41.138284°N 72.302498°W, 2.IX.1953, 4.X.1952, 5.IX.1953, coll. Roy Latham, USNM.ENT1027072, USNM.ENT1027073, USNM.ENT1027074, USNM.ENT1027075, (1♂ 3♀ USNM); **North Dakota**: Mandan, 46.826963°N 100.889502°W, 9.V.1917, coll. P. W. Fattig, P.W. Fattig, FMNH-INS95577, FMNH95577, (2♂ FMNH); **Oregon**: Crook County, 28 miles East of Prineville, Ochoco

National Forest, 44.470335°N 120.422745°W, meadow, 6.IX.1995, coll. E.E. Grissell, USNM.ENT1027105, (1♀ USNM); Middle Fork, Crooked Creek, Warner Mountains, 42.320438°N 120.181901°W, 3.VIII.1968, coll. D.R. Miller, R.F. Denno, CNCD249194, (1♂ UCDC); **South Dakota**: Brookings, 44.311357°N 96.798388°W, 28.VIII.1991, coll. J.M. Aldrich, CNCD1027078, (1♀ CNC); **Texas**: Dallas, 32.802955°N 96.769923°W, on Dewberry, 9.IV.1960, coll. J.C. Crawford, USNM.ENT1027079, (1♀ USNM); **Utah**: Cove, Cache County, 41.958875°N 111.812676°W, 3.VIII.1967, coll. D.S. Horning Jr., CNCD249192, (1♀ UCDC); Logan Dry Canyon, 41.729979°N 111.787843°W, CNCD1027071, (1♀ CNC); **Virginia**: Great Falls, 38.98333°N 77.28333°W, 22.IX.1940, USNM.ENT1027081, (1♀ USNM); USNM.ENT1027080, (1♀ USNM); Riverhead, L.I, 9.VII.1950, coll. Roy Latham, USNM.ENT1027066, (1♀ USNM).

Diagnosis. Wing cell r_{4+5} is open (Fig. 4A); tergites-3-4) (tg-3-4) are distinctly elongated in the female (Fig. 1 D); body brownish-gray with variable presence of 6-7 thin, black, bare maculation stripes on the dorsal thorax (Fig. 18 E).

Description. Male. Body length (including antennae): ~8-10 mm.

Head. Antennae orange; scape brownish-orange; scape and pedicel with long spiky black setae; flagellum, rounded, about equal length of pedicel; pedicel may be only slightly longer; eyes dark brown to black; frons, antennal grooves and facial carina pale yellow with very little silver microtomentum within antennal grooves and lining eyes; frons and gena pale yellow, without setae; frontal vitta dull yellow above scape, sometimes patchy yellow and brown about ocellar triangle, with very thin line of silver microtomentum along lateral margins above eyes, and with sparse, short black setulae becoming thicker and longer about the ocellar triangle; ocellar triangle shiny black to brown with two black forward-facing bristles; occiput and postgena patchy brown with patches of whitish silver

microtomentum; occiput with black setulae; postgena with pale yellow setulae; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with either dull grayish-brown, or grayish-blue microtomentum with 6-7 thin and prominent bare black stripes (Fig. 18 E); the medial stripe extends from below the postpronotal lobe to the transscutal suture with two submedial stripes on either side of varying lengths; sometimes medial stripe is very faint, or absent; submedial stripes-3 somewhat thicker, and broken up by sutures along the notopleuron; dorsal thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing bushy; postalar callus with gray microtomentum and long black setae; scutellum same colour as scutum, with microtomentum with several long black setae; lateral thorax mainly dark brown to black, covered in microtomentum the same colour as dorsum, though ventral margin of katepisternum variably bare; katepisternum with long black bristles; anepisternum has 1-3 long setae variably present; cluster of black bristles around cervical sclerite.

Legs. Coxae shiny brown with long black bristles; hind coxa with gold microtomentum; variably present on mid coxa; legs unicolourous brown, covered in a very faint, dusting of silver microtomentum with many black bristles, somewhat bushy; inside hind tibia with concentrated patch of setae basally; tarsomeres brown with thick short setae; tarsi brown with black tips with yellow pulvilli.

Wing. Membrane clear with slight smoky brown colour, completely microtrichose; the r_{4+5} cell is open (Fig. 4 A); halter pale yellow to brown.

Abdomen. Tergite-1 (tg-1) dull brown, with dorso-lateral tufts of short black setae and slight dusting of silver microtomentum; tg-2 lighter brown with tufts of longer black

bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally, with dusting of gold microtomentum appearing more uniform laterally, while fainter dorsally; tg-2-3 often appear slightly elongated; tg-3-6 with irregular dusting of gold microtomentum, with the ventrolateral margins bare; abdomen covered in fine, long black setae; slightly bushy.

Male Genitalia. (Fig. 33 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in rather short, black setae, especially along lateral margins, with concentrated patch about seem of posterior surstylus; hypoproct divided, rounded, large and elongated, covered in fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus somewhat elongate and bulbous, slightly truncate, without sharpened teeth or points, with short, fine setae, appearing distally; posterior surstylus large, somewhat flat and elongate and apically truncate with obvious inward curl, with concentrated cluster of black bristles not as long as surstyli, with slight membranous appendage present; hypandrium Y-shaped, elongate with a sharply rounded sheath; postgonite skinny, elongated and pointed, almost protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus flat, wide, generally pointed, arrow-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, faint, mid-length, ventral cluster of setae; sperm pump small, rounded, somewhat flat, with long, conical, and apically curled and pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia (Fig. 1 D) that includes elongated tergites 3 and 4, elongated genital plate (sternite-5) with a concentrated bristle field that

extend above st-6, in opposition to st-7 that contain apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually dull brown, or brownish-gray.

Hosts. Unknown.

Distribution. Map 5 C (▲). Widespread, throughout North America, though mainly concentrated in the east and especially the west, as far north as southern Canada.

Habitat. Found on *Chrysothamnus* sp. (Freeman, 1966), Dewberry, the flowers of *Solidago*, or *Symphotrichum lanceolatum* ssp. (Willd.) G.L.Nesom var. *lanceolatum* (formerly *Aster simplex*), in open meadows, or elevations as high as 678 m.

Remarks. Emergence March through October, peaking in August. A short sequence of COI data (322 bps) is available at BOLD under the Conopidae of the World (CONW) (CNC Diptera 28530). This sequence was not used in analysis, as it was too short missing the bulk of the 215 bps near the beginning of the 5' end.

***Z. pictulum* Williston, 1885**

Figs (35 D-F, 18 F, 21 H), Map 4 C (■).

Synonymy

Zodion pictulum Williston, 1885: 379. Type locality: United States of America, New Mexico.

Type depository: syntype, UKAL.

Lectotype designation: Syntype: *Z. pictulum* Williston, 1885 (1♂); Type locality: United States of America, New Mexico (SEMC). This specimen is here designated as the lectotype to fix and ensure the universal and consistent interpretation of the name.

Type material. Syntype: *Z. pictulum* Williston, 1885 (1♂); Type locality: United States of America, New Mexico (SEMC).

Material dissected. CNCD200118 (♂).

Additional material examined. **MEXICO: Chihuahua:** Sierra Madre, HdR Piedras Verdes, 30.30087°N 108.224401°W, 2225m, VIII.1926, coll. Townsend, USNM.ENT1024917, (1♀ USNM); Michoacan, Uruapan, 19.410743°N 102.053027°W, X.1954, coll. N.L.H. Krauss, USNM.ENT1024918, (1♀ USNM); **U.S.A.: Arizona:** Cochise County, Carr Canyon, end of road, Huachuca Mountains, 31.43273°N 110.291886°W, 3.X.1995, coll. A.S. & N. Menke, USNM.ENT1027173, (1♀ USNM); Cochise County, Chiricahua Mountains, Onion Saddle, 31.93333°N 109.26278°W, 15.VIII.1986, coll. McGinley & Norden, USNM.ENT1024916, (1♂ USNM); Huachuca Mountains, Carr Peak, 31.413333°N 110.305°W, 2804m, 12.VIII.1999, coll. J.E. O'Hara, J.E. O'Hara, CNCD190114, CNCD196000, CNCD200118, CNCD89243, (4♂ CNC, MZUL); Huachuca Mtns. Carr Peak, hilltop, hilltop, 20.IX.2008, coll. J.E. O'Hara, CNCD28502, (1♂ CNC); Santa Catalina Mts., 32.441818°N 110.783058°W, 20.VI.1942, coll. H. A. Scullen, FMNH95580, (1♂ FMNH); Santa Catalina, Mountains, 20.VII.1942, coll. H.A. Scullen, FMNH-INS95580, (1♂ FMNH); **New Mexico:** Granite Gap, 18 miles North of Rodeo, 32.083333°N 108.951389°W, 7.IX.1976, coll. R.M. Bohart, CNCD250026, (1♂ UCDC); Rio Ruidso, White Mountain, 33.329096°N 105.665037°W, 1981m, on flowers *Heliopsis scabra*, VII.1925, coll. Townsend, USNM.ENT1024915, (1♂ USNM).

Diagnosis. Body is dull gray with many striking black dots of bare maculation (figs); wing cell r_{4+5} open (Fig. 4 A).

Description. Male. Body length (including antennae): ~8 mm.

Head. Antennae yellowish-orange; scape brown; scape and pedicel with sparse short black setae; flagellum about equal length of pedicel, rounded; antennae covered in silver dusting of microtomentum; eyes dark brown to black; frons, antennal grooves and facial carina brownish yellow with patchy dark brown areas, with silvery microtomentum.

Frons and genae patchy brown and dark brown, without setae; frontal vitta dull orange-

brown with strong silvery microtomentum at lateral margins above eyes; ocellar triangle dull dark brown to black with two black forward-facing bristles, surrounded by black microtomentum (Fig. 19 F); occiput dull white with two dull white stripes of microtomentum and postgena with pale whitish silver microtomentum; occiput and postgena with black bristles; palps dark black; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Mesoscutum and scutellum mainly covered in dark gray microtomentum with four black bare maculation stripes; thin medial stripes extend from prescutum to transscutal suture (Fig. 18 F); thicker stripes at margins extend after prescutum and extend just beyond the transscutal suture; punctuated with a black spot posteriorly with short black setae sparsely distributed; two large irregular black spots of microtomentum appear at lateral margins near notopleuron with 3 black setae; dark gray microtomentum covers postpronotol lobe except for black spot at anterio-lateral tip with several black setae; notopleuron with three black setae; postalar callus dark gray with black spot with 3-5 black setae; scutellum with usually six setae; dark gray with a small lateral black spot on each side of large posterior black spot of microtomentum; lateral thorax mainly black and dark gray; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Mid and hind coxae dark brown to black with thick black bristles, with golden microtomentum; front coxa with sparse, golden microtomentum and few black bristles; legs covered in patchy dusting of golden microtomentum. Femora mainly light brown with patchy dark brown maculation distally; front femur variably with darker brown maculation; tibia light brown with one band of brown maculation at about the middle and

one distally, at knee; legs with short black bristles evenly distributed; hind tibia with thick patch of thick black bristles slightly longer than rest of leg bristles; tarsomeres (tm) light brown except for tm-5, which is dark brown, all with thick short setae; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear with only slight brown fogginess, completely microtrichose, without colour patterns; halter pale yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull dark gray, with only short setae; tg-2 dark gray with tufts of short black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally on black microtomentum; irregular black microtomentum pattern emerges halfway across tg-2 and is divided medially by a gray stripe when viewed dorsally; 3-4 variable spots of black microtomentum appear at the posterior edge and extend ventrolaterally; tg-3 as tg-2 except microtomentum pattern is not divided medially by a gray stripe; tg-4 mainly covered in a dark gray microtomentum except for 2-3 black spots which extend ventrolaterally; tg-5 as tg-4; tg-6 short with dark gray microtomentum with smaller black spots appearing along the posterior edge before terminalia.

Male Genitalia. (Figs. 35 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in rather short, black setae, especially along lateral margins, with concentrated patch about seem of posterior surstylus; hypoproct divided, rounded, large and elongated, covered in fuzzy tomentum; cerci oval-shaped, protruding with long, fine setae extending distally only; anterior surstylus somewhat elongate and bulbous, slightly truncate, without sharpened teeth or points, with short, fine setae, appearing distally; posterior surstylus large, somewhat flat and elongate and apically

truncate with obvious inward curl, with concentrated cluster of black bristles not as long as surstylus, with slight membranous appendage present; hypandrium Y-shaped, elongate with a sharply rounded sheath; postgonite skinny, elongated and pointed, almost protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus flat, wide, generally pointed, arrow-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, faint, mid-length, ventral cluster of setae; sperm pump small, rounded, somewhat flat, with long, conical, and apically curled and pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. Unknown.

Distribution. Map 4 C (■). Few collection records exist, but this species is mainly found in southern Arizona and New Mexico, and Mexico.

Habitat. Can be found on hilltops as high as 855 m, on flowers *Heliopsis scabra* Dunal.

Remarks. Emergence June through October, peaking in August. Two short COI sequences (124 + 179 bps) were obtained and are available on BOLD under Conopidae of the World (CONW) (CNC DIPTERA 190114, CNC DIPTERA 196000), but were not used as they are too short, missing the bulk of the 215 bps region near the beginning of the 5' end. A third short sequence was obtained which covers this region and was used in the analysis.

***Z. pygmaeum* Williston, 1885**

Figs. (25 A-C, 19 D), Map 6 A (▲).

Synonymy

Zodion pygmaeum Williston, 1885: 381. Type locality: United States of America, California.

Type depository: syntypes, SEMC, MCZ

Note. *Z. pygmaeum* was synonymized under the South American (Uruguay) species, *Z. americanum* Wiedemann, 1830, but this is surely in error given the type locality of both types. Until the holotype for *Z. americanum* can be obtained from NMW we will not be able to verify this synonymy, though the original descriptions from Van Duzee and Wiedemann provide some confidence in their division.

Lectotype designation: Syntype: ♂; USA: California; type#437 (MCZ). This specimen is here designated as the lectotype to fix and ensure the universal and consistent interpretation of the name.

Type material. Syntype: ♂; USA: California; type#437 (MCZ); 5 Syntypes: USA: California: Baron (3♂, 1♀); North Park Colorado (1♂) (SEMC).

