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A new vernal species of *Hesperapis* from the lower Midwestern United States (Hymenoptera: Melittidae)

Michael S. Engel^{1,2} & Denis Michez³

Abstract. A new species of vernal *Hesperapis* Cockerell (Melittidae: Dasypodainae: Hesperapini) is described and figured from localities spanning Texas, Oklahoma, and southern Kansas in the United States. *Hesperapis* (*Carinapis*) *infuscata* Engel & Michez, new species, is distinguished from its relatives in subgenus *Carinapis* Stage and particularly the *carinata* species group, to which it belongs. The species is most notable for the apically infusate wings and is possibly specialized (broadly oligolectic) on *Gaillardia* Foug., *Helianthus* L., *Ratibida* Raf., and *Rudbeckia* L. (Asteraceae).

INTRODUCTION

The bee genus *Hesperapis* Cockerell (Melittidae: Dasypodainae) includes numerous species of small to moderate-sized, broadly oligolectic (Cane & Sipes, 2007; Müller & Kuhlmann, 2008; Rasmussen *et al.*, 2020), solitary bees found principally in desert to semidesert regions of North America (Stage, 1966; Michener, 2007; Michez *et al.*, 2008). The genus superficially resembles several other short-tongued bees such as *Andrena* Fabricius or *Halictus* Latreille, but aside from the usual familial characters, the characteristically limited female scopa on the metafemur and metabasitarsus, flattened metasoma, and soft integument can readily distinguish species of *Hesperapis* from these other taxa. For a time the genus also included those species of the southern African genus *Capicola* Friese (Michener, 2007), but the African clade has been subsequently reinstated as a distinct genus (Michez *et al.*, 2007, 2009). Michener

¹ Division of Entomology, Natural History Museum, and Department of Ecology & Evolutionary Biology, University of Kansas, 1501 Crestline Drive – Suite 140, Lawrence, Kansas 66045, USA (msengel@ku.edu).

² Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024-5192, USA.

³ Laboratory of Zoology, Research Institute for Biosciences, University of Mons, Place du parc 20, 7000 Mons, Belgium (denis.michez@umons.ac.be).

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Figures 1–2. Female of *Hesperapis (Carinapis) infuscata*, new species. 1. Lateral habitus. 2. Dorsal habitus.

(1981) placed *Hesperapis* into the tribe Dasypodaini, along with *Capicola*, *Dasypoda* Latreille, *Xeralictoides* Stage (today a subgenus of *Hesperapis*: Michener, 2007), and *Eremaphanta* Popov. Subsequently, Ascher & Engel in Engel (2005) placed the genus (then including *Capicola*) into the subtribe Hesperapina, and distinct from the remaining groups of Dasypodaini (*sensu* Michener, 1981). Based on a phylogenetic analysis of the family, Michez *et al.* (2009) considered Hesperapini a tribe distinct from Dasypodaini, including therein *Hesperapis*, *Capicola*, and *Eremaphanta* (the latter of which was removed to subtribe Eremaphantina by Engel, 2015). As of today, *Hesperapis* is



Figures 3–4. Male of *Hesperapis (Carinapis) infuscata*, new species. 3. Lateral habitus. 4. Dorsal habitus.

restricted to North America where it is the sole representative of the tribe, with most species found in the more arid regions of the western United States and Mexico, although the genus is distributed as far north as North Dakota and across the Southeast to Florida (Michener, 2007).

