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Taxonomy of *Agapostemon angelicus* and the *A. texanus* species complex (Hymenoptera, Halictidae) in the United States

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Abstract. The identification of females of *Agapostemon angelicus* Cockerell and *A. texanus* Cresson has been a longstanding problem, with females of the two species considered morphologically indistinguishable. Prompted by recent collections in Minnesota that unexpectedly revealed the presence of *A. angelicus* as well as a cryptic form of *A. texanus*, we reassess the taxonomy of the "doubly punctate" *Agapostemon* species in both Minnesota and the broader United States. Examination of both new and old specimens has allowed us to identify *A. angelicus* females morphologically, and we reinstate *A. subtilior* Cockerell stat. rev. from synonymy with *A. texanus*. We recognize a number of new synonyms of *A. subtilior* that were formerly considered synonyms of *A. texanus*: *A. borealis* Crawford syn. nov., *A. californicus* Crawford syn. nov., *A. texanus vandykei* Cockerell syn. nov., *A. californicus psammobius* syn. nov., *A. angelicus idahoensis* syn. nov., and *A. californicus clementinus* syn. nov. We provide keys and diagnoses to allow for morphological identification of *A. angelicus*, *A. subtilior*, and *A. texanus*. We show that *A. texanus* s. s. has a relatively restricted range in the prairie region of the United States, with *A. subtilior* making up the bulk of what was formerly considered *A. texanus*. We further show that *A. angelicus* has a more extensive range than previously thought. Additional work remains, as there are a number of gaps in the known ranges of these species and more taxonomic work is required in the *A. texanus* complex south of the United States.

Keywords. Apoidea, cryptic species, identification key, Halictinae, America.

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Introduction

The genus *Agapostemon* Guérin-Méneville, 1844 is a group of New World bees containing 40 species, of which 14 are recorded from the United States (Ascher & Pickering 2022). The first revisionary work was performed by J.C. Crawford (in Viereck *et al.* 1906), who published a key and records of the *Agapostemon* of Oregon, Washington, British Columbia, and Vancouver. This was followed by Sandhouse (1936), who revised the North American species, and Mitchell (1960) who treated four eastern US species. Additional regional keys were produced for Kentucky by Lovell (1942) and for Michigan by Dreisbach (1945), and a species list was made for Kansas (Fischer 1950). The most extensive taxonomic work was performed by Roberts (1972), who revised the entire genus. Since then, there has been relatively limited taxonomic and systematic work, with a morphological phylogeny by Janjic & Packer (2003), a species list for Nuevo Leon, Mexico (Ramírez-Freire *et al.* 2012), clarification of some types by Sheffield *et al.* (2021), a key to the species of the midwestern US by Portman *et al.* (2022), and a preliminary treatment of the *A. melliventris* Cresson, 1874 species complex (Sheffield 2023).

The taxonomy and identification of the species *Agapostemon angelicus* Cockerell, 1924 and *A. texanus* Cresson, 1872 has been a longstanding issue in the genus. The females of both species are characterized by being "doubly punctate," which refers to the presence of punctures of two distinct sizes on the scutum. The females of the two species have been considered morphologically indistinguishable, with most females identified as *A.* "*angelicus* or *texanus*" (Roberts 1972; Portman *et al.* 2022). However, the males of the species can be separated by coloration and genitalia, and females are often identified indirectly using the known distribution of males (Roberts 1972). The inability to identify females using morphology is an issue because the two species are common and abundant in many areas, have partially overlapping ranges, and they are often collected in the hundreds or thousands in ecological studies (Wilson *et al.* 2008; Spears *et al.* 2016; Begosh *et al.* 2019). However, despite the current inability to accurately identify females, Sandhouse (1936) was able to separate females of *A. angelicus* and *A. texanus* using morphology, suggesting that this problem may have a ready solution. Unfortunately, the taxonomic situation is complicated by the decision of Roberts (1972) to synonymize 10 species and subspecies under *A. texanus* (five of which were known only from the female sex) despite his inability to identify the females of *A. texanus*.

Recently, ecological studies of bee communities in southwestern Minnesota resulted in the collection of hundreds of *Agapostemon* specimens in the "doubly punctate" group, which unexpectedly included multiple males of *A. angelicus* (Portman *et al.* 2022, 2023). This prompted an in-depth examination of new and old specimens, which revealed that *A. texanus* included two morphologically distinct taxa in Minnesota (Portman *et al.* 2023), and it further allowed us to associate and accurately identify the females of *A. angelicus* using morphology. As a result, we are reinstating *Agapostemon subtilior* Cockerell, 1898, which was previously considered a junior subjective synonym of *A. texanus*. We clarify the taxonomy and identity of *A. texanus* and provide keys and morphological diagnoses to identify both sexes of *A. angelicus*, *A. subtilior*, and *A. texanus*. We also provide relevant taxonomic references in order to help reduce the large amount of past confusion of these species. While our focus was on Minnesota, we examined specimens from different areas of the range of all three species. The scope of this work covers the United States, and we largely do not treat the Mexican and Central American synonyms of *A. texanus*, and available evidence suggests those synonymized species are not *A. texanus* s. s. and need to be reevaluated and revised.

Material and methods

The following museum and collection abbreviations are used throughout the text:

AMC = Alex Morphew collection; specimens identified by M. Arduser and will be deposited in the University of Arizona insect collection

ANSP = The Academy of Natural Sciences of Drexel University, Philadelphia, Pennsylvania, USA (J. Gelhaus and J. Weintraub)
CAS = California Academy of Sciences, San Francisco, California, USA (C. Grinter and D. Montelongo)
CBG = Chicago Botanic Garden, Chicago, Illinois, USA (S. Wagenius)
CNBL = The collection of the Cariveau Native Bee Lab, St. Paul, Minnesota, USA (Z. Portman); all specimens will eventually be accessioned into the UMSP
CRC = Catherine Reed Collection. Currently resides in the Cariveau Native Bee Lab and will be accessioned into the UMSP
MAPC = Mike Arduser Personal Collection (M. Arduser)
MCZ = Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA (C. Maier)
MNDNR = Minnesota Department of Natural Resources, St Paul, Minnesota, USA; most specimens are being accessioned into the UMSP, except for a synoptic collection (J. Petersen and N. Gerjets)
MTEC = Montana Entomology Collection, Montana State University, Bozeman, Montana, USA (C. Delphia)
NACH = Nachusa Grasslands Projects; specimens identified by Z. Portman and will be deposited at the Lady Bird Johnson Wildflower Center, University of Texas, Austin, Texas, USA (S. Griffin)
UCMC = University of Colorado Museum of Natural History, Boulder, Colorado, USA (V. Scott)
UMSP = University of Minnesota Insect Collection, St. Paul, Minnesota, USA (R. Thomson)
UNSM = University of Nebraska State Museum, Lincoln, Nebraska, USA (M.J. Paulson)
USNM = Smithsonian National Museum of Natural History, Washington D.C., USA

Classification and morphological terminology follow Michener (2007), including the terminology for the tagmata, specifically the usage of thorax for what is technically the mesosoma, and metasoma for what is colloquially referred to as the abdomen. Genitalia terminology follows Roberts (1972), with the gonostylus bearing an apical stylus, medial plate, and a basal stylus. Terga and sterna are abbreviated to T and S, and flagellomeres are abbreviated to F. Images were taken with an Olympus DP27 camera mounted on an Olympus SZX16 stereo microscope, with the exception of images provided by other institutions. Specimens shown in figures are deposited in UMSP except for the two type specimens whose depositories are noted in the captions.

For the treated species, we provide references to the major taxonomic works and try to provide an accurate accounting of which species are treated in which works. However, given the extreme degree to which *A. angelicus*, *A. texanus* s. s., and *A. subtilior* have been confused, there remains a fair amount of uncertainty as to which species were treated by previous authors. Throughout, we refer to *A. texanus* sensu stricto (abbreviated to s. s.) to refer to *A. texanus* as defined herein (referring to the species with extremely coarse genal striae in the female), and *A. texanus* sensu lato (abbreviated to s. lat.) to refer to the *A. texanus* complex as defined by Sandhouse (1936), Roberts (1972), and Portman *et al.* (2022), which lumps *A. texanus* s. s., *A. subtilior*, and the synonyms south of the United States not treated here.

All maps were created using QGIS ver. 3.30.1 (http://www.qgis.org). The state and provincial boundaries for Canada, Mexico, and the United States were derived from a North American political boundaries shapefile (U.S. Geological Survey *et al.* 2004). Elevation data was sourced from a 1-kilometer resolution raster file spanning North America (U.S. Geological Survey 2007). For mapping purposes, specimens without GPS points on the label were manually georeferenced using Google Earth, with county-level records mapped to county centroids.

Results

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Apoidea Latreille, 1802
Family Halictidae Thomson, 1869

Genus ***Agapostemon*** Guérin-Méneville, 1844

Keys to "doubly punctate" species of *Agapostemon* of the United States

Females can be recognized from other US *Agapostemon* species by the doubly-punctate scutum, which contains intermixed punctures of two distinct sizes. Males lack the doubly-punctate scutum, but can be recognized by the following combination of characters: hind femur only moderately enlarged with a ventral tooth present, S4 with swelling that reaches the posterior edge of the segment laterally, and a longer F1 that is ⅔ to ¾ the length of F2 (as opposed to half or less the length of F2). Both sexes of the "doubly punctate" species key out to *A. texanus* in Mitchell (1960) and both sexes key out to either *A. angelicus* or *A. texanus* in Roberts (1972) and Portman *et al.* (2022).

Key to females

Note that *A. angelicus* and *A. subtilior* are quite variable species, and though the characters listed here are mostly consistent, sometimes they vary. In the key, the word "generally" is used to indicate characters that work in about 90% of specimens.

1. Genal striations in hypostomal area exceptionally coarse and deep, with valleys between the ventral ridges so deep and irregular that it is difficult to see the bottom, with 5–7 large straight striae heading towards and ending along the longitudinal part of the hypostomal carina (Fig. 1C–D) ..... ***A. texanus*** Cresson, 1872
– Genal striations fine (Fig. 1A) to moderately coarse (Fig. 1B); genal striations generally curving away from or parallel to the longitudinal part of the hypostoma and towards the lateral part of the hypostomal carina (Fig. 1A–B) 2

2. Clypeus flatter, distinctly flat all the way to the apical margin, with the apical margin present as a very narrow vertical overhang (just above the apical fimbriae), forming a weak but distinct complete carina (Fig. 2A–B); dorsal propodeal sculpturing moderately coarse (Fig. 3A); pleural reticulations more strongly carinate, even posteriorly (Fig. 3C); metasoma with denser punctures (Fig. 4A), punctures on T1 generally contiguous (separated by less than one puncture width), even on lateral areas basal to premarginal line (Fig. 4D red arrow) ..... ***A. angelicus*** Cockerell, 1924
– Clypeus more convex, apical margin without a very narrow vertical portion, instead more evenly curving onto the base of the apical fimbriae (Fig. 2C–D); dorsal propodeum with sculpturing generally weaker, ranging from delicate to somewhat coarse (Fig. 3B), and if coarser, then typically strongly anastomizing; pleural reticulations more weakly carinate, especially posteriorly (Fig. 3D); metasoma with sparser punctures (Fig. 4B), punctures on T1 generally with distinct interspaces, with punctures in some areas separated by greater than one puncture width, especially laterally, just basal of the premarginal line (Fig. 4E red arrow) ..... ***A. subtilior*** Cockerell, 1898

Key to males

Note that we rely on color of the hind tibia because it is easy and convenient, but given the color variation seen in males, it would not be surprising to find males that break the color rules, and structure should always be given precedence.

1. Hind tibia with extensive dark mark ONLY on posterior face (Fig. 5A–B; anterior face with no dark mark, though there may be a dark spot at the apex as in Fig. 5A); hind femur and tibia relatively less inflated (Fig. 5A); hind basitarsus relatively narrow (Fig. 5K); genitalia with basal stylus thickened and a relatively small medial plate that is broader than long (Fig. 6A)..... ..... ***A. angelicus*** Cockerell, 1924
– Hind tibia never with dark mark only on posterior face, can have dark marks on both anterior and posterior face (Fig. 5E–F and Fig. 5G–H and Fig. 5I–J), no dark marks on either side (Fig. 5C–D), or a dark mark only anteriorly (similar to Fig. 5E); hind femur and tibia relatively larger (Fig. 5E, I); hind basitarsus not as narrow (Fig. 5L–M); genitalia with basal stylus slender and tapering, and medial plate relatively large and roughly as long as broad (Fig. 6B–C) 2

2. Hind tibia with posterior face with large black mark (Fig. 5J), taking up most of the tibia and generally more or less narrowly attenuated in the basal half; genitalia with basal stylus shorter and more evenly curved (Fig. 6C–D); hind tarsus with second tarsomere shorter and more completely fused to basitarsus, with transition between them less obvious (Fig. 5M) . ***A. texanus*** Cresson, 1872
– Hind tibia posterior face with dark mark smaller, not taking up most of tibia (Fig. 5F, H) or sometimes absent (Fig. 5D), and if the dark mark is larger, it is limited to the apical half of the tibia and generally abruptly cut off rather than narrowly attenuated (Fig. 5H); genitalia with basal stylus longer and straighter basally, more abruptly upturned towards apex (Fig. 6B, E); hind tarsus with second tarsomere longer and less completely fused to basitarsus, with transition between them quite obvious (Fig. 5L) ..... ***A. subtilior*** Cockerell, 1898

Agapostemon* (*Agapostemon*) *angelicus Cockerell, 1924
Figs 1A, 2A–B, 3A, C, 4A, D, 5A–B, K, 6A, 7A, 8B

Original reference

Agapostemon angelicus Cockerell, 1924: 537, ♀. Holotype, ♀, Mexico, Baja California, Angel de la Guardia Island (also known as Isla Estanque), Pond Island Bay 1 Jul. 1921, EP Van Duzee leg., deposited in CAS, type no. 1502. Images examined by ZP. Online record: https://monarch.calacademy.org/taxa/index.php?tid=672893

Taxonomy and references

Agapostemon texanus – Robertson 1897: 328 [in part, combined with *A. texanus* and *A. subtilior*] (description, range). — Vachal 1903: 94 [likely in part, mixed with *A. texanus*] (key, description).
Agapostemon angelicus – Cockerell 1927: 156 (description of male, key, records). — Sandhouse 1936: 83 (key, diagnosis, distribution). — Fischer 1950: 78 (records). — Roberts 1972: 461 (key, description, distribution); 1973: 5 (key, diagnosis, biology, distribution). — Hurd 1979: 1953 (catalog). — Moure & Hurd 1987: 188 (catalog). — Portman *et al.* 2022: 114 (key, diagnosis).
Agapostemon angelicus angelicus – Michener 1951: 1125 (catalog).

Diagnosis

Females of *A. angelicus* are similar to those of *A. texanus* s. s. and *A. subtilior*, and they can co-occur with both species. *Agapostemon angelicus* can be separated from *A. texanus* s. s. by the striations on the gena, which are relatively fine in *A. angelicus* (Fig. 1A) and extremely strong in *A. texanus* (Fig. 1C–D). *Agapostemon angelicus* can be separated from *A. subtilior* by the shape of the clypeus, which is flattened all the way to the apical margin and terminates in a very narrow vertical overhang just above the apical fimbriae, forming a weak carina between the 90-degree separation of anterior and ventral faces of the clypeus (Fig. 2B). In contrast, *A. subtilior* has the clypeal weakly convex, not flat, and more evenly and somewhat irregularly sloping to the base of the apical fimbriae (Fig. 2D), lacking the very narrow vertical

portion and associated carina which typifies *A. angelicus*. Note these clypeal characters are subtle and somewhat variable depending on wear, they but are useful in separating *A. angelicus* from *A. subtilior* throughout its range. In addition, *A. angelicus* has a more coarsely striate propodeum, with the ridges parallel or moderately anastomizing (Fig. 3A), whereas *A. subtilior* typically has the propodeum more weakly sculptured (Fig. 3B). The pleura of *A. angelicus* are also more strongly sculptured (Fig. 3C), with the reticulations more strongly upraised (even along the posterior margin) than in *A. subtilior*, which has the reticulations more weakly upraised and with smaller gaps (Fig. 3D); this character is subtle but distinctive and reliable.

There are additional, less reliable characters that can help separate females of *A. angelicus* and *A. subtilior*. These include the black mark on the apex of the clypeus, which is generally straight across in *A. angelicus* (Fig. 1A) whereas it typically is thickened or has a 'tooth' medially in *A. subtilior* (Fig. 2C). *Agapostemon angelicus* typically has a longer dorsal face of the propodeum, which is generally longer than the metanotum (Fig. 3A), whereas the length of the dorsal face of the propodeum is typically about equal to that of the metanotum in *A. subtilior* (Fig. 3B). In addition, *A. angelicus* typically has contiguous punctures on the terga (Fig. 4A, D), whereas *A. subtilior* typically has distinct interspaces between the punctures (Fig. 4B, E); this character is most reliable on the lateral areas of the T1 and T2 just basal to the premarginal line. Further, *A. angelicus* tends to have whiter hairs versus more yellowish

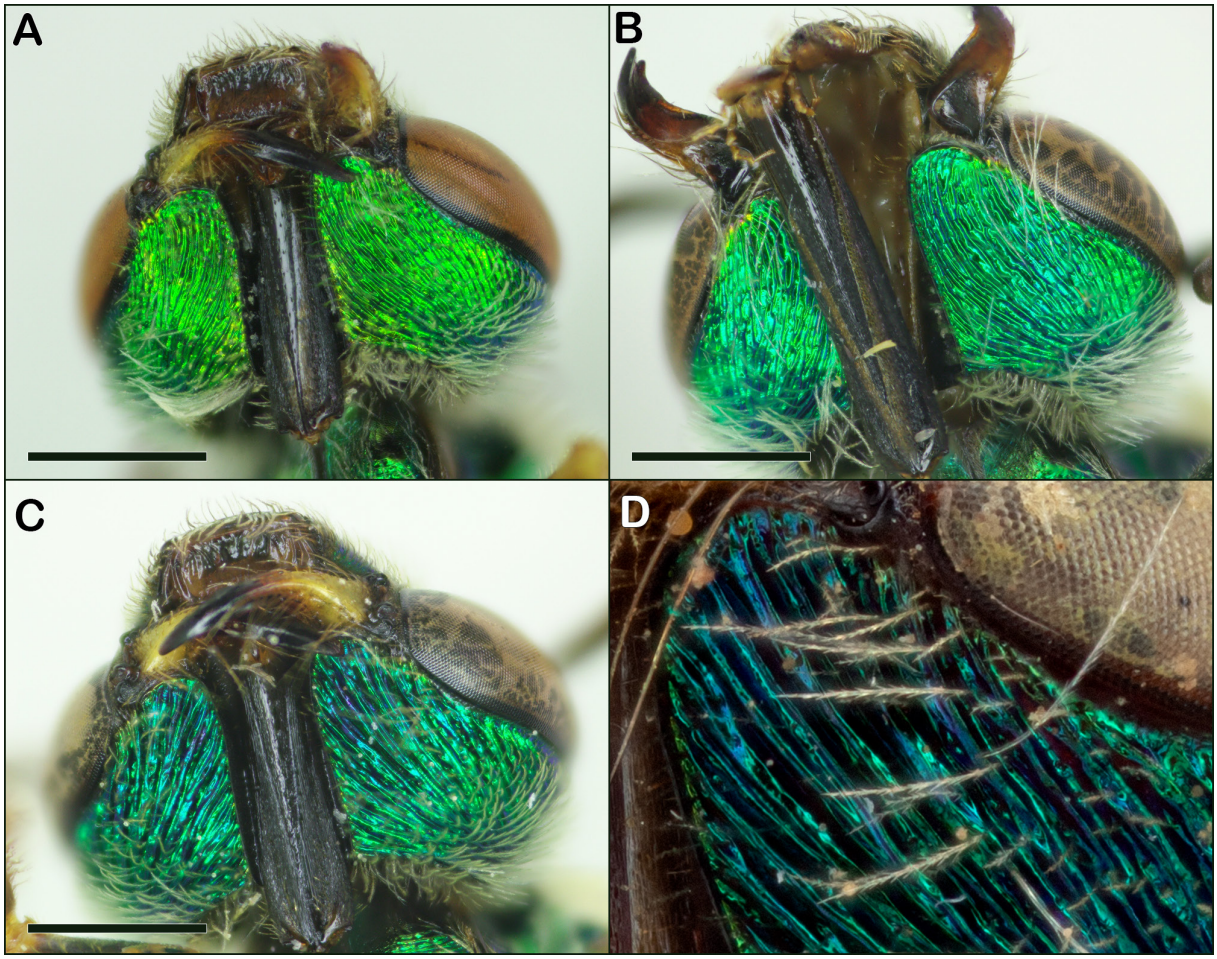

Fig. 1. Genal striae of females. **A**. *Agapostemon angelicus* Cockerell, 1924. **B**. *A. subtilior* Cockerell, 1898. **C**. *A. texanus* Cresson, 1872 s. s. **D**. Zoomed-in view of *A. texanus* s. s. striae, image of paralectotype (MCZENT548), provided by Zoe Flores and Crystal Maier of the MCZ. Scale bars: 1 mm.

hairs in *A. subtilior* (though this character is rather unreliable), *A. angelicus* tend to have any dark hairs on the tibial scopa limited to the very base (compared to typically extending down in line from the basatibial plate through most of the tibia in *A. subtilior*), and *A. anglicus* tend to have more copious hairs laterally on the terga, especially T1 (Fig. 4A). Finally, *A. angelicus* are, on average, smaller than both *A. subtilior* and especially *A. texanus* s. s.

Males of *A. angelicus* are similar to those of both *A. texanus* s. s. and *A. subtilior*, but they can be definitively separated by the genitalia, with the basal stylus much thicker and the medial plate smaller and more acute (Fig. 6A). In addition, *A. angelicus* males have a dark mark ONLY on the posterior hind tibia (Fig. 5A–B; not counting a small dark mark on the apex of the tibia), whereas *A. texanus* and *A. subtilior* males also have a dark mark on the anterior face of the hind tibia (Fig. 5E, G, I) (or in the case of some *A. subtilior*, the hind tibia can be entirely light as in Fig. 5C–D). In addition, *A. angelicus* has the hind leg with a distinctly narrower femur, tibia, and basitarsus (Fig. 5K) compared to *A. subtilior* (Fig. 5L) and *A. texanus* (Fig. 5M), though the difference between *A. angelicus* and *A. subtilior* is somewhat subtle.