Material dissected. CNCD200010 (♂), CNCD200011 (1♀)

Additional material examined. CANADA: **British Columbia:** Salmon Arm, 50.700103°N 119.283844°W, 16.VI.1925, coll. A.A. Dennys, CNCD200031, (1♀ CNC); U.S.A.: **California:** 1.5 miles North of San Antone, Jet on Mines Road, Santa Clara County, 38.2065°N 122.591929°W, 22.V.1976, coll. R.B. Kimsey, M.L. Siri, CNCD249124, (1♂ UCDC); Andreas Cyn Canyon, River County, 33.763325°N 116.555000°W, 30.III.1977, coll. N.J. Smith, CNCD249423, (1♀ UCDC); Apple Valley, 34.500831°N 117.185876°W, 12.V.1955, 9.V.1955, coll. J.E.H. Martin, W.R.M. Mason, CNCD200010, CNCD200011, (1♂ 1♀ CNC); Calaveras

County, 19884 Highway 26, 4 km Southwest West Point, 38.377333°N 120.548167°W, 760m, Malaise trap, 1-4.VII.2006, coll. P.H. & M.M. Arnaud Jr. & Stanley C. Williams Arnaud, USNM.ENT1027119, (1♀ USNM); El Dorado County, along Silver Crk Creek, 8 km Northwest of Kyburz, 38.8°N 120.383333°W, wet meadow, 19.VI.1999, coll. S.L. Heydon, CNC249419, (1♂ UCDC); Lang Crossing, South Yuba R., Nevada County, 39.32°N 120.65°W, 1425m, 19-21.VI.1984, coll. L.D. French, CNC249422, (1♂ UCDC); Lily Pond, Alpine Lake, Marin County, 37.953803°N 122.634977°W, 457m, Malaise trap, 28.VIII-7.IX.1971, coll. D.D. Munroe, CNC28519, (1♀ CNC); Marin Co., Mill Valley, 37.9°N 122.55°W, 110m, flight interception trap, 17-19.VI.1965, coll. P.H. Arnaud, Jr., USNM.ENT1024232, (1♂ USNM); Redwood City, San Mateo County, 37.485215°N 122.236355°W, 2.VIII.1959, coll. P.H. Arnaud, Jr., USNM.ENT1024228, (1♂ USNM); San Bernadino Co., San Bernadino Mountains, Mt. Home Canyon, 34.130137°N 116.880172°W, 4000m, 27.IX.1955, coll. A.L. Melander, USNM.ENT915871, (1♀ USNM); San Bernadino Co., San Bernadino Mountains, Up Sta. Ana River, 34.091253°N 117.120741°W, Malaise trap, 15.VI.1955, coll. A.L. Melander, USNM.ENT915881, (1♂ USNM); **Iowa**: Sioux City, 42.499994°N 96.400307°W, sweeping, 8.IX.1918, coll. C.N. Ainslie, CNC200025, (1♂ CNC).

Diagnosis. Larger species within the Group (5-7 mm); tergites dull, dark blackish-brown, mainly covered in an ill-defined light gray microtomentum, appearing dusty, and slightly bushy with black setae (Figs. 20 E-F); legs are nearly unicolourous brown; gena tend to be sparsely covered in short black setae; r_{4+5} cell open (Fig. 4 A).

Description. Male. Body length (including antennae): ~5-7 mm.

Head. Antennae yellowish-brown with variable presence of light dusting of silverish-white microtomentum; scape slightly darker brown; flagellum with darker brown patches distally; scape and pedicel with spiky black setae; flagellum about equal length of pedicel, rounded; eyes brown; frons, antennal grooves and facial carina pale yellow with

light dusting of silvery microtomentum; frons and gena pale yellow with sparse black setae; frontal vitta long and narrow, dull brown with very thin line of silver microtomentum along lateral margins above eyes, with sparse black setae; ocellar triangle somewhat shiny black with four black forward-facing bristles; occiput and postgena brownish-black with grayish-brown microtomentum with black bristles; sometimes postgena with paler bristles near gena; palps brown; single geniculate proboscis short, shiny, dark brown.

Thorax. Scutum dark brown, or blue, or mixed with four black stripes that extend just beyond the transscutal suture; a pair of submedial bare maculation stripes variably thinner than thicker stripes at margins (Fig. 19 D); dorsal thorax sparsely covered with black setae, with slightly longer bristles at lateral margins along notopleuron and postalar callus; scutellum same colour as scutum, with four black setae; lateral thorax mainly dull black or dark brown; katepisternum with 1-2 long black bristles; one black bristle at cervical sclerite.

Legs. Hind and mid coxae brown with black setae; front coxa brown with variable presence of setae; hind coxa with faint silver microtomentum; legs mainly unicolourous brown, though slightly paler at knees, sparsely covered in black setae; posterior distal area of hind tibia with short, concentrated patch of black setae; tarsomeres brownish-yellow with short black setae; tarsomere-1 tends to be paler than tm-5; tarsi brown with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open.

Abdomen. (Figs. 20 C-F) Tergites dull brown, often dark; tergite-1 (tg-1) with lateral tufts of short black setae; tg-2 with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with faint dusting of ill-defined gray microtomentum; tg-3-5 dull, dark blackish-brown, mainly covered in an ill-defined light gray microtomentum, variably forming poorly defined triangular spots dorsally, divided by gray microtomentum; tg-6 covered in gray microtomentum; tergites 2-5 with a variably pale or dark band along posterior edge extending laterally; abdomen variably covered in long black setae, usually appearing somewhat bushy (Figs. 20 E-F).

Male Genitalia. (Figs. 25 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, very sparsely covered in setae, without longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, small and somewhat narrow and bulbous, projecting forward, covered in fuzzy tomentum; cerci oval-shaped with long, fine setae extending distally only; anterior surstylus short, truncate, with very sharp forward and back-facing teeth or points, with short, fine setae, distally, somewhat bristly; posterior surstylus elongated, pointed apically though somewhat rounded, with a slight rounded lateral protrusion forming a slight enclosure with anterior forward-facing teeth, with a slight downward-inward curl, without concentrated cluster of long black bristles in line with surstylus, without membranous appendage, and exaggerated and pointed lateral protrusion present; hypandrium Y-shaped, elongate with a very sharply pointed sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in tomentum; distiphallus small, narrow, pointed, dagger-shaped covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and pointed without short, mid-length, ventral cluster of

setae; sperm pump rounded, somewhat flat, with conical, pointed and apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes a slightly elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. Unknown.

Distribution. Map 6 A (▲). Western; mainly in California, United States, north to British Columbia, Canada.

Habitat. Has been collected in wet meadows.

Remarks. Emergence from May through to September, slightly peaking in June.

Intraspecific COI pairwise distance variation: 0%. Interspecific variation with: *Z.*

albifacies: 15.0% *Z. harrisi*: 11.5-12.5%; *Z. hirsialiae*: 14.4-15.5%; *Z. hitchensi*: 15.9%;

Z. nanellum: 13.5-14.1%.

***Z. reclusum* Banks, 1916**

Figs. (32 D-F, 4 A), Map 4 A (▲).

Synonymy

Zodion reclusum Banks, 1916: 195. Type locality: United States of America, California:

Redlands; Oregon: Corvallis. Type depository: syntype, MCZ, ORSU.

Note. *Z. reclusum* Banks, 1916 was synonymized under *Z. fulvifrons* Say, 1823 incorrectly. Here it has been removed from synonymy after examination of the holotype

and genitalia (combination of examination of dissected genitalia and the distended abdomen with intact terminalia exposed).

Type material. *Z. reclusum* Banks, 1916: Syntype; ♂; USA. California: Redlands; Oregon: Corvallis; MCZ-ENT13544 (MCZ).

Material dissected. CNC200380, CNC200390 (2♂).

Additional material examined. **CANADA: Ontario:** Echo Lake, Mount Evans, 39.658085°N 105.6035°W, 3231m, 17.VII.1961, coll. W.R.M. Mason, CNC200281, (1♀ CNC); Point Pelee, 41.956157°N 82.514529°W, 24.VI.1927, coll. F.P. Ide, CNC200580, (1♂ CNC); **MEXICO:** **Durango:** 5 miles West of Durango, 24.033333°N 104.666667°W, 1981m, 23.VII.1964, coll. J.F. McAlpine, CNC200248, (1♂ CNC); 6 miles South of Durango, 23.939819°N 104.661484°W, 1859m, 5.VII.1964, coll. W.R.M. Mason, CNC200246, (1♂ CNC); **U.S.A.: Alabama:** Kushla, 30.816786°N 88.161163°W, 9.V.1920, USNM.ENT1027021, (1♀ USNM); **Arizona:** Box Canyon, Chiricahua Mountains, 31.62315°N 109.46896°W, 6.IX.1977, coll. R.M. Bohart, CNC249468, (1♂ UCDC); **California:** Palo Verde, Imperial County, 33.432346°N 114.732593°W, 21.III.1967, coll. R.M. Bohart, CNC249103, (1♂ UCDC); **Colorado:** Echo Lake, Mount Evans, 39.658085°N 105.6035°W, 3231m, 11.VIII.1961, 20.VII.1961, 8.VIII.1961, coll. B.H. Poole, C.H. Mann, S.M. Clark, CNC200314, CNC200317, CNC200508, (3♀ CNC); **Iowa:** Ames, 42.023793°N 93.625687°W, 17.VI.1923, genitalia dissected, CNC200380 (1♂ CNC) **Kansas:** 3 miles Northeast of Lawrence, 38.998974°N 95.177971°W, *Helianthus petiolaris*, *Heterotheca grandiflora*, *Heterotheca petiolaris*, IX.1979, coll. R.W. Brooks, CNC249041, CNC249043, CNC249095, CNC249096, CNC249201, CNC249202, CNC249203, CNC249204, CNC249207, CNC250067, CNC250068, CNC250069, CNC250070, CNC250071, (14♂ UCDC); 38.998975°N 95.177972°W, *Helianthus petiolaris*, *Heterotheca grandiflora*, IX.1979, coll. R.W. Brooks, CNC249458, CNC249459, (2♂ UCDC); Douglas Co., Lawrence, 38.971669°N 95.23525°W, 17-28.VIII.1979, coll. R.J.

McGinley, USNM.ENT1024670, USNM.ENT1024671, USNM.ENT1024673, USNM.ENT1024674, USNM.ENT1024675, USNM.ENT1024676, USNM.ENT1024677, USNM.ENT1024678, USNM.ENT1024679, USNM.ENT1024680, USNM.ENT1024681, USNM.ENT1024682, USNM.ENT1024683, USNM.ENT1024684, USNM.ENT1024685, USNM.ENT1024686, USNM.ENT1024687, USNM.ENT1024688, USNM.ENT1024689, USNM.ENT1024690, USNM.ENT1024691, USNM.ENT1024692, USNM.ENT1024693, (23♂ USNM); **Maryland**: Cabin John, 38.973653°N 77.158582°W, 9.V.1914, coll. J.C. Crawford, USNM.ENT1024498, (1♂ USNM); **Massachusetts**: Woods Hole, 41.530302°N 70.667905°W, 28-30.VI.1919, USNM.ENT1027011, USNM.ENT1027016, (2♀ USNM); **Michigan**: Cheboygan Co., 13.VIII.1931, coll. H.C., USNM.ENT1024377, (1♂ USNM); Midland County, 43.574974°N 84.352846°W, 20.VI.1945, coll. R.R. Dreisbach, CNCN200390, (1ex CNC); **New York**: Long Island, Orient, 41.138284°N 72.302498°W, 5.X.1952, coll. Roy Latham, USNM.ENT1024378, (1♂ USNM); **Oklahoma**: Ardmore, Indian Territory, 34.174261°N 97.143625°W, 16.V, coll. C.R. Jones, USNM.ENT1024395, (1♂ USNM); Lake Texoma, 2 miles East of Willis, 33.88245°N 96.809728°W, VII.1965, coll. R.M. Bohart, CNCN249046, (1♂ UCDC); **Texas**: Highway 66, 10 miles East of New Mexico State Line, 35.74356°N 102.91168°W, 5.IX.1964, coll. F.M. & M.C. Hull, CNCN200393, (1♂ CNC); Kerrville, 30.046264°N 99.135349°W, 12.IV.1907, coll. F.C. Pratt, USNM.ENT1024399, (1♂ USNM); 30.047433°N 99.140319°W, sweeping, 3.IV.1959, coll. J.F. McAlpine, CNCN200261, (1♂ CNC); Lariat, Parma County, 34.330247°N 102.907956°W, Helianthus, 2.X.1965, coll. R.W. Thorp, CNCN249035, (1♂ UCDC); **Wyoming**: 10 miles Southeast of Laramie, 41.242548°N 105.439107°W, 16.VIII.1962, coll. R.M. Bohart, CNCN249106, (1♂ UCDC); 3 miles North of Pinedale, Sublette County, 42.906817°N 109.858641°W, 15.VII.1971, coll. R.M. Bohart, CNCN249452, (1♂ UCDC); Fal, USNM.ENT1027025, (1♀ USNM).

Diagnosis. Abdomen deep reddish-brown, or orangy with golden microtomentum; r_{4+5} cell open (Fig. 4 A); anipisternum (anepst) with 1-3 long black setae; legs and tarsomeres unicolourous light brown; frontal vitta often somewhat short and wide.

Description. Male. Body length (including antennae): ~8-10 mm.

Head. Antennae yellowish-orange with dusting of silverish microtomentum; scape yellowish-orange; scape and pedicel with very short spiky black setae; flagellum about equal length of pedicel, rounded; eyes dark brown encircled by silver microtomentum; frons, antennal grooves and facial carina yellow with dusting of silvery microtomentum; frons and gena yellow without black setae; frontal vitta somewhat short and wide, dull yellow above scape to brown after ocellar triangle, with lines of golden microtomentum along lateral margins above eyes that do not extend beyond ocellar triangle, with black setae; ocellar triangle shiny black with 2-4 black forward-facing bristles surrounded by black bristles, with small patches silver microtomentum on each side; occiput and postgena dark brown with silverish-white microtomentum with black bristles about occiput and paler bristles about postgena; palps brown; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum mainly covered with dull gray or grayish-brown microtomentum with four prominent bare black stripes of varying length, and one variably present central medial stripe; central medial stripe often very faint, if present at all; stripes tend to be thin and vary in length with two submedial-1 stripes short beginning after postpronotal lobe and ending well before transscutal suture; second pair of stripes longer, beginning about where submedial-1 stripes end, just beyond transscutal suture; additional irregular marginal stripes somewhat thicker, broken by sutures along the notopleuron; dorsal

thorax regularly covered with black setae, with slightly longer bristles at lateral margins along notopleuron, appearing somewhat bushy; scutellum mainly covered in gray or grayish-brown microtomentum with several long black setae; lateral thorax mainly dark brown to black, covered in microtomentum the same colour as dorsum, though ventral margin of katepisternum variably bare; anepisternum with between 1-4 long black bristles; katepisternum with cluster of long black bristles; black bristles around cervical sclerite.

Legs. Coxae brown to black with golden-brown microtomentum, especially on anterior front coxa with black setae; legs unicolourous light brown with very light dusting of silver microtomentum with many black setae, somewhat bushy; tibia with slightly shorter black setae; distal posterior surface of hind tibia with thick transverse patch of setae; tarsomeres light brown (same as legs) with sparse black setae; tarsi yellow with black tips with pale yellow pulvilli.

Wing. Membrane clear with slight brownish-yellow colour, completely microtrichose, without colour patterns; halter yellow; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull, dark reddish-brown, with lateral tufts of short black setae; tg-2 deep orangy-brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally with faint golden microtomentum appearing laterally; tg-3-5 deep orangy-brown with dusting of golden microtomentum laterally; tg-6 covered in heavier golden microtomentum; microtomentum forms faint medial line on tg3-5, variably; tg2-5 with thin, pale yellow band at posterior edge; abdomen covered in black setae, slightly bushy.

Male Genitalia. (Fig. 32 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, sparsely covered in long setae, with concentrated patch of longer, thicker bristles near joint of surstylus; hypoproct divided, rounded, bulbous, covered in fuzzy tomentum; cerci oval-shaped and elongated, protruding with long, fine setae extending distally only; anterior surstylus large, wide, irregularly rounded, without obvious teeth or points, with short, fine setae, distally; posterior surstylus large, somewhat flat and elongated, slightly apically pointed, with a slight inward curl, with concentrated basal cluster of black bristles longer than and in line with surstyli, with thin lateral membranous appendage present, appearing somewhat like a scoop; hypandrium Y-shaped, elongate with a weakly rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus small, bulbous, covered in tomentum; distiphallus small, narrow, pointed or arrow-shaped, covered with tomentum; with medial and very little lateral sclerotization; phallapodeme elongated and slightly curled and sharply truncate, with short, mid-length, ventral fan of setae; sperm pump rounded, somewhat flat, with long, conical, pointed and slightly apically curled ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, slightly reddish-orange, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny, pale orangy-brown.

