

An illustrated key to *Anthophoroides* Cockerell & Cockerell, with the description of three new species (Hymenoptera: Apidae)

BY MICHAEL S. ENGEL

Division of Invertebrate Zoölogy, American Museum of Natural History, Central Park West at 79th
Street, New York, New York 10024-5192, U.S.A.

Received: 23 March 2023; Accepted: 2 June 2023; Published: 28 July 2023

ABSTRACT

Three new species of the cosmopolitan bee genus *Anthophora* Latreille are described and figured from North America, all of the subgenus *Anthophoroides* Cockerell & Cockerell and all based on a series of females and males. *Anthophora* (*Anthophoroides*) *buchmanni* sp. n. from Arizona, USA and Sonora, Mexico; *A. (A.) cinerula* sp. n. from California, Nevada, Utah, and Arizona, USA; while *A. (A.) kelliæ* sp. n. is recorded from southern California and Arizona, USA and Baja California, Mexico. An illustrated key is presented to the species of *Anthophoroides*.

Keywords: Anthophila, *Anthophora*, Anthophorinae, Apoidea, taxonomy, Nearctic

INTRODUCTION

The genus *Anthophora* Latreille comprises approximately 420 rather robust, ground-nesting (with the exception of *Clisodon* Patton) bees, distributed throughout the world except the Malagasy, Indomalayan, Papuasian, and Australian regions. Individuals are notoriously fast-flying bees, challenging to catch on the wing, and species can be rather abundant in many places, particularly throughout the Holarctic. Many species are floral specialists, sometimes possessing distinctive specializations in females for the collection of pollen (e.g., clypeal pectens, augmentations of the labiomaxillary complex), and males frequently have modifications of the mid- and hind legs for grasping the female during mating.

The diversity of the genus is organized into a large number of subgenera (Brooks 1988; Michener 2007; Orr, Pitts & Griswold 2018). The subgenus *Anthophoroides* Cockerell & Cockerell is one of the smaller lineages within the genus and is restricted to the western United States southward to at least Honduras (Michener 2007), although there are unpublished putative records as far south as northwestern Costa Rica. Species are often some of the smaller *Anthophora*, with many individuals ranging from 10–13mm in length, and closely resembling those of *Melea* Sandhouse. *Anthophoroides* can be distinguished from *Melea* by the presence of plumose setae on the retrodorsal margin of the female metatibia (simple in *Melea*), and the elaborate process of the male metatibia from which one of the spurs arises (metatibia simple in *Melea*). It is possible that the clade comprising *Anthophoroides* arises from within the species of *Melea*, in which case the two subgenera could be united, although this requires more extensive sampling of both groups of species to establish a robust suite of relationships. For now, both groups are easily distinguished and are therefore treated as distinct subgenera, with 11 species in *Anthophoroides*, inclusive of the three described herein. Species of *Anthophoroides* are sometimes challenging to distinguish in females, but males are easily recognized

by the species-specific modifications of the metatibia and metabasitarsus, as well as the forms of the hidden sterna and genitalia.

To date, there has been no comprehensive key to the species of *Anthophoroides*. The purpose here is to remedy that situation by providing a key to the species and, in doing so, to present the descriptions of three new species from the southwestern United States and northwestern Mexico.

MATERIAL AND METHODS

Material is deposited in the Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas, USA (SEMC) and the Division of Invertebrate Zoölogy, American Museum of Natural History, New York, New York, USA (AMNH). Morphological terminology follows that of Engel (2001) and Michener (2007), with terms for orientation of the hind legs following Engel *et al.* (2021). Given the overall great similarity among species of *Anthophoroides* abbreviated descriptions are provided as many characters are homogenous across the group (e.g., Brooks 1988; Orr *et al.* 2016), although the male terminalia are always diagnostic. The first species is described with a bit more detail and the remaining two are described in reference to the first account so as to minimize repetition of otherwise fixed features across this subset of *Anthophoroides*. Measurements were made with an ocular micrometer and an Olympus SZX9 stereomicroscope. This paper is registered in ZooBank under the following LSID: urn:lsid:zoobank.org:pub:4EEF4209-FCED-43BE-B062-BAA7CF8DB44F.

SYSTEMATICS

Genus *Anthophora* Latreille

Subgenus *Anthophoroides* Cockerell & Cockerell

Anthophora (*Anthophoroides*) *buchmanni* sp. n. (Figs 1–10)

Diagnosis: *Anthophora* (*Anthophoroides*) *buchmanni* is quite similar to *A. (A.) pueblo* Orr and the two could be easily confused were it not for the dull, matt, tessellate, and sparsely punctate mesoscutum of the former (smooth, shiny, and more densely punctate in *A. pueblo*); the more distinct tergal setal bands of the male (Fig. 1); the differences in the male terminalia (Figs 4–7); and the dramatic differences in the development of the male metatibial and metabasitarsal processes (Figs 2, 3 for *A. buchmanni* cf. Figs 47, 48 for *A. pueblo*).