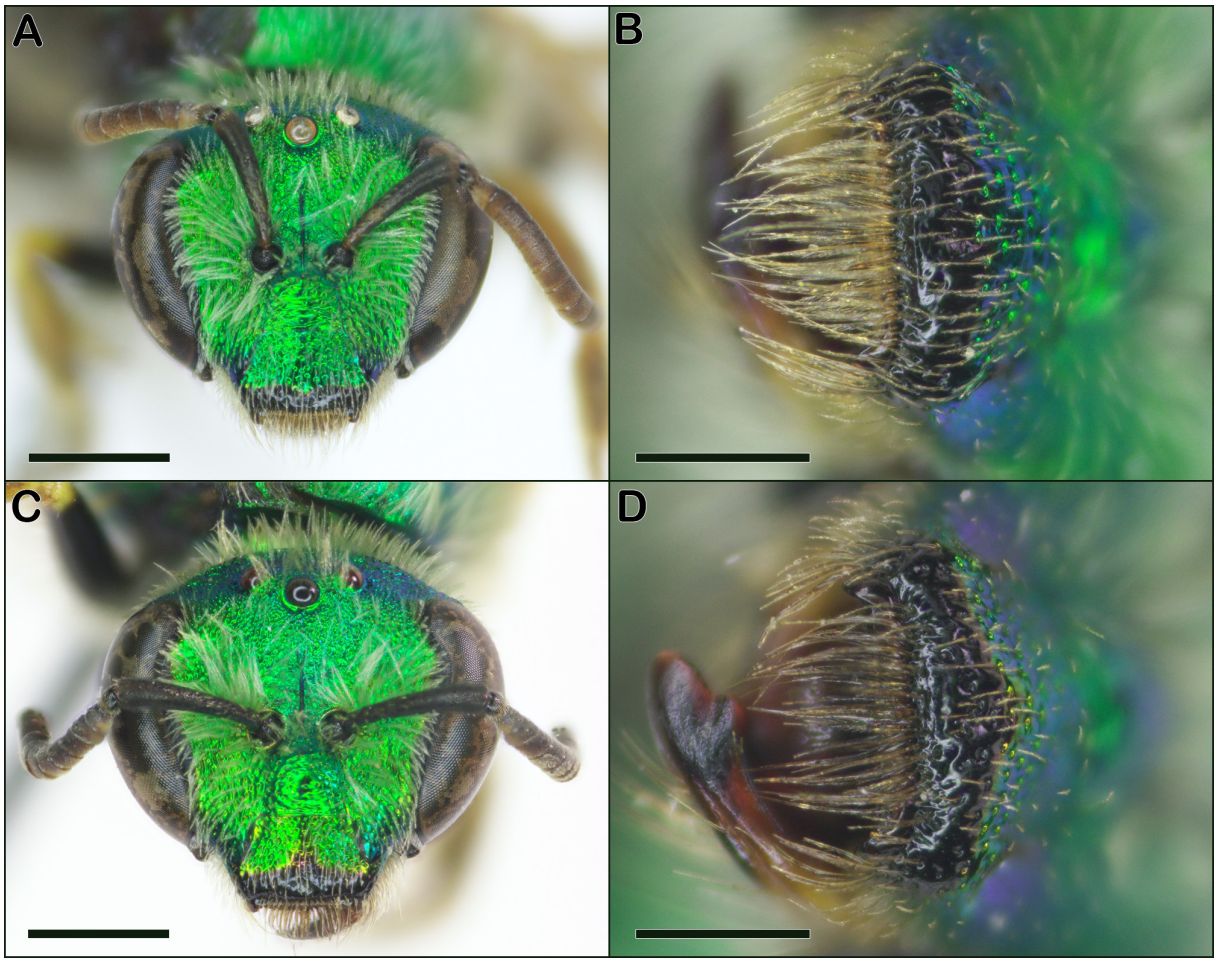

Fig. 2. Comparison of *Agapostemon angelicus* Cockerell, 1924 and *A. subtilior* Cockerell, 1898, female head and clypeus. **A**. *A. angelicus*, face. **B**. *A. angelicus*, apex of clypeus. **C**. *A. subtilior*, face. **D**. *A. subtilior*, apex of clypeus. Scale bars: A, C = 1 mm; B, D = 500 µm.

Material examined

USA – **ARIZONA – Apache Co.** • Apache NF, Terry Flat, 9700 ft, NE of Alpine ca. 5 air miles: 1 ♀; 31 Jul. 1998; Arduser and Stevens leg.; MAPC • Benny Crk USNF campground, by Bunch Reservoir: 1 ♂; 10 Jul. 1998; Arduser and Stevens leg.; net, *Potentilla crinita*; MAPC. – **Coconino Co.** • E. Page 7.9 mi. on Hwy 98: 3 ♂♂; 26 Jun. 2023; Arduser and MacRae leg.; MAPC • S. Page 15 mi. on Hwy 89: 1 ♀; 26 Jun. 2023; Arduser and MacRae leg.; net, *Sphaeralcea* sp.; MAPC. – **Gila Co.** • Globe: 1 ♀; Jul. 193?; Parker leg.; MCZ. – **Graham Co.** • Dublin: 1 ♀; 8 Mar. 1937?; Cockerell leg.; UMSP • Pinaleno Mtns., Hospital Flat, 9000 ft: 2 ♀♀, 1 ♂; 29 Jul. 2003; Arduser and Stevens leg.; MAPC. – **Greenlee Co.** • Apache NF, SE Rose Peak ca 2 mi. on Hwy 191: 3 ♀♀; 31 Jul. 1997; Arduser and Stevens leg.; net, *Machaeranthera* sp.; MAPC. – **Maricopa Co.** • Tempe: 1 ♀; 3 Aug. year unknown; J Bequaert leg.; MCZ. – **COLORADO – Baca Co.** • Comanche National Grasslands nr Springfield: 1 ♀, 4 ♂♂; 22 Jul. 1998; R Clinebell leg.; *Asclepias latifolia*; MAPC. – **Larimer Co.** • Cameron Pass, elev. 10 000 ft:

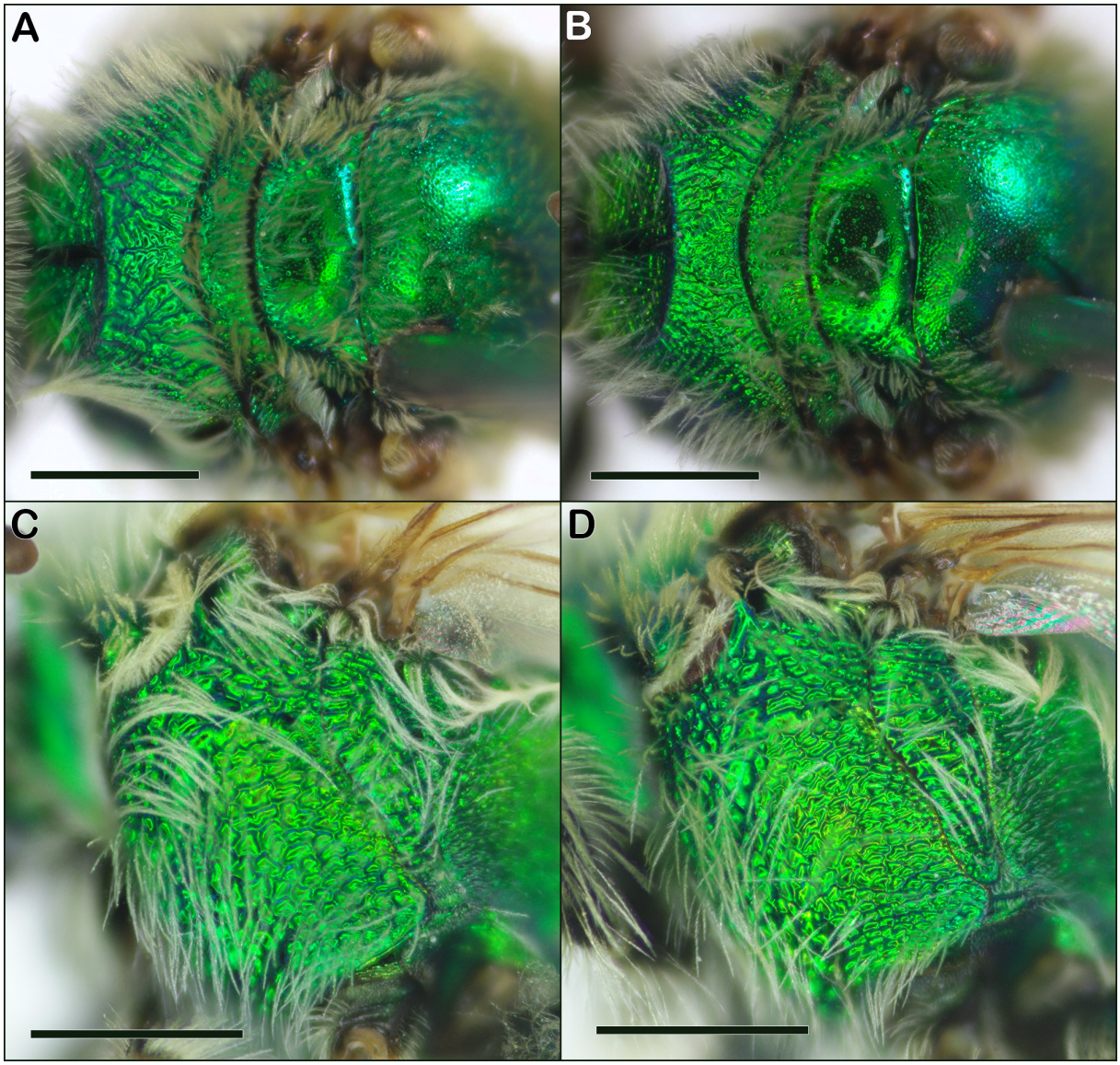

Fig. 3. Thorax of *Agapostemon angelicus* Cockerell, 1924 and *A. subtilior* Cockerell, 1898, females. **A**. *A. angelicus*, propodeum. **B**. *A. subtilior*, propodeum. **C**. *A. angelicus*, side. **D**. *A. subtilior*, side. Scale bars: 1 mm.

2 ♂♂; 18 Aug. 1940; HE Milliron leg.; UMSP • Pingree Park: 1 ♀, 1 ♂; 17–22 Aug. 1922; FC Hottes leg.; UMSP; 1 ♂; 20 Aug. 1926; RF Dawson leg.; UMSP. – **Otero Co.** • Vogel Canyon Picnic Area: 1 ♀; 23 Jun. 2023; Arduser and MacRae leg.; net, *Escobaria vivipara*; MAPC. – **IDAHO – Oneida Co.** • Stone: 1 ♂; 14 Sep. 1972; GF Knowlton leg.; UMSP. – **IOWA – Woodbury Co.** • Sioux City: 1 ♂; 17 Aug. 1937; CN Ainslie leg.; UMSP; 1 ♂; Oct. 1939; CN Ainslie leg.; UMSP. – **KANSAS – Ellsworth Co.** • (38.58598 -98.1401): 2 ♂♂; 13 Jul. 2018; A Morphew leg.; AMC. – **Gove Co.** • (38.970421 -100.5056): 3 ♂♂; 22 Jul. 2019; A Morphew leg.; AMC. – **Hodgeman Co.** • (38.100843 -98.6435): 2 ♂♂; 22 Jun. 2018; A Morphew leg.; AMC. – **Logan Co.** • (39.0784 -100.9095): 3 ♂♂; 28 Jul. 2018; A Morphew leg.; AMC. – **Morton Co.** • Cimarron National Grassland, "Point of Rocks" area: 1 ♀; 20 Jul. 1998; R Clinebell leg.; *Asclepias latifolia*; MAPC. – **Rice Co.** • (38.487554 -98.1573): 2 ♂♂; 11 Jun. 2018; A Morphew leg.; AMC. – **Sheridan Co.** • (39.207824 -100.2152): 1 ♂; 3 Jul. 2018; A Morphew leg.; AMC. – **Stafford Co.** • (38.186276 -98.6429): 1 ♂; 12 Jun. 2018; A Morphew leg.; AMC. – **Thomas Co.** • (39.149998 -101.0742): 7 ♂♂; 10 Jul. 2018; A Morphew leg.; AMC. – **Wallace Co.** • (38.912332 -101.8017): 2 ♂♂; 19 Jun. 2018; A Morphew leg.; AMC. – **MINNESOTA – Big Stone Co.** • Dybdahl WPA (45.43976 -96.2415): 1 ♀; 27 Jun. 2016; Pennarola and Leone leg.; UMSP • Ortonville: 1 ♀; 5 Aug. 1935; DG Denning leg.; UMSP. – **Brown Co.** • (44.2114 -94.542): 3 ♀♀; 16 Jul. 2021; ED leg.; bee bowl; CNBL • (44.29578 -94.7671): 2 ♂♂; 9 Sep. 2021; SM and RK leg.; bee bowl; CNBL • (44.39939 -94.7165): 1 ♀; 30 Jun. 2021; WB, SM leg.; bee bowl; CNBL. – **Clay Co.** • (46.74468 -96.4675): 1 ♀; 14 Jul. 2017; I Lane leg.; bowl; UMSP. – **Cottonwood Co.** • (43.99175 -95.2175): 1 ♀;

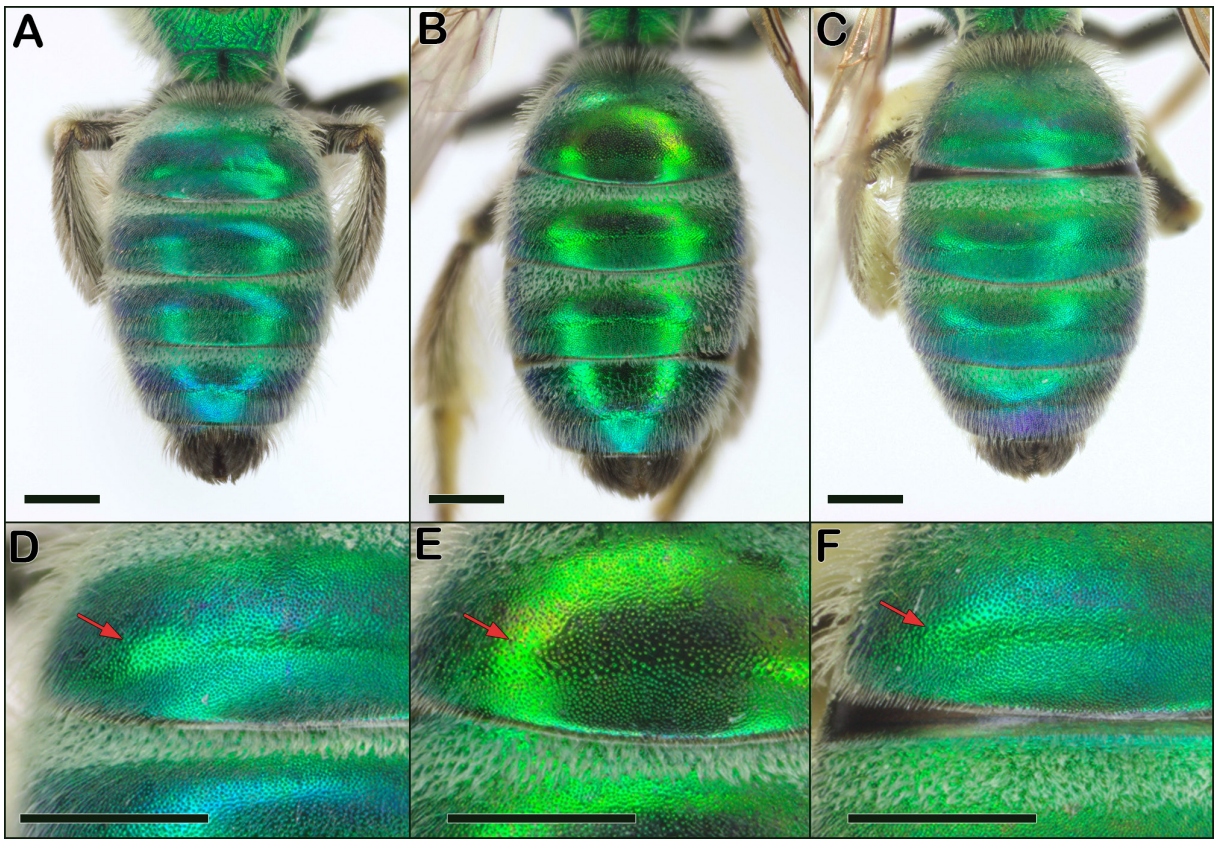

Fig. 4. Female metasoma comparison. **A**. *Agapostemon angelicus* Cockerell, 1924. **B**. *A. subtilior* Cockerell, 1898. **C**. *A. texanus* Cresson, 1872 s. s. **D**. *A. angelicus*, T1 and T2, with red arrow pointing to lateral areas basal to premarginal line with denser punctures. **E**. *A. subtilior*, T1 and T2, with red arrow pointing to area of sparser punctures. **F**. *A. texanus* s. s., T1 and T2, with red arrow pointing to area of denser punctures. Scale bars: 1 mm.

24 Jun. 2021; WB, SM leg.; bee bowl; CNBL; 1 ♀; 17 Aug. 2021; SM leg.; bee bowl; CNBL • (44.00121 -95.2591): 5 ♀♀; 24 Jun. 2021; SM, WB leg.; bee bowl; CNBL. – **Douglas Co.** • (45.4729 -95.3918): 1 ♀; 21 Jul. 2022; A Carroll, G Zebrasky leg.; yellow pan trap; CBG • (45.5044 -95.4531): 1 ♀; 12 Jul. 2022; A Carroll, G Zebrasky leg.; yellow pan trap; CBG. – **Faribault Co.** • 1 ♀, 1 ♂; 18 Aug. 1936;

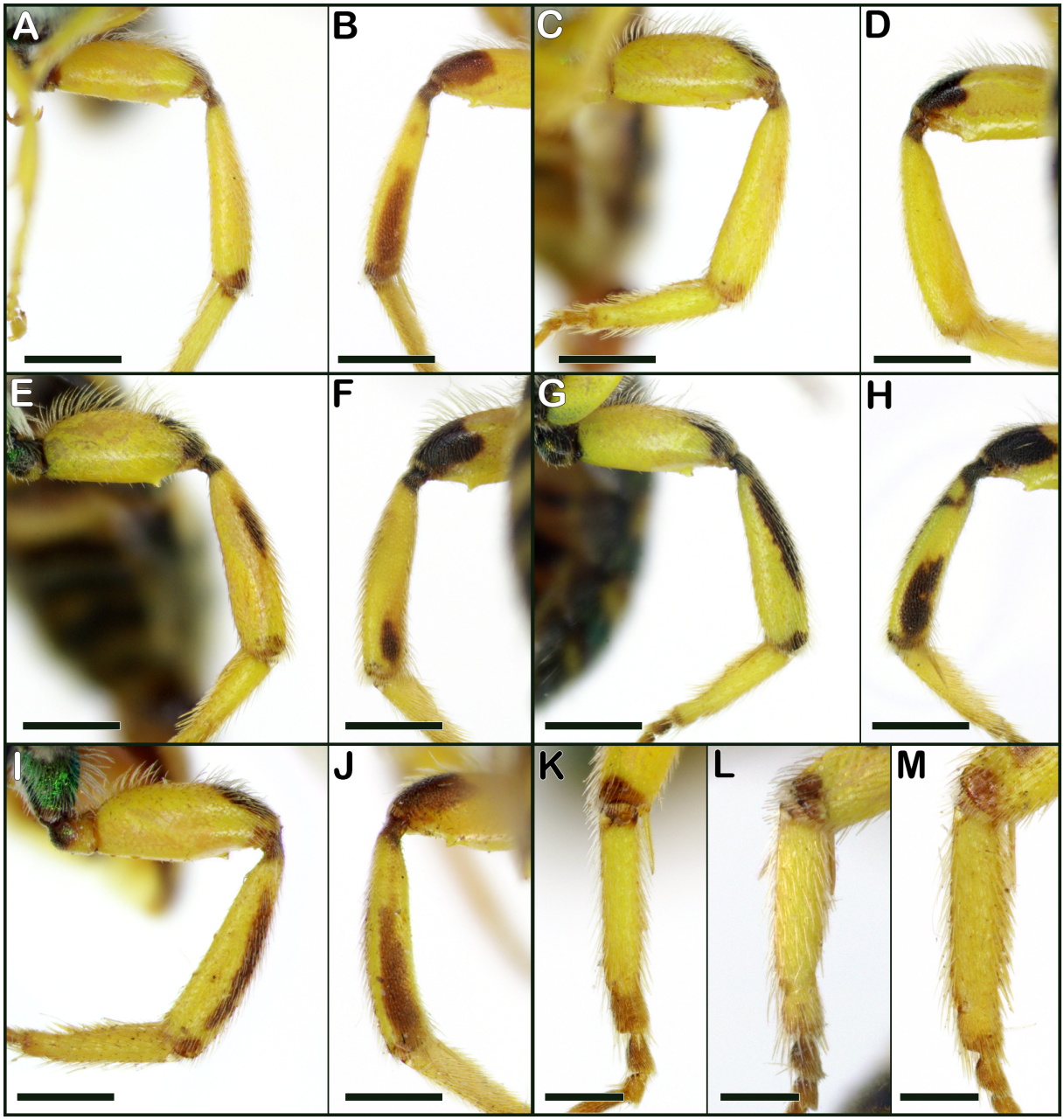

Fig. 5. Male hind legs. **A**. *Agapostemon angelicus* Cockerell, 1924, anterior view. **B**. *A. angelicus*, posterior view. **C**. *A. subtilior* Cockerell, 1898, lightest color, anterior view. **D**. *A. subtilior*, lightest color, posterior view. **E**. *A. subtilior*, anterior view. **F**. *A. subtilior*, posterior view. **G**. *A. subtilior*, dark, anterior view. **H**. *A. subtilior*, dark, posterior view. **I**. *A. texanus* Cresson, 1872, anterior view. **J**. *A. texanus*, posterior view. **K**. *A. angelicus*, basitarsus. **L**. *A. subtilior*, basitarsus. **M**. *A. texanus*, basitarsus. Scale bars: A–J = 1 mm; K–M = 500 µm.