Hosts. Unknown.

Distribution. Map 4 A (▲). Somewhat widespread, concentrated mainly in the southwestern United States, but can rarely reach northeast to southern Ontario, Canada.

Habitat. Found in a variety of habitats and elevations as high as 985 m, on *Heterotheca grandiflora* and *H. petiolaris*.

Remarks. Emergence March through October, peaking in August. Intraspecific COI pairwise distance variation: 3.3-8.2%. The wide genetic variation combined with the somewhat scattered range is suggestive of a complex of a few subtle species. Full COI sequences from more specimens may help to tease out the true nature of this putative complex.

***Z. triste* Bigot, 1887**

Figs. (24 D-F), Map 5 C (■).

Synonymy

Zodion triste Bigot, 1887: 203. Type locality: United States of America, California. Type depository: type, (unknown).

Note. The depository of the type of *Zodion triste* Bigot, 1887, is currently unknown.

Type material. The whereabouts of *Z. triste* Bigot, 1887 is currently unknown, but was believed to be at CAS. The collection manager and curatorial staff at CAS stated that the type is not deposited with that collection and noted that many of the Bigot types have historically been placed with European museums and collections, but could not elaborate beyond that (pers. comm.). Attempts to discover its location have been fruitless up to the point of the submission of this work. Contacting each European collection manager to check on the status of this type is daunting but may be required. Bigot is known to have deposited many of his types in French collections such as Muséum National d'Histoire

Naturelle (NMHN), and Muséum d'Histoire Naturelle de la ville de Bourges, Muséum Gabriel Foucher (BOUM).

Material dissected. CNCD190117, CNCD28513 (1♂, 1♀).

Additional material examined. **CANADA: Ontario:** Smith's Bay, near Picton, 43.905059°N

77.265953°W, 1.VII.1970, coll. J.F. McAlpine, genitalia dissected, CNCD28513, (1♀ CNC);

U.S.A.: California: 8 Miles East of Big Pine, Inyo County, 37.237158°N 118.201598°W,

25.V.1994, coll. R.M. Bohart, CNCD249121, (1♂ UCDC); Carnelian Bay, Placer County,

39.226751°N 120.081869°W, 24.VI.1973, coll. B. Villegas, CNCD249104, (1♂ UCDC); Davis,

38.544904°N 121.740514°W, 12.V.1949, 2.VI.1949, coll. R. M. Bohart, R.M. Bohart, FMNH-

INS95521, FMNH95521, (1♂ 1♀ FMNH); Graeagle, Plumas County, 39.766287°N

120.618552°W, 18.VI.1949, coll. E.I. Schilinger, UC_BME91918, (1♀ UCDC); Sagehen Creek

near Hobart Mills, Nevada County, 39.433869°N 120.254564°W, 1.VII.1964, coll. F.D. Parker,

CNCD249085, (1♂ UCDC); Yuba Pass, Sierra County, 39.323059°N 120.599169°W,

30.VII.1958, coll. A.A. Grigarick, UC_BME91924, (1♀ UCDC); **Colorado:** Boulder,

40.01552°N 105.271103°W, 1676m, 9.VI.1961, coll. B. H. Poole, B.H. Poole, FMNH-INS95601,

FMNH95601, (2♀ FMNH); 40.014986°N 105.270546°W, 1829m, 4.VI.1961, coll. B.H. Poole,

genitalia dissected, CNCD190117, (1♂ CNC); Estes Park, 40.376877°N 105.52137°W, 2286m,

2.VII.1961, coll. C.H. Mann, CNCD200925, (1♀ CNC); Frazer Fraser, Grand County,

39.944987°N 105.817232°W, 2896m, 7.VII.1961, coll. B.H. Poole, CNCD200110, (1♂ CNC);

Loveland Pass, Western Slope, 39.65°N 105.866667°W, 3002m, 8.VIII.1961, coll. B.H. Poole,

CNCD200091, (1♂ CNC); **Idaho:** Rock Creek, Oneida County, 42.432136°N 114.305436°W,

13.VII.1972, coll. G.F. Knowlton, CNCD249120, (1♂ UCDC); Taber, Bingham County,

43.317936°N 112.688898°W, 20.VI.1952, coll. E.I. Schilinger, UC_BME91915, (1♀ UCDC);

Massachusetts: Middlesex County Belmont, Rock Mdw Meadow, 42.401823°N 71.199064°W,

7.VIII.1981, coll. N.E. Woodley, USNM.ENT1027089, USNM.ENT1027090, (2♀ USNM);

Middlesex County Lincoln, 42.425928°N 71.303947°W, Malaise trap, 22.VIII.1982, 23.VIII.1982, coll. E.T. Armstrong, USNM.ENT1027113, USNM.ENT1027114, (1♂ 1♀ USNM); **Nevada**: Elko County, 2 miles West Harrison, Pass Summit, 40.324893°N 115.51113°W, 2134m, 12.VII.1981, coll. N. & C. Smith, A. Gilbert, W. Peregrin, CNCDD249470, (1♂ UCDC); **North Carolina**: Mount Graybeard, 35.68404°N 82.295056°W, 23.V, coll. N. Banks collection, USNM.ENT1024557, (1♂ USNM); **Washington**: Paterson, 45.938919°N 119.602583°W, 26.IV.1936, USNM.ENT1024943, (1♂ USNM); Wawawai, 46.636764°N 117.37699°W, 15.V.1909, coll. W.M. Mann, USNM.ENT1024944, (1♀ USNM).

Diagnosis. Very small species (~4 mm); wing cell r_{4+5} closed (Fig. 4 B); body black or blackish-brown, with striking black and brown stripes on the dorsal thorax (Fig. 19 C).

Description. Male. Body length (including antennae): ~4 mm.

Head. Antennae brownish-orange; scape brown; ccape and pedicel with spiky black setae; flagellum about equal length to pedicel, rounded; antennae with patchy silver dusting of microtomentum; eyes dark brown; frons, antennal grooves and facial carina dark yellow covered with silvery microtomentum; frons and gena dark yellow, with few short black setae; frontal vitta dull orange-brown with short black setae, with silver microtomentum concentrated at lateral margins above eyes; ocellar triangle dull dark brown to black with two black forward-facing bristles, surrounded by black microtomentum; occiput dull brown with two faint white stripes of microtomentum and postgena with very faint, whitish silver microtomentum; occiput and postgena with black bristles; palps brown to dark black; single geniculate proboscis long, shiny, dark brown to black.

Thorax. Scutum and scutellum mainly covered in grayish-brown microtomentum with two thin darker brown stripes which extend from prescutum to transscutal suture; two

thicker stripes at margins extend after prescutum and extend just beyond the transscutal suture though these are patchy and broken up (Fig. 19 C); grayish-brown microtomentum comes to a point before reaching scutellum, giving way to darker brown; dorsal thorax covered with patch of black setae, with longer bristles at lateral margins along notopleuron; scutellum grayish-brown covered in long black setae; lateral thorax mainly covered in grayish-brown microtomentum with some patchy areas of darker brown; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Coxae dark brown to black with thick black bristles, with only a slight dusting of silver microtomentum; legs covered in a very light dusting of golden microtomentum; mid and hind femora mainly light brown; front femur usually darker brown; tibia unicolourous light brown; legs with short black bristles evenly distributed; tarsomere-1 light brown; tarsomere-5 dark brown; tarsomeres-2-4 are gradations from light to darker brown; tarsomeres with thick short setae; tarsi brown with black tips with yellow pulvilli.

Wing. Membrane clear, completely microtrichose, without colour patterns; halter pale yellow; r_{4+5} cell closed (Fig. 4 B).

Abdomen. Tergite-1 (tg-1) dull dark brown to black, with only short black setae; tg-2 dark brown with dorso-lateral tufts of long black bristles appearing $1/5^{\text{th}}$ posteriorly along the lateral margins, though visible dorsally on golden-brown microtomentum; tg-3-6 covered entirely with golden-brown microtomentum and somewhat bushy with regular setae.

Male Genitalia. (Figs. 24 D-F) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in rather short, black setae and irregular tomentum; hypoproct divided, reduced, rounded, weakly projecting, covered in tomentum; cerci oval-

shaped, protruding with very long, fine setae extending distally only; anterior surstylus elongate, protruding, slightly truncated with a weak forward-facing tooth, and back-facing tooth, flat and pan-shaped, with fine setae, distally; posterior surstylus large, L-shaped, with strong inward curl, elongate with rounded apex, with basal cluster of long, black bristles, with membranous appendage present; fin-like; hypandrium Y-shaped, elongate with a strongly projecting, sharply rounded sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum; distiphallus tongue-like, rounded at apex, with patterned tomentum; with strong, black, medial and some lateral sclerotization; phallapodeme elongated sharply truncate at apex, with short, very faint, mid-length, ventral cluster of setae; sperm pump small, irregularly rounded, somewhat flat, with short conical, curled and pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia that includes an elongate genital plate (sternite-5) with a concentrated bristle field that extend above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is not generally reduced, unlike tg-6, while syntergosternite-8+9 (synt 8+9) is elongated, and usually dull.

Hosts. Unknown.

Distribution. Map 5 C (■). Concentrated mainly in the western United States, reaching the eastern coast and southeastern Canada in drastically fewer numbers.

Habitat. Can be found on hilltops with elevations as high as 915 m.

Remarks. Emergence as early as April (one Washington, USA record) through to August peaking in June and July. Few attempts have been made to obtain COI. A single partial sequence (474 bps) is available at BOLD under the Conopidae of the World (CONW)

(record CNC Diptera 28513). This sequence was not used in analysis because it was too short, missing the bulk of the 215 bp region near the beginning of the 5' end.

***Z. zebrinum* Bigot, 1887**

Figs. (37 A-C, 19 E, I), Map 4 C (▲).

Synonymy

Zodion zebrinum Bigot, 1887: 204. Type locality: Mexico (written as: "Mexique"). Type depository: holotype, UMO.

Zodion aureopictum Kröber, 1927: 122. Type locality: Costa Rica: San Jose. Type depository: holotype, ZMUH (Destroyed).

Note. The holotype of *Z. aureopictum* Kröber, 1927 from ZMUH has been destroyed.

Type material. *Z. zebrinum* Bigot, 1887: Holotype; ♂; Mexico (as "Mexique") (UMO).

Material dissected. CNCD190116, UCDC00919 (2♂).

Additional material examined. MEXICO: Jalisco: Jalostotitlan, 6 miles Northeast, 21.229042°N 102.402217°W, 20.VIII.1954, coll. J.G. Chillcott, CNCD200926, (1♀ CNC); **Morelos:** 17.5mi N.E. Yautepec, 1722m, 15.VIII.1962, coll. Ordway & Roberts, FMNH95642, (1♂ FMNH); **Sinaloa:** Mazatlan, 23.236111°N 106.415278°W, 28.III.1979, coll. L.D. French, CNCD249172, (1♀ UCDC); **Sonora:** Guaymas, 27.918333°N 110.898889°W, 7.IV.1921, coll. E.P. Van Duzee, CNCD200892, (1♂ CNC); **Zacatecas:** 10 mi. S Jalpa Zac, 18.IV.1970, coll. R. M. Bohart, FMNH95549, (1♀ FMNH); Oxaca, 17.055406°N 96.715303°W, coll. Crawford, USNM.ENT1027088, (1♂ USNM); Vera cruz Veracruz, 19.1725°N 96.153333°W, coll. Crawford, USNM.ENT1027086, USNM.ENT1027087, (1♂ 1♀ USNM); **U.S.A.:** Texas: Raymondville, 26.481846°N, 97.782514°W, 29.VI.1921, CNCD190116 (1♂ CNC).

Diagnosis. Wing cell r_{4+5} open (Fig. 4 A); dorsal thorax with two distinct golden stripes of microtomentum (Fig. 18 J); abdomen with distinct patterns of golden microtomentum.

Description. Male. Body length (including antennae): ~8 mm.

Head. Antennae dark reddish-brown; scape dark brown; scape and pedicel with spiky black setae; flagellum less than half length of pedicel, rounded; eyes dark brown; frons, antennal grooves and facial carina pale yellow with light dusting of silvery microtomentum; frons pale yellow, gena distinctly blackish brown, usually without setae (Fig. 19 I); frontal vitta dull deep yellow above scape; abruptly dark brown about ocellar triangle, with very thin line of silver microtomentum along lateral margins above eyes that comes to a point around the ocellar triangle, without setae (Fig. 19 E); ocellar triangle dark brown to black with some silver microtomentum with two short black forward-facing bristles; occiput black; postgena black with whitish-silver microtomentum; occiput and postgena with short black bristles; palps brown; single geniculate proboscis quite long (almost 3 times as long as head), shiny, dark brown to black.

Thorax. Mesoscutum mainly dull black with two thin gray stripes of microtomentum which extend from prescutum to transscutal suture; two slightly thicker stripes at margins cover and extend from postpronotal lobe to prescutum and extend to the transscutal suture (Fig. 18 J); postalar callus black with gray microtomentum and few short black setae; dorsal thorax sparsely covered with short black setae, with slightly longer bristles at lateral margins along notopleuron; scutellum dull black with very little or no gray microtomentum with few black setae; lateral thorax mainly dull black to dark brown with faint gray microtomentum on the anepisternum; katepisternum with long black bristles; cluster of black bristles around cervical sclerite.

Legs. Coxae dark brown to black with black bristles, with slight dusting of silver microtomentum; femora dark brown with a patchy dusting of silver microtomentum with black bristles, somewhat bushy; tibia light brown, covered entirely with golden-brown microtomentum with shorter black bristles, less bushy than femora; tarsomeres (tm) same colour as tibia, though tm-4-5 slightly darker with less microtomentum; all with short black setae; tarsi yellow with black tips with yellow pulvilli.

Wing. Membrane clear with brownish-yellow colour, completely microtrichose, without colour patterns; halter brown; r_{4+5} cell open (Fig. 4 A).

Abdomen. Tergite-1 (tg-1) dull dark brown, with sparse short black setae; tg-2 darker brown to black with dorso-lateral tufts of long black bristles appearing 1/5th posteriorly along the lateral margins, though visible dorsally with striking yellow-gold line of microtomentum appearing along the posterior edge; tg-3 dull brown with a lateral line of yellow-gold microtomentum divided medially, with a second unbroken band along the posterior edge; tg-4 is a reverse of tg-3: mainly yellow-gold microtomentum with a dull dark brown lateral line broken medially by microtomentum; tg-5 mainly covered in yellow-gold microtomentum, except for 2 faint brown spots near posterior margin when viewed dorsally; tg-6 covered in yellow-gold microtomentum except for a very thin brown band at posterior edge followed by faint silver microtomentum; abdomen sparsely covered in short black setae.