Herein we present the description and figures of a new species of *Hesperapis* from Texas, Oklahoma, and Kansas (Figs. 1–4). The species is presented ahead of a revision of the genus so as to make its name available for use in a forthcoming educational resource on bees in Kansas (Engel, in press). The species established here belongs to the

subgenus *Carinapis* Stage, with eight described species (including the one proposed herein), although many additional species remain to be published (Stage, 1966; pers. obs.). Aside from the new species, the subgenus includes *Hesperapis carinata* Stevens, *H. fulvipes* Crawford, *H. macrocephala* Cockerell, *H. oliviae* (Cockerell), *H. oraria* Snelling & Stage, *H. rhodocerala* (Cockerell), and *H. rodecki* Cockerell. Within the subgenus, the species belongs to the *carinata* species group, comprising *H. carinata*, *H. oraria*, *H. rodecki*, and the new taxon. The group can be recognized by the fact that males have a large, elevated, apically carinate, subtriangular pygidial plate, and in females by the absence of primary metatibial vestiture¹ and by the elevated, secondary, basal triangle of the pygidial plate broad, with the apex generally forming an angle greater than 45°, often nearly 90° (note that it is possible that *H. macrocephala* belongs as an autapomorphic basal species within this group, possessing primary vestiture and a unique propodeal sculpturing). Species are apparently broadly oligolectic on Asteraceae, probably specializing particularly on floral species of the tribes Heliantheae and Heleniinae.

MATERIAL AND METHODS

Specimens of the species reported herein were compared with other species of *Carinapis* in the collections of the University of Kansas Natural History Museum's Division of Entomology (Snow Entomological Collections), Lawrence, Kansas (SEMC) as well as the Division of Invertebrate Zoology, American Museum of Natural History, New York, New York (AMNH). Photographs were taken of specimens and dissected sclerites using a Canon EOS digital camera and illuminated with a Xenon flash system. Terminology for the descriptions follows that of Michener (2007) and Engel (2001). Decimal coordinates are estimated for each collecting locality and given in brackets. The map of localities was produced using the SimpleMappr tool of Shorthouse (2010).

SYSTEMATICS

Genus *Hesperapis* Cockerell

Subgenus *Carinapis* Stage

***Hesperapis (Carinapis) infuscata* Engel & Michez, new species**

ZooBank: urn:lsid:zoobank.org:act:20135604-5B7C-47F8-8F28-C9C37C3C1001

(Figs. 1–14)

DIAGNOSIS: *Hesperapis infuscata* is the only vernal species in the *carinata* group known to occur in the lower midwestern United States. Among species of the *carinata* group, *H. infuscata* differs from *H. carinata* and *H. oraria* by the infuscate wings, and from *H. rodecki* by the rounded pronotal lobe. It can be distinguished among other *Carinapis* by the following combination of traits in females and males: pronotal lobe rounded, not produced and spine-like (spine-like with spine acute, subapically flattened, and recurved in *H. rodecki*); wings notably infuscate apically (uniformly hyaline in *H. carinata* and *H. oraria*; lightly infuscate basally, apically lighter and milky in ap-

¹ In many species of *Hesperapis* the metatibial scopa is composed of two layers of setae. The primary vestiture (*sensu* Stage, 1966) refers to a thin, relatively dense, inner layer composed of short, subappressed, plumose setae, while the secondary vestiture references the sparse outer layer composed of long, suberect, minutely barbed or simple setae that extend above the inner layer.



Figures 5–6. Facial views of *Hesperapis (Carinapis) infuscata*, new species. 5. Female. 6. Male.

pearance in *H. oliviae*); and propodeal enclosure shiny, without conspicuous punctation (dull and contiguously punctured in *H. macrocephala*). In females the species can be further differentiated by the following characters: largely yellowish to lightly fulvous; mesotibial spur yellowish, with coarse, well-separated branches (whitish and finely serrate, with serrations sharp, contiguous, and inclined in *H. oliviae*); metatibial scopa yellowish (Fig. 1) to lightly tawny or even light brownish (reddish in *H. carinata* and *H. oraria*; dark in *H. oliviae*; golden in *H. rodecki*), without primary vestiture (with primary vestiture in *H. rhodocerata*, *H. fulvipes*, *H. macrocephala*, and *H. oliviae*); basal triangle of pygidial plate broad, with apical angle $>45^\circ$ (narrow with angle $<45^\circ$ in *H. rhodocerata* and *H. fulvipes*). Additional distinguishing features in males include: flagellum brown below (at least partly light reddish below in *H. carinata*, *H. oraria*, and *H. rodecki*; somewhat orange in *H. macrocephala*), and the plesiomorphic retention of a pygidial plate (absent or reduced to median carina in *H. oliviae*, *H. rhodocerata*, and *H. fulvipes*). The male terminalia are as depicted in figures 7–13.