CE Mickel leg.; UMSP. – **Jackson Co.** • (43.51976 -94.874): 1 ♀; 13 Jul. 2021; LS, WB leg.; bee bowl; CNBL; 1 ♀, 1 ♂; 1 Sep. 2021; SM leg.; bee bowl; CNBL • Graham Creek WMA (43.78235 -95.4131): 3 ♀♀; 2 Jul. 2021; WB, EB leg.; bee bowl; CNBL; 1 ♀; 29 Jun. 2022; ED leg.; bowl; CNBL • Sioux Valley WMA (43.51555 -95.2989): 1 ♀; 16 Jun. 2022; MM leg.; bowl; CNBL; 1 ♀; 30 Jun. 2022; WB leg.; bowl; CNBL. – **Lincoln Co.** • (44.35099 -96.0915): 1 ♀; 24 Jun. 2021; ED, IR leg.; bee bowl; CNBL • (44.40319 -96.4448): 21 ♀♀; 13 Jul. 2016; Pennarola and Leone leg.; UMSP • Hole in the Mountain (44.25681 -96.2925): 3 ♀♀; 12 Jul. 2016; Pennarola and Leone leg.; UMSP. – **Lyon Co.** • (44.46335 -95.8984): 6 ♀♀; 24 Jun. 2021; ED, IR leg.; bee bowl; CNBL • (44.53108 -95.8984): 5 ♀♀; 30 Jun. 2021; IR, ED leg.; hand net, *Ratibida columnifera*; CNBL; 1 ♀; 30 Jun. 2021; IR, ED leg.; hand net, *Verbena stricta*; CNBL; 31 ♀♀; 1 Jul. 2021; SM leg.; bee bowl; CNBL; 1 ♀; 28 Jul. 2021; CHS, IR leg.; bee bowl; CNBL; 1 ♀, 2 ♂♂; 18 Aug. 2021; LS leg.; bee bowl; CNBL; 1 ♂; 18 Aug. 2021; WB leg.; hand net, *Heliopsis helianthoides*; CNBL; 1 ♀; 23 Jun. 2022; ED leg.; bowl; CNBL • (44.5639 -95.7592): 1 ♀; 29 Jun. 2019; SG, LN leg.; bee bowls; CNBL • (44.564 -95.7593): 1 ♀; 28 Jul. 2021; WB, LF leg.; bee bowl; CNBL; 1 ♀; 18 Aug. 2021; IL leg.; hand net, *Helianthus maximiliani*; CNBL • Lines WMA (44.58493 -95.635): 1 ♀; 14 Jul. 2022; ED leg.; bowl; CNBL. – **Martin Co.** • (43.5495 -94.7961): 1 ♀; 12 Jul. 2019; MK, LN leg.; bee bowls; CNBL • (43.5495 -94.7962): 1 ♀; 30 Aug. 2021;

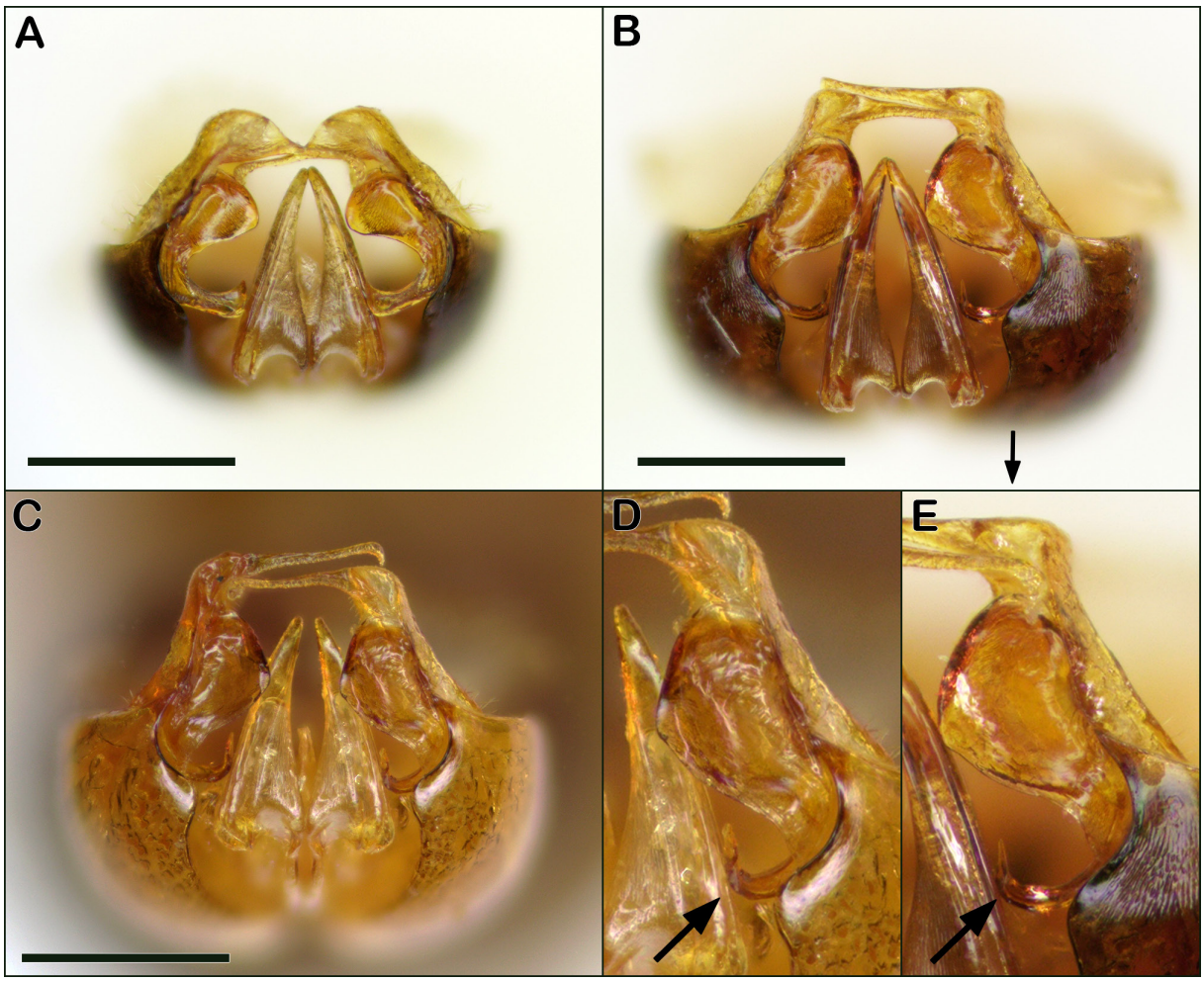

Fig. 6. Apical view of male genitalia. **A**. *Agapostemon angelicus* Cockerell, 1924. **B**. *A. subtilior* Cockerell, 1898. **C**. *A. texanus* Cresson, 1872 s. s. **D**. *A. texanus* s. s., zoomed in with black arrow pointing to more evenly curved lower stylus. **E**. *A. subtilior* zoomed in with black arrow pointing to more laterally extending lower stylus. Scale bars: 500 µm.

WB leg.; hand net, *Solidago rigida*; CNBL; 1 ♀; 1 Sep. 2021; SM leg.; bee bowl; CNBL • Krahmer WMA (43.69432 -94.6017): 1 ♀; 8 Jul. 2021; CHS, SM leg.; bee bowl; CNBL; 1 ♀; 17 Jun. 2022; WB leg.; bowl; CNBL. – **Meeker Co.** • (44.8927 -94.5042): 1 ♀; 12 Jun. 2020; B Bruninga-Socolar leg.; bowl; CNBL. – **Murray Co.** • (43.85734 -95.5938): 1 ♀; 2 Jul. 2021; ED, IR leg.; bee bowl; CNBL; 3 ♀♀; 29 Jun. 2022; ED, WL leg.; bowl; CNBL • (44.03932 -95.9301): 19 ♀♀; 24 Jun. 2021; CHS, ED leg.; bee bowl; CNBL; 5 ♀♀; 21 Jul. 2021; ED leg.; bee bowl; CNBL • (44.0676 -95.9281): 1 ♀; 29 Jun. 2019; ED, MK leg.; bee bowls; CNBL • (44.06761 -95.9281): 1 ♂; 12 Aug. 2021; ED leg.; bee bowl; CNBL • (44.07093 -95.5718): 1 ♀; 20 Jul. 2021; LF leg.; hand net, *Cirsium arvense*; CNBL • (44.08686 -95.7738): 5 ♀♀; 24 Jun. 2021; LS, LF leg.; bee bowl; CNBL; 1 ♀; 21 Jul. 2022; WL, LT leg.; bowl; CNBL • (44.0885 -95.6725): 1 ♀; 30 Jun. 2020; CHS leg.; hand net, *Achillea millefolium*; CNBL • (44.15208 -95.8779): 34 ♀♀; 24 Jun. 2021; LF, LS leg.; bee bowl; CNBL; 29 ♀♀; 24 Jun. 2021; LS, LF leg.; bee bowl; CNBL; 4 ♀♀; 22 Jul. 2021; CHS leg.; bee bowl; CNBL. – **Nobles Co.** • (43.52333 -95.7276): 1 ♀; 16 Jun. 2022; WB leg.; bowl; CNBL • (43.5793 -95.7551): 1 ♀; 12 Jul. 2021; IR leg.; hand net, *Achillea millefolium*; CNBL; 3 ♀♀; 13 Jul. 2021; IR, LF leg.; bee bowl; CNBL; 3 ♀♀; 3 Aug. 2021; LS, IR leg.; bee bowl; CNBL; 2 ♀♀; 16 Jun. 2022; WB leg.; bowl; CNBL; 2 ♀♀; 30 Jun. 2022; MM, LT leg.; bowl; CNBL; 3 ♀♀; 27 Jul. 2022; WB leg.; bowl; CNBL; 1 ♀; 11 Aug. 2022; MM leg.; bowl; CNBL • (43.74601 -95.7158): 1 ♀; 2 Jul. 2021; EB, WB leg.; bee bowl; CNBL; 1 ♀; 30 Jun. 2022; WB leg.; bowl; CNBL. – **Norman Co.** • 1 ♂; 31 Aug. 1936; DG Denning leg.; UMSP. – **Polk Co.** • 1 ♀; 21 Jul. 1936; DG Denning leg.; UMSP. – **Pope Co.** • (45.49639 -95.5788): 1 ♀; 7 Jul. 2017; I Lane leg.; bowl; UMSP. – **Redwood Co.** • (44.29963 -94.9282): 2 ♀♀; 16 Jul. 2021; SM, LF leg.; bee bowl; CNBL • (44.5825 -95.2099): 2 ♀♀; 30 Jul. 2019; CHS, MK leg.; bee bowls; CNBL • (44.58255 -95.21): 1 ♂; 17 Aug. 2022; WL leg.; bowl; CNBL. – **Renville Co.** • (44.53465 -94.8874): 1 ♀; 30 Jun. 2021; WB leg.; bee bowl; CNBL. – **Rock Co.** • Blue Mounds State Park: 1 ♀; 10 Aug. 1973; EF Cook leg.; UMSP. – **Sherburne Co.** • Sherburne National Wildlife Refuge (45.46477 -93.6744): 1 ♀; 10 Jun. 2016; E Evans leg.; bowl; CNBL. – **Washington Co.** • 1 ♀; 19 Jul. 1936; D Murray leg.; UMSP. – **Watonwan Co.** • (43.896 -94.6232): 2 ♀♀; 8 Jul. 2021; IR, LF leg.; bee bowl; CNBL; 1 ♀; 1 Sep. 2021; RK leg.; bee bowl; CNBL. – **Yellow Medicine Co.** • (44.685 -96.3092): 1 ♀; 29 Jun. 2019; LN, SG leg.; bee bowls; CNBL • (44.68504 -96.3092): 3 ♀♀; 1 Jul. 2021; LS, LF leg.; bee bowl; CNBL; 5 ♀♀; 28 Jun. 2022; LT, MM leg.; bowl; CNBL; 3 ♀♀; 15 Jul. 2022; ED leg.; bowl; CNBL • (44.7072 -96.3972): 1 ♀; 29 Jun. 2017; Pennarola and Leone leg.; UMSP • Archerville WMA (44.63281 -96.3278): 1 ♀; 1 Jul. 2021; LS, LF leg.; bee bowl; CNBL; 1 ♀; 28 Jun. 2022; MM, LT leg.; bowl; CNBL. – **MISSOURI – Greene Co.** • Rocky Barrens Cons. Area, NE Willard 1.5 mi.: 1 ♀; 14 Apr. 2006; M Arduser leg.; *Physaria filiformis*; MAPC. – **MONTANA – Carbon Co.** • Bobcat Pass Rd, 1289 m (45.0822 -108.8248): 1 ♀; 13–14 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Carter Co.** • Medicine Rocks State Park (46.0409 -104.4847): 1 ♀; 20 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC • Medicine Rocks State Park (46.0425 -104.4835): 1 ♀; 20 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Daniels Co.** • 1.5 mi. N Four Buttes (48.83 -105.6046): 1 ♀; 30–31 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Park Co.** • 0.2 mi. N; Hicks Park, Boulder River Rd (45.3042 -110.2415): 2 ♀♀; 5 Sep. 2020; MA Ivie, LL Ivie leg.; bee bowl; MTEC • Boulder River Rd (45.3282 -110.2305): 1 ♀; 5–6 Sep. 2020; MA Ivie, LL Ivie leg.; bee bowl; MTEC • S Four; Mile Cabin, Boulder Rd (45.3377 -110.233): 1 ♀; 5–6 Sep. 2020; MA Ivie, LL Ivie leg.; bee bowl; MTEC. – **Petroleum Co.** • Blakeslee Rd (47.0895 -108.5885): 1 ♀; 20–21 Aug. 2020; C Delphia, J Runyon leg.; bee bowl; MTEC. – **Phillips Co.** • Montana Gulch Campground (47.9004 -108.632): 1 ♀; 2–3 Aug. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Prairie Co.** • Coal Crk Rd entrance (46.8208 -105.2951): 1 ♀; 7 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **Richland Co.** • CR 115 Crane Cemetery (47.5725 -104.2647): 2 ♀♀; 14 Jul. 2020; JR Brower leg.; bee bowl; MTEC; 2 ♀♀; 29 Jul. 2020; J Brower leg.; bee bowl; MTEC • CR.115 sapling clearing (47.5763 -104.2687): 1 ♀; 14 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **Teton Co.** • N of Bynum, HWY 89, 1224 m (47.9865 -112.3157): 1 ♀; 7 Jul. 2020; J Wallace, MA Ivie leg.; bee bowl; MTEC • Young Rd N of Sun River (47.5533 -112.3664): 1 ♀; 7 Jul. 2020; J Wallace, MA Ivie leg.; bee bowl; MTEC. – **Wibaux Co.** • St. Phillip Rd entrance (46.8449 -104.1896): 2 ♀♀;

15–16 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **NEBRASKA – Hall Co.** • Platte River Prairies Preserve, Derr house lawn (40.7336 -98.5789): 7 ♀♀, 3 ♂♂; 5 Aug. 2013; Arduser, Helzer, Stine leg.; bowls; MAPC. – **Lancaster Co.** • Lincoln: 1 ♂; 17 Aug. 1927; CE Mickel leg.; UMSP. – **Lincoln Co.** • Sutherland: 1 ♀; 20 Jun. 1932; MJ Oosthuizen leg.; UMSP. – **NEW MEXICO – Doña Ana Co.** • Hatch: 1 ♀; date unknown; collector unknown; MCZ • Mesilla Park: 3 ♀♀; 12 Jul. year unknown; J Bequaert leg.; MCZ. – **Guadalupe Co.** • Pastura, 1.5 mi. south on Hwy 54: 2 ♀♀, 5 ♂♂; 21 Aug. 1995; Arduser and Stevens leg.; MAPC. – **Harding Co.** • Kiowa Nat'l Grasslands, Mills Rim campground: 2 ♀♀, 1 ♂; 5 Jul. 2023; Arduser and MacRae leg.; net, *Ratibida* sp.; MAPC. – **Hidalgo Co.** • 28 mi. S of Animas: 1 ♀; 30 Aug. 2010; J Gardner leg.; net, *Machaeranthera tanacetifolia*; UMSP; 4 ♀♀; 30 Aug. 2010; J Gardner leg.; net, *Mentzelia* sp.; UMSP. – **Lincoln Co.** • nr Carrizozo on Hwy 54: 2 ♂♂; 21 Aug. 1995; Arduser and Stevens leg.; net, *Grindelia* sp.; MAPC. – **McKinley Co.** • Cibola NF, Quaking Aspen Campground: 4 ♀♀, 11 ♂♂; 28 Jul. 1998; Arduser and Stevens leg.; net, *Melilotus alba*; MAPC • Ramah: 1 ♀; date unknown; collector unknown; MCZ. – **Otero Co.** • Lincoln NF, Bailey Canyon Rd, 8300 ft: 3 ♀♀, 9 ♂♂; 5 Aug. 2003; Arduser and Stevens leg.; net, *Wyethia* sp.; MAPC. – **Quay Co.** • W. Tucumcari 15 mi. along I-40 at Palomas: 1 ♂; 5 Aug. 1997; Arduser and Stevens leg.; MAPC. – **Rio Arriba Co.** • Carson NF on Rd 310, 2 mi. N of Hwy 64: 1 ♂; 7 Aug. 2000; Arduser and Stevens leg.; net, *Chrysothamnus* sp.; MAPC. – **San Juan Co.** • Head of Pump Canyon, NW of La Plata, 6000 ft: 3 ♂♂; 4 Jul. 2023; Arduser and MacRae leg.; MAPC. – **Sandoval Co.** • Jemez Mountains: 1 ♀; 13 Jun. year unknown; Woodgate leg.; MCZ • Jemez Springs: 1 ♀; date unknown; collector unknown; MCZ. – **Socorro Co.** • 19 mi. W of Magdalena on Hwy 52: 4 ♀♀, 12 ♂♂; 30 Jul. 1997; Arduser and Stevens leg.; net, *Cleome serrulata*; MAPC. – **Torrance Co.** • Moriarty: 2 ♂♂; 25 Aug. 1940; HE Milliron leg.; UMSP; 2 ♂♂; 26 Aug. 1940; HE Milliron leg.; UMSP. – **Union Co.** • Hwy 56 at mi. mrkr 129: 4 ♀♀, 7 ♂♂; 26 Jul. 1997; Arduser and Stevens leg.; net, *Asclepias latifolia*; MAPC. – **NORTH DAKOTA – Barnes Co.** • 10.7 km NE of Rogers (47.11298 -98.06702): 3 ♀♀; 13 Jul. 2012; E Evans leg.; pan trap; UMSP • 11.7 km NE of Rogers (47.09531 -98.04099): 1 ♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP • 11.7 km NE of Rogers (47.0962 -98.07721): 1 ♂; 15 Aug. 2012; J Castro, K Holzenthal leg.; net, *Melilotus* ; UMSP • 2.2 km NE of Rogers (47.08152 -98.17183): 1 ♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP • 2.2 km NE of Rogers (47.0823 -98.1718): 1 ♀; 18 May 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP • 4.5 km NE of Rogers (47.09616 -98.1509): 1 ♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP • 6.6 km NW of Sandborn (46.9794 -98.2916): 2 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP • 7.8 km NW of Sandborn (46.97964 -98.28512): 1 ♀; 11 Sep. 2010; E Evans leg.; pan trap; UMSP. – **Griggs Co.** • 2 km E of Karnak (47.2784 -98.03435): 1 ♀; 10 Sep. 2012; E Evans leg.; pan trap; UMSP • 3.5 km SE of Karnak (47.25538 -98.03372): 1 ♀; 13 Jul. 2012; E Evans leg.; pan trap; UMSP. – **Stutsman Co.** • 2.4 km E of Edmunds (47.24819 -98.93286): 1 ♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP • 2.4 km E of Edmunds (47.25226 -98.9328): 1 ♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 2 ♀♀; 13 Jul. 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP • 4.6 km SE of Edmunds (47.2258 -98.9217): 2 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 4 ♀♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP • 8.2 km NE of Pingree (47.1948 -98.8056): 1 ♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP • 8.2 km NE of Pingree (47.20049 -98.80618): 2 ♀♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP • 8.7 km NE of Pingree (47.1816 -98.7945): 1 ♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP. – **OKLAHOMA – Cimarron Co.** • Black Mesa St. Pk West Canyon Campground: 2 ♀♀; 23 Jun. 2023; Arduser and MacRae leg.; net, *Opuntia* sp.; MAPC. – **Comanche Co.** • Wichita Mountains NWR, Charon's Garden Trail (34.7101 -98.7307): 1 ♂; 4 May 2012; Arduser leg.; *Helenium amarum*; MAPC. – **Ellis Co.** • Four Canyon Preserve, head of Horse Canyon (36.0223 -99.494): 1 ♀; 7 Jun. 2009; Arduser leg.; bowls; MAPC. – **Major Co.** • Gloss Mountains State Park, top of Mesa (36.3649 -98.5788): 17 ♀♀; 6 May 2022; Arduser leg.; bowls; MAPC. – **SOUTH DAKOTA – Fall River Co.** • Hot Springs: 1 ♂; 4 Aug. 1940; RH Daggy leg.; UMSP. – **Hughes Co.** • 1 ♂; 8 Aug. 1934; F Morton leg.; UMSP. – **Jackson Co.** • Bad Lands, Cedar Pass: 2 ♂♂; 14 Aug. 1940; HE Milliron leg.; UMSP. – **Jones Co.** • 8 ♂♂; 11 Aug. 1934; F Morton leg.; UMSP. – **Pennington Co.** • 3 ♂♂; 14 Aug. 1934; F Morton leg.; UMSP • Lake

Pactola: 1 ♂; 11 Sep. 1971; Woods leg.; UMSP. – **Stanley Co.** • 1 ♂; 7 Aug. 1934; F Morton leg.; UMSP; 7 ♂♂; 9 Aug. 1934; F Morton leg.; UMSP. – **TEXAS – Brewster Co.** • 1 ♀; 22 May 2000; R. Clinebell leg.; net, *Calylophus* sp.; MAPC • Chisos Mountains, Big Bend National Park: 1 ♀; date unknown; J Bequaert leg.; MCZ. – **Eastland Co.** • 1 ♀; 23 May 1921; GO Wiley leg.; UMSP; 1 ♂; 14 Aug. 1921; GO Wiley leg.; UMSP • Cisco: 1 ♀; 21 Jun. 1921; GO Wiley leg.; UMSP. – **El Paso Co.** • Fabens: 4 ♀♀; 10 Jul. year unknown; J Bequaert leg.; MCZ. – **Jeff Davis Co.** • Davis Mts: 1 ♀; 4 Sep. 1949; F Werner, W Nutting leg.; MCZ • Fort Davis: 1 ♀; 6 Jul. 1917; J Bequaert leg.; MCZ. – **Lee Co.** • Fedor: 1 ♀; 28 Apr. 1898; G Birkmann leg.; MCZ. – **Pecos Co.** • Ft Stockton: 2 ♀♀; 5 Aug. year unknown; J Bequaert leg.; MCZ. – **Presidio Co.** • Chinati Mts: 1 ♂; 16 Jun. 1930; E Tinkham leg.; UMSP • Presidio, 3 mi. E: 1 ♀; 1–3 May 1963; HE Evans leg.; MCZ. – **Somervell Co.** • Glen Rose: 2 ♀♀; 19 May 1940; H Knutson leg.; UMSP. – **UTAH – Emery Co.** • 1 ♂; 1 Aug. 1921; GO Wiley leg.; UMSP. – **Garfield Co.** • Hog Springs Rec. Area: 1 ♂; 26 Jun. 2023; Arduser and MacRae leg.; net, *Stanleya pinnata*; MAPC. – **Iron Co.** • Beryl: 1 ♂; 24 Oct. 1957; GF Knowlton leg.; UMSP. – **Kane Co.** • Moquith Mtn. Wilderness (dunes): 4 ♀♀, 3 ♂♂; 29 Jun. 2023; Arduser and MacRae leg.; net, *Eriogonum inflatum*; MAPC; 1 ♂; 29 Jun. 2023; Arduser and MacRae leg.; net, *Scabrethia* sp.; MAPC. – **San Juan Co.** • Bluff: 1 ♀; 7 Jul. 1935; Brues leg.; MCZ. – **Washington Co.** • Leeds Crk Canyon (37.292 -113.4128): 3 ♂♂; 30 Jun. 2023; Arduser and MacRae leg.; net, *Eriodyction* sp.; MAPC. – **WYOMING – Crook Co.** • 1 ♂; 31 Jun. 1939; HS Telford leg.; UMSP. – **Platte Co.** • Glendo: 2 ♀♀; 29 Jun. 1930; G Fairchild leg.; MCZ. – **Teton Co.** • Flat Creek: 1 ♂; 15 Aug. 1940; HE Milliron leg.; UMSP. – **Weston Co.** • 1 ♂; 11 Aug. 1939; HS Telford leg.; UMSP • Clifton: 2 ♂♂; 15 Aug. 1940; HE Milliron leg.; UMSP.