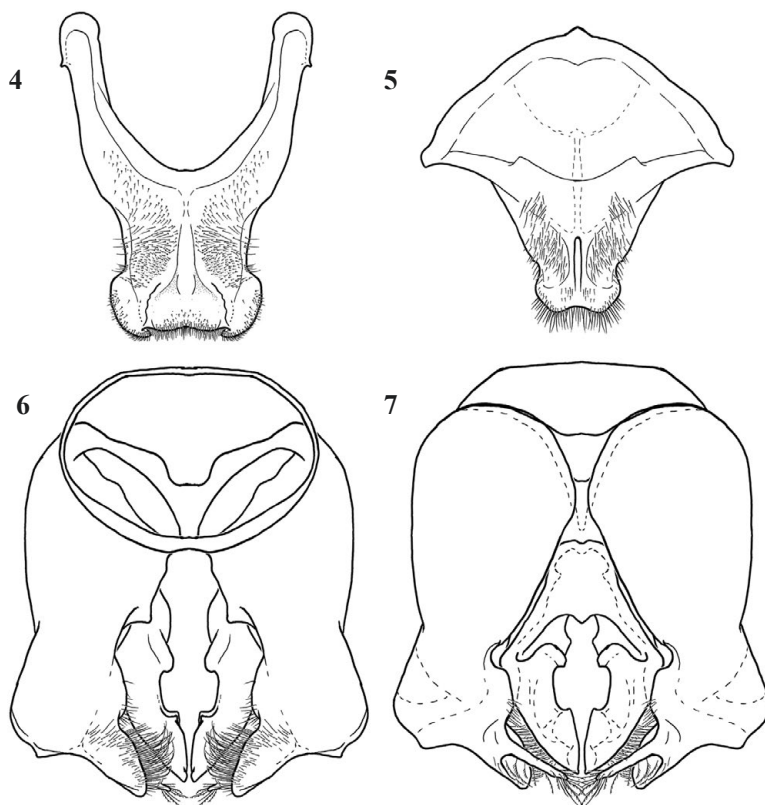
Description

♂: Total body length 10.10–12.17mm; forewing length 7.75–8.42mm. Head broader than long, medial length (clypeal apex to peak of vertex in facial view) 2.50–2.67mm, maximum width 3.83–4.08mm. Mandible with weakly delimited subapical tooth. Flagellomere I slightly longer than flagellomere II. ♂ metafemur crassate; metatibia without spine or knob-like projection proximal to articulation of posterior (=inner) metatibial spur (Fig. 3); anterior (=outer) spur arising from prominent thick proventral process, process as long as or slightly shorter than spur (Fig. 2), apex weakly concave and forming thick blunt point near rachis of spur and less distinct angle opposite (Fig. 2); metabasitarsus with proventral surface weakly concave, nearly straight, retrodorsal surface weakly arched (Fig. 3), proximal proventral process a short triangular flange, shorter than posterior (=inner) metatibial spur and with transverse width about as long as apical width of metabasitarsus (Figs 2, 3), apical proventral process a short spine, largely obscured by surrounding pubescence (Fig. 2). ♂ terminalia as in figures 4–7.



Figs 1–3. — *Anthophora* (*Anthophoroides*) *buchmanni*, sp. n., ♂: 1, Lateral habitus; 2, Metatibia and metabasitarsus, prolateral view; 3, Metatibia and metabasitarsus, retrolateral view.

Labrum with coarse, shallow, contiguous punctures giving faintly irregular appearance, particularly at base; clypeus with scattered small, shallow punctures and weak irregular mediolongitudinal wrinkles, otherwise integument minutely and finely imbricate; supraclypeal area as on clypeus, between antennal toruli small punctures well-defined and contiguous; face below tangent of antennal toruli with small punctures more defined but sparse, such punctures becoming denser toward antennal torulus and in area of black integument on frons where punctures are contiguous; punctures of upper frons becoming weaker and sparser in largely polished and depressed ocellocular area; punctures contiguous again on vertex posterior to ocelli but blending laterally to more widely spaced and better-defined punctures above compound eye and on gena, such puncture separated by 1–3× a puncture width, integument otherwise smooth. Mesoscutum dull, matt, and largely tessellate, with punctures shallow and sparse on central disc, blending to more numerous, nearly contiguous, shallow punctures laterally, anteriorly, and posteriorly; mesoscutellum and pleura punctured as on lateral portion of mesoscutum except punctures of pleura more well-defined; basal area of propodeum dull, matt, tessellate and impunctate; lateral surface of propodeum sculptured as on pleura. Metasoma finely and faintly imbricate, discs with minute, shallow, setigerous punctures separated by 1–2× a puncture width; semitranslucent apical margins impunctate; sterna as on terga.