DESCRIPTION: ♀: Total body length 12–14 mm; head wider than long, length about $0.78\times$ width. Labrum length about $0.28\times$ width, upper surface strongly, transversely convex; mandible preapical tooth at apical quarter of mandible length, apex narrowly rounded; galea outer edge strongly curved apically, inner edge straight; labial palpus about $1.15\times$ length of glossa, about $0.45\times$ length of prementum and about $1.3\times$ length of maxillary palpus; ratio of lengths of labial palpomeres: 24:16:10:8. Clypeus weakly protuberant, clypeal disc distinctly convex; ratio of lengths of basal four flagellomeres: 25:12:15:15; median flagellomeres about $0.90\times$ as long as wide; inner compound eye margins weakly convergent below, upper third faintly, broadly emarginate; vertex gently convex. Pronotal lobe rounded, not greatly produced and apically acute. Mesotibial spur with coarse, separated, short branches. Metabasitibial plate well developed, broadly ovoid, margin weakly incrassate. Pygidial plate apically subtruncate with weak median notch, laterally weakly sinuate, apical third weakly concave; surface of distal third strongly concave and with coarse longitudinal striae originating at carinate margin of elevated basal triangle; surface of basal triangle finely and irregularly rugose or papillose and with margins forming angle of about 80° apically.

Integument shiny. Labrum smooth basally, anteriorly with minute, piligerous punctures. Galea upper surface finely tessellate, with widely scattered, minute piligerous punctures. Punctures of face small, coarse, shallow, scattered, separated by about 1–2× a puncture width except sparser medially on clypeus and supraclypeal area and denser laterally on clypeus, similar setae on face, gena posteriorly, and vertex behind ocelli; punctures more minute and denser on upper face, anterior to ocelli, and vertex, such punctures more spaced in ocellular area. Mesoscutum, mesoscutellum, and metanotum densely punctured, punctures nearly contiguous, punctures of mixed sizes; mesepisternum punctured as on mesoscutum except punctures of more uniform sizes and becoming slightly sparser posteriorly; metepisternum with larger punctures dorsally, smaller ventrally; lateral and posterior surfaces of propodeum with sparsely punctate; propodeal enclosure smooth and shiny (without faint reticulae). Metasomal terga largely finely imbricate, except anterior-facing surface of tergum I smooth, otherwise with dense, minute, piligerous punctures and some widely spaced, larger, shallow, piligerous punctures; hyaline margins impunctate; sterna finely imbricate with widely spaced, shallow, piligerous punctures like those of terga.

Head and mesosoma dark reddish brown to black, sometimes lighter on pleura and posterior surface of propodeum; mandible dark reddish brown in apical third, basal two-thirds lighter reddish brown (almost dark testaceous in some individuals); labrum dark reddish brown, nearly black apically; maxilla dark brown to black; antenna primarily black but paling to dark brown beneath on flagellum; legs reddish brown to dark reddish brown, spurs amber; dark reddish brown on basal terga, becoming nearly black on apical terga, terga I–IV sometimes paler brownish across middle; tergal margins lighter brown and semi-translucent to hyaline beneath apical setal bands; pygidial plate dark reddish brown subapically, basally and along apical margin dark reddish brown to black. Wing membranes lightly infuscate, with apical area more conspicuously infuscate; veins amber brown to brown except Sc+R darker.