Remarks

The type of *A. angelicus* is female, which has contributed to the confusion between this species and the *A. texanus* complex. We have examined images of the type specimen, which have sufficient detail to confirm the identity of the species based on the shape of the apex of the clypeus and the size and sculpturing of the propodeum.

Sandhouse (1936) was clearly able to identify the females of *A. angelicus* and correctly pair them with the males based on the characters reported in Sandhouse (1936), and we have seen a number of correctly-determined female *A. angelicus* bearing Sandhouse determination labels. With the exception of the differences in punctation of the scutum, the characters Sandhouse (1936) used to separate female *A. angelicus* (including the more strongly sculptured propodeum, smaller size, and whiter hairs) generally work, but none of them are 100% consistent. Roberts (1972) could not separate female *A. angelicus* and *A. texanus* and separated associated males and females primarily by the greater relative abundance of *A. angelicus* males, though he accepted the *A. angelicus* type female as determined by Sandhouse (1936).

The range of *A. angelicus* appears to be somewhat more extensive than reported by Roberts (1972). For example, Roberts (1972) reported only *A. texanus* s. lat. from Minnesota; however, in the UMSP collection, there are multiple male and female specimens of *A. angelicus* from Minnesota that were misidentified by Roberts as *A. texanus* (5 males and numerous females). One of the historic females of *A. angelicus* is from Washington County, MN, which borders Wisconsin, and raises the possibility that *A. angelicus* could be found even further eastward. Similarly, Roberts (1972) did not report *A. angelicus* from Montana, but we have found it to have an extensive range in that state. This demonstrates one of the dangers of identifying species based on range, and this led to further misidentifications as various workers misidentified *A. angelicus* females in Minnesota up until newly collected males and females prompted a complete rechecking of all historic material. As a result, the number of Minnesota counties that *A. angelicus* is known to occur in has increased to 23 from the four reported in Portman *et al.* (2023) (Fig. 8B). Finally, *A. angelicus* no doubt extends further northwards and westwards than shown in our distribution maps (Fig. 7A), with the more limited distribution being an artifact of our more limited material from those areas.

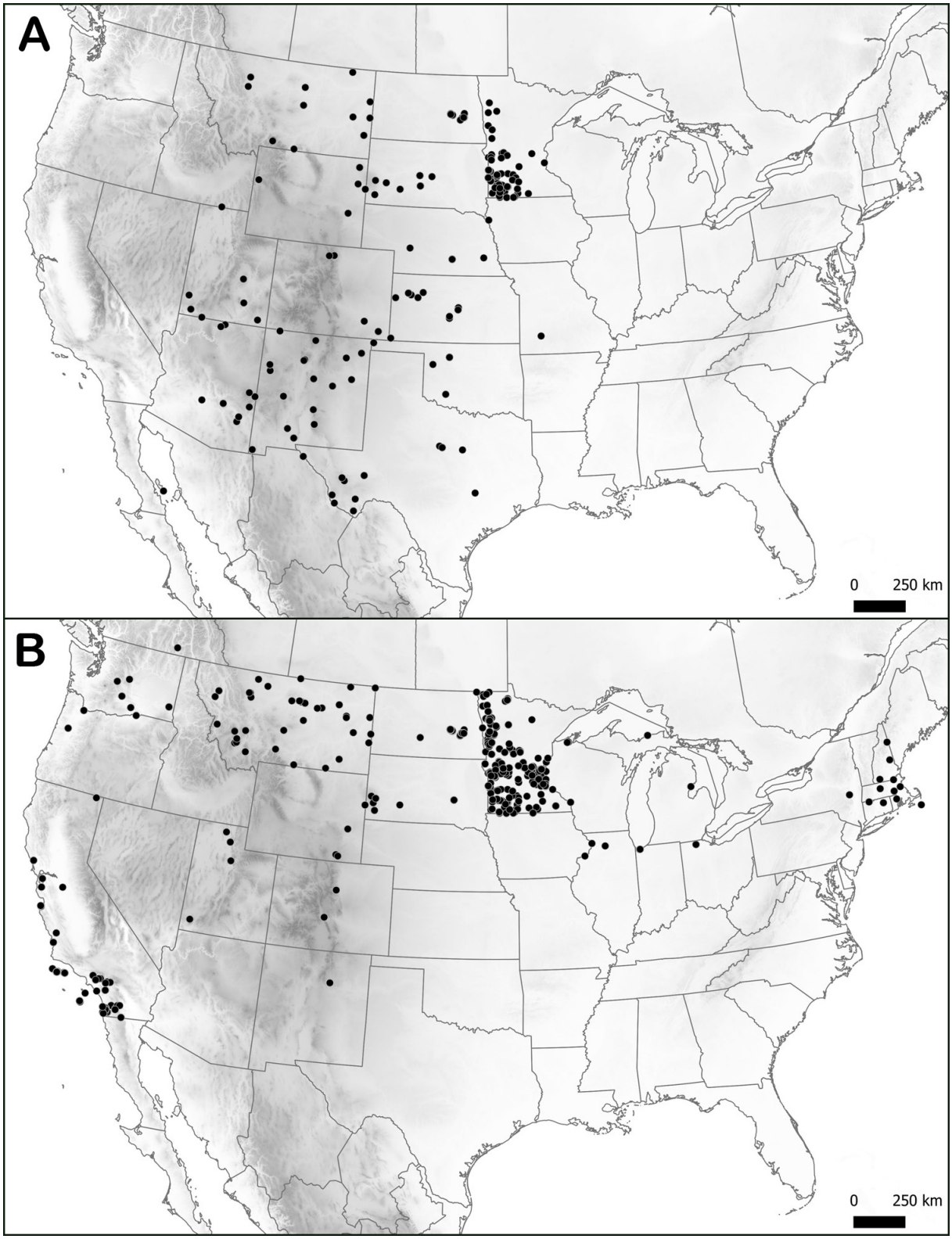

Fig. 7. Range maps of specimens examined by the authors. **A**. *Agapostemon angelicus* Cockerell, 1924. **B**. *A. subtilior* Cockerell, 1898.

Ecology

The nesting biology of *A. angelicus* from Arizona is reported in Eickwort (1981), though the bees were identified from females and we have not had the opportunity to confirm the identification. *Agapostemon angelicus* is a ground-nester, polylectic, multivoltine, and solitary, though it may practice communal nesting (Eickwort 1981).

Distribution

Agapostemon angelicus occurs across western North America. For this study, we have confirmed specimens from: AZ, CO, IA, ID, KS, MN, MT, ND, NE, MO, NM, OK, SD, TX, UT, WY. The western

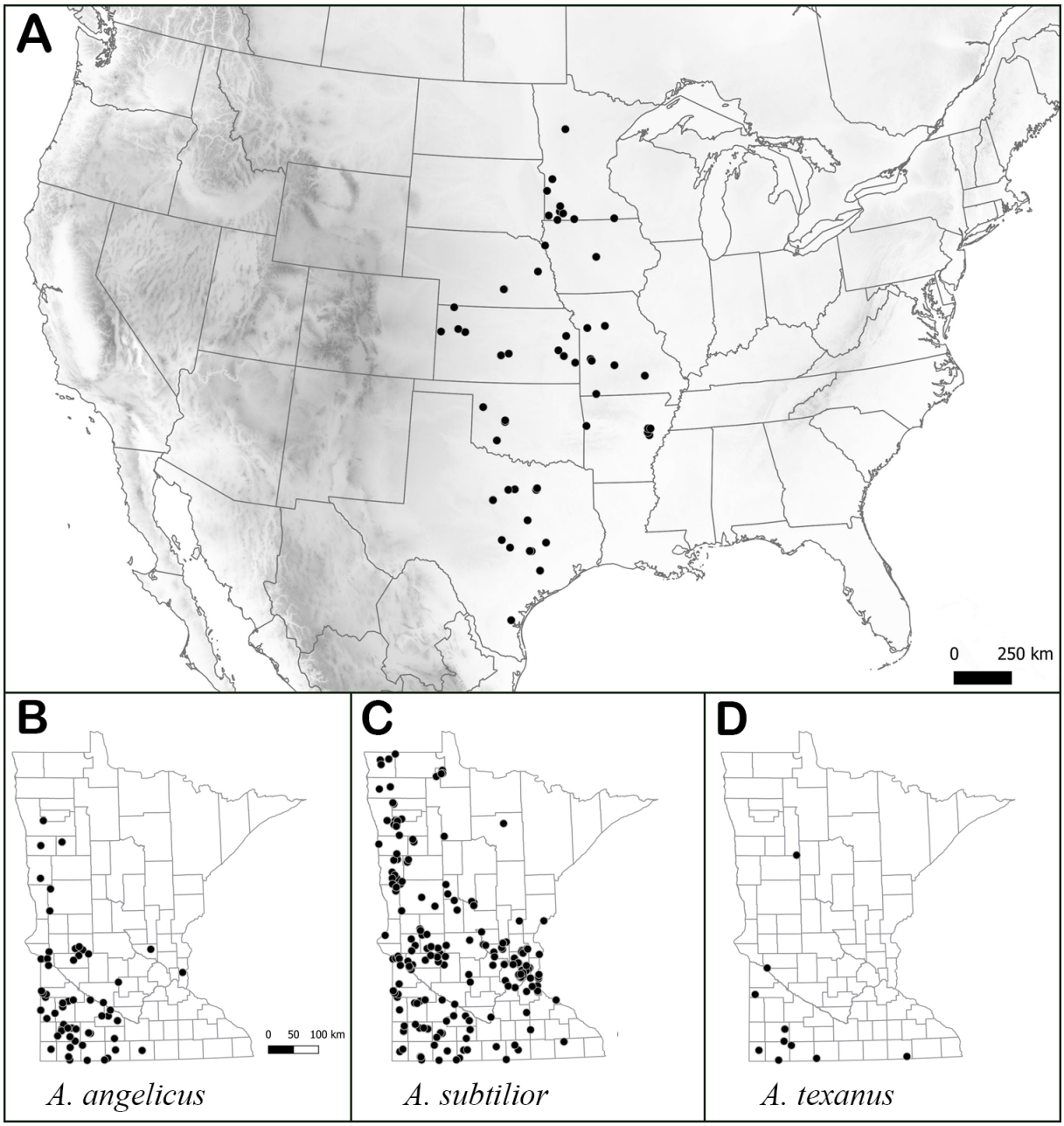

Fig. 8. Range maps of specimens examined by the authors. **A**. *Agapostemon texanus* Cresson, 1872 s. s. **B**. Distribution of *A. angelicus* Cockerell, 1924 in Minnesota. **C**. Distribution of *A. subtilior* Cockerell, 1898 in Minnesota. **D**. Distribution of *A. texanus* s. s. in Minnesota.

and northern limits of this species remain uncertain to us. It has previously been documented as far west as California (Roberts 1972) and Oregon (Roberts 1973) and as far north as Saskatchewan, Canada (Sheffield *et al.* 2014). *Agapostemon angelicus* is generally a common species.

Agapostemon* (*Agapostemon*) *subtilior Cockerell, 1898 stat. rev.
Figs 1B, 2C–D, 3B, D, 4B, E, 5C–H, L, 6B, E, 7B, 8C, 9

Original reference

Agapostemon subtilior Cockerell, 1898: 27, ♀. Neotype, ♀ (designated by Roberts 1972), Pasco, Washington State, 25 May 1896, deposited in UCMC, shown in Fig. 9.

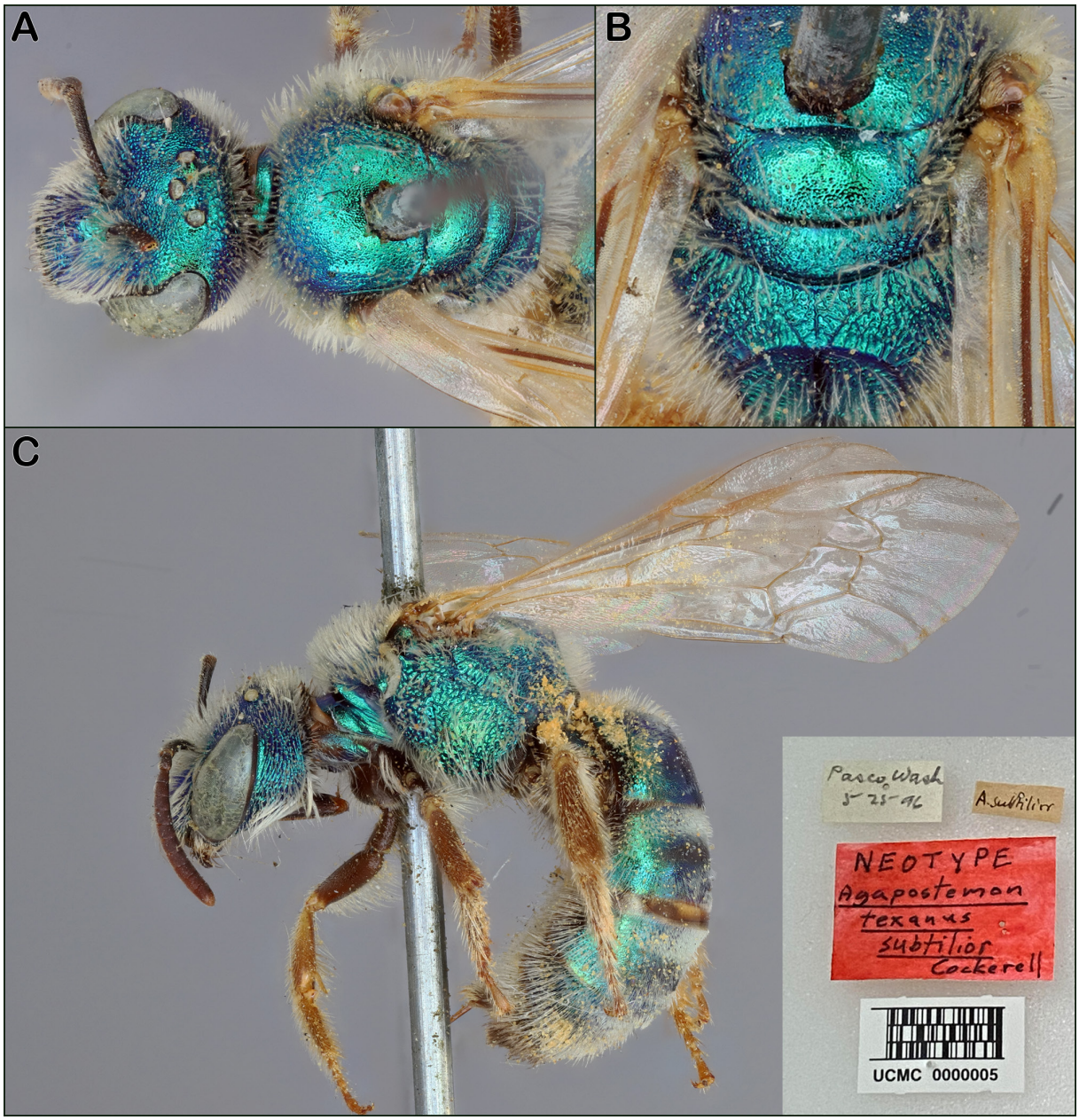

Fig. 9. *Agapostemon subtilior* Cockerell, 1898, neotype, female (UCMC0000005). **A**. Dorsal view of head and thorax. **B**. Propodeum. **C**. Lateral view with inset of labels. Images provided by Bekka Shupe and Virginia Scott (UCMC).

Synoynymy

Agapostemon borealis Crawford, 1901: 160, ♀ (syn. under *A. texanus* s. lat. by Sandhouse 1936). Holotype, ♀, Vancouver, British Columbia, Canada, Livingston leg., 4 Apr. 1896, deposited in ANSP. Images examined by ZP. **Syn. nov.**

Agpostemon californicus Crawford, 1901: 164, ♂ [not ♀] (syn. under *A. texanus* s. lat. by Sandhouse 1936). Lectotype, ♂ (designated by Cockerell 1927, see remarks), Pacific Grove, California, Saunders leg., Jul. 1894, deposited in UNSM [UNSMe12747]. Images examined by ZP. **Syn. nov.**

Agapostemon texanus vandykei Cockerell, 1925: 191, ♀ (syn. under *A. texanus* s. lat. by Sandhouse 1936). Holotype, ♀, Yosemite Valley, California, E.C. Van Dyke leg., 25 Jun. 1921, deposited in CAS, type no. 1652. Images examined. Online record: https://monarch.calacademy.org/collections/individual/index.php?occid=2497037&clid=. **Syn. nov.**

Agapostemon californicus psammobius Cockerell, 1937: 150, ♂♀ (syn. under *A. texanus* s. lat. by Roberts 1972). Holotype, ♂, San Miguel Island, California, Cockerell leg., Jul. [1937], deposited in CAS. Images examined. Online record: https://monarch.calacademy.org/collections/individual/index.php?occid=2499296. **Syn. nov.**

A*gapostemon angelicus idahoensis* Michener, 1937: 314, ♀ (syn. under *A. texanus* s. lat. by Roberts 1972). Holotype, ♀, Challis, Idaho, Louise Ireland leg., 26 Jun. 1932. Deposited in the Snow Entomological Museum at the University of Kansas. Not examined. **Syn. nov.**

Agapostemon californicus clementinus Cockerell, 1939b: 431, ♂ (syn. under *A. texanus* s. lat. by Roberts 1972). Holotype, ♂, San Clemente Island, California, Cockerell leg., 18 Jun. [1938], deposited in UCMC. Images examined by ZP. **Syn. nov.**

Taxonomy and references

Agapostemon texanus – Robertson 1897: 328 [in part, combined with *A. angelicus* and *A. texanus* s. s.] (description, range). — Crawford 1901: 160 [in part, mixed with *A. texanus* s. s. and potentially *A. angelicus*] (key, taxonomy). — Sandhouse 1936: 82 [in part, combined with *A. texanus* s. s.] (key, diagnosis, distribution). — Roberts 1972: 533 [in part, combined with *A. texanus* s. s.] (key, diagnosis, distribution); 1973: 10 [in part, combined with *A. texanus* s. s.] (key, diagnosis, distribution). — Hurd 1979: 1953 [in part, combined with *A. texanus* s. s.] (catalog). — Moure & Hurd 1987: 190 [in part, combined with *A. texanus* s. s.] (catalog). — Portman *et al*. 2022: 117 [in part, combined with *A. texanus* s. s.] (key, diagnosis [all images of "*A. texanus*" show *A. subtilior*]).

Agapostemon texanus subtilior – Crawford 1901: 160 (key, taxonomy). — Cockerell 1910b: 244 (record, description of male); 1927: 157 (key, taxonomy, records). — Graenicher 1911: 234 (records); 1935: 302 (distribution in WI).

Agapostemon subtilior – Vachal 1903: 95 (key, description).

Agapostemon borealis – Cockerell 1927: 157 (notes on taxonomy, key).

Agapostemon californicus – Cockerell 1927: 158 (designation of lectotype, distribution, key); 1939a: 138 (distribution, notes on variation). — Michener 1937: 314 (note on taxonomy).

Agapostemon vandykei – Cockerell 1927: 155 (raised to species, key).

Agapostemon californicus clementinus – Cockerell 1939a: 138 (distribution, notes on variation).

Agapostemon californicus psammobius – Cockerell 1939a: 138 (distribution, notes on variation).

Agapostemon texanus californicus – Michener 1951: 1124 (catalog).

Agapostemon texanus clementinus – Michener 1951: 1124 (catalog).

Agapostemon texanus psammobius – Michener 1951: 1124 (catalog).

Agapostemon texanus texanus – Michener 1951: 1124 [combined with *A. texanus* s. s.] (catalog). — Mitchell 1960: 454 [combined with *A. texanus* s. s.] (key, description, distribution, floral records).

Agapostemon texanus vandykei – Michener 1951: 1124 (catalog).

Diagnosis

Agapostemon subtilior females are similar to those of both *A. texanus* and *A. angelicus*. They can be separated from *A. texanus* by the genal striae in the hypostomal area, which are extremely coarse and deep in *A. texanus* (Fig. 1C–D) compared to only moderately coarse in *A. subtilior* (Fig. 1B). Further, *A. texanus* have the punctures on the terga dense and contiguous (Fig. 4C, F), whereas *A. subtilior* tend to have the punctures separated with shining interspaces (Fig. 4B, E). Finally, in areas where they overlap, *A. subtilior* have the propodeum more weakly sculptured than *A. texanus*.

Females of *A. subtilior* and *A. angelicus* are quite similar and can be difficult to separate. They can be most reliably separated by the shape of the clypeus, which is weakly convex in *A. subtilior*, with the apex more evenly curved over onto the base of the apical fimbriae, and lacking a distinct narrow vertical overhang (Fig. 2 C–D). In contrast, *A. angelicus* has the clypeus flattened (Fig. 2A), with the transition to the apical margin forming a 90-degree angle above the base of the apical fimbriae, this angle demarcated by a weak carina rather than evenly curved over (Fig. 2B). *Agapostemon subtilior* can be further recognized by the more weakly sculptured dorsal surface of the propodeum (Fig. 3B), compared to strongly sculptured in *A. angelicus* (Fig. 3A). In cases where *A. subtilior* has the propodeum somewhat more strongly sculptured, the rugae are typically strongly anastomizing. The pleura of *A. subtilior* are also more weakly rugose (Fig. 3D) compared to *A. angelicus* (Fig. 3C), especially posteriorly.

There are additional, less reliable characters that can help separate females of *A. subtilior* and *A. angelicus*. The length of the dorsal surface of the propodeum of *A. subtilior* is typically shorter, not much longer than the length of the metanotum (Fig. 3B), whereas *A. angelicus* typically has the propodeum distinctly longer than the metanotum (Fig. 3A). The terga of *A. subtilior* are typically more sparsely punctured (Fig. 4B), with distinct shiny interspaces, particularly laterally, just basal of the premarginal line on T1 and T2 (Fig. 4E), compared to the more closely punctured terga in *A. angelicus* (Fig. 4A, D); however, this character can be somewhat variable. In addition, *A. subtilior* typically have the black mark on the apex of the clypeus thickened medially (Fig. 2C; sometimes forming a 'tooth'), compared to straight across in *A. angelicus* (Fig. 2A). There are also differences in hair color, with *A. subtilior* typically having the hairs of the thorax and legs yellowish compared to whitish in *A. angelicus*, though this character is not particularly reliable, and *A. subtilior* typically have more extensive black hairs on the outer hind tibial scopa, with the black hairs generally extending in a line down most of the tibia whereas black hairs are generally absent or limited to the hairs directly under the basatibial plate in *A. angelicus*. Finally, *A. subtilior* are, on average, larger than *A. angelicus*.