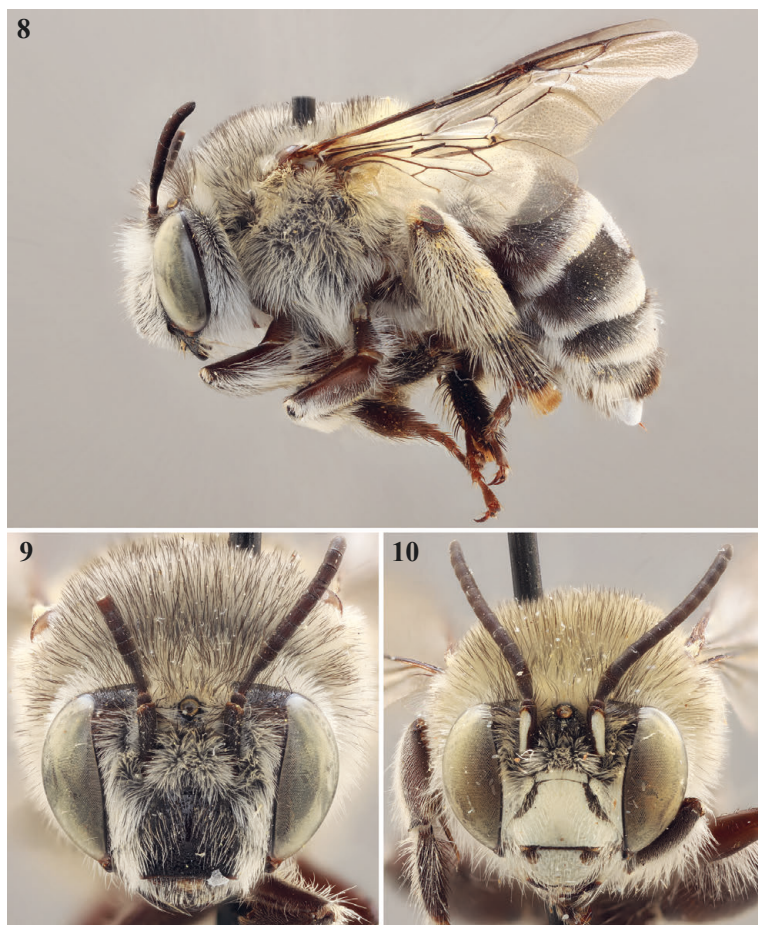


Figs 4–7. — ♂ terminalia of *Anthophora* (*Anthophoroides*) *buchmanni* sp. n.: 4, Metasomal sternum VII; 5, Metasomal sternum VIII; 6, Genitalia in ventral view; 7, Genitalia in dorsal view.

Integument of head and mesosoma black except white to off-white markings on face (Fig. 10), specifically basal half of mandible, labrum except rim and basolateral ovoids, clypeus except areas bordering anterior tentorial pits, supraclypeal area, paraocular areas lateral to and below tangent of antennal toruli, and ventral surface of scape. Tegula semi-translucent brown. Legs dark brown although more dark reddish brown on tarsi. Metasoma dark brown to black except apical margins of terga I–IV semitranslucent off-white, those of terga V and VI semitranslucent yellow (Fig. 1).

Pubescence generally white to off-white except upper half of head and vertex with largely pale ochraceous to tan, intermixed on uppermost frons and vertex with some dark fuscous setae (Fig. 10); mesosoma dorsally and upper portions of pleura with pubescence like that of vertex, otherwise white to off-white (Fig. 1), although intermixed fuscous setae lacking on metanotum and propodeum; legs with predominantly white setae except brownish on ventral surface of metafemur, metatibia, and retrolateral surfaces of tarsi. Metasomal tergum I with abundant setae like that of mesosomal dorsum except without intermixed fuscous setae; discs of terga II–VI with numerous, short, simple, suberect brownish setae, blending apically to longer, white setae forming bands covering tergal apical margins (Fig. 1).

♀: As described for the ♂ except in typical sex differences and as follows: Total body length 11.50–13.19mm; forewing length 8.00–9.08mm. Head broader than long, medial length (clypeal apex to peak of vertex in facial view) 2.50–2.83, maximum width 4.00–4.67mm. Flagellomere I nearly as long as combined lengths of flagellomeres II–IV. Metafemur, metatibia, and metabasitarsus unmodified (typical for genus).



Figs 8–10. — *Anthophora* (*Anthophoroides*) *buchmanni* sp. n.: 8, Lateral habitus, ♀; 9, Facial view, ♀; 10, Facial view, ♂.

Integument of head black, without pale markings of ♂ except uncommonly with off-white spot mediobasally on labrum, otherwise black on most individuals.

Pubescence generally as in ♂ except mesoscutum often more greyish and contrasting with the pale ochraceous to tan of mesoscutellum and uppermost pleura; legs with predominantly white setae except metatibial scopa tinged yellowish toward retrodorsal margin, retrolateral surfaces of meso- and metatarsi dark brown to fuscous; penicillum tawny.

Material examined

Holotype, ♂, ARIZONA: Yuma Co., Palm Cyn., Kofa Mts., IV-8-63 [8 April 1963], C.A. Toschi [=Catherine A. Tauber, née Toschi] (SEMC).

Paratypes, ARIZONA: 1♂, 1♀, Arizona: Pima Co., Kings Canyon (nr. Tucson), 13 April 1980, S.L. Buchmann, *Coursetia microphylla* (SEMC); 2♂♂, 3♀♀, Arizona: Yuma Co., Palm Cyn., Kofa Mts., IV-8-63 [8 April 1963], C.A. Toschi [=Catherine A. Tauber, née Toschi] (2♂♂, 2♀♀ SEMC, 1♀ AMNH); 6♂♂, 4♀♀, Arizona: Yuma Co., Palm Cyn., Kofa Mts., IV-8-63 [8 April 1963], J. Powell, Beloperon: *californica* (5♂♂, 4♀♀ SEMC, 1♂ AMNH); 4♀♀, Arizona: Yuma Co., Palm Cyn., Kofa Mts., IV-8-63 [8 April 1963], R.L. Langston (SEMC); 1♂, Arizona: Yuma