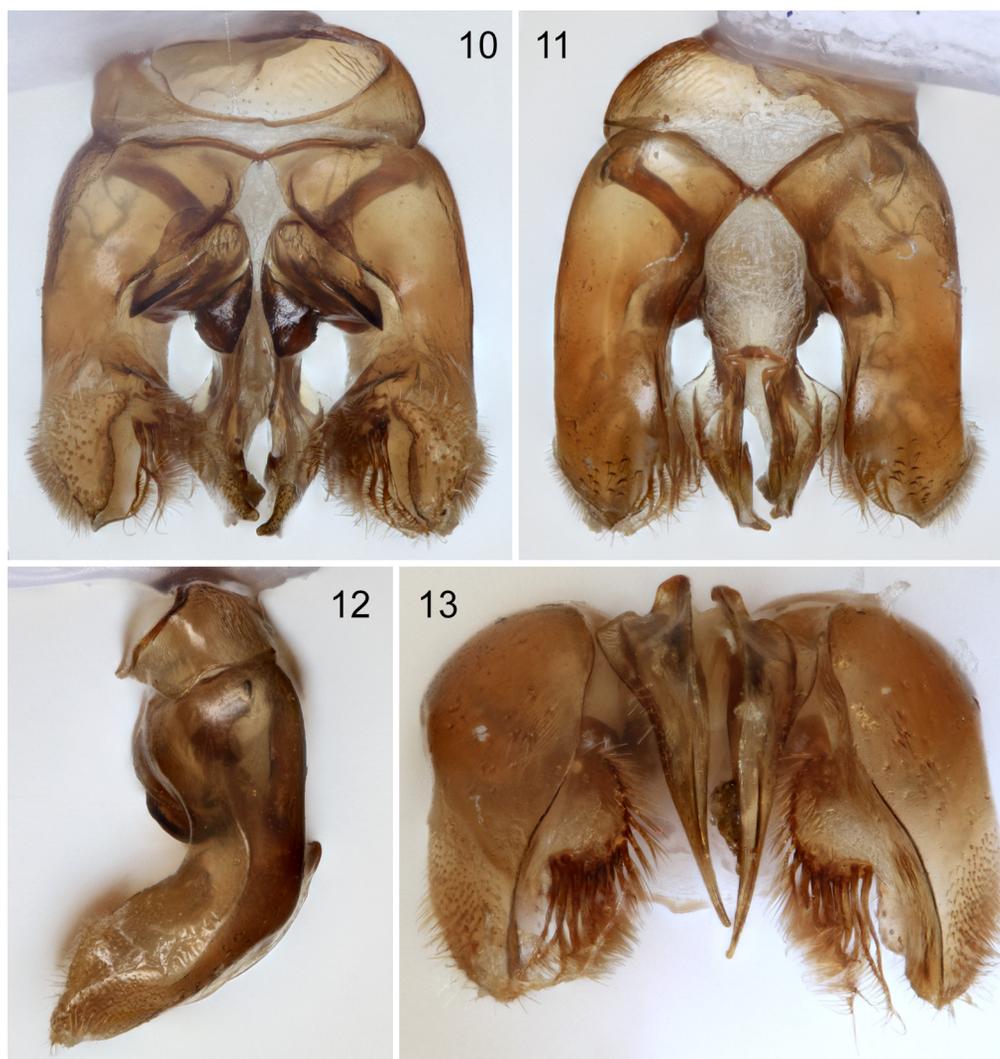
Pubescence entirely pale, off-white to yellowish or lightly fulvous; long, suberect, minutely barbate setae numerous around antennal toruli, lower face, and laterally and apically on clypeus, shorter, sparser, and more semi-decumbent elsewhere, although becoming long, erect, and dense again on vertex posterior to ocelli, gena, and postgena; setae on gena bordering compound eye short and subappressed to suberect; labrum anteriorly with sparse, short, thick setae set in minute punctures, apical margin fringed with long, simple, golden setae; galea outer edge with fringe of short, simple, sparse setae, apex with long setae, inner edge without fringe, upper surface with erect, long, simple setae set in minute punctures. Setae of mesosoma entirely long, dense, and minutely barbate, barbs longer and more conspicuous than those on head; setae largely off-white, more lightly fulvous dorsally and lightly fuscous centrally on mesoscutum and mesoscutellum; metepisternum with long erect setae dorsally, becoming short and appressed to subappressed elsewhere; patch of similarly short, albeit erect, setae on propodeum bordering upper portion of metepisternum. Mesotibial setae of outer surface off-white and dense, almost obscuring integument, setae mostly long and semi-decumbent, with some equally long simple setae near margins, subapically along posterior margin setae lightly fuscous, inner surface glabrous; mesobasitarsus outer surface densely covered with pale, long, suberect setae that do not obscure surface. Metabasitibial plate disc covered with oblique, pale setae; metatibial scopa without primary vestiture, secondary vestiture composed of long, off-white to lightly tawny (although lightly brownish in one population), gently arched, suberect, more spaced (creating somewhat more open scopa) setae, setae barbate along one edge only; metabasitarsus