Male *A. subtilior* are similar to those of both *A. angelicus* and *A. texanus*, and they can be separated principally by the genitalia and coloration of the hind tibia. *Agapostemon angelicus* has the hind tibia with the anterior face all light (Fig. 5A; not counting a dark spot on the apex) and a well-developed dark mark posteriorly (Fig. 5B). In contrast, *A. subtilior* has a dark mark on the basal anterior face of the hind tibia (Fig. 5F, H) OR lacks dark marks on both the anterior and posterior face (Fig. 5C–D). In addition, the genitalia are different, with *A. subtilior* having a much narrower basal stylus and a broader medial plate (Fig. 6B) compared to *A. angelicus* (Fig. 6A).

Male *A. subtilior* are very similar to those of *A. texanus*, but they can be separated by the dark mark on the posterior face of the hind tibia and the genitalia. Specifically, *A. subtilior* have a smaller dark mark on the rear face of the hind tibia, which ranges from totally absent (Fig. 5D) to taking up the apical half of the tibia (Fig. 5H), and in cases where the dark mark takes up half the tibia, it ends rather abruptly. In contrast, *A. texanus* has a larger dark mark, taking up at least half of the posterior face of the hind tibia, and the basal portion is generally more narrowed and attenuated rather than abruptly ending (Fig. 5J). The genitalia of *A. subtilior* and *A. texanus* are very similar, but they can be separated principally by the shape of the basal stylus: in *A. subtilior* the basal stylus extends laterally with the end relatively abruptly

turned up towards the apex (Fig. 6E, black arrow), whereas in *A. texanus* the basal stylus is more evenly curving and is distinctly closer to the medial plate (Fig. 6D, black arrow).

Material examined

CANADA – **BRITISH COLUMBIA** • Robson: 1 ♂; 12 Sep. 1937; HR Foxlee leg.; UMSP.

USA – **CALIFORNIA – Alameda Co.** • Oakland: 1 ♂; 29 Aug. 1924; AT Hertig leg.; UMSP. – **Berkshire Co.** • Monterey: 1 ♂; 25 Sep. 1934; Melander leg.; MCZ; 3 ♀♀, 3 ♂♂; 25 Sep. 1934; AL Melander leg.; MCZ. – **Los Angeles Co.** • Claremont: 1 ♀; 13 May 1902; collector unknown; MCZ • La Poente: 1 ♀; 24 Mar. 1967; collector unknown; UMSP • La Puente: 1 ♂; 1 Jul. 1968; R Lundberg leg.; UMSP • Middle Ranch, Catalina Island: 1 ♀; 21 Mar. year unknown; WP Cockerell leg.; UMSP • Pasadena: 1 ♀; 24 Mar. 1934; CD Michener leg.; MCZ; 1 ♂; 13 Sep. 1934; CD Michener leg.; *Stephanomeria* sp.; MCZ; 2 ♀♀; date unknown; collector unknown; MCZ • San Clemente Island (32.9408 -118.5339): 3 ♀♀, 2 ♂♂; 16 Apr. 2018; MD Abemayor leg.; net, *Calystegia macrostegia*; UMSP • San Dimas: 1 ♀; 28 Mar. 1960; ROS leg.; UMSP. – **Modoc Co.** • Goose Lake: 1 ♀; date unknown; Holleman leg.; MCZ. – **Monterey Co.** • Pacific Grove: 2 ♀♀; date unknown; Mann leg.; MCZ. – **Orange Co.** • Laguna Beach: 1 ♀; 16 Aug. 1979; Wheeler leg.; MCZ. – **Riverside Co.** • Elsinore: 1 ♀, 4 ♂♂; 24 Aug. 1962; HE Evans leg.; MCZ • Riverside: 1 ♀, 1 ♂; 21 Jul. 1936; AE Pritchard leg.; UMSP. – **San Bernardino Co.** • Colton: 1 ♀, 2 ♂♂; date unknown; FA Eddy leg.; MCZ • Redlands: 1 ♀; date unknown; N Banks leg.; MCZ. – **San Diego Co.** • Anza Borrego (33.108 -116.4976): 4 ♀♀; 23 Mar. 2012; KJ Hung leg.; Blue bowl trap; UMSP; 1 ♀; 20 Apr. 2013; Hung, Borchers, Lee leg.; white bowl trap; UMSP • Anza Borrego (33.1369 -116.3796): 1 ♀; 23 Mar. 2013; KJ Hung leg.; white bowl trap; UMSP • Ced. Rid. pk (32.7219 -117.1186): 4 ♀♀; 26 Apr. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♀; 3 Jun. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♂; 15 Jul. 2022; JL Mullins leg.; net, *Isocoma menziesii*; UMSP • Coronado (32.6398 -117.1423): 1 ♀; 14 Aug. 2013; KJ Hung leg.; net; UMSP • Coronado (32.6864 -117.1904): 1 ♀; 14 Aug. 2013; KJ Hung leg.; net, *Helianthus* sp.; UMSP • Cuyamaca Rancho (32.9169 -116.5715): 2 ♂♂; 13 Sep. 2013; KJ Hung, Japaacha leg.; net, *Corethrogyne filaginifolia*; UMSP • Cuyamaca Rancho (32.9236 -116.5658): 2 ♀♀; 27 May 2013; Hung, Borchers, Lee leg.; white bowl trap; UMSP • Cuyamaca Rancho (32.9731 -116.5772): 1 ♀; 27 May 2013; Hung, Borchers, Lee leg.; yellow bowl trap; UMSP • Governor Dr. (32.8555 -117.1883): 2 ♀♀; 26 Apr. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♀; 12 May 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♂; 26 May 2022; JL Mullins leg.; white bowl; UMSP; 1 ♂; 26 May 2022; T Le leg.; fluorescent blue bowl; UMSP • Jacumba: 1 ♂; 12 Aug. 1917; Wheeler leg.; MCZ; 1 ♂; 12 Aug. 1917; J Bequaert leg.; *Eriogonum fasciculatum*; MCZ • La Jolla (32.9237 -117.2584): 1 ♂; 2 Aug. 2013; KE Borchers leg.; net, *Cordylanthus rigidus*; UMSP; 1 ♀, 1 ♂; 2 Aug. 2013; KJ Hung leg.; net, *Stephanomeria* sp.; UMSP • Mission Tr. (32.8346 -117.0751): 1 ♂; 9 May 2022; B Spencer leg.; fluorescent blue bowl; UMSP • SD NWR (32.7319 -116.9557): 1 ♀; 2 May 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • San Diego (32.7201 -117.0778): 1 ♂; 15 Jun. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • San Diego (32.7922 -117.0605): 1 ♂; 1 Jun. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • San Diego (32.822 -117.0755): 1 ♂; 12 Jul. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • San Diego (32.8346 -117.0751): 1 ♂; 11 May 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♂; 2 Jun. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • San Diego (32.8928 -117.0916): 1 ♀; 21 Apr. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♀; 23 Jun. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♂; 14 Jul. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • San Diego (32.8996 -117.0752): 1 ♂; 13 May 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP; 1 ♂; 14 Jul. 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • Spring Valley (32.7274 -116.94): 2 ♀♀; 2 May 2016; K Hung, A Lee leg.; fluorescent bowl trap; UMSP • Warren's: 1 ♀; 14 Aug. 1917; Wheeler leg.; MCZ. – **San Luis Obispo Co.** • Miles: 3 ♂♂; 11 Jul. 1936; AE Pritchard leg.; UMSP • Pao Robles: 1 ♀; 26 Sep. 1926; AL Melander leg.; MCZ. – **Santa Barbara Co.** • San Clemente Island: 1 ♀; 10 May 1939; Cockerell leg.;

MCZ; 1 ♀; May 1939; JT Scott leg.; MCZ • San Miguel Island: 1 ♀; 3 May year unknown; Cockerell leg.; MCZ; 1 ♀; 3 May year unknown; WP Cockerell leg.; MCZ • San Rosa Island: 2 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Cruz Island: 1 ♀, 1 ♂; 4 Jun. 2011; collector unknown; UMSP; 1 ♀, 1 ♂; 6 Jun. 2011; collector unknown; UMSP; 6 ♀♀; 11 Sep. 2011; collector unknown; UMSP • Santa Cruz Island (33.9866 -119.6695): 1 ♀; 6 Sep. 2012; collector unknown; UMSP • Santa Cruz Island (33.9908 -119.6786): 1 ♀; 24 Apr. 2012; collector unknown; UMSP • Santa Cruz Island (33.9998 -119.7277): 1 ♀; 4 Jun. 2012; collector unknown; UMSP • Santa Rosa Island, Black Mountain (33.9791 -120.0794): 4 ♀♀; 8 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Black Mountain (33.9792 -120.07942): 3 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP; 6 ♀♀; 22 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Black Mountain (33.98157 -120.07454): 2 ♀♀; 21 Jun. 2017; S Calloway, D Knapp leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9442 -120.1176): 19 ♀♀; 6 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9442 -120.1177): 17 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94424 -120.11773): 52 ♀♀; 2 Jun. 2017; D Knapp leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9452 -120.1164): 27 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94524 -120.11646): 24 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94567 -120.1179): 7 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9457 -120.1178): 3 ♀♀; 4 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9457 -120.1179): 8 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.946 -120.1087): 2 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP; 3 ♀♀; 4 Jun. 2014; R Alarcón leg.; pitfall traps; UMSP • Santa Rosa Island, Soledad Ridge (33.94602 -120.10871): 2 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94721 -120.11671): 11 ♀♀, 2 ♂♂; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9479 -120.1105): 5 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP; 39 ♀♀; 4 Jun. 2014; R Alarcón leg.; pan trap; UMSP; 8 ♀♀; 6 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.948 -120.1107): 5 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94808 -120.1107): 15 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94916 -120.10148): 43 ♀♀, 4 ♂♂; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP; 6 ♀♀; 21 Jun. 2017; S Calloway, D Knapp leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9495 -120.1043): 40 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP; 12 ♀♀; 8 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.94959 -120.10439): 25 ♀♀; 21 Jun. 2017; S Calloway, D Knapp leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.951 -120.1091): 11 ♀♀; 8 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9511 -120.1007): 20 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP; 13 ♀♀, 5 ♂♂; 8 Jun. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9511 -120.1092): 1 ♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.95116 -120.10071): 60 ♀♀, 1 ♂; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.95116 -120.10922): 11 ♀♀; 21 Jun. 2017; D Knapp, S Calloway leg.; pan trap; UMSP; 18 ♀♀, 2 ♂♂; 21 Jun. 2017; S Calloway, D Knapp leg.; pan trap; UMSP • Santa Rosa Island, Soledad Ridge (33.9513 -120.1007): 21 ♀♀; 29 Mar. 2014; R Alarcón leg.; pan trap; UMSP; 32 ♀♀; 8 Jun. 2014; R Alarcón leg.; pan trap; UMSP. – **Santa Clara Co.** • Stanford U: 1 ♂ (*A. californicus* paralectotype); 19 Sep. 1898; CT Brues leg.; MCZ; 2 ♂♂; 19 Sep. 1898; collector unknown; MCZ. – **Sonoma Co.** • Mesa Grande: 1 ♀; Jul. 1908; N Banks leg.; MCZ. – **Stanislaus Co.** • Modesto: 1 ♀; Jun. 1939; WC Cook leg.; light trap; UMSP. – **COLORADO – Fremont Co.** • Swissvale: 1 ♀; 17 Jun. year unknown; M Steele leg.; MCZ. – **Jefferson Co.** • Clear Creek: 1 ♂; date unknown; Oslar leg.; MCZ. – **CONNECTICUT – Litchfield Co.** • Colebrook: 1 ♂; 19 Aug. 1918; WM Wheeler leg.; MCZ; 1 ♀; 3 Aug. 1922; WM Wheeler leg.; MCZ; 1 ♂; 16 Aug. 1922; WM Wheeler leg.; MCZ. – **Tolland Co.** • Storrs: 1 ♀; 26 May 1931; collector unknown; MCZ. – **ILLINOIS – Carroll Co.** • Upper Mississippi

River NWR: 1 ♀; day and month unknown 2015; collector unknown; MAPC. – **Lee Co.** • Nachusa (41.886 -89.3228): 1 ♀; 21 Aug. 2020; J Klostermann leg.; pantrap; NACH. – **Rock Island Co.** • Rock Island: 1 ♂; date unknown; OW Oestlund leg.; UMSP. – **INDIANA – Lake Co.** • Indiana Dunes NP, Marquette Trail (41.6111 -87.2365): 1 ♀; 23 Jul. 2019; McGill leg.; B pan; UMSP • Indiana Dunes NP, Miller Woods b/w Lake St. & Grand Blvd (41.6057 -87.2644): 1 ♂; 12 Jul. 2018; McLaughlin leg.; W pan; UMSP. – **MASSACHUSETTS – Middlesex Co.** • Dracut: 1 ♀; date unknown; collector unknown; MCZ • Holliston: 1 ♂; 1 Sep. year unknown; N Banks leg.; MCZ. – **Nantucket Co.** • Nantucket: 1 ♀; 8 Aug. 1929; CW Johnson leg.; MCZ. – **Suffolk Co.** • Thomson Island (42.3145 -71.0119): 1 ♂; 30 Aug–7 Sep. 2005; J Rykken leg.; malaise trap; MCZ. – **Worcester Co.** • Petersham: 1 ♀; 24 Jun. year unknown; CT Brues leg.; MCZ. – **MICHIGAN – Alger Co.** • Sable Dunes: 2 ♀♀; 7–8 Jul. 1982; M Arduser leg.; malaise trap; MAPC; 3 ♀♀; 9–15 Jul. 1982; M Arduser leg.; malaise trap; MAPC; 2 ♀♀; 16–17 Jul. 1982; M Arduser leg.; malaise trap; MAPC; 1 ♀; 17–22 Jul. 1982; M Arduser leg.; malaise trap; MAPC; 1 ♀; 23–28 Jul. 1982; M Arduser leg.; malaise trap; MAPC. – **Dickinson Co.** • 5 mi. E Turner: 1 ♂; 16 Aug. 1983; M Arduser leg.; net, *Centaurea maculosa*; MAPC; 1 ♂; 16 Aug. 1983; M Arduser leg.; net, *Helianthus maximilliani*; MAPC. – **MINNESOTA – Anoka Co.** • Bunker Hills Reg. Park (45.2176 -93.2899): 1 ♂; 8 Aug. 2016; J Garnder leg.; bowl trap; CNBL • Bunker Hills Regional Park (45.2037 -93.2792): 2 ♀♀; 29 Apr. 2015; J Gardner leg.; bowl; CNBL; 23 ♀♀; 21 May 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 8 Jun. 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 1 Jul. 2015; J Gardner leg.; bowl; CNBL; 2 ♀♀; 3 May 2016; E Evans leg.; bowl; CNBL; 3 ♀♀; 19 May 2016; J Gardner leg.; bowl; CNBL; 1 ♀; 8 Jun. 2016; E Evans leg.; bowl; CNBL • Bunker Hills Regional Park (45.2105 -93.2877): 1 ♀; 29 Apr. 2015; J Gardner leg.; bowl; CNBL; 58 ♀♀; 21 May 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 20 Jul. 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 19 May 2016; J Gardner leg.; bowl; CNBL; 1 ♀; 8 Jun. 2016; E Evans leg.; bowl; CNBL; 1 ♂; 31 Aug. 2016; E Evans leg.; bowl; CNBL • Bunker Hills Regional Park (45.2165 -93.2909): 1 ♂; 10 Aug. 2015; J Gardner leg.; net, *Helianthus pauciflorus*; CNBL • Bunker Hills Regional Park (45.2176 -93.2899): 1 ♀; 29 Apr. 2015; J Gardner leg.; bowl; CNBL; 25 ♀♀; 21 May 2015; J Gardner leg.; bowl; CNBL; 18 ♀♀; 8 Jun. 2015; J Gardner leg.; bowl; CNBL; 2 ♀♀; 1 Jul. 2015; J Gardner leg.; bowl; CNBL; 3 ♀♀; 10 Aug. 2015; J Gardner leg.; bowl; CNBL; 1 ♀, 2 ♂♂; 3 Sep. 2015; J Gardner leg.; bowl; CNBL; 3 ♀♀; 3 May 2016; E Evans leg.; bowl; CNBL; 8 ♀♀; 19 May 2016; J Gardner leg.; bowl; CNBL; 2 ♀♀; 8 Jun. 2016; E Evans leg.; bowl; CNBL; 1 ♀, 1 ♂; 8 Aug. 2016; J Gardner leg.; bowl; CNBL • Cedar Creek Ecosystem Science Reserve (45.3978 -93.1592): 1 ♀; 12 Jun. 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 3 Jul. 2015; J Gardner leg.; bowl; CNBL; 3 ♀♀; 6 May 2016; J Gardner leg.; bowl; CNBL; 2 ♀♀; 19 May 2016; E Evans leg.; bowl; CNBL; 3 ♀♀; 9 Jun. 2016; J Gardner leg.; bowl; CNBL; 1 ♀; 21 Jun. 2016; E Evans leg.; bowl; CNBL • Cedar Creek Ecosystem Science Reserve (45.40267 -93.164): 1 ♀; 4 May 2015; E Evans leg.; bowl; CNBL • Cedar Creek Ecosystem Science Reserve (45.4029 -93.1993): 1 ♀; 22 May 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 12 Jun. 2015; J Gardner leg.; bowl; CNBL; 1 ♀; 6 May 2016; J Gardner leg.; bowl; CNBL; 1 ♀; 19 May 2016; E Evans leg.; bowl; CNBL • Cedar Creek Ecosystem Science Reserve (45.43096 -93.1894): 2 ♀♀; 4 May 2015; E Evans leg.; bowl; CNBL • Cedar Creek Ecosystem Science Reserve (45.4323 -93.1894): 3 ♀♀; 22 May 2015; J Gardner leg.; bowl; CNBL • Cedar Creek Natural History Area: 1 ♀; 24 Sep. 1990; collector unknown; UMSP • Lino Lakes: 1 ♀; 2 Jul. 1969; MJ Woloch leg.; net, daisies ; UMSP • Rum River Central Regional Park (45.3003 -93.3826): 1 ♂; 1 Sep. 2016; J Gardner leg.; net, *Cirsium vulgare*; CNBL. – **Becker Co.** • (47.03367 -96.0814): 3 ♀♀; 6 Jun. 2017; A Waananen leg.; bowl; UMSP; 1 ♀; 8 Jun. 2017; R Tucker leg.; net, *Zizia aurea*; UMSP; 8 ♀♀; 4 Jul. 2017; I Lane leg.; bowl; UMSP; 1 ♀; 25 Jul. 2017; S Marconie leg.; bowl; UMSP • Heliksen WPA (47.07929 -96.0579): 1 ♀; 4 Jul. 2017; M Gullickson leg.; bowl; UMSP. – **Big Stone Co.** • (45.30653 -96.2874): 1 ♀; 9 Jun. 2017; C Herron-Sweet leg.; blue vane; UMSP; 1 ♀; 9 Jun. 2017; S Marconie leg.; bowl; UMSP; 1 ♀; 5 Jul. 2017; A Waananen leg.; net, *Dalea purpurea*; UMSP; 1 ♀; 6 Jul. 2017; I Lane leg.; bowl; UMSP • Larson Slough WPA (45.3612 -96.3119): 2 ♀♀; 3 Jun. 2017; Pennarola and Leone leg.; UMSP • Ortonville: 1 ♂; 11 Sep. 1935; HS Telford leg.; UMSP • Schellberg Prairie Bank (45.32595 -96.3714): 1 ♀; 30 Aug. 2018; M Rancour leg.; bowl; UMSP. – **Brown Co.** • (44.2114