Co., Palm Cyn., Kofa Mts., IV-8-63 [8 April 1963], G. Tamaki (SEMC); 1♂, 1♀, Arizona: Pima Co., Sierrita Mts., 20 April 1995, R.L. Minckley, H. Cox, at *Dalea* sp. (SEMC); 1♀, Arizona: Pima Co., Sierrita Mts., 20 April 1995, R.L. Minckley, H. Cox (SEMC); 1♂, Arizona: Pima Co., Sierrita Mts., 20 April 1995, R.L. Minckley, H. Cox, at *Dalea greggii* (SEMC); 1♀, Arizona: Pima Co., 7 km S Robles Jct., 32°01'N, 111°21'W, 930m, 13 April 1995, H. Cox, R.L. Minckley, at *Dyssodea* [sic] sp. (AMNH); 1♂, Arizona: Pima Co., St. Rita E.R., J.L. Neff (SEMC); 1♀, Arizona: Graham Co., Bonita Cr. & Gila R., 32°53'N, 109°29'W, 975m, 29 April 1995, H. Cox (SEMC); MEXICO (Sonora): 1♂, 5♀♀, Mexico: Sonora, between Ratanova & Mazatlan, Hwy 14, 21 April 1990, B. Danforth, B. Alexander (4♀♀ SEMC, 1♂, 1♀ AMNH); 1♀, Mexico: Sonora, 1km W. Sahuaripa, 21 April 1990, B. Alexander, B. Danforth (SEMC); 1♀, Mexico: Sonora, 19km N of Hwy 15 & Hwy 24 junction, Microordas Road, 20 March 1990, R.L. Minckley (AMNH).

Etymology: The specific epithet honours Stephen L. Buchmann, distinguished pollination ecologist, and who collected some of the specimens in the type series.

ZooBank *LSID*: urn:lsid:zoobank.org:act:837628B6-34D8-44A6-A951-2223D4EEF909

Floral records: *Coursetia glandulosa* A. Gray (Fabaceae: Faboideae: Robinieae); *Dalea greggii* A. Gray (Fabaceae: Faboideae); *Justicia californica* (Benth.) D. Gibson (Acanthaceae); *Dyssodia* sp. (Asteraceae: Asteroideae: Tageteae). Currently, pollen collection has only been documented from *C. glandulosa* (*vide* Remarks, *infra*).

Remarks: Steve Buchmann kindly provided me with notes from his observations collecting some of the Arizonan individuals in the type series (*vide* Paratypes, *supra*). The small series collected by him on 13 April 1980 were, (*in litteris*, March 2023) ‘..along the edges of a major wash (King’s Canyon, about 340m north of the trailhead) in the Tucson Mountains west of Tucson, Arizona. This location is about one kilometre from the parking lot of the Arizona-Sonora Desert Museum. At the time, the site was owned/managed as the Tucson Mountain Park (Pima County, 8093 hectares), while today the King’s Canyon wash has been added to the west unit of the Saguaro National Park. The coordinates for the approximate collection area are: 32°15'00"N, 111°09'57"W, at 898m elevation. Both sexes were foraging for nectar and females for pollen at the white and yellow flowered native legume, perennial deciduous shrubs known as Rosary Babybonnets [*Coursetia glandulosa* A. Gray (Fabaceae); *C. microphylla* A. Gray is a current synonym]. This is the only plant this species was collected on then or has been seen on since. *Coursetia* flowers during March and April in the Sonoran Desert of Arizona. I have seen this bee over subsequent years at this site. However, it is never very abundant, and I haven’t found its likely solitary scattered nests.’

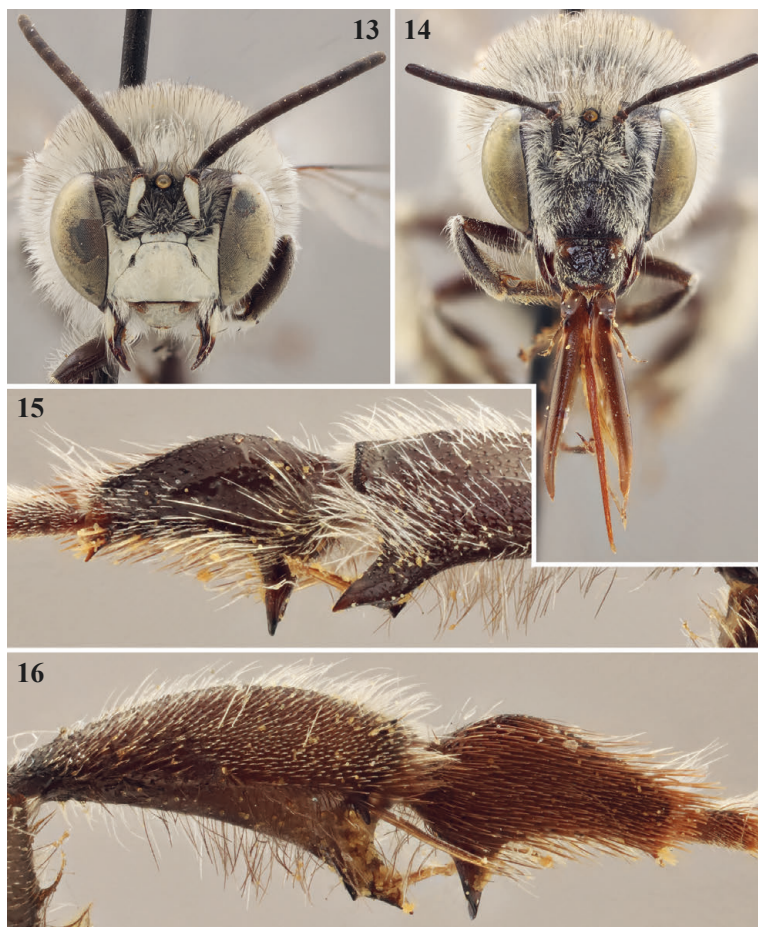
***Anthophora (Anthophoroides) cinerula* sp. n.**
(Figs 11–20)