Figures 7–9. Male terminalia of *Hesperapis (Carinapis) infuscata*, new species. 7. Sixth sternum. 8. Seventh sternum. 9. Eighth sternum.

with setae like those of metatibia. Metasoma with short, appressed, simple, brownish setae; long, pale, erect setae shorter or absent except basally on tergum I and laterally on terga II–VI; apical setal bands composed of long, dense, apically directed, minutely barbulate setae; sterna with short, scattered, suberect, minutely barbulate setae.

♂: As described for female except as follows: Total body length 10.5–13 mm; head slightly broader than in female, length about 0.69–0.74× width. Labrum with preapical setal patch denser and somewhat subtriangular; mandible as in female but subapical tooth area broadened and somewhat blade like; maxilla and labium as in female but smaller; ratio of lengths of labial palpomeres: 20:16:8:7. Clypeus broadly convex but with weak longitudinal median sulcus, sulcus weakest distally; ratio of lengths of first four flagellomeres: 7:14:18:18; median flagellomeres 1.25× as long as wide; inner



Figures 10–13. Male genitalia of *Hesperapis (Carinapis) infuscata*, new species. 10. Ventral view. 11. Dorsal view. 12. Lateral view. 13. Apical view.

compound eye margins strongly convergent below (Fig. 6). Metabasitibial plate more subacute apically. Pygidial plate subtriangular, strongly elevated and sharply carinate posteriorly, apex minutely and acutely pointed. Terminal sterna and genitalia as depicted in figures 7–13.

Color largely as in female; antenna color largely as in female, sometimes slightly lighter, flagellum brown beneath.

Punctuation as in female except that of clypeus somewhat coarser and denser. Pygidial plate surface primarily finely and faintly tessellate, but with sparse, coarse punctures bearing fine short, appressed setae basolaterally.

Pubescence of clypeus, supraclypeal area, and face distinctly longer, denser (nearly obscuring integument, particularly on clypeus), and covering more area than in female (*cf.* Figs. 5, 6), such setae typically more yellowish than in female. Mesosomal pubescence generally longer and denser than in female, particularly centrally on me-

soscutum and mesoscutellum. Pubescence of tibiae and basitarsi generally somewhat sparser, particularly along posterior margins. Metasomal apical setal bands somewhat narrower and more diffuse than in female, particularly on tergum I.

HOLOTYPE: ♀, **TEXAS: Goliad County:** 16 mi E Goliad, 8 May 1953, R.H. Beamer, taken on *Gaillardia* sp. [28.6681, -97.1244] (SEMC).

PARATYPES: **TEXAS: Goliad County:** 11 ♀♀, 2 ♂♂, 16 mi E Goliad, 8 May 1953, R.H. Beamer, taken on *Gaillardia* sp. [28.6681, -97.1244] (SEMC); 10 ♀♀, 1 ♂, 16 mi E Goliad, 7 May 1953, R.H. Beamer, taken on *Gaillardia* sp. [28.6681, -97.1244] (SEMC).