Male Genitalia. (Figs. 37 A-C) Epandrium brown, rounded and bulbous, somewhat shiny with sparse microsculpture, covered in rather short, black setae and regular tomentum; hypoproct so reduced as to appear absent, or flattened, covered in tomentum; cerci oval-shaped, protruding with very short, fine setae extending distally only. Anterior

surstyli weakly extended, reduced, but wide and somewhat triangular-shaped, slightly pointed, without teeth, with short, black setae, distally; posterior surstylus moderate, slightly pointed, with a weak inward curl, with basal cluster of sparse, short, black bristles, without membranous appendage present; paddle-like; hypandrium Y-shaped, elongate with a rounded, protruding sheath; postgonite skinny, elongated and pointed, not protruding beyond hypoproct; epiphallus bulbous, covered in short tomentum; distiphallus fat, bulbous, bag-like, rounded at apex, fat at mid-length, with patterned tomentum; with strong, black, medial and some lateral sclerotization; phallapodeme elongated and curled and sharply pointed at apex, with short, faint, mid-length, ventral fan of setae; sperm pump irregularly rounded, somewhat flat, with short conical, pointed ejaculatory apodeme, with tubular ejaculatory duct.

Female. As male except for specialized terminalia which includes an elongate genital plate (sternite-5) with a concentrated bristle field that extends above st-6, in opposition to st-7 which contains apical sclerotized teeth; tg-5 is reduced, much shorter than broad, as is tg-6 while syntergosternite-8+9 (synt 8+9) is elongated, and usually shiny.

Hosts. Unknown.

Distribution. Map 4 C (▲). Found mainly in the southwestern United States, especially southern Arizona, New Mexico and Texas, into Mexico.

Habitat. Little is known about the habitat, though it can be collected at elevations as high as 540 m.

Remarks. Steady emergence March through August. No COI sequence data are available at this time as two attempts to obtain DNA from old museum material failed.

3.26 Results and Discussion (*Zodion*)

All COI sequences have been trimmed to match the shorter sequences (215 bps) for most of the taxa. The region obtained from recent extractions is located at the 5' end.

Parsimony analyses were performed on PAUP* (Swofford, 2001) with a tree bisection-reconnection (TBR) branch swapping heuristic search employing stepwise-addition with non-additive multistate characters and 1000 random replications. *Thecophora* outgroup (*Thecophora australiana* Camras, JSS19823; *Thecophora distincta* Wiedemann, CNCD28471; *Thecophora bimaculata* Preysslner, CNCD28421) was designated to root all trees and polarize characters.

Parsimony analysis produced 168 equally parsimonious trees that were concatenated in a strict consensus (CI: 0.4664; HI: 0.5336; CI excluding uninformative characters: 0.4401; HI: excluding uninformative characters: 0.5599; RI: 0.5351; rescaled consistency index (RI): 0.2496) and a strict consensus parsimony tree was generated (Fig. 40).

Nonparametric bootstraps (BS – 1000 replicates) were used to assess clade supports.

The *Zodion americanum* complex (*Z. hirsialiae*, *Z. hitchensi*, *Z. harrisi*, *Z. pygmaeum*, *Z. nanellum*, and *Z. albifacies*) forms a distinct clade with BS support of 98%. *Zodion obliquefasciatum*, *Zodion lisafyrea*, and *Zodion californicum* form a clade supported by 71% BS, though these taxa form a tritomy. Many branch supports fall below 50% and are therefore not reported, with many taxa unresolved (Fig. 40).

A phenetic neighbour-joining tree (Fig. 41) was generated with PAUP* (Swofford, 2001) to explore species concepts. The neighbor-joining tree (Fig. 40) support species relationships hypothesized on the basis of genitalic dissections and morphology. Multi-specimen examples of *Z. cinereiventris*, and *Z. intermedium* cluster, thus supporting morphology-based concepts. The *Zodion americanum* complex also show similar

grouping which includes many novel species such as *Z. harrisi*, *Z. hirsialiae*, and *Z. hitchensi*. The topology of the neighbor-joining tree and the parsimony tree are congruent. However, poor BS supports with a number of taxa unresolved is likely caused by the lack of molecular data used in the analysis. Full COI sequences, and possibly even multigene data combined with a comprehensive morphological character matrix would provide greater confidence in the resolution of species and relationships within the genus.

4. Chapter 4: Conclusion and Future Work: A Preliminary assessment of additional

Nearctic genera

4.1

MYOPA

Class **Insecta** Linnaeus, 1758

Order **Diptera** Linnaeus, 1758

Family **Conopidae** Latreille, 1802

Subfamily **Myopinae** Macquart, 1834

Tribe **Myopini** Macquart, 1834

Genus *Myopa* Fabricius, 1775

Myopa is a robust genus, with strong defining characters. However, some species are very difficult to differentiate due to wide variation within species and the possibility of intermediates between species (Camras, 1953). For example, specimens of *Myopa curticornis* Kröber from Utah are on average smaller than those from California.

Additionally, the r_{4+5} cell appears closed (Fig. 4 B) more often in the Utah specimens.

Many of the species of this genus are difficult to key out due to cryptic characters and ill-defined variation. In most cases Camras (1953) asserted that there were many intermediates and wide variation, but never elaborated on exactly what character was variable or how it varied.

Banks (1916) completed a very serviceable key and provided many decent descriptions of old and new species. Camras (1953) provided a very thorough revision with updated descriptions with an updated key. He also attempted to discern male genital characters to

differentiate species. He found this difficult, though he admits to being a “first-timer” at dissecting genitalia and may have overlooked important but subtle features. Camras attempted to place species into two categories: Primitive and Specialized. I have applied this interesting approach in revising the large genus *Zodion* to make it more manageable. Camras (1953) also created the *Myopa curticornis*-complex, involving four species (*M. curticornis*, *M. rubida*, *M. clausa*, and *M. perplexa*). These species are easily recognizable and differentiate themselves from other more brightly coloured species. Currently there are 15 recognized species in the Nearctic region, though early assessments of male genitalia and some exterior morphology indicate that this number may increase to about 17-18 species.

4.2 General diagnosis of genera

Myopa is a fairly robust genus of fly, appearing rather wide and plump when viewed dorsally. When viewing the face laterally, the eye of *Myopa* appears reduced relative to the over all head thus distinguishing it from all other Conopid genera, and the facial profile is quite distinct with its upper carina protruding (Fig. 5 B). Their colouration varies from black to light brown, tan, reddish, with few species with distinct markings. They tend to be somewhat hairy. The sub-costa (sc_1) cell is absent. The arista point of insertion is well before the apex or at the dorsal mid-length of flagellum (Fig. 5 K). The scape is not elongated and skinny, but reduced (Fig. 5 B), smaller than the flagellum. The area of the gena below the eye is about half the area of the eye or greater when viewed laterally (Fig. 5 B). The frontal suture is not strongly pronounced or protruding (Fig. 5 B). There are three ocelli present. The proboscis has a single basal bend and a second bend about half the length (Fig. 5 B), pointing up or forward and then downward. There are

distinct ctenidia (2-5) appearing distally along the ventrolateral margins (inner and outer) of the femora like in *Robertsonomyia* sp. (Fig. 17 A-C). The second tergite is not overly constricted compared to the third (Fig. 6 B).

4.3

PHYSOCEPHALA

Class **Insecta Linnaeus, 1758**

Order **Diptera Linnaeus, 1758**

Family **Conopidae Latreille, 1802**

Subfamily **Conopinae Latreille, 1802**

Tribe **Physocephalini Smith and Petersen, 1987**

Genus ***Physocephala* Schiner, 1861**

Physocephala is an easily identifiable genus, though notably similar to *Physoconops*. The North American fauna can be distinguished by the total lack of ocelli (often only a remnant dent, or impression remains). The genus also lacks a lateral thoracic microtomentuous stripe, which is fairly common in *Physoconops*.

A little is known about the biology and habits of some of the species. In his study of Hymenoptera: Megachilidae, Davidson (1895) discovered a specimen of *Physocephala texana* Williston in one of the underground cells of *Anthidium emarginatum* Say, strongly suggestive of a parasitic association with this species. Frison (1922) gathered seemingly parasitized bumblebees and found typical conopid larvae, and in one instance discovered a puparium that appeared very close to *Physocephala sagittaria* Say. More recently extensive parasitism work by Malfi et al. (2014) show that *Physocephala tibialis* Say is

able to induce self-burial behaviour in a number of bumblebee species (*Bombus bimaculatus* Cresson, *Bombus griseocollis* DeGeer, and *Bombus impatiens* Cresson).

Gibson et al. (2014) has also shown that *P. tibialis* induces self-burial in *B. impatiens*, and has recorded the eclosion behaviour specifically highlighting the use of the ptilinum, legs, and mouthparts in the process.

Van Duzee (1934) provided a good regional overview of Conopidae with some emphasis on descriptions of new *Physocephala* species, a fairly inclusive key with some illustrations, and three host records. William W. Baker (Washington) (Van Duzee, 1934) managed to rear three species from unspecified “honey bees.”

Camras (1957) completed a very thorough revision of New World *Physocephala* with an inclusive key to species based on accumulated material from extensive field collecting work by R.C. Shannon. Aside from his reasonably in depth description of the new species *Physocephala floridanus* Camras (Fig. 7 A), most of the descriptions are wanting and provide little more than varied diagnostic mentions. Currently there are 8 recognized species of *Physocephala* in the Nearctic region.

4.4 General diagnosis of genera

Physocephala appears very similar to *Physoconops* in that they are rather elongate, with a basally pinched abdomen that is somewhat bulbous distally; the second tergite is obviously constricted compared to third (Fig. 6 F). The female genitalia are most distinct laterally with a large and exaggerated, fang-like ventral genital plate which directly opposes an elongate syntergosternite 7 (Fig. 7 A). There is a spurious M_1 vein or a faint crease, with the presence of a sub-costa (sc_1) cell. The antennal style is at the apex of the flagellum (Fig. 5 J). The frontal suture is not strongly pronounced or protruding (Fig. 5

F). The scape is elongated and skinny, and about as long as the flagellum. The ocelli are completely absent, though there often appears to be a slight indentation where ocelli would normally be. The area of the gena below the eye is much less than half the area of the eye when viewed laterally (Fig. 5 F). The proboscis has a single basal bend (Fig. 5 F), pointing up or forward.

4.5 Key to species of Nearctic *Physocephala*

- 1 Frontal vitta about ocellar triangle light yellow; same as brightest area on face
... 4
- Frontal vitta about ocellar triangle darker (black or brown), contrasting with face
... 2
- 2 No pubescence present dorsally on anterior mesonotum ... 6
- Pubescence present dorsally on anterior mesonotum (golden or silver) ... 3
- 3 Anterior mesonotum pubescence does not extend to margins; antennal grooves entirely yellow; back of head with bare patch ... ***P. furcillata* Williston**
- Anterior mesonotum pubescence extends to margins; antennal grooves black or variable; back of head with bare patch or variable ... 4
- 4 Anterior mesonotum pubescence extends to margins; three median dorsal stripes, black on brown; lateral pubescence extends from mesocoxa to katepisternum; antennal grooves entirely yellow ... ***P. texana* Williston**
- Anterior mesonotum pubescence may or may not extend to margins; stripe maculation absent; may or may not have pubescence extending from the mesocoxa to katepisternum; antennal grooves may be variable ... 5

- 5 Ocellar triangle brownish with blackish margins; thorax without maculation; lateral pubescence extends from mesocoxa to katepisternum; central facial grooves entirely black . . . ***P. marginata* Say**
- Ocellar triangle yellow with blackish margins; thorax without maculation; pubescence absent from katepisternum; antennal grooves darkish brownish black with a lighter-coloured median crest . . . ***P. sagittaria* Say**
- 6 Thorax matte black or dark brown, patchy, darker species; wing cloudiness extends beyond the discal-medial cubital crossvein; antennal grooves entirely black . . . ***P. tibialis* Say**
- Thorax with distinct black maculation on lighter brown; wing cloudiness may or may not extend beyond the discal-medial cubital crossvein; antennal grooves entirely yellow, or black with lighter crest . . . 7
- 7 Thorax with median stripe (sometimes 3) with pubescence on anterior mesonotum; costal and subcostal cells of wing clear; antennal grooves entirely light (yellow) . . . ***P. texana* Williston**
- Thorax with median stripe (sometimes 3) without pubescence on anterior mesonotum; cells with cloudiness complete; antennal grooves entirely light (yellow), or black with lighter (yellow) central crest . . . 8
- 8 Larger, dark species, with median black stripe, with a broken stripe on either side; antennal grooves black with a lighter (dark brown-yellow) crest; pubescence present on coxae . . . ***P. floridana* Camras**

- Medium, rufous species, with median black stripe (sometimes 3) not broken on either side of median stripe; antennal grooves completely yellow; bare spot at occiput; pubescence absent from coxae . . . *P. burgessi* Williston

4.6

PHYSOCONOPSClass **Insecta** Linnaeus, 1758Order **Diptera** Linnaeus, 1758Family **Conopidae** Latreille, 1802Genus ***Physoconops*** Szilady, 1926Subgenera ***Physoconops***, Szilady, 1926***Pachyconops***, ***Gyroconops*** Camras, 1955

North American *Physoconops* (Fig. 7 B) is a large and very diverse genus with strong diagnostic characters for the genus itself, and for most of the species. It is a widespread genus with species found in a variety of habitats, and some species with cosmopolitan ranges. Unfortunately very little work has been focused on this colourful group compared to other North American genera like *Physocephala*, *Zodion*, and *Myopa*. Much of the focus has been on the Afrotropical and Neotropical fauna. Work on the Nearctic *Physoconops* has been undertaken by Sid Camras (1963) with his notes on New World Conopidae, though this is terribly incomplete, with the mention of only two species, neither of which is from the Northern region. Camras included six species in a key with sparse diagnostic descriptions in his review of Conopidae of California (1957). He described a new species (*Physoconops weemsi* Camras) from the southeastern United

States (Camras, 2007) with a short key to three closely related species. His major contribution to the classification and taxonomy of *Physoconops* has been the establishment of the Subgenera: *Physoconops*, *Pachyconops*, and *Gyroconops* (Camras, 1955). The Subgenera have been retained. Currently there are 14 recognized species of *Physoconops* in the Nearctic region, though early assessments of the male genitalia indicate that there may be 3-4 novel species yet to be described.

4.7 General diagnosis of genus

Physoconops appears very similar to *Physocephala* in that they are elongated, with a sharply pinched abdomen basally, that is quite bulbous distally; the second tergite is extremely constricted compared to the third (Fig. 6 G). The female genitalia is most distinct laterally with a large and exaggerated, fang-like ventral genital plate which directly opposes an elongate syntergosternite 7 (Fig. 7 B). There is a spurious M_1 vein or a faint crease, with the presence of a sub-costa (sc_1) cell. The antennal style is at the apex of the flagellum (Fig. 5 J). The frontal suture is strongly pronounced or protruding (Fig. 5 H). The scape is elongated and skinny, and about as long as the flagellum (Fig. 5 H). There are two ocelli present at most, though greatly reduced, with strong tubercle. The area of the gena below the eye is much less than half the area of the eye when viewed laterally (Fig. 5 H). The proboscis has a single basal bend (Fig. 5 H), pointing up or forward.