Diagnosis: *Anthophora cinerula* is a pale greyish species, individuals of whom are superficially similar to those of *A. phaceliae* Brooks and even more so to *A. kelliieae* (*vide infra*) and *A. buchmanni* (*vide supra*). As is the case in all of these species, the mesoscutum is dull, matt, and tessellate centrally to weakly microareolate laterally. Males are perhaps most similar to *A. phaceliae* owing to the presence of a projection (spine-like in *A. cinerula*, knob-like in *A. phaceliae*) proximal and adjacent to the



Figs 11–12. — *Anthophora* (*Anthophoroides*) *cinerula* sp. n.: 11, Lateral habitus, ♂; 12, Lateral habitus, ♀.

articulation of the posterior (=inner) metatibial spur (Fig. 16). In addition, both species have the retrodorsal surface of the metabasitarsus prominently arched in the proximal half, this margin then tapering relatively straightly to the apex (Figs 15, 16), and the tergal apical margins are semitranslucent but not covered and obscured by distinct white setal bands. From *A. phaceliae*, the male of *A. cinerula* is most easily distinguished by the pale cinereous setae of the mesoscutum and mesoscutellum (versus pale ochraceous to tan in *A. phaceliae*), the spine-like (rather than knob-like) projection adjacent to the spur, and the largely white to off-white semitranslucent tergal apical margins (rather than semitranslucent brown to light brown in *A. phaceliae*). Females are more difficult to distinguish and are most easily confused with those of *A. kellieae*, differing in the pale cinereous setae of the mesoscutum and mesoscutellum (versus pale ochraceous to tan in *A. kellieae*) and the predominance of short white setae on the disc of tergum II (predominantly fuscous in *A. kellieae*). All three species differ noticeably in the terminalia: cf. Figs 17–20 for *A. cinerula* vs. Figs 25–28 for *A. kellieae* vs. fig. 45 in Brooks (1988) for *A. phaceliae*.

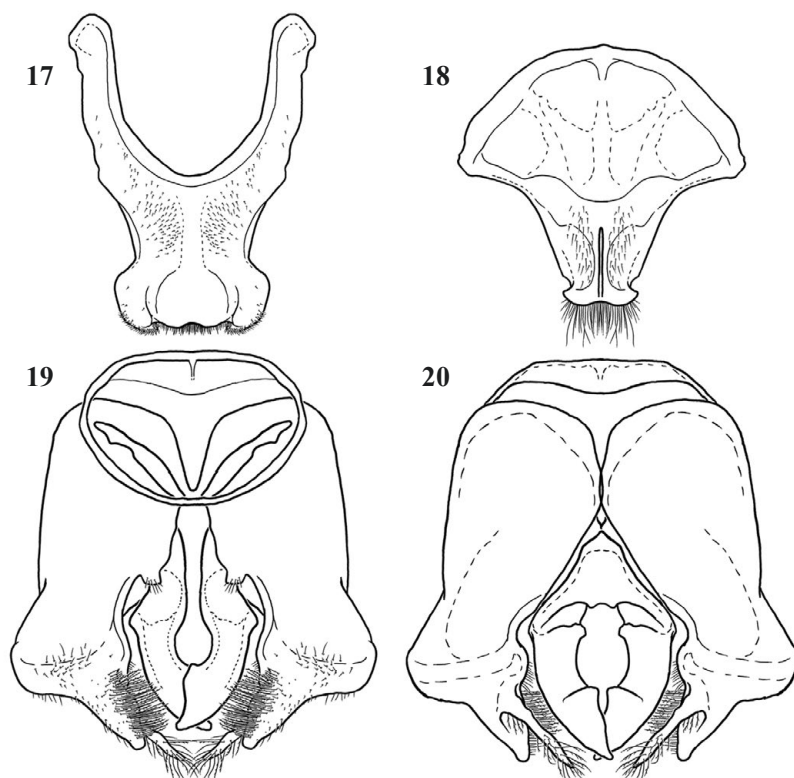


Figs 13–16. — *Anthophora (Anthophoroides) cinerula* sp. n.: 13, Facial view, ♂; 14, Facial view, ♀; 15, Metatibia and metabasitarsus, ♂, prolatateral view; 16, Metatibia and metabasitarsus, ♂, retrolateral view.

Description

As described for *A. (A.) buchmanni* (*vide supra*), with the following exceptions: ♂: Total body length 11.08–12.08mm; forewing length 7.75–8.17mm. Head broader than long, medial length (clypeal apex to peak of vertex in facial view) 2.33–2.50mm, maximum width 3.83–4.08mm. Flagellomere I longer than flagellomere II. ♂ metafemur crassate; metatibia with short spine proximal to articulation of posterior (=inner) metatibial spur (Fig. 16); anterior (=outer) spur arising from prominent thick proventral process, process as long as or longer than spur, apex weakly concave and forming thick acute point near rachis of spur and pointed angle opposite (Figs 15, 16); metabasitarsus with proventral surface weakly concave, nearly straight, retrodorsal surface prominently arched in proximal half (Figs 15, 16), proximal proventral process a large flange, with transverse width longer than apical width of metabasitarsus (Figs 15, 16), apical proventral process a short spine (Fig. 15). ♂ terminalia as in Figs 17–20.

Integument of head and mesosoma black except white to off-white markings on face (Fig. 13), specifically basal half of mandible, labrum except rim and basolateral ovoids, clypeus except small spots bordering anterior tentorial pits, supraclypeal area, paraocular areas lateral to and below tangent of antennal toruli, and ventral surface of scape. Tegula semi-translucent brown.



Figs 17–20. — ♂ terminalia of *Anthophora* (*Anthophoroides*) *cinerula* sp. n.: 17, Metasomal sternum VII; 18, Metasomal sternum VIII; 19, Genitalia in ventral view; 20, Genitalia in dorsal view.