-94.542): 2 ♀♀; 13 Jun. 2019; SG leg.; bee bowls; CNBL; 1 ♀; 8 Jul. 2019; MK, ED leg.; bee bowls; CNBL • (44.2936 -94.6332): 1 ♀; 8 Jul. 2019; MK, ED leg.; bee bowls; CNBL. – **Chisago Co.** • Pleasant Vly Orchard (45.3533 -92.7523): 1 ♀; 9 Jun. 2015; K Foord leg.; UMSP. – **Clay Co.** • (46.64058 -96.2578): 1 ♀; 1 Jun. 2017; R Tucker leg.; bowl; UMSP • (46.64143 -96.4625): 2 ♂♂; 12 Aug. 2016; Pennarola and Leone leg.; UMSP; 3 ♀♀; 10 Jun. 2017; Pennarola and Leone leg.; UMSP • (46.74468 -96.4675): 5 ♀♀; 20 Jun. 2017; I Lane leg.; bowl; UMSP; 1 ♀; 28 Aug. 2017; J Brokaw leg.; net, *Ratibida pinnata*; UMSP; 1 ♀; 29 Aug. 2017; I Lane leg.; blue vane; UMSP; 1 ♀; 29 Aug. 2017; I Lane leg.; bowl; UMSP • (46.80157 -96.4056): 1 ♀; 21 Aug. 2017; A Waananen leg.; blue vane; UMSP • Bluestem SNA (46.85422 -96.4723): 13 ♀♀; 2 Jun. 2017; A Waananen leg.; bowl; UMSP; 1 ♀; 22 Jun. 2017; C Herron-Sweet leg.; blue vane; UMSP; 1 ♀; 22 Jun. 2017; C Herron-Sweet leg.; net, *Calylophus serrulatus*; UMSP; 2 ♀♀; 28 Jun. 2017; A Waananen leg.; bowl; UMSP; 1 ♀; 21 Jul. 2017; I Lane leg.; bowl; UMSP • Clay County WMA (46.74776 -96.3535): 1 ♀; 14 Jul. 2017; I Lane leg.; bowl; UMSP • Ulen WMA (47.082 -96.3382): 8 ♀♀; 11 Jun. 2017; Pennarola and Leone leg.; UMSP. – **Cottonwood Co.** • (43.9917 -95.218): 1 ♀; 31 May 2019; ED leg.; bee bowls; CNBL; 3 ♀♀; 25 Jun. 2019; MK, LN leg.; bee bowls; CNBL • (43.99175 -95.2175): 13 ♀♀; 24 Jun. 2021; WB, SM leg.; bee bowl; CNBL • (44.0012 -95.2591): 3 ♀♀; 31 May 2019; CH leg.; bee bowls; CNBL; 4 ♀♀; 25 Jun. 2019; LN, MK leg.; bee bowls; CNBL; 1 ♀; 25 Jun. 2019; MK, LN leg.; bee bowls; CNBL • (44.00121 -95.2591): 1 ♀; 3 Jun. 2021; LF, SM leg.; bee bowl; CNBL; 3 ♀♀; 24 Jun. 2021; SM, WB leg.; bee bowl; CNBL; 2 ♀♀; 21 Jun. 2022; WB leg.; bowl; CNBL. – **Dakota Co.** • Rosemount (44.7036 -93.102): 1 ♀; 8 Jun. 2020; A Coker leg.; vacuum; CNBL. – **Douglas Co.** • (45.8455 -95.7581): 1 ♀; 16 Jul. 2004; S Pimm, S Wagenius leg.; yellow pan trap; CBG • Staffanson TNC (45.81606 -95.746): 1 ♀; 22 Jun. 2018; M Rancour leg.; net, *Heliopsis helianthoides*; UMSP • Staffenson Prairie, 3 mi. NW Kensington: 1 ♀; 5 Jul. 1977; E Ordway, B Goecke leg.; net, *Coreopsis palmata*; UMSP; 1 ♀; 13 Sep. 1977; B Goecke leg.; net, *Aster novaeangliae*; UMSP; 1 ♀; 30 May 1978; B Goecke leg.; net, *Zizia aptera*; UMSP; 1 ♀; 27 Jun. 1979; E Ordway leg.; net, *Aster novaeangliea*; UMSP. – **Faribault Co.** • (43.74105 -93.888): 1 ♀; 15 Jul. 2021; ED leg.; bee bowl; CNBL • (43.7411 -93.8879): 1 ♀; 19 Jul. 2019; LN, ED, MK leg.; bee bowls; CNBL. – **Freeborn Co.** • 1 ♀; 11 Aug. 1936; E Woolveton leg.; UMSP. – **Goodhue Co.** • Lake Pepin: 1 ♀; 25 May 1956; Patel leg.; UMSP. – **Hennepin Co.** • Bauer Dr (45.1905 -93.4204): 1 ♀; 1 Jun. 2015; K Foord leg.; UMSP; 9 ♀♀; 9 Jun. 2015; K Foord leg.; UMSP • Crow Hassan Reserve (45.1846 -93.9283): 1 ♀; 2 Jul. 1991; CC Reed leg.; *Achillea millefolium*; CRC; 1 ♀; 9 Sep. 1991; CC Reed leg.; *Amorpha canescens*; CRC; 1 ♀; 3 Jun. 1992; CC Reed leg.; CRC; 1 ♀; 6 Jul. 1992; CC Reed leg.; CRC • Eagle Creek (44.7793 -93.3842): 1 ♀; 11 Jun. 1996; CC Reed leg.; *Penstemon grandiflorus*; CRC; 2 ♀♀; 13 Jun. 1996; CC Reed leg.; *Penstemon grandiflorus*; CRC • East Phillips Comm. Garden (44.958 -93.2502): 3 ♂♂; 8 Aug. 2017; A Irber leg.; sweep net; CNBL; 4 ♂♂; 18 Aug. 2017; A Irber leg.; sweep net; CNBL; 2 ♂♂; 8 Sep. 2017; A Irber leg.; sweep net; CNBL; 1 ♂; 13 Sep. 2017; A Irber leg.; sweep net; CNBL; 1 ♀, 2 ♂♂; 21 Sep. 2017; A Irber leg.; sweep net; CNBL; 2 ♀♀; 1 Jun. 2018; A Irber leg.; net, *Allium schoenoprasum*; CNBL; 1 ♀; 5 Jun. 2018; A Irber leg.; net, *Brassica rapa*; CNBL; 1 ♀; 5 Jun. 2018; A Irber leg.; net, *Glechoma hederacea*; CNBL • Fairview Prk (45.0065 -93.2865): 1 ♀; 15 Jun. 2015; I Lane leg.; vacuum; UMSP • Fairview Prk (45.0076 -93.2864): 1 ♀; 29 Jun. 2015; I Lane leg.; vacuum; UMSP; 1 ♂; 10 Sep. 2015; I Lane leg.; vacuum; UMSP • Hall Prk (44.9948 -93.2887): 1 ♀; 15 Jun. 2015; I Lane leg.; vacuum; UMSP • Hall Prk (44.995 -93.2884): 2 ♂♂; 26 Jun. 2015; I Lane leg.; vacuum; UMSP • Lake Minnetonka: 1 ♀; 14 Jun. 1932; DG Denning leg.; UMSP • Matthews Prk (44.9585 -93.2313): 1 ♀; 15 Jun. 2015; I Lane leg.; vacuum; UMSP; 1 ♂; 25 Aug. 2015; I Lane leg.; vacuum; UMSP • Pollinator Patch 23st Ave S (44.9515 -93.2416): 1 ♀; 27 Jun. 2017; A Irber leg.; sweep net; CNBL; 1 ♂; 8 Sep. 2017; A Irber leg.; sweep net; CNBL • Pollinator Patch 3rd Ave S (44.9601 -93.2502): 1 ♂; 21 Sep. 2017; A Irber leg.; sweep net; CNBL • Windom Prk (45.0124 -93.2355): 1 ♀; 10 Sep. 2015; I Lane leg.; vacuum; UMSP • Windom Prk (45.9585 -93.2313): 1 ♀; 15 Jun. 2015; I Lane leg.; vacuum; UMSP. – **Isanti Co.** • Cedar Creek Ecosystem Science Reserve (45.3922 -93.164): 1 ♀; 22 May 2015; J Gardner leg.; bowl; CNBL • Cedar Creek Ecosystem Science Reserve (45.3922 -93.1643): 9 ♀♀; 22 May 2015; J Gardner leg.; bowl; CNBL • Cedar Creek Ecosystem

Science Reserve (45.4323 -93.1894): 1 ♀; 6 May 2016; J Gardner leg.; bowl; CNBL; 1 ♀; 19 May 2016; E Evans leg.; bowl; CNBL • Irving & John Anderson County Park (45.4614 -93.0675): 2 ♀♀; 21 May 2015; E Evans leg.; bowl; CNBL; 1 ♀; 16 May 2016; J Gardner leg.; bowl; CNBL • Irving & John Anderson County Park (45.462 -93.061): 5 ♀♀; 21 May 2015; E Evans leg.; bowl; CNBL; 2 ♀♀; 10 Jun. 2015; E Evans leg.; bowl; CNBL • Irving & John Anderson County Park (45.4663 -93.0542): 2 ♀♀; 21 May 2015; E Evans leg.; bowl; CNBL. – **Jackson Co.** • (43.51976 -94.874): 1 ♀; 17 Jun. 2021; ED leg.; bee bowl; CNBL • Graham Creek WMA (43.7823 -95.4131): 1 ♀; 5 Jun. 2019; ED, LN leg.; bee bowls; CNBL; 1 ♀; 26 Jun. 2019; LN, SG leg.; bee bowls; CNBL • Graham Creek WMA (43.78235 -95.4131): 1 ♀; 15 Jun. 2021; LF, SM, CHS leg.; bee bowl; CNBL • Sioux Valley WMA (43.51555 -95.2989): 2 ♀♀; 15 Jun. 2021; EB, LS leg.; bee bowl; CNBL; 2 ♀♀; 30 Jun. 2022; WB leg.; bowl; CNBL. – **Kandiyohi Co.** • (45.20311 -95.1528): 1 ♀; 20 Jun. 2017; I Lane leg.; bowl; UMSP • (45.3529 -95.1192): 5 ♀♀; 2 Jun. 2017; C Herron-Sweet leg.; bowl; UMSP; 1 ♀; 20 Jun. 2017; I Lane leg.; bowl; UMSP; 1 ♀; 26 Jun. 2017; R Tucker leg.; net, *Cirsium arvense*; UMSP; 1 ♀; 5 Jun. 2018; T Eicholz leg.; bowl; UMSP; 1 ♀; 27 Jun. 2018; G Pardee leg.; net, *Trifolium hybridum*; UMSP; 2 ♀♀; 7 Sep. 2018; M Rancour leg.; bowl; UMSP • Brenner Lake WPA (45.40062 -95.2463): 1 ♀; 5 Jun. 2018; S Marconie leg.; bowl; UMSP. – **Kittson Co.** • 1 ♂; 28 Aug. 1936; DG Denning leg.; UMSP • Lancaster: 2 ♂♂; 26 Aug. 1935; DG Denning leg.; UMSP; 1 ♀; 26 Aug. 1936; DG Denning leg.; UMSP. – **Lac qui Parle Co.** • Florida Creek WPA (44.86759 -96.2836): 2 ♀♀; 1 Jun. 2017; Pennarola and Leone leg.; UMSP. – **Lincoln Co.** • 1 ♀; 20 Jul. 1936; D Sandager leg.; UMSP. – **Lyon Co.** • (44.52408 -95.8357): 1 ♀; 10 Jun. 2021; WB, IR leg.; bee bowl; CNBL • (44.5311 -95.8983): 1 ♀; 20 Jun. 2019; MK, CHS leg.; bee bowls; CNBL • (44.5639 -95.7592): 1 ♀; 29 Jun. 2019; SG, LN leg.; bee bowls; CNBL • (44.564 -95.7593): 2 ♀♀; 9 Jun. 2021; SM, LF leg.; bee bowl; CNBL; 1 ♀; 30 Jun. 2021; ED leg.; bee bowl; CNBL • Lines WMA (44.58493 -95.635): 1 ♀; 30 Jun. 2021; IR leg.; bee bowl; CNBL; 1 ♀; 22 Jun. 2022; WL, MM leg.; bowl; CNBL. – **Marshall Co.** • Argyle: 1 ♂; 26 Aug. 1936; DG Denning leg.; UMSP. – **Martin Co.** • (43.5495 -94.7961): 1 ♂; 17 Sep. 2019; LF, KF leg.; bee bowls; CNBL • Krahmer WMA (43.69432 -94.6017): 1 ♀; 17 Jun. 2022; WB leg.; bowl; CNBL • Rooney Run WMA (43.6904 -94.692): 1 ♀; 6 Jul. 2019; CHS leg.; bee bowls; CNBL; 1 ♀; 6 Aug. 2019; SG leg.; bee bowls; CNBL. – **Meeker Co.** • (44.8927 -94.5042): 1 ♀; 12 Jun. 2020; B Bruninga-Socolar leg.; blue vane; CNBL • (45.0267 -94.5367): 1 ♀; 12 Jun. 2020; B Bruninga-Socolar leg.; bowl; CNBL; 1 ♀; 26 Aug. 2020; B Bruninga-Socolar leg.; blue vane; CNBL. – **Mille Lacs Co.** • JQ Fruit Farm: 1 ♀; 9 Jun. 2013; K Foord leg.; UMSP; 3 ♀♀; 23 May 2016; K Foord leg.; UMSP. – **Murray Co.** • (44.0709 -95.5718): 3 ♀♀; 31 May 2019; CHS leg.; bee bowls; CNBL; 1 ♀; 29 Jun. 2019; ED, MK leg.; bee bowls; CNBL; 1 ♀; 29 Jun. 2019; MK, ED leg.; bee bowls; CNBL • (44.07093 -95.5718): 8 ♀♀; 16 Jun. 2021; CHS, WB leg.; bee bowl; CNBL; 1 ♀; 16 Jun. 2021; SM, LF leg.; bee bowl; CNBL; 1 ♀; 2 Jul. 2021; LS, LF leg.; bee bowl; CNBL • (44.0868 -95.7738): 1 ♀; 31 May 2019; KF leg.; bee bowls; CNBL; 1 ♀; 29 Jun. 2019; MK leg.; bee bowls; CNBL; 1 ♀; 16 Aug. 2019; CHS leg.; bee bowls; CNBL • (44.08854 -95.6725): 1 ♀; 28 Jun. 2022; ED, DPC, WL leg.; bowl; CNBL • (44.15208 -95.8779): 2 ♀♀; 24 Jun. 2021; LS, LF leg.; bee bowl; CNBL • (44.1521 -95.8779): 1 ♀; 29 Jun. 2019; MK leg.; bee bowls; CNBL. – **Nobles Co.** • (43.5233 -95.7276): 1 ♀; 3 Jun. 2019; ED leg.; bee bowls; CNBL; 1 ♀; 3 Jun. 2019; LN leg.; bee bowls; CNBL • (43.5793 -95.7551): 2 ♀♀; 3 Jun. 2019; CHS leg.; bee bowls; CNBL; 4 ♀♀; 3 Jun. 2019; ED leg.; bee bowls; CNBL; 1 ♀; 3 Jun. 2019; LN leg.; bee bowls; CNBL; 10 ♀♀; 25 Jun. 2019; KF, SG leg.; bee bowls; CNBL; 11 ♀♀; 15 Jun. 2021; IR, WB leg.; bee bowl; CNBL; 1 ♀; 13 Jul. 2021; IR, LF leg.; bee bowl; CNBL; 5 ♀♀; 16 Jun. 2022; WB leg.; bowl; CNBL; 2 ♀♀; 30 Jun. 2022; MM, LT leg.; bowl; CNBL. – **Norman Co.** • Halstad: 1 ♂; 31 Aug. 1935; DG Denning leg.; UMSP. – **Otter Tail Co.** • 2 ♀♀; 15 Jun. 1936; DG Denning leg.; UMSP; 5 ♀♀; 15 Jun. 1936; HS Telford leg.; UMSP. – **Polk Co.** • 1 ♀; 4 Jul. 1936; DG Denning leg.; UMSP; 3 ♂♂; 14 Aug. 1936; DG Denning leg.; UMSP • Crookston: 1 ♂; 30 Aug. 1936; DG Denning leg.; UMSP; 1 ♀; 20 Jul. 1956; BA Haws leg.; sweet clover ; UMSP. – **Pope Co.** • (45.49639 -95.5788): 2 ♀♀; 15 Jun. 2017; A Waananen leg.; bowl; UMSP • (45.52598 -95.479): 16 ♀♀; 1 Jul. 2016; Pennarola and Leone leg.; UMSP; 7 ♀♀, 1 ♂; 1 Aug. 2016; Pennarola and Leone leg.; UMSP; 5 ♀♀, 1 ♂; 26 Aug. 2016; Pennarola and Leone leg.;

UMSP; 151 ♀♀; 5 Jun. 2017; Pennarola and Leone leg.; UMSP; 6 ♀♀; 6 Jul. 2017; Pennarola and Leone leg.; UMSP • (45.73565 -95.7054): 3 ♀♀; 6 Jun. 2017; S Marconie leg.; bowl; UMSP • Ben Wade WPA (45.74681 -95.5819): 1 ♀; 1 Jul. 2016; Pennarola and Leone leg.; UMSP • Overby WPA (45.50158 -95.3045): 5 ♀♀; 30 Jun. 2016; Pennarola and Leone leg.; UMSP; 66 ♀♀; 4 Jun. 2017; Pennarola and Leone leg.; UMSP; 2 ♀♀; 5 Jul. 2017; Pennarola and Leone leg.; UMSP. – **Ramsey Co.** • Bald Eagle-Otter Lake Regional Park (45.1005 -93.0371): 3 ♀♀; 5 Jun. 2015; E Evans leg.; net, *Trifolium repens*; CNBL • Bald Eagle-Otter Lake Regional Park (45.10069 -93.0367): 1 ♀; 5 Jun. 2015; E Evans leg.; bowl; CNBL • Bald Eagle-Otter Lake Regional Park (45.1184 -93.0061): 1 ♀; 21 Jun. 2016; J Gardner leg.; bowl; CNBL • Bald Eagle-Otter Lake Regional Park (45.1187 -93.0049): 8 ♀♀; 5 Jun. 2015; E Evans leg.; bowl; CNBL • Bald Eagle-Otter Lake Regional Park (45.1237 -93.0044): 1 ♀; 29 Jun. 2015; E Evans leg.; bowl; CNBL • Battle Creek Regional Park (44.9384 -92.9933): 1 ♀; 8 Jun. 2016; J Gardner leg.; bowl; CNBL • Bunker Hills Regional Park (45.21434 -93.2798): 1 ♀; 24 Jun. 2016; J Gardner leg.; net, *Crepis tectorum*; CNBL • Bunker Hills Regional Park (45.21659 -93.2865): 1 ♀; 24 Jun. 2016; J Gardner leg.; net, *Crepis tectorum*; CNBL • Long Lake Regional Park: 7 ♀♀; 12 Jun. 1996; CC Reed leg.; *Penstemon grandiflorus*; CRC; 4 ♀♀; 13 Jun. 1996; CC Reed leg.; *Penstemon grandiflorus*; CRC • Roseville, 3035 Fairview Ave (45.0325 -93.1775): 1 ♀; 26–27 Apr. 2003; Holzenthal leg.; UMSP • Sucker Lake: 1 ♀; 15 Jun. 1952; collector unknown; net; UMSP • University Farm: 1 ♀; 22 May 1960; TM Peters leg.; UMSP. – **Redwood Co.** • (44.2996 -94.9282): 1 ♀; 7 Sep. 2019; ED leg.; bee bowls; CNBL; 1 ♀; 7 Oct. 2019; ED leg.; bee bowls; CNBL; 1 ♀; 7 Nov. 2019; MK leg.; bee bowls; CNBL • (44.29963 -94.9282): 1 ♀; 21 Jun. 2022; MM, WL leg.; bowl; CNBL; 2 ♀♀; 21 Jun. 2022; WL, MM leg.; bowl; CNBL • (44.58255 -95.21): 1 ♀; 23 Jun. 2022; WL, MM leg.; bowl; CNBL. – **Rock Co.** • 1 ♀; 19 Jun. 1938; Nicholson-Pederson leg.; UMSP • Blue Mounds State Park: 1 ♀; 27 Jun. 1973; EF Cook leg.; Malaise trap; UMSP. – **Sherburne Co.** • Becker City Park (45.4171 -93.8964): 1 ♀; 29 Apr. 2015; E Evans leg.; bowl; CNBL • Sherburne National Wildlife Refuge (45.46477 -93.6744): 3 ♀♀; 5 May 2016; E Evans leg.; bowl; CNBL; 1 ♀; 10 Jun. 2016; E Evans leg.; bowl; CNBL • Sherburne National Wildlife Refuge (45.49192 -93.6968): 1 ♀; 5 May 2016; E Evans leg.; bowl; CNBL; 1 ♀; 10 Jun. 2016; E Evans leg.; bowl; CNBL. – **Stearns Co.** • St Cloud: 1 ♀; 10 Aug. 1970; collector unknown; UMSP • State College, St. Cloud: 1 ♀; 1 Oct. 1965; collector unknown; UMSP. – **Stevens Co.** • Coleman Prairie, 4 mi. SE Morris: 1 ♀; 2 Jul. 1916; E Ordway leg.; UMSP • Fults WPA (45.66481 -95.9795): 1 ♀; 30 Jun. 2016; Pennarola and Leone leg.; UMSP • John Freeman WMA (45.46111 -95.9681): 1 ♀; 22 May 2018; G Pardee leg.; net, *Taraxacum officinale*; UMSP; 1 ♀; 7 Jun. 2018; I Lane leg.; bowl; UMSP. – **Swift Co.** • (45.20793 -95.949): 2 ♀♀; 7 May 2018; A Ritchie leg.; bowl; UMSP; 1 ♀; 31 May 2018; S Marconie leg.; net, *Erigeron philadelphicus*; UMSP; 6 ♀♀; 1 Jun. 2018; G Pardee leg.; blue vane; UMSP; 4 ♀♀; 1 Jun. 2018; M Rancour leg.; bowl; UMSP; 5 ♀♀; 20 Jun. 2018; I Lane leg.; blue vane; UMSP; 5 ♀♀; 21 Jun. 2018; T Eicholz leg.; bowl; UMSP; 1 ♀; 22 Aug. 2018; I Lane leg.; bowl; UMSP • (45.27196 -96.0645): 1 ♀; 6 Jul. 2017; M Gullickson leg.; bowl; UMSP • Bengtson WPA (45.25929 -95.2977): 3 ♀♀; 1 Jun. 2017; Pennarola and Leone leg.; UMSP • Rice WPA (45.34487 -95.3201): 1 ♀; 26 Jun. 2016; Pennarola and Leone leg.; UMSP; 1 ♀; 2 Jul. 2017; Pennarola and Leone leg.; UMSP. – **Todd Co.** • (46.3465 -94.8796): 1 ♂; 3 Sep. 2019; M Dutta, D Harder leg.; bowl; CNBL; 1 ♀; 12 Jun. 2020; B Bruninga-Socolar leg.; blue vane; CNBL; 2 ♂♂; 4 Sep. 2020; B Bruninga-Socolar leg.; blue vane; CNBL. – **Wadena Co.** • potato field margin (46.4638 -95.0446): 1 ♀; 25 Jun. 2019; E Middleton leg.; UMSP. – **Washington Co.** • Belwin Conservancy (44.924 -92.79): 1 ♀; 14 Aug. 2015; J Gardner leg.; bowl; CNBL • Belwin Conservancy (44.9357 -92.8): 2 ♀♀; 12 Jun. 1995; CC Reed leg.; *Penstemon grandiflorus*; CRC • Belwin Conservancy (44.9493 -92.791): 1 ♀; 7 Jun. 2016; E Evans leg.; bowl; CNBL • Belwin Conservancy (44.9502 -92.791): 1 ♀; 4 Sep. 2015; J Gardner leg.; bowl; CNBL • St Croix Savannah SNA (44.9953 -92.7785): 1 ♀; 9 Jun. 2015; J Gardner leg.; net, *Potentilla recta*; CNBL • St Croix Savannah SNA (44.9953 -92.7801): 1 ♀; 9 Jun. 2015; J Gardner leg.; net, *Hesperis matrionalis*; CNBL • St Croix Savannah SNA (44.9957 -92.7826): 1 ♀; 14 Aug. 2016; J Gardner leg.; bowl; CNBL. – **Watonwan Co.** • (43.896 -94.6232): 1 ♀; 24 Jul. 2019; SG, LN leg.; bee bowls; CNBL • (44.0514