4.8

THECOPHORAClass **Insecta** Linnaeus, 1758Order **Diptera** Linnaeus, 1758Family **Conopidae** Latreille, 1802Subfamily **Myopinae** Macquart, 1834Tribe **Myopini** Macquart, 1834Genus *Thecophora* Rondani, 1845**Invalid Genera (synonyms)***Occemyia* Robineau-Desvoidy, 1853*Oncomyia* Loew, 1866*Occemya* Curran, 1934

This unusual genus has had a troubled taxonomic and systematic history. The North American species vary only slightly and much of this variation appears to overlap with other species. Developing strongly defined species concepts has therefore proven difficult. At least three additional designations have been erected and consequently synonymized back to *Thecophora* Rondani - *Occemyia* Robineau-Desvoidy, *Oncomyia* Loew, and *Occemya* Curran. Camras (1945) revised the group under *Occemyia*, and constituted the first strong effort to make sense of the group. Unfortunately his concepts were largely based on highly variable and ultimately meaningless leg colour and leg colour patterns. In short, species-defining characters are wanting in this group. Until now no one has dissected genitalia or conducted a phylogenetic analysis. This approach has

proven useful in refining concepts in other groups and the development of keys.

Currently there are approximately 8-10 species of *Thecophora* in the Nearctic region based on early assessments of COI data and genitalic dissections of males.

4.9 General diagnosis of genus

Thecophora is a rather distinctive genus of Conopidae, easily characterized by their black bodies and small size and abdominal shape. The sub-costa (sc_1) wing cell is absent. The arista point of insertion is well before the apex or at dorsal mid-length of the flagellum (Fig. 5 I). The scape is not elongated and skinny, but reduced (Fig. 5 C), smaller than flagellum. There are three ocelli present. The frontal suture is not strongly pronounced or protruding (Fig. 5 C). The area of the gena below the eye is about half the area of the eye or greater when viewed laterally (Fig. 5 C). The proboscis has a single basal bend and a second bend at about half the length (Fig. 5 C), pointing up or forward and then downward. Ctenidia (2-5) appears distally along the ventrolateral margins (inner and outer) of the femora just as in *Robertsonomyia* (Fig. 17 A-C). The second tergite is not overly constricted compared to the third and is always black or brownish black (Fig. 6 E).

4.10 Conclusion and Future Work

Over the course of this revision we have gathered a considerable amount of molecular data that we intended to use in robust Parsimony and Bayesian analyses in hopes of providing additional support to the species concepts outlined above. Unfortunately many of the sequences were rather short (215 bps) vastly reducing confidence in this layer of data. Genitalic dissections and exterior morphology provided the foundation of species concepts. Molecular data provided only a thin layer of additional support and helped direct hypotheses surrounding historically difficult taxa.

Much work has been completed on *Physocephala*. Genitalic dissections and exhaustive examination of exterior morphology combined with some analyses with full sequences of COI have provided a framework for the refinement of Sid Camras's species concepts. New dichotomous and matrix keys have been written and illustrated and redcriptions are nearly complete. The review of this genus with robust concepts should prevent many common misidentifications in the future.

The male genitalia of every Nearctic *Physoconops* has been dissected and analysed, revealing that there are roughly 3-5 new species. A new key has been generated. Illustrations are needed to round out the treatment, combined with a molecular assessment.

Males of *Myopa* have been dissected and analysed. There appears to be very little variation in the genitalia, even between species. The exterior morphological characters reveal that there may be at least 2-3 new species normally identified as *M. curticornis*, or *M. rubida*. The concept for *M. pleibia* may be in question, as it appears to be a minor variant of *M. curticornis*. However, few specimens exist, making any assessment of character variation quite weak. Molecular data will be valuable in directing species concepts and thus elucidate stronger morphological distinctions between species. An early draft of a new key has been completed but is under refinement as new species are detected.

Thecophora is a very cryptic genus, with few morphological characters to diagnose species. Recent molecular data and genitalic dissections have helped develop species concepts, but further work needs to be focused on exterior morphology. Establishing exterior morphological differences is paramount in the development of a dichotomous

key. Most of the type specimens have been examined and the non-type genitalic dissections have yielded promising characters such as the shape and length of the surstyli. These characters combined with a building COI dataset will help define species and the group as a whole. At this stage it is too early to develop a new key. Early assessment of the genus suggests there are about 8-10 species in the Nearctic region.

References

- Adams, C. F. 1903. Dipterological contributions. Kansas University Science Bulletin, 2, 21-47.
- Aldrich, J.M. 1930. American two-winged flies of the genus *Stylogaster* Macquart. Proceedings of the United States National Museum, 78: 1–27.
- Banks, N. 1912. At the Ceanothus in Virginia. Entomology News and the Proceedings of the Entomological Section of the Academy of Natural Sciences of Philadelphia, 23: 1–484.
- Banks, N. 1916. Synopses of *Zodion* and *Myopa* with notes on other Conopidae. Annals of the Entomological Society of America, 9,191-200.
- Bates, H.W. 1863. The Naturalist on the River Amazon. London: Publisher. J. Murray, 2:vi+423.
- Bequaert, J. 1922. The predaceous enemies of ants. Bulletin of the American Museum of Natural History, 45: 271–332.
- Bigot, J. 1887. Dipteres nouveaux ou peu connus. 31e partie. XL. Descriptions de nouvelles especes de Myopidi. Annates de la Societe Entomologique de France, Paris, 7, 203-208.
- Bohart, G. E. 1938. Synopsis of the genus *Dalmannia* in North America (Diptera, Conopidae). The Pan-Pacific Entomologist, 14,132-136.
- Bohart, G.E. & MacSwain, J.W. (1939) The life history of the sand wasp, *Bembix occidentalis buetenmuelleri* Fox and its parasites. Bulletin of the Southern California Academy of Sciences(2)38: 84-97.
- Bohart, G.E. & MacSwain, J.W. 1940. A record of *Physocephala affinis* Williston as a

- parasite of adult *Bembix comata* Parker. Pan-Pacific Entomologist(1)16: 1-16.
- Bohart, G. E. 1941. A review of the genus *Physocephala* of the western United States. The Pan Pacific Entomologist, 17,141-144.
- Britton, W.E. 1920. Check-list of the insects of Connecticut. Bulletin of the Connecticut State Geological and Natural History Survey, 31: 1–397.
- Burt, T.O., Rocha, L.S.G. & Skevington, J.H. 2015. Revision of Nearctic *Stylogaster* (Diptera: Conopidae). The Canadian Entomologist 147: 125-147.
- Burt, T.O., Rocha, L.S.G., Dawson, J. & Skevington, J.H. 2016. A new stab at *Stylogaster* (Diptera: Conopidae) oviposition (in prep.).
- Burt, T.O. & Skevington, J.H. 2015. Description of multi-specimen Myopinae (Diptera: Conopidae) fossil from Oligo/Miocene Dominican amber. Insect Science (In prep.).
- Camras, S. 1943. Notes on the North American species of the *Zodion* *Obliquefasciatum* group (Diptera: Conopidae). Entomological News, 54,187- 191.
- Camras, S. 1944. Notes on the North American species of the *Zodion* *fulvifrons* group (Diptera, Conopidae). The Pan-Pacific Entomologist, 20,121-128.
- Camras, S. 1945. Further notes on some species of *Zodion* (Diptera, Conopidae). Pan-Pacific Entomologist, 21, 31.
- Camras, S. 1945. A study of the genus *Occemyia* in North America (Diptera: Conopidae). Annals of the Entomological Society of America, 38, 216-222.
- Camras, S. 1953. Notes on Neotropical *Zodion* and *Parazodion* (Diptera: Conopidae). Annals and Magazine of Natural History, 6, 395-399.
- Camras, S. 1953. A Review of the Genus *Myopa* in North America (Diptera:

- Conopidae). The Wasmann Journal of Biology, 11,97-114.
- Camras, S. 1954. A new species of *Zodion* from California (Diptera: Conopidae). The Pan-Pacific Entomologist, 30,165-166.
- Camras, S. 1955. New Conopidae from South America, Africa, and Australia (Diptera). Entomological News, 66,119-125.
- Camras, S. 1955. A review of the New World flies of the genus *Conops* and allies (Diptera: Conopidae). Proceedings of the United States National Museum, 105, 155-187.
- Camras, S. 1957. Descriptions and records of Neotropical Conopidae (Diptera). Psyche, 64, 9-16.
- Camras, S. 1957. On some Conopidae (Dipt.) from Ceylon. Verhandlungen der Naturforschenden Gesellschaft in Basel, 68, 68-71.
- Camras, S. 1957. On some Conopidae (Dipt.) from Flores and Sumba. Verhandlungen der Naturforschenden Gesellschaft in Basel, 68,160-164.
- Camras, S. 1957. On some Conopidae from the East Indies (Diptera). Treubia, 24, 107-117.
- Camras, S. 1957. A review of the New World Physocephala (Diptera: Conopidae). Annals of the Entomological Society of America, 50, 213-218.
- Camras, S. 1960. Flies of the family Conopidae from eastern Asia. Proceedings of the United States National Museum, 112,107-131.
- Camras, S. 1961. Notes on Australian flies of the family Conopidae. Proceedings of the United States National Museum, 113, 61-76.
- Camras, S. 1962. The Conopidae of Madagascar (Diptera). Memoires de l'Institut

- Scientifique de Madagascar, (E) 13,179-187.
- Camras, S. 1962. Records and descriptions of African Conopidae (Diptera). *Revue de Zoologie et de Botanique Africaines*, 66, 203-242.
- Camras, S. 1963. Notes on some New World Conopidae (Diptera). *Annals of the Entomological Society of America*, 56, 824-826.
- Camras, S. 1965. Family Conopidae. In: A. Stone, C. W. Sabrosky, W. W. Wirth, R.
- Camras, S. 1994. A new subfamily for the fossil conopid fly, *Palaeomyopa tertiaria* (Diptera: Conopidae). *Entomological News*, 105,175-177.
- Camras, S. & Parrillo, P. P. 1995. New *Stylogaster* and ranges of Conopidae (Diptera) from the Brazilian and Bolivian Amazonia. *Acta Amazonica*, 25, 221- 234.
- Camras, S. 2007. A new conopid fly from Florida and Georgia (Diptera: Conopidae). *Insecta Mundi*, 0007,1-4.
- Clements, D. 1997. Diptera: Conopidae – World checklist and key words (a catalogue). in draft form – unpublished.
- Cole, F.R. & Lovett, A.L. 1921. An annotated list of the Diptera (Flies) of Oregon. *Proceedings of the California Academy of Sciences*, 11(15), 197-344.
- Couri, M.S. and Pont, A.C. 2006. Eggs of *Stylogaster* Macquart (Diptera: Conopidae) on Madagascan muscids (Diptera: Muscidae). *Proceedings of the California Academy of Sciences*, 57: 473–478.
- Couri, M.S. and Silva Barros, G.P.d. 2010. Diptera hosts of *Stylogaster* Macquart (Diptera, Conopidae) from Madagascar and South Africa. *Revista Brasileira de Entomologia*, 54: 361–366.
- Coquillett, D. W. 1892. A new *Dalmannia* from California. *Entomological News*, 3,

150-151.

Coquillett, D.W. 1902. New cyclorhaphous Diptera from Mexico and New Mexico. The Canadian Entomologist 34: 195-202.

Cresson, E.T. Jr. 1919. Dipterological notes and descriptions. Journal of the Academy of Science 71: 171-194.

Cumming, J. M. & Wood, D. M. 2009. Adult morphology and terminology. In: B. V. Brown, A. Borkent, J. M. Cumming, D. M. Wood, N. E. Woodley & M. Zumbado (Eds), Manual of Central American Diptera. NRC Research Press, Ottawa.

Curran, C. H. 1942. American Diptera. Bulletin of the American Museum of Natural History, 80,51-84.

Davidson, A. 1895. The Habits of Californian Bees and Wasps. Entomological News 6: 252-253.

Fabricius, J. C. 1775. Systema Entomologiae Sistens Insectorum Classes, Ordines, Genera, Species, Adiectis Synonymis, Locis, Descriptionibus, Observationibus. Flensburgi et Lipsiae [=Flensburg and Leipzig]: Kortii.

Fabricius, J. C. 1782. Species insectorum exhibentes eorum differentias specificas, synonyma, auctorum loca natalia, metamorphosin adiectis observationibus descriptionibus. (Tome II). Hambvrgi et Kilonii [=Hamburg and Cologne]: C.E. Bohnii.

Foote & J. R. Coulson (Eds), A Catalog of the Diptera of America north of Mexico. United State Department of Agriculture, Agricultural Research Service, Washinton, D.C., pp. 625-632.

Freeman, B. A. 1966. Notes on conopid flies, including insect host, plant and phoretic

- relationships (Diptera: Conopidae). Journal of the Kansas Entomological Society, 39,123-131.
- Freeman, B.A. 1968. Status of *Zodion zebrinum*, *Z. auricaudatum*, and *Z. albonotatum* (Diptera: Conopidae). Annals of the Entomological Society of America(2)61: 276-278
- Frison, T.H. 1922. Notes on the life history, parasites and inquiline associates of *Anthophora abrupta* Say, with some comparisons with the habits of certain other Anthophorinae (Hymenoptera). Transactions of the American Entomological Society, Philadelphia (2)48: 137-156.
- Gibson, J.F., Skevington, J.H. & Kelso, S. 2010. Placement of the Conopidae (Diptera) within the Schizophora based on ten mtDNA and nrDNA. Molecular Phylogenetics and Evolution 56: 91-103.
- Gibson, J.F., Kelso, S., Jackson, M.D., Kits, J.H., Miranda, J.F.G. & Skevington, J.H. 2011. Diptera-Specific Polymerase Chain Reaction Amplification Primers of Use in Molecular Phylogenetic Research. Annals of the Entomological Society of America. 104(5): 976-997.
- Gibson, J.F., Skevington, J.H. & Kelso, S. 2012. A phylogenetic analysis of relationships among genera of Conopidae (Diptera) based on molecular and morphological data. Cladistics 1: 1-34.
- Gibson, J.F. & Skevington, J.H. 2013. Phylogeny and taxonomic revision of all genera of Conopidae (Diptera) based on morphological data. Zoological Journal of the Linnean Society 167: 43-81.
- Gibson, J.F., Slatosky, A.D., Malfi, R.L., Rooulston, T., & Davis, S.E. 2014. Eclosion of

- Physocephala tibialis* (Say) (Diptera): Conopidae) from a Bombus (Apidae: Hymenoptera) host: A video record J. ent. Soc. Ont. Volume 145: 49-58.
- Girault, A.A. 1911. Notes on the Hymenoptera Chalcidoidea with the descriptions of several new genera and species. Journal of the New York Entomological Society 19: 1-179.
- Goloboff, P.A. 1999. Analyzing large data sets in reasonable times: solutions for composite optima. Cladistics 15(4): 415-428.
- Goloboff, P.A., Farris, S. & Nixon, K. 1999. Tree analysis using New Technology: What is TNT? <http://www.cladistics.com/aboutTNT.html>. & <http://www.lillo.org.ar/phylogeny/>.
- Graenicher, S. 1910. Some new and rare Diptera from Wisconsin. The Canadian Entomologist 42: 26-29.
- Greene, G.M. 1913. Secretarial report on Feldman collecting social. Entomology News and the Proceedings of the Entomological Section of the Academy of Natural Sciences of Philadelphia, 24: 45.
- Han, H. Y., & K. E. Ro. 2005. Molecular phylogeny of the superfamily Tephritoidea (Insecta: Diptera): new evidence from the mitochondrial 12S 16S, and COII genes. Molecular Phylogenetics and Evolution 34: 416-430.
- Hennig, W. 1973. 31. Diptera (two-winged flies). Handbuch der Zoologie. Eine Naturgeschichte der Stämme des Tierreiches, 4: 1-337.
- Jaenicke, J. F. 1867. Neue exotische Dipteren. *Abh. Senckenberg. Naturforsch. Ges.* 6: 311-407.
- Jiang, W., Chen, S-Y., Wang, H., Li, D-Z. & Wiens, J.J. 2014. Should genes with

- missing data be excluded from phylogenetic analyses? *Molecular Phylogenetics and Evolution* 80: 308-318.
- Johannsen, O.A. 1928. List of the insects of New York with a list of the spiders and certain other allied groups. *Memoirs. Cornell University Agricultural Experiment Station*, 101: 687–869.
- Johnson, C.W. 1910. Order Diptera. A report of the insects of New Jersey by J. B. Smith and others. *Annual Report New Jersey State Museum*, 1910: 703–814.
- Johnson, C.W. 1913. Insects of Florida. I. Diptera. *Bulletin of the American Museum of Natural History*, 32: 37–90.
- Johnson, C.W. 1925. *Fauna of New England*. 15. List of the Diptera or two-winged flies. *Occasional Papers of the Boston Society of Natural History*, 7: 1–326.
- Jones, P.R. 1907. A preliminary list of the Conopidae of Nebraska. *The Canadian Entomologist*, 39: 250–251.
- Kotrba, M. 1997. Shoot or stab? Morphological evidence on the unresolved oviposition technique in *Stylogaster Macquart* (Diptera: Conopidae), including discussion of behavioral observations. *Proceedings of the Entomological Society of Washington*, 99, 614-622.
- Kröber, O. 1914. Das Genus *Stylogaster* Macqu. (Dipt.). *Entomologische Mitteilungen*, 3: 338–353.
- Kröber, O. 1915. Die Gattung *Zodion* Latr. *Archiv für Naturgeschichte*, (A) 81 (4), 84-117.
- Kröber, O. 1925. 35. Conopidae. In: Lindner (Ed), *Die Fliegen der palaearktischen Region*, Stuttgart, pp. 1-48.