Legs dark brown to nearly black although sometimes more dark reddish brown on tarsi. Metasoma dark brown to black except apical margins of terga I–VI semitranslucent white.

Pubescence generally white to off-white except upper half of head and vertex with more pale cinereous (pale ash greyish) setae, intermixed on uppermost frons and vertex with some dark fuscous setae (Fig. 13); mesosoma dorsally and upper portions of pleura with pubescence like that of vertex (*i.e.*, more pale greyish), otherwise white to off-white (Fig. 11), intermixed fuscous setae lacking on metanotum and propodeum. Metasomal tergum I with abundant setae like that of mesosomal dorsum except without intermixed fuscous setae and often more whitish than greyish; discs of terga II–VI with numerous, short, simple, suberect white brownish setae intermixed with similar white setae, such brownish setae progressively less predominant from tergum II onward, with white setae becoming more dominant and progressively longer on more apical terga, white setae not covering tergal apical margins and not forming distinct apical bands.

♀: As described for the ♂ except in typical sex differences and as follows: Total body length 10.83–12.50mm; forewing length 8.08–8.33mm. Head broader than long, medial length (clypeal apex to peak of vertex in facial view) 2.42–2.75mm, maximum width 4.17–4.33mm. Flagellomere I nearly as long as combined lengths of flagellomeres II–IV. Metafemur, metatibia, and metabasitarsus unmodified (typical for genus).

Integument of head black, without markings of ♂ (Fig. 14).

Pubescence generally as in ♂ except legs with predominantly white setae except those of tarsi and often metatibial apices tinged yellowish, metatibial scopa tinged yellowish toward retrodorsal margin; penicillum pale ochraceous to tawny.

Material examined

Holotype, ♂, CALIFORNIA: Surprise Cyn., Inyo Co., III-31-51 [31 March 1951], E.G. Linsley (SEMC).

Paratypes, CALIFORNIA: 1♂, California: Riverside Co., Berdoo Cyn., 28 Mar. 1969, T.J. Zavortink, 1000–1015 PST, *Hoffmannseggia microphylla* (AMNH); 1♀, California: Riverside Co., Berdoo Cyn., 5 Apr. 1969, T.J. Zavortink, 1000–1015 PST, *Hoffmannseggia microphylla* (SEMC); 1♀, California: Riverside Co., Boyd Desert Res. Center, 4 mi S Palm Desert, IV-10-63, P.D. Hurd, *Hyptis emoryi* (SEMC); 1♀, California: Imperial Co., Indian Pass Rd. 4.5 mi E of Ogilby Rd., el. 300', 21 Mar '84, coll. R.R. Snelling, on flrs. of *Cercidium floridum* (SEMC); 1♀, California: Imperial Co., 9 mi. W. Coyote Wells, III-28-61 [28 March 1961], R.L. Langston (SEMC); 1♀, California: Inyo Co., Darwin Falls, IV-9 1972 [9 April 1972], G.E. Bohart (SEMC); 1♀, California: Inyo Co., Surprise Cyn., Panamint Mts., IV-24-57 [24 April 1957], P.D. Hurd, *Encelia farinosa* (SEMC); 1♀, California: Riv. Co., Coyote Wash, PL Boyd DRC, IV-5-1978 [5 April 1978], R.W. Brooks (SEMC); 5♀♀, California: 1 mi S Ocotillo Wells, San Diego, III-26-1977, R.W. Brooks, *Hyptia emoryi* (3♀♀ SEMC, 2♀♀ AMNH); 1♀, California: Deep Cyn., Palm Springs, III-30-1977, R.W. Brooks, *Cercidium floridum* (SEMC); NEVADA: 2♂♂, 2♀♀, Nevada: Clark Co., Grand Gulch Rd, 22air mi S Mesquite, 11/21-V-83, F.D./JH Parker (SEMC); 1♂, Nevada: Clark Co., Valley of Fire St. Pk., V-1/3-82 [1–3 May 1982], F.D. Parker (AMNH); UTAH: 1♀, Utah: Emery Co., 4900' Wild Horse Cr N of Goblin Vly, VI-3-82, Veirs/Frohlich (SEMC); 1♀, Utah: Grand Co., Green River, 22 mi W-SW, V-22, 1980, D.B. Wahl (SEMC).

Additional material, 1♂, California: Deep Canyon, Riverside Co., II-27-1953 [27 February 1953], E. Schlinger (SEMC); 1♀, California: Surprise Canyon, Panamint Mts., Apr 29 53 [29 April 1953], *Peucephyllum schottii*, Timberlake (SEMC).

Etymology: The specific epithet is a combination of the Latin adjective *cinereus* (meaning, 'ashen' or 'grey') and the suffix *-ulus* (forming a diminutive of nouns or adjectives of diminished effect).

ZooBank LSID: urn:lsid:zoobank.org:act:FAC19D7C-CB3F-4EF7-91D9-9C19856F26D6

Floral records: *Hoffmannseggia microphylla* Torr., *Parkinsonia florida* (Benth. ex A.Gray) S.Wats. (as *Cercidium floridum*) (Fabaceae: Caesalpinioideae), *Peucephyllum schottii* A.Gray (Asteraceae: Asteroideae: Bahieae), *Encelia farinosa* Torr. & A.Gray (Asteraceae), *Condea emoryi* Torr. (as *Hyptis emoryi*) (Lamiaceae).