-94.5258): 1 ♀; day and month unknown 2019; SG leg.; bee bowls; CNBL; 1 ♀; 1 Aug. 2019; KF leg.; bee bowls; CNBL; 1 ♀; 29 Aug. 2019; RM, LF, KF leg.; bee bowls; CNBL; 1 ♀; day and month unknown 2019; LN leg.; bee bowls; CNBL • (44.05143 -94.5259): 3 ♀♀; 17 Jun. 2021; SM, LF leg.; bee bowl; CNBL; 1 ♀; 8 Jul. 2021; ED leg.; bee bowl; CNBL; 9 ♀♀; 21 Jun. 2022; MM, WL leg.; bowl; CNBL. – **Wedena Co.** • Sabeka: 1 ♂; 9 Aug. 1935; CE Mickel leg.; UMSP. – **Wilkin Co.** • Rice SNA (46.58837 -96.368): 1 ♀; 1 Jun. 2017; C Herron-Sweet leg.; bowl; UMSP; 1 ♀; 20 Jun. 2017; M Gullickson leg.; bowl; UMSP • Rothsay WMA (46.51869 -96.3758): 2 ♀♀; 9 Jun. 2017; Pennarola and Leone leg.; UMSP. – **Wright Co.** • Strawberry Basket (45.3345 -93.882): 2 ♀♀; 19 Jun. 2013; K Foord leg.; UMSP; 5 ♀♀; 3 Jun. 2014; K Foord leg.; UMSP; 5 ♀♀; 10 Jun. 2014; K Foord leg.; UMSP; 7 ♀♀; 23 May 2015; K Foord leg.; UMSP; 8 ♀♀; 9 Jun. 2015; K Foord leg.; UMSP; 5 ♀♀; 19 Jun. 2015; K Foord leg.; UMSP. – **Yellow Medicine Co.** • (44.685 -96.3092): 2 ♀♀; 29 Jun. 2019; LN, SG leg.; bee bowls; CNBL • (44.68504 -96.3092): 2 ♀♀; 10 Jun. 2021; CHS, LS leg.; bee bowl; CNBL • (44.7072 -96.3972): 1 ♀; 15 May 2017; Pennarola and Leone leg.; UMSP • Archerville WMA (44.6328 -96.3278): 1 ♀; 29 Jun. 2019; SG, LN leg.; bee bowls; CNBL • Archerville WMA (44.63281 -96.3278): 1 ♀; 10 Jun. 2021; EB, ED leg.; bee bowl; CNBL. – **MONTANA – Beaverhead Co.** • Trapper Creek Rd (45.6373 -112.7581): 3 ♀♀; 2–3 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC • Trapper Creek Rd Cabin (45.6381 -112.7584): 2 ♀♀; 2–3 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Big Horn Co.** • Tongue River S.P., 1064 m (45.1062 -106.7924): 1 ♀; 18–19 May 2020; Z Pritchard, KE Behme leg.; bee bowl; MTEC. – **Blaine Co.** • BLM land S of Cow Island (47.9226 -109.5174): 1 ♀; 23 Jul–26 Aug. 2021; J Kole, J Wallace leg.; BVT; MTEC • Bagan Rd, 2 mi. S CAN bdr (48.9732 -109.1328): 1 ♀; 18 May–22 Jul. 2021; J Kole, J Rainey leg.; BVT; MTEC • SW of Hays, Hays Rd, 1037 m (47.9364 -108.8867): 1 ♀; 2–3 Aug. 2020; Z Pritchard leg.; bee bowl; MTEC • W Hays; Timber Ridge Rd, 957 m (47.9682 -109.0171): 1 ♀; 2–3 Aug. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Carbon Co.** • Bobcat Pass Rd, 1289 m (45.0822 -108.8248): 1 ♀; 13–14 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC • Bobcat Pass Rd, 1336 m (45.0707 -108.8371): 1 ♀; 13–14 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Daniels Co.** • N side of Killenbeck Res (48.8672 -105.7303): 1 ♀; 30–31 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Deer Lodge Co.** • Lost Creek Rd (46.1847 -112.9061): 1 ♀; 1 Jul. 2019; Z Pritchard leg.; bee bowl; MTEC • Lost Creek Rd, 1558 m (46.1568 -112.8903): 2 ♀♀; 30 Jun–1 Jul. 2019; Z Pritchard leg.; bee bowl; MTEC. – **Fallon Co.** • Rolling Hills Trail (46.4339 -104.1946): 1 ♀; 23–24 Jul. 2020; Z Pritchard leg.; bee bowl; MTEC. – **Jefferson Co.** • High Ore Rd (46.2722 -112.2045): 2 ♀♀; 28–29 Jun. 2019; Z Pritchard leg.; bee bowl; MTEC. – **Lake Co.** • HWY 28, 1 mi. W Elmo (47.8217 -114.3899): 2 ♀♀; 8–9 Jun. 2020; J Wallace leg.; bee bowl; MTEC. – **Liberty Co.** • Willow; Creek Rd, Lake Elwell (48.4091 -111.2343): 1 ♀; 14 Jul. 2020; J Wallace leg.; bee bowl; MTEC. – **Madison Co.** • Granite Creek Rd (45.3306 -111.9917): 4 ♀♀; 27–28 Jun. 2019; Z Pritchard leg.; bee bowl; MTEC. – **McCone Co.** • 3 mi. down Weldon Rd (47.5197 -105.8095): 1 ♀; 20 Jul. 2020; JR Brower leg.; bee bowl; MTEC • 4 mi. down Weldon Rd (47.5366 -105.812): 1 ♀; 20 Jul. 2020; JR Brower leg.; bee bowl; MTEC • Flat Lake Rec Area (48.0137 -106.364): 1 ♀; day and month unknown 2020; DL Gustafson leg.; MTEC; 1 ♀; 21 Nov. 2020; DL Gustafson leg.; MTEC; 1 ♀; day and month unknown 2020; DL Gustafson leg.; MTEC • Weldon Rd entrance (47.4717 -105.8092): 1 ♀; 20 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **Petroleum Co.** • Arid Shale Pine Forest (47.116 -108.5889): 1 ♀; 20–21 Aug. 2020; C Delphia, J Runyon leg.; bee bowl; MTEC. – **Phillips Co.** • Coal Mine Hill Rd (47.7805 -107.4796): 1 ♀; 19 May–22 Jul. 2021; J Kole, J Rainey leg.; BVT; MTEC; 3 ♀♀; 22 Jul–25 Aug. 2021; J Kole, J Wallace leg.; BVT; MTEC • Enrico Lning centr Cmpgrd (47.7425 -107.7802): 1 ♀; 22 Jul–25 Aug. 2021; J Kole, J Wallace leg.; BVT; MTEC • Montana Gulch Campground (47.8987 -108.6304): 1 ♀; 2–3 Aug. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC • Montana Gulch Campground (47.9004 -108.632): 1 ♀; 2–3 Aug. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Powder River Co.** • Wilbur Crk Rd, 1064 m (45.5722 -105.9941): 1 ♀; 11 Jul. 2019; Z Pritchard, F Etzler leg.; bee bowl; MTEC. – **Prairie Co.** • 2 mi. down Coal Crk Rd (46.8286 -105.257): 2 ♀♀; 7 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **Ravalli Co.** • WARC, 2.6 km NE Corvallis (46.3287 -114.0858): 1 ♀; 21–22 May 2020; K Hubbel leg.; bee bowl; MTEC; 3 ♀♀; 28–29 May 2020; K

Hubbel leg.; bee bowl; MTEC. – **Richland Co.** • CR.115 sapling clearing (47.5763 -104.2687): 2 ♀♀; 14 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **Sanders Co.** • Big Gulch Rd, 1049 m (47.5279 -114.5617): 2 ♀♀; 8–9 Jun. 2020; J Botti, J Wallace leg.; bee bowl; MTEC. – **Sheridan Co.** • 2-Track nr Pond, Westley (48.9322 -104.0764): 1 ♀; 2 Jun. 2020; JR Brower leg.; bee bowl; MTEC. – **Silver Bow Co.** • Highland Rd, 1635 m (45.8479 -112.6724): 1 ♀; 6–7 Jul. 2020; Z Pritchard, W Griffiths leg.; bee bowl; MTEC • Soap Gulch Rd, 1722 m (45.681 -112.6586): 1 ♀; 2–3 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC • Soap Gulch Rd, 1830 m (45.6946 -112.6391): 1 ♀; 2–3 Jul. 2020; Z Pritchard, J Botti leg.; bee bowl; MTEC. – **Sweet Grass Co.** • 0.25 mi. E McLeod (45.6617 -110.1131): 1 ♀; 5 Sep–6 Oct. 2020; MA Ivie, LL Ivie leg.; bee bowl; MTEC. – **Teton Co.** • Bellview Road (47.7965 -112.2256): 1 ♀; 21 Jul. 2020; J Wallace leg.; bee bowl; MTEC • Blackleaf Rd, 3 mi. W Bynum (47.9864 -112.3836): 1 ♀; 22–23 Jul. 2019; Z Pritchard, C Fimbel leg.; bee bowl; MTEC • N of Bynum, Hwy 89, 1224 m (47.9865 -112.3157): 1 ♀; 7 Jul. 2020; J Wallace, MA Ivie leg.; bee bowl; MTEC. – **Toole Co.** • Potter Rd (48.6533 -111.932): 1 ♀; 16 Jul. 2020; J Wallace leg.; bee bowl; MTEC. – **Wheatland Co.** • 8.5 mi. S Judith Gap, 1385 m (46.5517 -109.7662): 2 ♀♀; 20–21 Aug. 2020; CM Delphia, J Runyon leg.; bee bowl; MTEC. – **Wibaux Co.** • 4 mi. down St Phillip Rd (46.831 -104.1112): 1 ♀; 15–16 Jul. 2020; JR Brower leg.; bee bowl; MTEC. – **NEW HAMPSHIRE – Carroll Co.** • Wolfeboro: 1 ♂; 20 Aug. 1911; W Reiff leg.; MCZ. – **Cheshire Co.** • Mt. Monadnock: 1 ♀; date unknown; collector unknown; MCZ. – **Coos Co.** • Shelburne: 1 ♀; date unknown; collector unknown; MCZ. – **NEW MEXICO – San Miguel Co.** • Las Vegas, Arroyo Pecos: 1 ♀; date unknown; WP Cockerell leg.; MCZ. – **NEW YORK – Albany Co.** • 2mi. S. Rensselaerville: 1 ♂; 5 Sep. 1970; HE Evans leg.; MCZ. – **NORTH DAKOTA – Barnes Co.** • (46.99628 -98.27705): 1 ♂; 11 Sep. 2012; E Evans leg.; net; UMSP • 10.7 km NE of Rogers (47.11298 -98.06702): 1 ♀; 18 May 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 1 ♂; 10 Sep. 2012; E Evans leg.; pan trap; UMSP • 11.7 km NE of Rogers (47.09531 -98.04099): 1 ♀, 1 ♂; 11 Sep. 2010; E Evans leg.; pan trap; UMSP • 11.7 km NE of Rogers (47.09572 -98.0468): 1 ♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP • 11.7 km NE of Rogers (47.0962 -98.07721): 2 ♀♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 15 Jun. 2012; E Evans leg.; net, Brassicaceae sp.; UMSP; 2 ♀♀, 1 ♂; 10 Sep. 2012; E Evans leg.; pan trap; UMSP • 2.2 km NE of Rogers (47.08152 -98.17183): 11 ♀♀; 25 May 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 2 Aug. 2010; E Evans leg.; pan trap; UMSP; 1 ♀, 4 ♂♂; 11 Sep. 2010; E Evans leg.; pan trap; UMSP • 2.2 km NE of Rogers (47.0823 -98.1718): 1 ♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 10 Sep. 2012; E Evans leg.; pan trap; UMSP • 3.3 NNE of Rogers (47.09591 -98.15093): 2 ♀♀; 26 May 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 10 Sep. 2010; E Evans leg.; pan trap; UMSP • 3.3 NNE of Rogers (47.10305 -98.1933): 1 ♀; 18 May 2011; E Evans leg.; net, *Taraxacum*; UMSP; 1 ♀; 13 Jul. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 15 Jun. 2012; K Lee, R Rudd leg.; net; UMSP; 1 ♂; 10 Sep. 2012; E Evans leg.; pan trap; UMSP; 1 ♂; 11 Sep. 2012; R Rudd leg.; net, *Grindelia squarrosa*; UMSP • 4.5 km NE of Rogers (47.09616 -98.1509): 1 ♂; 10 Sep. 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 12 Sep. 2012; J Gardner, K Foord leg.; net, *Cirsium* ; UMSP • 6.3 km NW of Sandborn (46.9945 -98.257): 3 ♀♀; 18 May 2012; E Evans leg.; pan trap; UMSP; 3 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 10 Sep. 2012; E Evans leg.; pan trap; UMSP • 6.6 km NW of Sandborn (46.9794 -98.2916): 3 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP • 7.8 km NW of Sandborn (46.97964 -98.28512): 8 ♀♀; 26 May 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 15 Jun. 2010; E Evans leg.; pan trap; UMSP; 2 ♀♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP; 2 ♀♀; 11 Sep. 2010; E Evans leg.; pan trap; UMSP • 7.8 km NW of Sandborn (46.994 -98.293): 1 ♀; 10 Sep. 2012; E Evans leg.; pan trap; UMSP • 9.5 km NE of Rogers (47.09572 -98.0468): 1 ♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 3 ♀♀; 18 May 2012; E Evans leg.; pan trap; UMSP; 2 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP • 9.5 km NE of Rogers (47.11018 -98.07701): 3 ♀♀; 25 May 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 15 Jun. 2010; E Evans leg.; pan trap; UMSP. – **Griggs Co.** • 3.5 km SE of Karnak (47.25538 -98.03372): 1 ♀; 10 Sep. 2012; E Evans leg.; pan trap; UMSP. – **Morton Co.** • Mandan: 1 ♀; 14 May 1939; HS Telford leg.; UMSP. – **Pembina Co.** • Pembina: 1 ♀; 9 Jul. 1935; DG Denning leg.; UMSP. – **Richland Co.** • Wahpeton: 2 ♀♀; 18 May 1939;

DG Denning leg.; UMSP. – **Stutsman Co.** • (47.24218 -98.91154): 1 ♂; 10 Sep. 2012; E Evans leg.; net; UMSP; 2 ♂♂; 10 Sep. 2012; E Evans leg.; net, *Heterotheca villosa*; UMSP • (47.254 -98.92969): 1 ♀; 12 Jul. 2012; K Pouliquen, M Smart leg.; net; UMSP • (47.25482 -98.94766): 8 ♂♂; 10 Sep. 2012; E Evans leg.; net; UMSP • (47.25488 -98.9019): 1 ♀; 14 Jun. 2012; J Castro, E Evans leg.; net, *Melilotus officinalis*; UMSP • 2.4 km E of Edmunds (47.24819 -98.93286): 3 ♀♀; 26 May 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 2 Aug. 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 11 Sep. 2010; E Evans leg.; pan trap; UMSP • 2.4 km E of Edmunds (47.25226 -98.9328): 1 ♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 12 Jul. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 22 Apr. 2012; E Evans leg.; pan trap; UMSP; 6 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 3 ♀♀; 13 Jul. 2012; E Evans leg.; pan trap; UMSP • 4.6 km SE of Edmunds (47.22578 -98.9096): 12 ♀♀; 26 May 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 15 Jun. 2010; E Evans leg.; pan trap; UMSP; 1 ♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP; 2 ♀♀; 11 Sep. 2010; E Evans leg.; pan trap; UMSP • 4.6 km SE of Edmunds (47.2258 -98.9217): 1 ♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 9 ♀♀; 12 Jul. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 10 Aug. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Jun. 2012; J Castro, E Evans leg.; net, *Brassica rapa*; UMSP; 3 ♀♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP; 1 ♂; 10 Sep. 2012; E Evans leg.; net; UMSP • 5.6 km SE of Edmunds (47.2259 -98.901): 2 ♀♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 2 ♀♀; 12 Jul. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 10 Aug. 2011; E Evans leg.; pan trap; UMSP; 5 ♀♀; 18 May 2012; E Evans leg.; pan trap; UMSP; 6 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 1 ♂; 14 Aug. 2012; E Evans leg.; pan trap; UMSP • 6.8 km NE of Pingree (47.18306 -98.81944): 4 ♀♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP • 6.8 km NE of Pingree (47.18348 -98.82031): 7 ♀♀; 26 May 2010; E Evans leg.; pan trap; UMSP; 5 ♀♀; 15 Jun. 2010; E Evans leg.; pan trap; UMSP • 8.2 km NE of Pingree (47.1948 -98.8056): 2 ♀♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 13 Jul. 2011; E Evans leg.; pan trap; UMSP; 1 ♀; 18 May 2012; E Evans leg.; pan trap; UMSP; 2 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP; 1 ♀; 14 Aug. 2012; E Evans leg.; pan trap; UMSP • 8.2 km NE of Pingree (47.20049 -98.80618): 8 ♀♀; 25 May 2010; E Evans leg.; pan trap; UMSP; 19 ♀♀; 15 Jun. 2010; E Evans leg.; pan trap; UMSP; 3 ♀♀; 6 Jul. 2010; E Evans leg.; pan trap; UMSP; 7 ♀♀, 1 ♂; 11 Sep. 2010; E Evans leg.; pan trap; UMSP • 8.7 km NE of Pingree (47.1816 -98.7945): 2 ♀♀; 13 Jun. 2011; E Evans leg.; pan trap; UMSP; 15 ♀♀; 14 Jun. 2012; E Evans leg.; pan trap; UMSP. – **OHIO – Lucas Co.** • Oak Openings Metro Park: 1 ♀; 27 Aug. 1996; M Arduser leg.; MAPC; 1 ♀; 14–16 Jun. 2006; M Arduser leg.; bowls; MAPC. – **OREGON – Benton Co.** • Corvallis: 1 ♀; Jul. 1896; collector unknown; UMSP; 1 ♀; 15 May 1897; collector unknown; UMSP; 1 ♀; 3 Jun. 1897; collector unknown; UMSP; 1 ♀; Jun. 1897; collector unknown; UMSP. – **Multnomah Co.** • Portland: 1 ♀; 1 Jul. 1921; MO Nelson leg.; UMSP; 3 ♀♀; day and month unknown 1927; E Walley Jones leg.; UMSP. – **Umatilla Co.** • Umatilla: 1 ♀; 24 Jun. 1882; collector unknown; MCZ. – **RHODE ISLAND – Providence Co.** • Providence: 1 ♀; 3 Jun. 1928; B Lewis leg.; MCZ. – **SOUTH DAKOTA – Custer Co.** • Custer: 2 ♂♂; 15 Aug. 1940; HE Milliron leg.; UMSP. – **Fall River Co.** • Hot Springs: 2 ♀♀; 4 Aug. 1940; RH Daggy leg.; UMSP. – **Jackson Co.** • Bad Lands, Cedar Pass: 1 ♂; 14 Aug. 1940; HE Milliron leg.; UMSP. – **Jerauld Co.** • Wessington Springs: 1 ♀; 13 Jun. 1939; PH Harden leg.; UMSP; 1 ♀; 23 Jun. 1939; P Harden leg.; UMSP; 2 ♀♀; 20 Jun. 1940; DG Denning leg.; UMSP. – **Pennington Co.** • Sheridan Lake: 3 ♂♂; 10 Sep. 1971; Woods leg.; UMSP. – **Unknown Co.** • Black Hills: 1 ♀; 15–30 Jun. 1930; F Miller leg.; UMSP. – **UTAH – Box Elder Co.** • Cedar Hills: 1 ♀; 10 Aug. 1972; GF Knowlton leg.; net, *Chrysothamnus viscidiflorus*; UMSP • Penrose: 1 ♀; 28 May 1963; TK Stodd leg.; UMSP. – **Washington Co.** • Pinto: 1 ♂; 24 Sep. 1957; GF Knowlton leg.; net, *Chrysothamnus* sp.; UMSP. – **Weber Co.** • Ogden: 2 ♀♀; 3 Oct. 1942; GF Knowlton leg.; net, rabbitbrush ; UMSP. – **WASHINGTON – Benton Co.** • Yakima R., Lone Tree [Prosser]: 3 ♀♀; 30 Jun. 1882; collector unknown; MCZ. – **Chelan Co.** • Wenatchee: 1 ♀; 5 Jul. year unknown; Wickham leg.; MCZ. – **Kittitas Co.** • Yakima R., Nelson's: 2 ♀♀; 4–5 Jul. 1882; collector unknown; MCZ. – **Whitman Co.** • Wawawai: 1 ♂; 6 Sep. 1908; WM Mann leg.; MCZ; 2 ♀♀, 2 ♂♂; date unknown; WM Mann leg.; MCZ. – **Yakima Co.** • Yakima City: 5 ♀♀; 2–4 Jul. 1882; collector unknown; MCZ. – **WISCONSIN – Bayfield Co.** • Moquah Barrens

State Natural Area (46.6157 -91.3117): 1 ♀; 18 Jun. 2020; E North leg.; UMSP • Moquah Barrens State Natural Area (46.6319 -91.2235): 1 ♀; 22 May 2020; E North leg.; UMSP • Moquah Barrens State Natural Area (46.6533 -91.2743): 1 ♀; 18 Jun. 2020; E North leg.; UMSP. – **Burnett Co.** • Grantsburg, Johnson Rd: 1 ♂; 27 Jul. 1996; M Sabourin leg.; malaise; UMSP. – **Lacrosse Co.** • Upper Mississippi River NWR: 2 ♀♀; day and month unknown 2015; collector unknown; MAPC. – **Polk Co.** • Tewksbury Scientific and Natural Area (45.3031 -92.7311): 1 ♀; 22 Jun. 2018; K Friedrich leg.; vac; CNBL. – **WYOMING – Albany Co.** • dirt farm, 8 mi. SE Laramie: 1 ♀; 15 Jun. 1974; VJ Tepedino leg.; net, *Cryptantha flavoculata*; UMSP • Laramie: 1 ♀; 21 Jun. 1934; BC and VD Christenson leg.; UMSP. – **Platte Co.** • Glendo: 2 ♀♀; 29 Jun. 1930; G Fairchild leg.; MCZ. – **Weston Co.** • Clifton: 1 ♀, 1 ♂; 15 Aug. 1940; HE Milliron leg.; UMSP.

Remarks

Agapostemon subtilior has historically been treated as a synonym of *A. texanus*, and the bulk of what was previously considered *A. texanus* in the US is now referable to *A. subtilior*. *Agapostemon subtilior* was originally described by Cockerell (1898), who correctly determined it was distinct (though he appears to have been comparing it to what is now *A. angelicus* rather than *A. texanus* s. s.). However, *A. subtilior* was synonymized under *A. texanus* by Sandhouse (1936), and this was followed by subsequent revisers, including Mitchell (1960) and Roberts (1972). Cockerell (1910b), in his brief description of the male, appears to have appropriately associated the sexes, as he mentions the more delicately sculptured metathorax, smaller size, and reduced black marks on the legs.

Some of the extreme variation in coloration and sculpture mentioned by Roberts (1972) was due to his lumping of *A. subtilior* and *A. texanus*, though *A. subtilior* is still a variable species, displaying a relatively broad range of variation in density and shininess of the scutum and the degree of sculpturing of the propodeum. The propodeum in particular is quite variable, and the presence or absence of an inner triangle, which has been given much weight by many previous authors, is too variable to be a reliably useful character for identification. The metallic coloration of the integument (green, blue, or golden-green) has also been given weight by some workers, but we have found this character to be extremely variable and unreliable as well. We have not been able to examine the type of *Agapostemon angelicus idahoensis*, but the horizontal ridges on the propodeum described by Michener (1937) is a condition seen occasionally in *A. subtilior* females.

There is a mildly unsettling amount of variation in the *A. subtilior* that extend down into southern California (at one point considered a separate species, *A. californicus*). Many of these specimens have the propodeal triangle more rugose, as well as having the scutum more densely punctured, to the point where they are hardly doubly-punctate. However, examination of the genitalia of specimens throughout southern California and the Channel Islands reveal no differences between *A. subtilior* from there and other parts of its range. In addition, though the California females of *A. subtilior* tend to have the scutum more densely sculptured and the propodeum more coarsely sculptured, there is a fair amount of variation, and the degree of variation is such that many are indistinguishable from specimens of *A. subtilior* from the midwestern and eastern United States. Therefore, we are considering *A. californicus* a synonym of *A. subtilior*.

The type of *A. californicus* (which we consider a junior synonym of *A. subtilior*) has garnered some confusion and was previously considered lost (Moure & Hurd 1987). This species was described by Crawford (1901) based on multiple specimens from disparate locations in California and Idaho. The females lack the doubly punctate scutum and belong to the species *A. femoratus* (Roberts 1972). Sandhouse (1936) synonymized the male sex with *A. texanus* s. lat. and did not mention the females. Sandhouse (1936) referenced a lectotype of *A. californicus* designated by Crawford in the Smithsonian, but according to Moure & Hurd (1987) one was never properly designated by Crawford, and we also

have not located any published designation by Crawford. Instead, Cockerell (1927) properly designated the male from Pacific Grove, California as the lectotype, and we have located that specimen in the University of Nebraska State Museum (UNSMe12747) even though Moure & Hurd (1987) had considered the lectotype to be lost. Roberts (1972) incorrectly referenced a female lectotype in the Smithsonian and it is unclear what he was referring to. There is a male specimen deposited in the Smithsonian (USNM ENT00536739), which appears to be the specimen Sandhouse (1936) treated as the lectotype (and presumably the specimen Roberts (1972) considered the type and incorrectly noted the sex); however this, specimen is a paralectotype.