- Kröber, O. 1927. Beiträge zur Kenntnis der Conopidae. *Konowia*, 6, 122-143.
- Kröber, O. 1927. Die Conopiden der Philippinen. *The Philippine Journal of Science*, n34, 331-348.
- Kröber, O. 1928. Neue Dipteren des Deutschen Entomologischen Museums in Dahlem (Conopidae, Omphralidae, Therevidae, Tabanidae). *Entomologische Mitteilungen*, 17, 31-41.
- Kröber, O. 1928. Neue und wenig bekannte Dipteren aus den Familien Omphralidae, Conopidae und Therevidae. *Konowia*, 7, 1-23.
- Kröber, O. 1928. Neue und wenig bekannte Dipteren aus den Familien Omphralidae, Conopidae und Therevidae* [part 2]. *Konowia*, 7, 113-134.
- Kröber, O. 1929. Neue Dipteren aus Ägypten aus den Familien Tabanidae, Therevidae, Omphralidae u. Conopidae. *Bulletin de la Société Royale Entomologique d'Égypte*, 13, 73-84.
- Kröber, O. 1929. Die Ausbeute der Deutschen Chaco-Expedition 1925/26 (Diptera). *Konowia*, 8, 170-193, + 172 pl.
- Kröber, O. 1930. Familie Conopidae (Blasenkopffliegen). *Tierwelt Deutschlands*, 20, 119-142.
- Kröber, O. 1932. Zwei neue Dipteren aus Palästina. *Stettiner Entomologische Zeitung*, 93, 302-303.
- Kröber, O. 1933. Nachträge zu meiner Arbeit: Die Conopidae Südafrikas in *Annals of the Transvaal Museum XIV Part II*. 1931. *Konowia*, 12, 272-288.
- Kröber, O. 1937. Neue Beiträge zur Kenntnis der Conopidae (Diptera). *Stettiner Entomologische Zeitung*, 98, 96-100.

- Latreille, P. A. 1797. *Precis des caracteres generiques des Insectes*, disposes dans un ordre naturel. Paris: Prevot.
- Latreille, P. A. 1802. *Histoire naturelle, generale et particuliere des crustaces et des insectes: ouvrage faisant suite aux oeuvres de Leclerc de Buffon, et partie du cours complet d'histoire naturelle redige par C. S. Sonnini/par P. A. Latreille*. (Vol. Tome 3). Paris: F. Dufart.
- Linnaeus, C. 1758. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis, Locis* (Editio Decima, Reformata ed. Vol. Tomus 1). Holmiae (= Stockholm): L. Salvii.
- Leonard, M.D. 1928. *A list of insects of New York*. Cornell University Agricultural Experiment Station, Ithaca, New York, United States of America.
Pp. 1–1121
- Loew, H. 1866. *Diptera Americae septentrionalis indigena. Centuria septima*. Berliner Entomologische Zeitschrift, 10,1-54.
- Lopes, H. d. S. 1937. *Contribuicao ao conhecimento do genero "Stylogaster" Macquart*. 1835, (Dipt. Conopidae) Archivos do Instituto de Biologia Vegetal. Rio de Janeiro, 3, 257-293.
- Macquart. 1843. *Diptères exotiques nouveaux ou peu connus*. [Ier] Suplément. Mémoires de la Société royale des Sciences, de l'Agriculture et des Arts, Lille, 1844: 133–364.
- Macquart, J. 1846. *Dipteres exotiques nouveaux ou peu connus. Supplement*. [1]. Mémoires de la Societe (Royale) des Sciences, de l'Agriculture et des Arts a Lille, 1844,133-364.

- Maddison, W.P. and Maddison, D.R. 2011. Mesquite: a modular system for evolutionary analysis. Version 2.75 [online]. Available from <http://mesquiteproject.org> [accessed 10 May 2014].
- Malfi, R.L., Davis, S.E., & Roulston, T.H. 2014. Parasitoid fly induces manipulative grave-digging behaviour differentially across its bumblebee hosts. *Animal Behaviour* 92: 213-230.
- Malfi, R.L. & Roulston, T.H. 2014. Patterns of parasite infection in bumble bees (*Bombus* spp.) of Northern Virginia. *Ecological Entomology* 39: 17-19.
- Malloch, J.R. 1919. The generic status of *Zodion palpalis* Robertson (Diptera, Conopidae) with generic key to the family. *Proceedings of the Entomological Society of Washington* 21(9): 204-205.
- Marshall, S. A. 2012. Flies: The natural history and diversity of Diptera. Firefly Press. September 2012. 616pp.
- Mawdsley, J.R. 1993. The entomological collection of Thomas Say. *Psyche* 100:163-171.
- Mei, M, Gibson, J.F. & Skevington, J.H. 2008. Observation on hilltopping in the Conopidae (Diptera). *Journal of Insect Science*, 27,1-15.
- Meunier, F. 1899. Sur les Conopaires de l'ambre tertiaire [Dipt.]. *Bulletin de la Societe entomologique de France*, 1899,145-146.
- Meunier, F. 1912. Coup d'oeil retrospectif sur les Dipteres du succin de la Baltique. *Annates de la Societe Scientifique de Bruxelles*, 35,160-186.
- Meunier, F. 1916. Sur quelques dipteres (Bombylidae, Leptidae, Dolichopodidae,

- Conopidae et Chironomidae) de l'ambre de la Baltique. *Tijdschrift voor Entomologie*, 59, 274-286.
- Miller, M.A., Pfeiffer, W., and Schwartz, T. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. In *Proceedings of the Gateway computing environments workshop (GCE)*. 14 November 2010, New Orleans, LA, Association for Computing Machinery, Institute of Electrical and Electronics Engineers (IEEE), New York, New York, United States of America. Pp. 1–8.
- Osten Sacken, C.R. 1878. Catalogue of the described Diptera of North America. In *Smithsonian Miscellaneous Collections*. Volume 16, 2nd edition. Smithsonian Institute, Washington, DC, United States of America. Pp. 1–276.
- Papavero, N. 1971. Family Conopidae. In *A catalogue of the Diptera of the Americas south of the United States*. Edited by N. Papavero. Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil. Pp. 1–28.
- Parsons, C. T. 1948. A classification of North American Conopidae. *Annals of the Entomological Society of America*, 41, 223-246.
- Peck, O. 1951. Hymenoptera of America North of Mexico. U.S.D.A. Agr. Monograph No. 2. 1420 p.
- Posada, D. and Crandall, K.A. 1998. MODELTEST: testing the model of DNA substitution. *Bioinformatics Applications Note*, 14: 817–818.
- Rettenmeyer, C. W. 1961. Observations on the biology and taxonomy of flies found over swarm raids of army ants. (Diptera: Tachinidae, Conopidae). *The University of Kansas Science Bulletin*, 42, 993-1066.
- Robertson, C. 1901. Some new Diptera. *The Canadian Entomologist* 33: 284-286.

- Robineau-Desvoidy, J. B. 1830. Essai sur les Myodaires. Memoires Presentes par Divers Savants a l'Academie des Sciences de l'Institut de France, 2, 1-813.
- Robineau-Desvoidy, J. B. 1853. Dipteres des environs de Paris. Famine des myopaires. Bulletin de la Societe d'Histoire Naturelle de L'Yonne, 7, 83-160.
- Rocha, L.S.G., Burt, T.O., de Mello-Patiu, C.A. & Skevington, J.H. 2015. The first *Stylogaster* Macquart, 1835 (Diptera: Conopidae) fossil, from Oligo-Miocene Dominican amber, and some phylogenetic and biogeographic considerations. Fossil Record 18: 119-125.
- Röder, V.V. 1892. Ueber die Dipteren-Gattung Stylogster Mcq. Wiener Entomologische Zeitung, 11: 286–288.
- Rondani, C. 1845. Sulle differenze sessuali delle Conopinae e Myopinae negli insetti ditteri. Memoria undecima per servire alia ditteologia italiana. Nuovi Annali delle Scienze Naturali. Bologna, 3, 5-16.
- Ronquist, F. and Huelsenbeck, J.P. 2003. MrBayes 3: Bayesian phylogenetic inference under mixed models. Bioinformatics Applications Note, 19: 1572–1574.
- Say, T. 1823. Descriptions of dipterous insects. Academy of Natural Sciences of Philadelphia, 3: 73–104.
- Schiner, I.R. 1861. Vorläufiger Commentar zum dipterologischen Theile der "Fauna austriaca" III. Wiener Entomologische Monatschrift, 5, 137-144.
- Severin, H. C. 1937. *Zodion fulvifrons* Say (Diptera: Conopidae), a parasite of the honey bee. Entomological News, 48, 243-244.
- Shorthouse, David P. 2010. SimpleMappr, an online tool to produce publication-quality point maps; <http://www.simplemappr.net/>.

- Skevington, J. H., Thompson, F. C. & Camras, S. 2010. Conopidae (Thick-Headed Flies). In: B. V. Brown, A. Borkent, J. M. Cumming, D. M. Wood, N. E. Woodley & M. Zumbado (Eds) 1981. Manual of Central American Diptera. NRC Press, Ottawa, p. 847-855.
- Skevington, J.H. and Thompson, F.C. 2012. Review of New World Sericomyia (Diptera: Syrphidae), including description of a new species. The Canadian Entomologist, 144: 216–247.
- Smith, K. G. V. 1966a. The larva of Thecophora occidensis, with comments upon the biology of Conopidae (Diptera). Journal of Zoology, London, 149, 263-276.
- Smith, K.G.V. 1966b. A new species of Stylogaster Macquart, 1835 (Diptera: Conopidae, Stylogasterinae) from New Guinea. Proceedings of the Royal Entomological Society of London (B), 35, 7-8.
- Smith, K. G. V. 1967a. The biology and taxonomy of the genus Stylogaster Macquart, 1835 (Diptera: Conopidae, Stylogasterinae) in the Ethiopian and Malagasy regions. Transactions of the Royal Entomological Society of London, 119, 47-69.
- Smith, K. G. V. 1967b. Diptera (Brachycera): Conopidae. In: B. Hanstrom, P. Brinck & G. Rudebeck (Eds), South African Animal Life, Results of the Lund Expedition in 1950-1951. Swedish Natural Science Research Council, Lund, Sweden, pp. 284-287.
- Smith, K. G. V. 1969. Diptera: Conopidae. In. Royal Entomological Society of London, London, pp. 1-19.
- Smith, K. G. V. & Cunningham-Van Someren, G. R. (1985) The larva of Stylogaster

- varifrons Malloch (Dipt., Stylogasteridae). Entomologist's Monthly Magazine, 121,81-85.
- Smith, K. G. V. 1959a. The Conopidae (Diptera) of British Columbia. Proceedings of the Entomological Society of British Columbia, 56, 54-56.
- Smith, K. G. V. 1959b. The distribution and habits of the British Conopidae (Dipt.). Transactions of the Society for British Entomology, 13,113-136.
- Smith, K. G. V. 1960 A new species of Pleurocerinella Brunetti (Dipt, Conopidae) from South Africa. The Entomologist's Monthly Magazine, 96,43-44.
- Smith, K. G. V. 1966. The larva of Thecophora occidentis, with comments upon the biology of Conopidae (Diptera). Journal of Zoology, London, 149, 263-276.
- Smith, K.G.V. 1966a A new species of Stylogaster Macquart, 1835 (Diptera: Conopidae, Stylogasterinae) from New Guinea. Proceedings of the Royal Entomological Society of London (B), 35, 7-8.
- Smith, K. G. V. 1967a. The biology and taxonomy of the genus Stylogaster Macquart, 1835 (Diptera: Conopidae, Stylogasterinae) in the Ethiopian and Malagasy regions. Transactions of the Royal Entomological Society of London, 119, 47-69.
- Smith, K. G. V. 1967b. Diptera (Brachycera): Conopidae. In: B. Hanstrom, P. Brinck & G. Rudebeck (Eds), South African Animal Life, Results of the Lund Expedition in 1950-1951. Swedish Natural Science Research Council, Lund, Sweden, pp. 284-287.
- Smith, K. G. V. 1969. Diptera: Conopidae. In. Royal Entomological Society of London, London, pp. 1-19.
- Smith, K. G. V. & Cunningham-Van Someren, G. R. 1970. The identity of

- Physocephala bimarginipennis* Karsch (Diptera, Conopidae) with notes on the immature stages and biology. *Journal of Natural History*, 4, 439-446.
- Smith, K. G. V. & Cunningham-Van Someren, G. R. 1985. The larva of *Stylogaster varifrons* Malloch (Dipt., Stylogasteridae). *Entomologist's Monthly Magazine*, 121, 81-85.
- Smith, K. G. V. & Peterson, B. V. 1987. Conopidae. In: J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth & D. M. Wood (Eds), *Manual of Nearctic Diptera*. Agriculture Canada Monograph No. 28, Research Branch, Agriculture Canada, Ottawa, pp. 749-756.
- Szilady, Z. 1926. Dipterenstudien. *Annales Musei Nationlis Hungarici*, 24, 586-593.
- Townsend, C.H.T. 1897. Diptera from the lower Rio Grande or Tamaulipan region of Texas. I. *Journal of the New York Entomological Society* 5: 171-178.
- Van Duzee, M. C. 1927. A contribution to our knowledge of the North American Conopidae (Diptera). *Proceedings of the California Academy of Sciences*, 16, 573-604.
- Van Duzee, M. C. 1934. Conopidae from North Dakota and the Rocky Mountain region. *Annals of the Entomological Society of America*, 27, 315-323.
- Walker, F. 1849. List of the specimens of dipterous insects in the collection of the British Museum. Part III. Printed by order of the Trustees [British Museum], London. 485-687 pp.
- Wiedemann, C.R.G. 1830. Meigens Systematische Beschreibung der bekannten Europäischen Zweiflügeligen Insekten 1770-1840. Aussereuropäische zweiflügelige Insekten (v1 or v2): 242.