***Anthophora (Anthophoroides) kelliiae* sp. n.**

(Figs 21–32)

Diagnosis: This species can be confused in females but is more obvious in the male owing to the easily overlooked metatibial and metabasitarsal modifications. A superficial and quick glance might lead one to believe that the usual modifications, typical of *Anthophoroides*, are lacking in this species, but in fact they are merely minutely developed. First, the metafemur is not crassate, contrasting with the crassate form of other species. The proximal processes of the metatibia and metabasitarsus are so small that they are largely obscured by the surrounding pubescence, particularly true for the exceptionally short metabasitarsal process, which appears more as a slight, blunt knob or slight triangular angle (Figs 23, 24). The male hind legs are unique among the species of *Anthophoroides*, perhaps most closely approximated by the comparatively simple form of *A. vallorum* (Cockerell) (Figs 41, 42). Females are most similar to *A. cinerula* for the reasons cited earlier (*vide supra*). Unlike *A. cinerula*, however, the setae of the mesoscutum and mesoscutellum are pale ochraceous to tan (pale cinereous in *A. cinerula*) and the

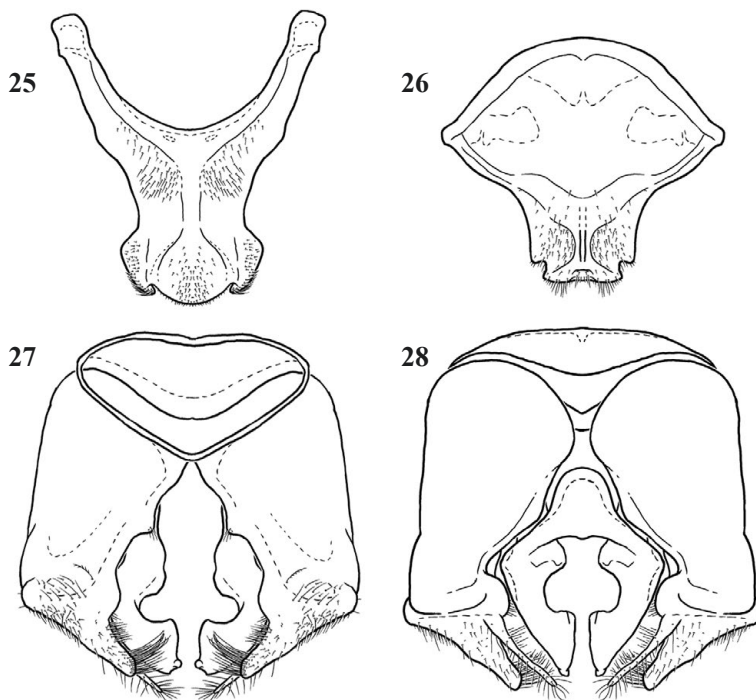


Figs 21–24. — *Anthophora (Anthophoroides) kellieae* sp. n., ♂: 21, Lateral habitus; 22, Facial view; 23, Metatibia and metabasitarsus, retrolateral view; 24, Detail of metatibia-metabasitarsus articulation; upper arrow pointing to short metatibial process, lower arrow indicating minute proximal metabasitarsal process.

short setae on the disc of tergum II are predominantly fuscous (predominantly white in *A. cinerula*). Naturally, the male terminalia is quite distinctive: cf. Figs 17–20 for *A. cinerula* vs. Figs 25–28 for *A. kellieae*.

Description

As described for *A. (A.) buchmanni* (*vide supra*), with the following exceptions: ♂: Total body length 10.00–10.42mm; forewing length 6.83–7.00mm. Head broader than long, medial length (clypeal apex to peak of vertex in facial view) 2.25–2.42mm, maximum width 3.83–3.75mm. Flagellomere I slightly longer than flagellomere II. ♂ metafemur not crassate; metatibia without spine or knob-like projection proximal to articulation of posterior (=inner) metatibial spur (Fig. 23); anterior (=outer) spur arising from short but thick proventral process, process much shorter than spur, apex blunt to faintly concave (Figs 23, 24); metabasitarsus with proventral surface not concave, nearly straight (aside from proximal process) (Fig. 23), retrodorsal surface weakly arched (Fig. 23), proximal proventral process a short triangular angle or knob, largely obscured



Figs 25–28. — ♂ terminalia of *Anthophora* (*Anthophoroides*) *kellieae* sp. n.: 25, Metasomal sternum VII; 26, Metasomal sternum VIII; 27, Genitalia in ventral view; 28, Genitalia in dorsal view.

by surrounding pubescence (Figs 23, 24), apical proventral process lacking. ♂ terminalia as in Figs 25–28.

Integument of head and mesosoma black except white to off-white markings on face (Fig. 22), specifically basal half of mandible, labrum except rim and basolateral ovoids, clypeus except spots bordering anterior tentorial pits, supraclypeal area, paraocular areas lateral to and below tangent of antennal toruli, and ventral surface of scape. Tegula semi-translucent brown to light brown. Legs dark brown to black although dark reddish brown on tarsi. Metasoma dark brown to black except apical margins of terga I–VI semitranslucent white to off-white.

Metasomal tergum I with abundant setae like that of mesosomal dorsum except without intermixed fuscous setae; discs of terga II–VI with numerous, short, simple, suberect fuscous setae, intermixed with fewer white setae, blending apically to longer, wispy, white setae, such setae not appressed or obscuring apical margins as bands.

♀: As described for the ♂ except in typical sex differences and as follows: Total body length 10.83–11.67mm; forewing length 7.67–8.00mm. Head broader than long, medial length (clypeal apex to peak of vertex in facial view) 2.50–2.75mm, maximum width 4.00–4.17mm. Flagellomere I as long as combined lengths of flagellomeres II, III, and 0.5× IV. Metafemur, metatibia, and metabasitarsus unmodified (typical for genus).