ADDITIONAL MATERIAL: **KANSAS: Sedgwick County:** 1 ♀, Wichita, June 1949, C.D. Michener [37.69222, -97.33733] (SEMC).

OKLAHOMA: Carter County: 1 ♂, Ardmore vicinity, 3 June 1961, University of Kansas Mexico Expedition, on flowers of *Rudbeckia* [34.17417, -97.14333] (SEMC). **Jackson County:** 1 ♂, 15 mi S of Altus, 2 June 1979, C.D. Michener [34.42121, -99.33361] (SEMC).

TEXAS: Bastrop County: 4 ♀♀, 11 ♂♂, McDade, 10 May 1954, L.D. Beamer, taken on *Gaillardia* [30.2836, -97.2375] (SEMC); 2 ♂♂, McDade, 10 May 1954, L.D. Beamer, taken on *Opuntia* [30.2836, -97.2375] (SEMC); 13 ♂♂, McDade, 10 May 1954, R.H. Beamer, taken on *Gaillardia* [30.2836, -97.2375] (SEMC). **Dimmit County:** 2 ♀♀, Catarina, 11 April 1950, Michener, Rozens, Beamer, Stephen, taken on *Gaillardia* [28.3453, -99.6131] (SEMC). **Goliad County:** 1 ♀, 2 ♂♂, Weser [misspelled on two labels as "Wiser"], 9 May 1953, R.H. Beamer, taken on *Gaillardia* [28.865, -97.3672] (SEMC). **Howard County:** 1 ♂, Big Spring, 21 June 1947, D. Rockefeller Expedition, C.D. Michener [32.2433, -101.4752] (AMNH). **Wilbarger County:** 2 ♀♀, 15 mi N Vernon, C.D. Michener [34.3713, -99.2647] (SEMC). **Willacy County:** 1 ♀, Raymondville, 17 April 1952, Michener, Beamer, Wille, LaBerge, taken on *Helianthus annuus* [33.8139, -96.5569] (SEMC).

ETYMOLOGY: The specific epithet refers to the apically infusate wings.

DISCUSSION

Hesperapis infusata is a vernal species widely distributed from southern Kansas south through Oklahoma and Texas nearly to the Mexican border (Fig. 14). In Kansas the species approaches if not overlaps southern populations of *H. carinata* but since the two species are widely allochronic it is unlikely they would ever interbreed. In fact, all species in the *carinata* group appear to be allopatric and/or allochronic with populations of adjacent species (Stage, 1966). Species of *Hesperapis* are believed to be univoltine (Cane *et al.*, 1996; Rozen, 2016).

Among the present series of specimens, differences in color and size within *H. infusata* seemingly occur between different populations rather than between individuals of the same population, likely an artificial pattern resulting from the small sample sizes available. Nonetheless, for this reason the present description applies only to material from the type locality and to that collected from adjacent areas in Goliad County. As further material is sampled from intervening localities these differences are likely to more clearly intergrade and intermix within particular populations. The most extreme variation is a smaller (female length 11–13 mm; male 10 mm) melanic form collected at three widely separated localities in Texas: Big Springs, Howard County; Raymondville, Willacy County; and Lytle, Atascosa County (the last recorded by Stage, 1966). This form is easily recognized because nearly all pubescence, except the apical setal bands on the metasomal terga, is quite dark brown or nearly black. The remaining specimens of this species are intermediate between these extremes, most specimens are smaller but only slightly darker than the type material.