- Wiegmann, B.M., Trautwein, M.D., Winkler, I.S., Barr, N.B., Kim, J-W., Lambkin, C., Bertone, M.A., Cassel, B.K., Bayless, K.M., Heimberg, A.M., Wheeler, B.M., Peterson, K.J., Pape, T., Sinclair, B.J., Skevington, J.H., Blagoderov, V., Caravas, J., Kutty, S.N., Schmidt-Ott, U., Kampmeier, G.E., Thompson, F.C., Grimaldi, D.A., Beckenbach, A.T., Courtney, G.W., Friedrich, M., Meier, R. & Yeates, D.K. 2011. Episodic radiations in the fly tree of life. 108(14): 5690-5695.
- Wiens, J.J. & Morrill, M.C. 2011. Missing data in pylogenetic analysis: Reconciling results from simulations and empirical data. *Systematic Biology* 60: 719-731.
- Williston, S. W. 1883. North American Conopidae: Stylogaster, Dalmannia, Oncomyia. *Transactions. Connecticut Academy of Arts and Sciences, New Haven*, 6,91-98.
- Williston, S.W. 1885. North American Conopidae: Conclusions. *Trans. Conn. Acad. Arts and Science* 6:381. New Haven: Published by the Academy 1882-1885. Morehouse & Taylor (Printers)
- Williston, S. W. 1892. Family Conopidae. In: F. D. Godman & O. Salvin (Eds), *Biologia Centrali Americana, Zoologia-Insecta-Diptera*, London, pp. 79-86.

Appendix

Checklist of currently recognized Nearctic Conopidae

Order: Diptera

Family: Conopidae

Subfamily: Conopinae

Genus: *Physocephala*

- Species: *P. burgessi* Williston, 1882
- P. floridana* Camras, 1957
- P. furcillata* Williston, 1882
- P. marginata* Say, 1823
- P. sagittaria* Say, 1923
- P. texana* Williston, 1882
- P. tibialis* Say, 1829

Genus: *Physoconops*

Subgenus: *Gyroconops*

- Species: *P. sylvosus* Williston, 1882

Subgenus: *Pachyconops*

- Species: *P. analis* Fabricius, 1805
- P. brachyrhynchus* Macquart, 1843
- P. bulbirostris* Loew, 1853
- P. excisus* Wiedemann, 1830
- P. floridanus* Camras, 1955
- P. fronto* Williston, 1885

P. gracilis Williston, 1885

P. pallifrons Coquillett, 1904

P. townsendi Camras, 1955

P. weemsi Camras, 2007

Subgenus: *Physoconops*

Species: *P. discalis* Williston, 1892

P. nigrimanus Bigot, 1887

P. obscuripennis Williston, 1882

Subfamily: Dalmanniinae

Genus: *Dalmannia*

Species: *D. blaisdelli* Cresson, 1919

D. heterotricha Bohart, 1938

D. nigriceps Loew, 1866

D. pacifica Banks, 1916

D. picta Williston, 1883

D. vitiosa Coquillett, 1892

Subfamily: Myopinae

Genus: *Myopa*

Species: *M. bohartorum* Camras, 1953

M. castenea Bigot, 1887

M. clausa Loew, 1866

M. curticornis Kröber, 1916

M. flavopilosa Kröber, 1916

M. longipillis Banks, 1916

M. melanderi Banks, 1916

M. perplexa Camras, 1953

M. plebeia Williston, 1885

M. rubida Bigot, 1887

M. varians Banks, 1916

M. vesiculosa Say, 1823

M. vicaria Walker, 1849

M. virginica Banks, 1916

M. willistoni Banks, 1916

Genus: *Thecophora*

Species: *T. abbreviata* Loew, 1866

T. longicornis Say, 1823

T. luteipes Camras, 1945

T. modesta Williston, 1883

T. nigra Van Duzee, 1927

T. nigripes Camras, 1945

T. occidentalis Walker, 1849

T. propinqua Adams, 1903

Subfamily: Zodioninae

Genus: *Robertsonomyia*

Species: *Z. palpalis* Robertson, 1901

Z. parva Adams, 1903

Genus: **Zodion**

Species: *Z. abitus* Adams, 1903

Z. albifacies Van Duzee, 1927

Z. alexanderi Burt and Skevington, 2015

Z. anale Kröber, 1915

Z. auricaudatum Williston, 1892

Z. bilineata Van Duzee, 1927

Z. californicum Camras, 1954

Z. cinereiventre Van Duzee, 1927

Z. caynescens Camras, 1943

Z. dawkinsi Burt and Skevington, 2015

Z. dillahuntyi Burt and Skevington, 2015

Z. fulvifrons Say, 1823

Z. harrisi Burt and Skevington, 2015

Z. hauseri Burt and Skevington, 2015

Z. hirsialiae Burt and Skevington, 2015

Z. hitchensi Burt and Skevington, 2015

Z. intermedium Banks, 1916

Z. kraussi Burt and Skevington, 2015

Z. lisafyrea Burt and Skevington, 2015

Z. meigeni Burt and Skevington, 2015

Z. nanellum, Loew, 1866

Z. nigrifrons Kröber, 1915

Z. obliquefasciatum Macquart, 1846

Z. oharai Burt and Skevington, 2015

Z. perlogum Williston, 1885

Z. pictulum Williston, 1885

Z. pygmaeum Williston, 1885

Z. reclusum Banks, 1916

Z. triste Bigot, 1887

Z. zebrinum Bigot, 1887

Subfamily: Stylogastrinae

Genus: *Stylogaster*

Species: *S. beresfordi* Burt, Skevington & Rocha,

2013

S. biannulata Say, 1823

S. neglecta Williston, 1883

Figure 1. A-C. Diagrams of *Zodion* head (right lateral, anterior, dorsal); D. Diagram of *Zodion perlongum* abdomen (female: right lateral).

abbrev. ag, antennal groove(s); ar, arista; clyp memb, clypeus membrane; comp eye, compound eye; fcc, facial carina; flg, flagellum; fr vit, frontal vitta; gn, gena; lbl, labellum; oc, ocelli; ocp, occiput; oc tr, ocellar triangle; pa fc, parafacia (parafacial); ped, pedicel; pgn, postgena; premnt, prementum; pt f, ptilium fissure; scp, scape; str m, sternal membrane; st-5, sternite-5; tg-1, tergite-1; syntg 8+9, syntegosternite 8+9; vrt, vertex.

A **B**

358

C **D** **E**

Figure 2. Generic diagrams of Conopidae. A. Thorax of *Zodion* (right lateral); B. Thorax of *Zodion* (dorsal); C. Leg; D. Tarsomeres; E. Tarsomere-5.

abbrev. a spr, anterior spiracle; anepm, anepimeron; anepst, anepisternum; bmac m, bare maculation medial stripe; bmac sm-1 (sm-2,3), bare maculation sub-medial stripe (paired); cb, center bristle; cerv scl, cervical sclerite; cx (1-3), coxa (front, mid, hind); fr, femur; ipal s, intrapostalar seta; ktg, katatergite; kepst, keposternum; kepm, katepimeron; l par sut, lateral parapsidal suture; llb, left-lateral bristle; mtg, mediotergite; mr, meron; mt, microtomentum; npl, notopleuron; pal cal, postallar callus; p bas, posterior basalare; pprn lb, postpronotal lobe; presct, prescutum; presct sut, prescutal suture; prst, prosternum; p spr, posterior spiracle; psut sct, postsutural scutum; p spr, posterior spiracle; pv, pulvilli; rlb, right-lateral bristle; sbal scl, subalar sclerite; sctl, scutellum; tb, tibia; tm-1, tarsomere-1; tms, tarsomeres (1-5); trn sut, transverse suture; ts, tarsus.

Figure 3. A-B. Abdomen of *Zodion obliquefasciatum* (dorsal, right lateral); C. Generic *Zodion* genitalia placement detail (male; right lateral); D-E. Generic diagram of *Zodion* genitalia (male; 180° rotated anterior, right lateral).

abbrev. asur, anterior surstylus; bmac, bare maculation; cerc, cercus; dp, distphallus; dl-s, dorso-lateral setae; ed, ejaculatory duct; ej apod, ejaculatory apodeme; epand, epandrium; epp, epiphallus; hy, hypandrium; hyp, hypoproct; hypb, hypandrial bar; hyps, hypandrial sheath; mdp, medial scleritization of the distiphallus; mt, microtomentum; pa, phallic apodeme; poe, postgonite; psur, posterior surstylus; sp, sperm pump; str b, sternal bulge; str m, sternal membrane; tg-1, tergite-1.

Figure 4. Wing Diagrams of *Zodion*.

abbrev. A-C. *cells*. a2, 2nd anal lobe; al, alula; bc, basal costal; bm, basal medial; br, basal radial; c, costal; cup, posterior cubital; c+sc, costal + subcosta; dm, discal medial; m3, medial 3; r1, radial 1; m1+2, medial 1+2; r2+3, radial 2+3; r4+5, radial 4+5; r4+5 closed, radial 4+5 cell closed; R4+5, radial 4+5 vein; sc, sub-costal.

D. *venation*. A1, A2, first and second branches of the anal vein; A1+CuA2, intersection of first anal and second cubital-anal vein; bm-cu, basal medial-cubital crossvein; C, costal; CuA1, CuA2, branches of the anterior branch of cubital vein; dm-cu, discal medial-cubital crossvein; h, humeral crossvein; M1, M2, medial 1, 2; R1, radial 1; R2+3, radial 2+3; R4+5, radial 4+5; r-m, radial-medial crossvein; r4+5 open, radial 4+5 cell open; Sc, subcosta; sc-r, subcosta-radial crossvein; st vn, stem.

Figure 5. Generic heads and antennal details (right lateral): A. *Dalmannia*; B. *Myopa*; C. *Thecophora*; D. *Zodion*; E. *Stylogaster*; F. *Physocephala*; G. *Robertsonomyia*; H. *Physoconops*; I. flagellum and arista of *Thecophora*; J. flagellum and stylus of *Physocephala*; K. flagellum and arista of *Myopa*. Scale bar = 1 mm.

Figure 6. Generic abdomens (dorsal): A. *Dalmannia*; B. *Myopa*; C. *Zodion obliquifasciatum*; D. *Zodion americanum* group; E. *Thecophora*; F. *Physocephala*; G. *Physoconops*; H-I. *Robertsonomyia* leg and femur detail. Scale bar = 1 mm.

Figure 7. A-F. Conopid females with specialized terminalia. A. *Physocephala floridana*; B. *Physoconops nigrimanus*; C. *Thecophora* sp. D. *Stylogaster beresfordi*; E. *Robertsonomyia parva*; F. *Zodion perlongum* (right lateral).

Figure 8. A-D. Generic *Physocephala* and *Physoconops* heads with ocellar triangle (anterior oblique). A-B. *Physocephala* lacking ocellar triangle and ocelli; C-D. *Physoconops* with ocellar triangle and ocelli.

Figure 9. Male genitalia (anterior, right lateral). A-B *D. blaisdelli*; C-D. *D. nigriceps*; E-F. *D. pacifica*; G-H. *D. picta*. Scale bar = 1 mm.

Figure 10. Male genitalia (anterior, right lateral). A-B. *D. vitiosa*; C. Female genitalia (right lateral), *D. heterotricha*. Scale bar = 1 mm.

A

B

C

D

E

F

G

Figure 11. A-G. *Dalmannia* abdomens (Dorsal). A. *D. blaisdelli*; B. *D. heterotracha*; C. *D. nigriceps*; D. *D. pacifica*; E. *D. picta*; F. *D. vitiosa*; G. *D. vitiosa* to scale with *D. blaisdelli*. Scale bar = 1 mm.

Figure 12. A-C. Setae lengths. A. Short, pleated; B. Medium; C. Long, bushy. D. Generic *Dalmannia* head (right lateral); E. *D. nigriceps* head (right lateral, dark gena indicated). Scale bar = 1 mm.

Figure 13. A-C. *Dalmannia* thorax diagrams. A. Generic thorax (dorsal), pprn lb maculation indicated; D-E. *Dalmannia* wing diagrams. D. *D. vitiosa* wing bm-cu absent; E. Generic wing, bm-cu present. Scale bar = 1 mm

abbrev. A-B. **thorax.** npl, notopleuron; pal cal, postular callus; pprn lb, postpronotal lobes; pc sut, prescutellar suture; sct, scutum; sctl, scutellum; trn sut, transverse suture.

D-E. **cells.** a2, 2nd anal lobe; al, alula; bc, basal costal; bm, basal medial; br, basal radial; c, costal; cup, posterior cubital; c+r1, costal + radial 1; dm, discal medial; m3, medial 3; r1, radial 1; m1+2, medial 1+2; r2+3, radial 2+3; r4+5, radial 4+5; r4+5 closed, radial 4+5 cell closed; R4+5, radial 4+5 vein; sc, sub-costal.

D-E. **venation.** A1, A2, first and second branches of the anal vein; A1+CuA2, intersection of first anal and second cubital-anal vein; bm-cu, basal medial-cubital crossvein; C, costal; CuA1, CuA2, branches of the anterior branch of cubital vein; dm-cu, discal medial-cubital crossvein; h, humeral crossvein; M1, M2, medial 1, 2; R1, radial 1; R2+3, radial 2+3; R4+5, radial 4+5; r-m, radial-medial crossvein; r4+5 open, radial 4+5 cell open; Sc, subcosta; Sc-r, subcosta-radial crossvein; st vn, stem.

Figure 14. *Dalmannia* genital diagrams. A-B. Male (anterior, right lateral); C, E. *D. heterotricha* abdominal and terminalia diagram (dorsal, right lateral); D. Female terminalia (right lateral). Scale bar = 1mm.

abbrev. A-B. cerc, cerci; dp, distiphallus; epand, epandrium; epp, epiphallus; hyp, hypoproct; hy, hypandrium; hypb, hypandrial bar; hyps, hypandrial sheath; pa, phallapodeme; poe, postgonite.

C-E. cerc, cerci; mac, maculation; scl st-8, sclerotized pad of sternite 8; st-8, sternite (1-8); sr, spermatheca; str m, sternal membrane; str b, sternal brace; scl tg-8, sclerotized teeth; tg-1, tergite (1-8).

Figure 15. *Dalmannia* (female) diagrams. A. Hind leg (lateral); B. Generic female tarsomere 1; C. *D. pacifica* tm-1, mid-leg; D. *D. pacifica* tm-1, hind-leg; E. Troncanter (ventral) without thorns/pegs; F. Troncanter (ventral) without thorns/pegs. Scale bar = 1 mm

abbrev. f-tr, front-trochanter; h-tr, hind-trochanter; m-fr, mid-femur; m-tr, mid-trochanter; tb, tibia; tm-pt, tarsomere plate; tm-1, tarsomere (1-5); tms, tarsomeres; tr-gs, trochanter gripping spines; ts, tarsi.