The *A. subtilior* occurring in the Channel Islands of California deserve special mention. Cockerell (1939b) described two subspecies from the Islands, *A. californicus clementinus* from San Clemente Island (also occurring in Santa Barbara Island), and *A. californicus psammobius* from San Miguel Island. Cockerell (1939b) considered the other islands to have forms that matched the mainland species, which was then considered *A. californicus*. Of particular note, Cockerell (1939b) discussed differences in their genitalia. At this point, ZP has examined approximately 600 specimens of *A. subtilior* from the Channel Islands, including males and females from San Clemente Island, Santa Rosa Island, Santa Cruz Island, and two females from San Miguel Island. Dissection and examination of the male genitalia from various islands revealed no differences with the mainland form. The San Clemente specimens are bluer and somewhat larger, but dissection of the genitalia of two males from the island revealed no differences from typical *A. subtilior*, and there were no other morphological differences found in other important characters such as the sculpturing of the body and shape and size of the hind leg segments. As a result, we consider all forms from the Channel Islands to be synonyms of *A. subtilior*. However, additional data, such as genetic data, may require that this question be revisited in the future.

Ecology

The nesting biology of *A. subtilior* has not been investigated, though it is a solitary ground-nester. The species is polylectic.

Distribution

Agapostemon subtilior is a widespread species that ranges from coast to coast across the northern and central US, and it extends down further south in the western US, especially in California, where we have confirmed it as far south as the border of Mexico. The distribution is surprisingly similar to that of *Bombus fervidus* (Fabricius, 1798) s. lat. (i.e., *B. fervidus* + *B. californicus* Smith, 1854). *Agapostemon subtilior* extends further south in the eastern US along the Appalachian Mountains (Roberts 1972), but we have not had the opportunity to examine those specimens (recent records from further southeast, such as Florida, all appear to be georeferencing errors or misidentifications). We have confirmed specimens from: CA, CO, CT, IA, IL, IN, MA, MI, MN, MT, ND, NH, NM, NY, OH, OR, RI, SD, UT, WA, WI and WY. *Agapostemon subtilior* appears to be a common species throughout most of its range.

Agapostemon* (*Agapostemon*) *texanus Cresson, 1872
Figs 1C–D, 4C, F, 5I–J, M, 6C–D, 8A, D

Original reference

Agapostemon texanus Cresson, 1872: 255 ♀. Lectotype ♀ (designated by Cresson 1916), Texas. Deposited at ANSP, type No. 2111. Images examined.

Synonymy

Agapostemon texanus iowensis Cockerell 1910a: 363 ♀ (syn. under *A. texanus* s. lat. by Sandhouse 1936, syn. under *A. texanus* s. lat. by Roberts 1972). Holotype ♀, Ames, Iowa, 1899, Wilmon

Newell leg., deposited in USNM [no. 536746]. Images of type examined. Online record: http://n2t.net/ark:/65665/3e1e30975-da9e-4c6e-b300-700d7cbad4ee

Taxonomy and references

Agapostemon texanus – Dalla Torre 1896: 97 (catalog). — Robertson 1897: 328 [in part, mixed with *A. subtilior* and *A. angelicus*] (description, range); 1902: 246 (key). — Cockerell 1898: 27 (taxonomy). — Crawford 1901: 160 [in part, mixed with *A. subtilior* and potentially *A. angelicus*] (key, taxonomy). — Vachal 1903: 94 [in part, likely mixed with *A. angelicus*] (key, description). — Cresson 1916: 109 (lectotype designation). — Cockerell 1927: 157 [likely mixed with *A. subtilior*] (key, records). — Sandhouse 1936: 82 [in part, combined with *A. subtilior*] (key, diagnosis, distribution). — Roberts 1972: 533 [in part, mixed with *A. subtilior*] (key, diagnosis, distribution). — Hurd 1979: 1953 [in part, combined with *A. subtilior*] (catalog). — Moure & Hurd 1987: 190 [in part, combined with *A. subtilior*] (catalog). — Portman *et al.* 2022: 117 [in part, combined with *A. subtilior* s. s.] (key, diagnosis).

Agapostemon texanus texanus – Michener 1951: 1124 [in part, combined with *A. subtilior*] (catalog). — Mitchell 1960: 454 [in part, combined with *A. subtilior*] (key, description, distribution, floral records).

Diagnosis

Female *A. texanus* can be diagnosed from the other doubly-punctate species by the extremely coarse genal striae (Fig. 1C–D). In contrast to the weak or moderately coarse genal striae of *A. angelicus* and *A. subtilior* (Fig. 1A–B), the genal striae of *A. texanus* are very coarse and quite deep, with the ridges rather wavy and irregular, to the point where it is difficult to see the bottom between the ridges (Fig. 1D). In addition, *A. texanus* have around 5–8 genal striae that end along the longitudinal part of the hypostomal carina (Fig. 1C), whereas the genal striae of *A. angelicus* and *A. texanus* curve away from the longitudinal part of the hypostomal carina and towards the lateral part of the hypostomal carina (Fig. 1A–B). Females of *A. texanus* can be further recognized by the very closely punctate metasoma, which has contiguous punctures on the terga (Fig. 4 C, F), and they have a densely punctate and dull scutum (though this character intergrades with *A. subtilior* and *A. angelicus*). They can be further separated from *A. subtilior* by the shape of the apex of the clypeus, which is flat down to the apex in *A. texanus*, compared to curved over at the apex in *A. subtilior* (Fig. 2D).

With their large size and coarsely striate gena, *A. texanus* females are also similar to those of *A. splendens*, but *A. texanus* lacks the heavily dusky wings found in *A. splendens*. In addition, *A. splendens* lacks the doubly-punctate scutum.

Male *A. texanus* can be recognized from those of *A. subtilior* and *A. angelicus* by the combination of the moderately inflated hind femur (Fig. 5I), and the hind tibia with both a dark mark on the anterior face (Fig. 5I) AND an extensive dark mark on the posterior face (Fig. 5J). They are similar to *A. subtilior* but can be separated by the more extensive dark mark on the posterior face of the hind tibia (Fig. 5J), which takes up at least half the segment in *A. texanus* but takes up at most half the segment in *A. subtilior* (Fig. 5H). In addition, the genitalia of *A. texanus* have the basal stylus shorter and more evenly curved (Fig. 6D, black arrow), whereas *A. subtilior* have the basal stylus longer and with a more abrupt curve closer to the apex (Fig. 6E, black arrow). Finally, males of *A. texanus* have the hind basitarsus more completely fused to the following segment (Fig. 5M) than those of *A. subtilior* (Fig. 5L) and *A. angelicus* (Fig. 5K), though this is subtle. Males of *A. texanus* are also similar to males of *A. angelicus*, but *A. texanus* have a dark mark anteriorly on the hind tibia (Fig. 5I), which *A. angelicus* lack (Fig. 5A), and *A. texanus* have a distinctly more inflated hind femur than *A. angelicus*. The genitalia of these two species are also quite distinct, with *A. texanus* having a narrow, slender basal stylus and a larger medial plate (Fig. 6C), whereas *A. angelicus* have a thickened basal stylus and a smaller medial plate (Fig. 6A).

Material examined

USA – **ARKANSAS – Monroe Co.** • (34.971 -91.3029): 1 ♀; 20 Jul. 2016; PL Stephenson leg.; MAPC; 5 ♀♀; 11 Aug. 2016; PL Stephenson leg.; MAPC • Hallum Cemetery Rd (34.8571 -91.2376): 6 ♀♀; 2–9 Aug. 2016; PL Stephenson leg.; MAPC. – **Sebastian Co.** • Fort Chaffee park area nr Wells Lake/ Roberts Rd: 1 ♀; 7 Aug. 2004; Arduser leg.; *Cirsium discolor*; MAPC. – **Woodruff Co.** • Cache [River] National Wildlife Refuge (35.1186 -91.1612): 1 ♀; 11 Aug. 2016; PL Stephenson leg.; MAPC • Cache [River] National Wildlife Refuge (35.1262 -91.2809): 3 ♀♀; 9 Aug. 2016; PL Stephenson leg.; MAPC; 1 ♀; 2 Sep. 2016; PL Stephenson leg.; MAPC. – **IOWA – Story Co.** • Ames: 1 ♀ (*A. texanus iowensis* holotype); day and month unknown 1899; W Newell leg.; NMNH. – **Woodbury Co.** • Souix City: 1 ♂; Aug. 1939; CN Ainslie leg.; swept lawn; UMSP. – **KANSAS – Anderson Co.** • (38.098485 -95.4173): 1 ♂; 21 Jun. 2018; A Morphew leg.; AMC. – **Bourbon Co.** • (37.832724 -94.8391): 1 ♂; 19 Jun. 2018; A Morphew leg.; AMC. – **Coffey Co.** • (38.328091 -95.6975): 1 ♂; 9 Jul. 2018; A Morphew leg.; AMC – **Douglas Co.** • 2 ♀♀; 7 Jul. 1920; William E Hoffmann leg.; *Apocynun cannabinum*; UMSP; 1 ♂; day and month unknown 1920; William E Hoffmann leg.; *A. cannabinum*; UMSP. – **Gove Co.** • (38.97286 -100.536): 1 ♂; 22 Jul. 2019; A Morphew leg.; AMC. – **Hodgeman Co.** • (38.100843 -98.6435): 1 ♂; 24 Jul. 2018; A Morphew leg.; AMC. – **Logan Co.** • (39.0784 -100.9095): 2 ♂♂; 18 Jun. 2018; A Morphew leg.; AMC. – **Rice Co.** • (38.177082 -98.2506): 1 ♂; 29 Jun. 2018; A Morphew leg.; AMC. – **Thomas Co.** • (39.935156 -101.180707): 1 ♂; 2 Jul. 2019; A Morphew leg.; AMC. – **Wallace Co.** • (38.941923 -101.792): 1 ♂; 10 Jul. 2019; A Morphew leg.; AMC. – **MINNESOTA – Hubbard Co.** • Itasca Park: 1 ♂; 16 Jul. 1936; collector unknown; UMSP. – **Jackson Co.** • Graham Creek WMA (43.7823 -95.4131): 1 ♀; 5 Jun. 2019; ED, LN leg.; bee bowls; CNBL • Graham Creek WMA (43.78235 -95.4131): 1 ♀; 2 Jul. 2021; WB, EB leg.; bee bowl; CNBL. – **Martin Co.** • (43.5495 -94.7961): 3 ♀♀; 7 Aug. 2019; SG, MK leg.; bee bowls; CNBL. – **Murray Co.** • (43.8573 -95.594): 1 ♀; 25 Jun. 2019; MK, LN leg.; bee bowls; CNBL • (44.0709 -95.5718): 1 ♀; 22 Jul. 2019; SG, MK leg.; bee bowls; CNBL • (44.07093 -95.5718): 1 ♀; 2 Jul. 2021; LS, LF leg.; bee bowl; CNBL. – **Nobles Co.** • (43.52333 -95.7276): 1 ♀; 27 Jul. 2022; WL, MM leg.; bowl; CNBL. – **Swift Co.** • Chippewa TNC (45.15452 -96.0086): 1 ♀; 21 Jun. 2018; M Rancour leg.; bowl; UMSP. – **Yellow Medicine Co.** • (44.68504 -96.3092): 1 ♀; 28 Jun. 2022; LT, MM leg.; bowl; CNBL. – **MISSOURI – Barry Co.** • Roaring River State Park, Chute Ridge glade: 1 ♀, 4 ♂♂; 3 Jul. 2018; K McCarty leg.; *Silphium laciniatum*; MAPC. – **Cedar Co.** • Wah-Kon-Tah Prairie, house (37.8973 -93.9935): 1 ♀; 13–14 Jul. 2008; RP Jean leg.; blue bowls; MAPC. – **Laclede Co.** • Bennett Springs savanna (TNC): 2 ♀♀; 25 Jul. 2018; K McCarty leg.; *Helianthus hirsutus*; MAPC. – **Ray Co.** • Big Muddy Nat'l Wildlife Refuge, Jackass Bend, old field: 1 ♀; 22 May 2013; W Watkins leg.; MAPC. – **Saline Co.** • Van Meter State Park: 1 ♂; 10 Aug. 2020; K McCarty leg.; *Silphium perfoliatum*; MAPC. – **Shannon Co.** • Ozark Nat'l Scenic Riverways above Jertail Landing (37.2297 -91.3139): 1 ♂; 29 Sep. 2005; collector unknown; *Aster pilosus*; MAPC. – **St. Clair Co.** • Shell-Osage Conservation Area (37.9667 -94.0449): 13 ♀♀, 1 ♂; 22 Jul. 2014; Arduser, Jean leg.; malaise trap; MAPC. – **NEBRASKA – Dodge Co.** • North Bend: 1 ♂; 27 Aug. 1959; TM Peters leg.; UMSP. – **Hall Co.** • Platte River Prairies (TNC), Derr house, 50 yards into prairie reconstruction (40.7334 -98.579): 3 ♀♀; 5 Aug. 2013; Arduser leg.; bowls; MAPC • Platte River Prairies (TNC), Derr house, south lawn (40.7336 -98.5786): 2 ♀♀; 5 Aug. 2013; Arduser leg.; bowls; MAPC • Platte River Prairies (TNC), Studnicka Tract, NE (40.7309 -98.5957): 1 ♀; 5 Aug. 2013; Arduser, Helzer, Stine leg.; *Silphium integrifolium*; MAPC • Platte River Prairies (TNC), sandhills remnant (40.7287 -98.5763): 1 ♂; 9 Aug. 2013; Arduser leg.; *Helianthus petiolaris*; MAPC. – **OKLAHOMA – Caddo Co.** • 1 mi. N of Hinton on Hwy 281 (35.518 -98.3502): 1 ♀; 15 Aug. 1995; Arduser, Stevens leg.; *Prionopsis ciliata*; MAPC • Red Rock Canyon State Park (35.4583 -98.3528): 2 ♀♀; 15 Aug. 1995; Arduser leg.; *Chamaecrista fasciculata*; MAPC. – **Comanche Co.** • Wichita Mtns NWR, Charon's Garden Trail, south portion (34.7091 -98.7317): 1 ♀; 5 May 2012; Arduser leg.; *Opuntia engelmanni*; MAPC. – **Ellis Co.** • Four Canyon Preserve (TNC), head of Horse Canyon (36.0195 -99.4631): 1 ♀; 7 Jun. 2009; Arduser leg.; *Cornus drummondi*; MAPC. – **TEXAS – Brazos Co.** • 1 ♂;

date unknown; N Banks leg.; MCZ. – **Burnet Co.** • Inks Lake St. Park: 1 ♀; 18 Apr. 1962; TM Peters, FW Stahr leg.; UMSP. – **Colorado Co.** • Rock Island: 1 ♀; 31 May 1922; Grace O Wiley leg.; UMSP. – **Dallas Co.** • 1 ♀; 9 May 1948; Barr leg.; UMSP; 1 ♀; 15 May 1948; Barr leg.; UMSP • Dallas: 3 ♀♀ (paralectotypes); date unknown; collector unknown; MCZ. – **Eastland Co.** • 2 ♀♀; 23 May 1921; Grace O Wiley leg.; UMSP; 1 ♂; 8 Jun. 1921; Grace O Wiley leg.; UMSP; 1 ♂; 12 Jun. 1921; Grace O Wiley leg.; UMSP; 1 ♂; 14 Jun. 1921; Grace O Wiley leg.; UMSP. – **Kleberg Co.** • Kingsville: 1 ♀; date unknown; CT Reed leg.; MCZ. – **Lee Co.** • 1 ♂; date unknown; Birkmann leg.; MCZ • Fedor: 1 ♂; 3 Sep. 1897; G Birkmann leg.; MCZ; 1 ♂; 11 Sep. 1897; G Birkmann leg.; MCZ; 1 ♀; day and month unknown 1897; G Birkmann leg.; MCZ; 1 ♀; 24 Apr. 1899; G Birkmann leg.; MCZ; 1 ♂; 31 May 1899; G Birkmann leg.; MCZ; 2 ♂♂; 19 Jun. 1899; G Birkmann leg.; MCZ; 1 ♀; 5 May 1901; G Birkmann leg.; MCZ; 1 ♂; 7 Jun. 1901; G Birkmann leg.; MCZ; 1 ♂; 14 Jun. 1901; G Birkmann leg.; MCZ; 1 ♀; 30 Jun. 1902; G Birkmann leg.; MCZ; 1 ♀; 13 Mar. 1903; G Birkmann leg.; MCZ; 1 ♀; 13 Mar. 1903; collector unknown; MCZ; 2 ♀♀; 24 Feb. 1904; G Birkmann leg.; MCZ; 2 ♀♀; 19 Mar. 1904; G Birkmann leg.; MCZ; 1 ♀; 5 Jun. 1904; G Birkmann leg.; MCZ. – **McLennan Co.** • Waco: 1 ♀; date unknown; collector unknown; MCZ. – **Palo Pinto Co.** • 3 mi. N of Brazos R. on Rt. 281: 1 ♂; 12 Nov. 1990; V Scott, M Arduser leg.; *Aster* sp.; MAPC. – **Parker Co.** • 1 ♀; 30 May 1948; Barr leg.; UMSP. – **Travis Co.** • Lake Travis: 1 ♀; 19 Sep. 1982; collector unknown; UMSP. – **Unknown Co.** • 2 ♀♀; date unknown; collector unknown; MCZ.

Remarks

We define *A. texanus* in a much narrower sense than previous revisers, because *A. texanus*, as defined by Sandhouse (1936) and especially Roberts (1972), was a cryptic species complex. Most of what was previously considered *A. texanus* is now the newly reinstated *A. subtilior*. It is surprising that Roberts (1972) did not recognize that *A. subtilior* and *A. texanus* were distinct, given that differences in the size of the genal striae in the females is a character that Roberts (1972) used to separate females of other *Agapostemon* species. We can only speculate that Roberts (1972) was so stymied by attempts to separate *A. angelicus* females that it led to an over-reliance on male characters to define species boundaries, and while differences in male genitalia between *A. texanus* s. s. and *A. subtilior* are distinct, they are subtle enough that they could easily be overlooked.

There is still more work needed on the *A. texanus* species complex, as Roberts (1972) considered the range of *A. texanus* to extend down through Mexico and into Guatemala and Costa Rica. However, for this work, ZP examined 3 males and 5 females from various locations in Central and Southern Mexico, and a series of 3 females and 1 male from Guatemala. All of these specimens bear determination labels from Roberts in 1965 as *A. texanus*. However, none of these specimens are referable to *A texanus*. In particular, the females lack the strong genal striations of *A. texanus* s. s., and the dissected genitalia of the male were different, resembling more those of *A. subtilior* (though other characters, such as the hind basitarsus shape, do not match *A. subtilior*). The possibility that the Mexican members of the *A. texanus* species complex could extend up into the southern US (especially southern Texas) means that identification in that region should be approached with caution.

Ecology

The nesting biology of *A. texanus* from Kansas is reported in Roberts (1969); this species is solitary, ground nesting, and polylectic.

Distribution

Agapostemon texanus s. s. appears to be a largely tallgrass and mixed prairie species, ranging from Minnesota in the North to Texas in the South. We have confirmed specimens from: AR, IA, KS, MN,

MO, NE, OK, SD, TX. *Agapostemon texanus* is a relatively uncommon species, particularly compared to *A. angelicus* and *A. subtilior*.

Discussion

There has been much confusion about the doubly punctate species of *Agapostemon*, and this work will hopefully allow for the consistent identification of the US species. The fact that *A. texanus* as defined by Sandhouse (1936), Mitchell (1960), and Roberts (1972) was a species complex has contributed to a high degree of confusion, which was then compounded by the inability of Roberts (1972) to separate females of *A. texanus* s. lat. and *A. angelicus*. However, it should be noted that the identity of *A. angelicus* females was correctly resolved by Sandhouse (1936).

Here, we have only treated the US species, and more work is needed on the *A. texanus* species complex and to document the full extent of the range of the various species. In particular, more work is needed to determine the true extent of the range of *A. angelicus*, especially the western margin. In addition, though we have clarified the identity of *A. texanus* s. s., we have not treated the following six species that Roberts (1972) considered synonyms of *A. texanus* from south of the United States: *A. brachycerus* (Vachal, 1903) (described from Mexico and Guatemala), *A. proscriptus* Cockerell, 1912 (type locality Guatemala), *A. joseanus* Friese, 1917 (type locality Costa Rica), *A. sulfuripes* Friese, 1917 (type locality Costa Rica), *A. cyanozonus* Cockerell, 1924 (type locality Mexico), and *A. proscriptellus* Cockerell, 1912 (type locality Mexico). We consider it unlikely that any of these are actually synonyms of *A. texanus* s. s. and they must be reevaluated. In addition, *A. joseanus*, *A. proscriptus*, and *A. proscriptellus* are only known from the female, which Roberts (1972) could not distinguish. That said, Roberts should be recognized for placing the taxonomy of *Agapostemon* on a firm taxonomic foundation that we were able to build upon for this work.

This study was informed by the many specimens collected during ecological studies in Minnesota, where *A. angelicus* is the most common doubly-punctate *Agapostemon* species in the southwestern portion of the state. Somewhat surprisingly, the co-occurrence of all three species (Fig. 8B–D) allowed for them to be more easily separated. When we first discovered large numbers of *A. angelicus* in southwestern Minnesota, we hypothesized that it might be expanding its range since it had not been detected in the state before. However, rechecking available historic material quickly disabused us of that notion and revealed that *A. angelicus* has long occurred throughout Minnesota and had been misidentified as *A. texanus*. In addition to the many misidentified *A. angelicus* in the historic material of the UMSP collection, we were able to go back and find *A. angelicus* females that had been erroneously identified as *A. texanus* (or lumped under *A. texanus* or *angelicus*) in the deposited specimens of recent studies in North Dakota and Minnesota (Evans *et al.* 2018; Lane *et al.* 2020, 2022, 2023; Leone *et al.* 2022) as well as from the revisionary work of Roberts (1972). This demonstrates the importance of properly vouchering specimens as well as using consistent taxonomy and identification when monitoring changes in bees (Packer *et al.* 2018).

Finally, this further highlights the broader issue of misidentifications and cryptic species lurking in historic collections, even those that had been identified by the experts at the time. In hindsight, it is not surprising that *A. texanus* – a species for which Roberts (1972) stated: "The range is greater than that of any other species in the genus" – turned out to be a cryptic species complex. This joins numerous similar cases where variable, widespread species were found to be cryptic species complexes, including *Lasioglossum tegulare* (Robertson, 1890) and *L. tegulariforme* (Crawford, 1907) (Gibbs 2009; Gardner & Gibbs 2023), *Augochloropsis metallica* (Fabricius, 1793) (Portman *et al.* 2022), *Halictus ligatus* Say, 1837 (Carman & Packer 1996), and *Ceratina dupla* Say, 1837 (Rehan & Sheffield 2011). No doubt there are many more such cases in the bee fauna of the United States, some of which are known but still need

taxonomic work (e.g., *Hoplitis producta* (Cresson, 1864) (Rowe 2017); *Hylaeus mesillae* (Cockerell, 1896) (Oram 2018)), and doubtless many others which are unknown.

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