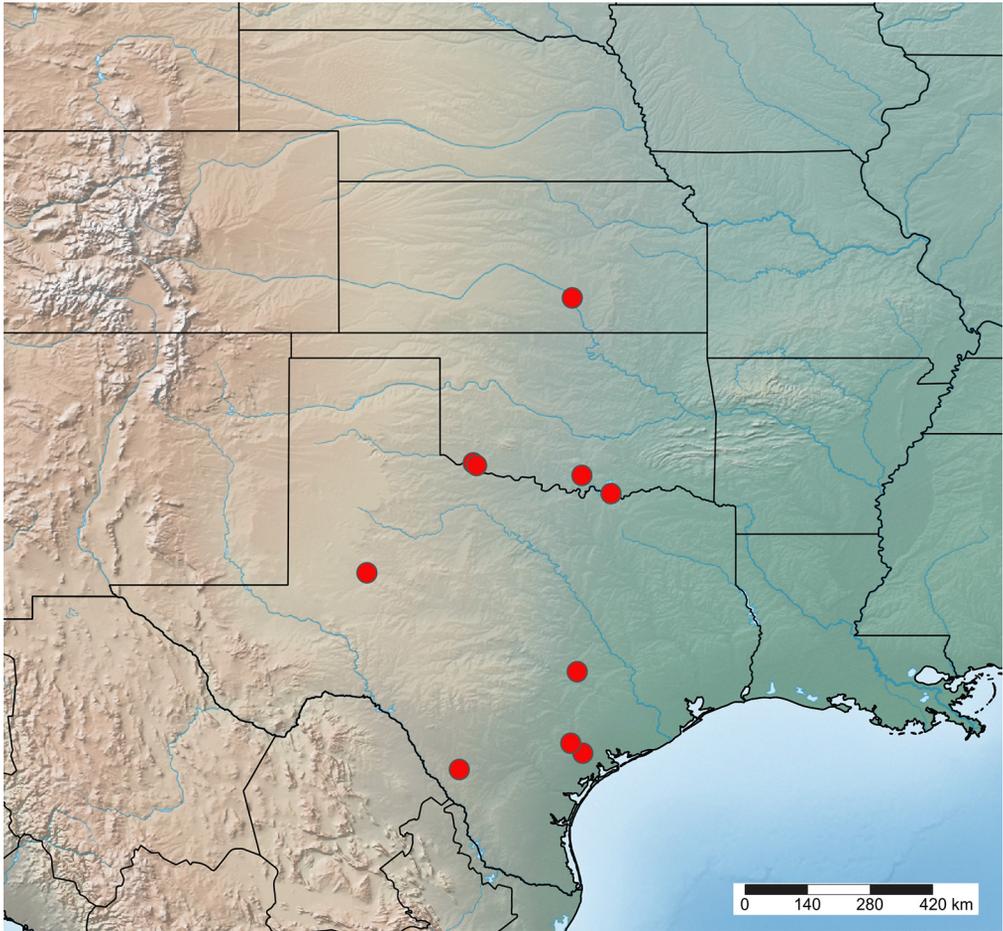


Figure 14. Map of lower Midwestern states, with confirmed occurrences of *Hesperapis (Carinapis) infuscata*, new species, mapped. Mapped using SimpleMapp (Shorthouse, 2010).

As far as we are aware, most species of *Hesperapis* are broadly oligolectic, and most of the species of the subgenus *Carinapis* have been recorded on Asteraceae (Michez *et al.*, 2008). Here, most of the specimens of *H. infuscata* were collected from species of flowers in three genera of Asteroideae (Asterales: Asteraceae): *Helianthus* L., *Ratibida* Raf., *Rudbeckia* L., and *Gaillardia* Foug., representing two tribes, Heliantheae and Heleinaeae (includes records indicated by Stage, 1966). Two males were also collected at *Opuntia* Mill. (Cactaceae: Opuntioideae), but were obviously not collecting pollen. Since nearly all females from these plants bear pollen loads in their scopae it is reasonable to conclude that *H. infuscata* regularly utilizes these plants as a pollen source and perhaps is broadly oligolectic on them. It is hoped that with the species properly characterized, melittologists will seek out populations of *H. infuscata* to locate their nesting habits and elaborate on the floral associations.

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