Figure 16. A-B. *R. palpalis* genitalia (male; anterior, right lateral); C. surstylus detail; D-E. *R. parva* genitalia (male; anterior, right lateral); F. surstylus detail; G. Generic *Robertsonomyia* wing (closed r4+5 with petiole indicated). Scale bar = 1 mm.

Figure 17. A-B. *R. parva*, *R. palpalis* hind legs (left lateral); C. Black thorns/pegs detail of femur; D-E. *R. palpalis*, *R. parva* proboscis (right lateral); F-H. *R. palpalis*, *R. parva* thoraces (dorsal); G-I. *R. palpalis*, *R. parva* thoraces (right lateral). Scale bar = 1 mm.

Figure 18. A-J. *Zodion* thoraces (dorsal); A. *Z. meigeni*, B. *Z. bilineata*, C. *Z. intermedium* (and var. *hauseri*); D. *Z. fulvifrons*; E. *Z. perlongum*; F. *Z. pictulum*; G. *Z. californicum*; H. *Z. cyanescens*; I. *Z. obliquefasciatum*; J. *Z. zebrinum*; K. *Z. obliquefasciatum* thorax (right lateral). Scale bar = 1 mm.

Figure 19. A-D. *Zodion* thoraces (dorsal); A. *Z. anale*; B. *Z. nigrifrons*; C. *Z. triste*; D. *Z. nanellum*; E-F. *Zodion* heads (dorsal) E. *Z. zebrinum*; F. *Z. pictulum*; G. sub-equal antennae (elongate); H. equal antennae (short, rounded); I-J. *Zodion* heads (right lateral); I. *Z. zebrinum*; J. *Z. perlongum*. Scale bar = 1 mm.

Figure 20. A-B. Tarsomere-1 detail. A. tm-1 black central bristle; B. tm-1 pale central bristle; C-D. Americanum Group abdomen; sparse setae; C. (dorsal); D. (left lateral); E-F. Americanum Group abdomen; bushy setae; E. (dorsal); F. (left lateral); G-H. *Zodion obliquefasciatum* abdomen; G. (dorsal); H. (lateral). Scale bar = 1 mm.

A **B**

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C **D** **E** **F** **G** **H**

Figure 21. A-G. *Zodion Americanum* Group wings. A. *Z. pygmaeum*; B. *Z. harrisi*; C.; *Z. nanellum*; D. *Z. kraussi*; E. *Z. hitchensi*; F. *Z. albifacies*; G. *Z. dawkinsi*, *Z. hirsialiae*. H. *Z. pictulum* (right lateral habitus). Scale bar = 1 mm.

Figure 22. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. abitus*; D-G. *Z. alexanderi*. A-B, D-E. Scale bar = 1 mm. C, F-G. Scale bar = 0.25 mm.

Figure 23. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. oharai*; D-F. *Z. anale*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 24. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. nigrifrons*; D-F. *Z. triste*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure. 25. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. pygmaeum*; D-F. *Z. harrisi*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 26. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. albifacies*; D-F. *Z. nanellum*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 27. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. hitchensi*; D-F. *Z. kraussi*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 28. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. dawkinsi*; D-F. *Z. hirsialiae*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 29. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. intermedium*. A-B. Scale bar = 1 mm. C. Scale bar = 0.25 mm.

Figure 30. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. meigeni*; D-F. *Z. bilineata*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 31. Male genitalia (anterior, right lateral, surstylus detail). A-D. *Z. dillahuntyi*; E-G. *Z. cinereiventris*. A-B, F-F. Scale bar = 1 mm. C-D, G. Scale bar = 0.25 mm.

Figure 32. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. fulvifrons*; D-F. *Z. reclusum*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 33. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. perlongum*; A-B. Scale bar = 1 mm. C. Scale bar = 0.25 mm.

Figure 34. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. auricaudatum*; D-F. *Z. californicum*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure. 35. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. cyanescens*; D-F. *Z. pictulum*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 36. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. lisafyrea*; D-F. *Z. obliquefasciatum*. A-B, D-E. Scale bar = 1 mm. C, F. Scale bar = 0.25 mm.

Figure 37. Male genitalia (anterior, right lateral, surstylus detail). A-C. *Z. zebrinum*. A-B. Scale bar = 1 mm. C. Scale bar = 0.25 mm.

Figure 38. Strict consensus parsimony tree of Nearctic *Dalmannia* with bootstraps and *Myopa* outgroup.

Figure 39. Neighbour-joining tree of Nearctic *Dalmannia* with *Myopa* outgroup.

Figure 40. A Strict consensus parsimony tree with bootstraps for Nearctic *Zodion* with *Thecophora* outgroup designation.

Figure 41. A neighbor-joining tree for Nearctic *Zodion* with *Thecophora* outgroup designation.

A

B

C

Figure 42. *Stylogaster beresfordi* new species. (A) Right lateral habitus drawing, male. Scale bar = 1 mm; (B) right lateral habitus photograph, male; (C) right lateral habitus photograph, female. Photos: David Moll.

Figure 43. *Stylogaster beresfordi* new species. (A) Dorsal head with antennae. Scale Bar= 1.8 mm; (B) left lateral habitus of abdominal ovipositor of female. Scale bar=1 mm; (C) right lateral habitus photograph CNCD199772. Scale bar=1 mm; (D) right lateral of egg. Scal bar = 0.25 mm; (E) dorsal habitus photograph CNCD199772. Scale bar = 1 mm; (F) left lateral habitus of female terminalia: cerc, cerci; hyp, hypoproct; gb genital brush. Scale bar = 1 mm.

Figure 44. *Stylogaster biannulata* (A) Dorsal head with antennae. Scale Bar= 1.8 mm; (B) dorsal habitus of thorax. Scale bar=1.8 mm; (C) right lateral of egg. Scale bar = 0.25 mm; (D) left lateral habitus of female terminalia: cerc, cerci; hyp, hypoproct; gb genital brush. Scale bar = 1 mm; (E) left lateral habitus of abdominal stylus of female (fused tg-6-8). Scale bar = 1 mm; (F) right lateral habitus photograph CNCD195559. Scale bar = 1 mm; (G) dorsal habitus photograph CNCD195559. Scale bar = 1 mm.

Figure 45. *Stylogaster neglecta* (A) Dorsal head with antennae. Scale Bar= 1.8 mm; (B) dorsal habitus of thorax. Scale bar=1.8 mm; (C) right lateral of egg. Scale bar = 0.25 mm; (D) left lateral habitus of female terminalia: cerc, cerci; hyp, hypoproct; gb genital brush. Scale bar = 1 mm; (E) left lateral habitus of abdominal stylus of female (fused tg-6-8). Scale bar = 1 mm; (F) right lateral habitus photograph CNCD79778. Scale bar = 1 mm; (G) dorsal habitus photograph CNCD79778. Scale bar = 1 mm.

Figure 46. Left lateral of male terminalia. (A) *Stylogaster beresfordi*; (B) *Stylogaster neglecta*: cerc, cerci; ej apod, ejaculatory apodeme; epand, epandrium; hyp, hypandrium; ph, phallus; phapod, phallapodeme; pgt, postgonite; spm pmp, sperm pump; sur surstylus. Scale bars = 0.25 mm.

Figure 47. (A) Left lateral of male genitalia of *Stylogaster biannulata*: cerc, cerci; ej apod, ejaculatory apodeme; epand, epandrium; hyp, hypandrium; ph, phallus; phapod, phallapodeme; pgt, postgonite; spm pmp, sperm pump; sur, surstylus. Scale bars = 0.25 mm. (B) Range map; *Stylogaster beresfordi* (▲), *Stylogaster biannulata* (●), *Stylogaster neglecta* (■).

Figure 48. Majority rule consensus Bayesian-analysis cladogram based on COI sequence data. Numbers at nodes indicate posterior probability support measures. *Dalmannia*, *Myopa*, *Physoconops*, and *Zodion* were defined as the outgroup.

Figure 49. Neighbour-joining tree based on COI sequence data.

Figure 50. Strict consensus parsimony tree with bootstrap support values for world Conopidae with multi-taxa outgroups, generated from combined 28S, 12S, COI (partial COI sequences for *Robertsonomyia*), CytB, and AATS sequence data and 111 morphological characters (Gibson et al. 2012 with updated taxonomy), (length XXX; CI XXX; RI XX); Missing branch supports indicate less than 50% clade support; *Robertsonomyia palpalis* (blue), *Robertsonomyia parva* (orange).

Table 1. List of taxa with specimen data used in neighbour-joining tree and Bayesian analysis.

Species	Unique Identifier	Genbank#	Country – State/Province	Deposition
<i>S. banksi</i>	CNCD19903	KJ637696	Costa Rica - Guanacaste	CNC
<i>S. beresfordi</i>	CNCD195998	KF715066	USA – New Mexico	CNC
<i>S. beresfordi</i>	CNCD199773	KJ637700	USA – New Mexico	CNC
<i>S. beresfordi</i>	CNCD199801	KJ637699	USA – New Mexico	CNC
<i>S. beresfordi</i>	CNCD199803	KJ637698	USA – New Mexico	CNC
<i>S. beresfordi</i>	CNCD199810	KJ637697	USA – New Mexico	CNC
<i>S. beresfordi</i>	CNCD199811	KJ637701	USA – New Mexico	CNC
<i>S. biannulata</i>	JSS19827	HM398255	USA - Texas	CNC
<i>S. biannulata</i>	CNCD28428	KF715070	Canada - Ontario	CNC
<i>S. biannulata</i>	CNCD195993	KF715069	USA - Alabama	CNC
<i>S. biannulata</i>	CNCD195994	KF715068	USA - Alabama	CNC
<i>S. breviventris</i>	JSS19828	HM398256	Guyana – Upper Takutu / Essequi	CNC
<i>S. camrasi</i>	JSS19881	KJ637702	Madagascar	
<i>S. decorata</i>	JSS19829	HM398257	Guyana - Upper Takutu / Essequi	CNC
<i>S. dispar</i>	JSS19882	HM398292	French Guyana	
<i>S. ethiopa</i>	CNCD28430	KJ637704	Mexico - Chiapas	
<i>S. fasciata</i>	CNCD19928	KJ637705	Costa Rica - Alajuela	CNC
<i>S. frauci</i>	JSS19830	HM398258	Australia - Queensland	CNC
<i>S. frauci</i>	JSS19831	HM398259	Australia - Queensland	CNC
<i>S. frauci</i>	CNCD28495	KJ637706	Australia - Queensland	CNC
<i>S. frontalis</i>	CNCD28431	KJ637707	Uganda - Mpigi	
<i>S. indistincta</i>	CNCD19891	KJ637710	Costa Rica - Alajuela	CNC
<i>S. indistincta</i>	JSS19892	KJ637711	Costa Rica - Alajuela	CNC
<i>S. indistincta</i>	CNCD19910	KJ637709	Costa Rica - Alajuela	CNC
<i>S. indistincta</i>	CNCD28433	KJ637708	Colombia – Valle del Cauca Dept	
<i>S. intermedia</i>	CNCD19971	KJ637713	Costa Rica	CNC
<i>S. intermedia</i>	CNCD19975	KJ637712	Costa Rica - Petén	CNC
<i>S. leonum</i>	CNCD28434	KJ637715	Uganda - Mpigi	
<i>S. longicornis</i>	CNCD28435	KJ637716	Ecuador - Pastaza	
<i>S. longispina</i>	CNCD19972	KJ637717	Costa Rica	CNC
<i>S. magna</i>	CNCD19956	KJ637718	Costa Rica	CNC
<i>S. neglecta</i>	JSS18593	KJ637722	USA - Virginia	CNC
<i>S. neglecta</i>	JSS18868	KJ637721	USA - Virginia	CNC
<i>S. neglecta</i>	JSS19843	HM398267	USA - Virginia	CNC
<i>S. neglecta</i>	CNCD195996	KF715065	Canada - Ontario	CNC
<i>S. neglecta</i>	CNCD195997	KF715067	Canada - Ontario	CNC
<i>S. pardecorata</i>	JSS18169	KJ637723	Guyana – Mazaruni-Potaro Dist	DEBU
<i>S. peruviana</i>	CNCD28505	KJ637724	Ecuador - Napo	CNC
<i>S. rectinervis</i>	JSS19833	KJ637725	French Guiana - Régina	CNC
<i>S. sp. CR-01</i>	JSS19889	KJ637727	Costa Rica - Alajuela	CNC
<i>S. sp. CR-02</i>	JSS19848	HM398272	Costa Rica	
<i>S. sp. CR-03</i>	JSS19904	KJ637729	Costa Rica - Alajuela	CNC
<i>S. sp. CR-04</i>	JSS19894	KJ637726	Costa Rica - Heredia	CNC
<i>S. sp. nov. MAD-01</i>	CNCD28498	HM398239	Madagascar - Mahajanga	CNC
<i>S. sp. nov. MAL-01</i>	CNCD28511	KJ637728	Malaysia - Selangor	CNC
<i>S. sp. nov. PNG-01</i>	CNCD28510	KJ637730	Papua New Guinea - Western	CNC
<i>S. sp. VEN-01</i>	JSS19825	HM398254	Venezuela - Lara	
<i>S. stylata</i>	JSS18170	KJ637734	Brazil - Minas Gerais	DEBU
<i>S. stylata</i>	CNCD28441	KJ637733	French Guiana - Régina	
<i>S. tarsata</i>	JSS18197	KJ637736	Costa Rica	CNC
<i>S. tarsata</i>	JSS19893	KJ637737	Costa Rica - Alajuela	CNC
<i>S. tarsata</i>	CNCD19973	KJ637738	Costa Rica	CNC
<i>S. tarsata</i>	JSS19978	KJ637735	Costa Rica	CNC
<i>S. triannulata</i>	CNCD19927	KJ637739	Costa Rica - Guanacaste	CNC
<i>S. westwoodi</i>	JSS19836	KJ637740	D.R. Congo - Katanga	CNC
<i>S. westwoodi</i>	CNCD28509	KJ637741	Uganda - Mpigi	CNC

A

B

Map 1. Range maps. A. *D. nigriceps* (▲); *D. pacifica* (■); *D. picta* (●). B. *D. heterotricha* (■); *D. blaisdelli* (▲); *D. vitiosa* (●).

Map 2. Range map of *R. palpalis* (■), and *R. parva* (▲).

Map 3. A-C. Range maps. A. *Z. abitus* (■), *Z. cinereiventre* (●); B. *Z. alexanderi* (●), *Z. anale* (■), *Z. nigrifrons* (▲); C. *Z. auricaudatum* (●), *Z. californicum* (■), *Z. cyanescens* (▲).

A

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B

C

Map 4. A-C. Range maps. A. *Z. meigeni* (●); *Z. bilineata* (■), *Z. reclusum* (▲); B. *Z. lisafyrea* (●), *Z. obliquefasciatum* (■); C. *Z. dillahuntyi* (●), *Z. pictulum* (■), *Z. zebrinum* (▲).

A

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B

C

Map 5. A-C. Range maps. A. *Z. fulvifrons* (●); B. *Z. intermedium* (●); C. *Z. oharai* (●), *Z. triste* (■), *Z. perlongum* (▲).

Map 6. A-C. Range maps. A. *Z. albifacies* (●), *Z. nanellum* (■), *Z. pygmaeum* (▲); B. *Z. dawkinsi* (●), *Z. kraussi* (■); C. *Z. hitchensi* (●), *Z. harrisi* (■), *Z. hirsaliae* (▲).