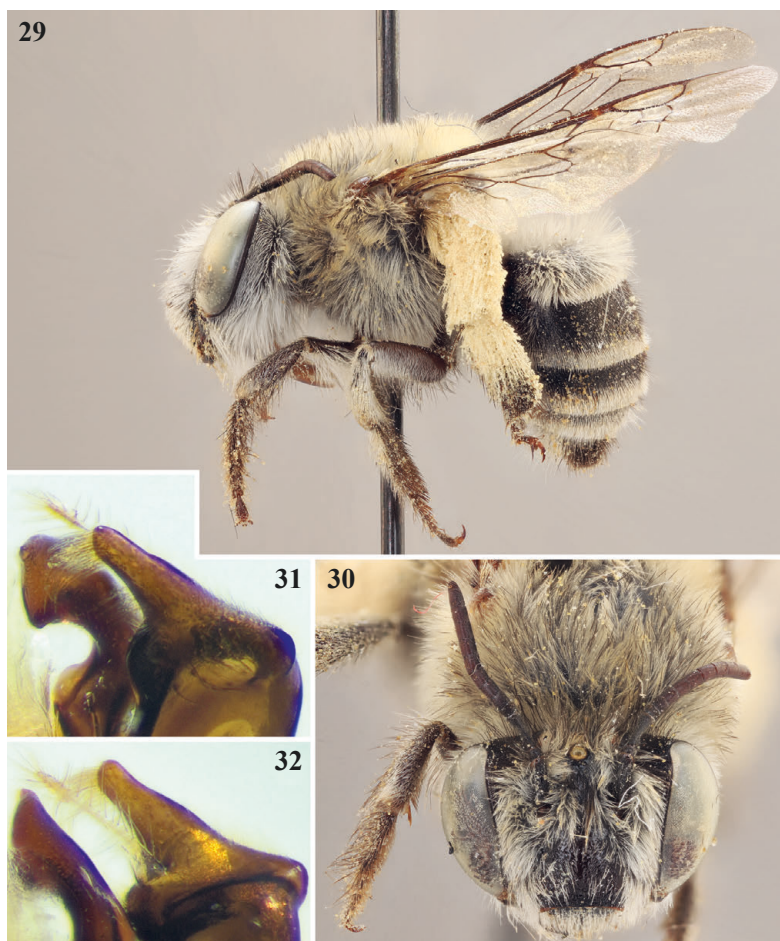
Integument of head black, without markings of ♂ (Fig. 30).

Pubescence as in ♂ except legs with brownish or fuscous setae more predominant on tarsi.

Material examined

Holotype, ♂, ARIZONA: Pinal Co., 10km W. Maricopa, 15 March 1989, W.T. Wcislo & R.L. Minckley (SEMC).

Paratypes, ARIZONA: 1♀, Arizona: Pinal Co., 10km W. of Maricopa, 21 March 1989, W.T. Wcislo, R.L. Minckley, & S.L. Buchmann (AMNH); 1♂, 1♀, Arizona: Buckeye [Maricopa Co.],



Figs 29–32. — *Anthophora (Anthophoroides) kelliæ* sp. n.: 29, Lateral habitus, ♀; 30, Facial view, ♀; 31, Detail of apex of ♂ gonocoxa (ventral view); 32, Detail of apex of ♂ gonocoxa and gonostylus (dorsal view), note gonostylus weakly sclerotized (typical of most species).

Mar 30, 34 [30 March 1934], Timberlake, on *Lycium torreyi* (SEMC); CALIFORNIA: 1♂, California: Niland [Imperial Co.], Oct 27, 1955 [27 October 1955], on *Lycium brevipes*, R.A. H? [illegible] coll. (SEMC); MEXICO (Baja California): 3♂♂, Mexico: Baja California del Sur Hwy 1-km 135 (S. of Santa Rita), 17 March 1990, D. Brzoska (2♂♂ SEMC, 1♂ AMNH); 1♂, Mexico: Baja Cal. Sur, 7 mi. SE Guerrero Negro, 8-IV-76, Doyen & Rude, *Prosopis juliflora* (AMNH).

Additional material, 1♂, ARIZONA: Maricopa Co., 23km W. Gila Bend rd. to Painted Rocks State Park, 15 April 1990, B. Alexander (SEMC) [specimen badly damaged].

Etymology: The specific epithet honours my wife, Kellie K. Magill Engel and her love of 'teddy bear' bees.

ZooBank LSID: urn:lsid:zoobank.org:act:AAD2127-4802-4AA9-87AF-848F5A E7C2D2

Floral records: *Prosopis juliflora* (Sw.) DC. (Fabaceae: Caesalpinioideae), *Lycium torreyi* A. Gray, *Lycium brevipes* Benth. (Solanaceae).

Key to species of *Anthophoroides*

- 1 Male 2
 – Female 11
- 2(1) Metasomal terga I–IV with opaque white, off-white, or pale yellow apical integumental bands (Figs 33, 35) 3
 – Metasomal terga I–IV without opaque integumental bands, at most with apical margins semitranslucent and lighter than discs (Figs 1, 11, 21, 68, 70, 72, 74) 4
- 3(2) Proventral surface of metabasitarsus with proximal spine short, not forming triangular flange longer than metabasitarsal midlength (Fig. 38); anterior (=outer) metatibial spur situated near apex of small proventral process (Fig. 37), spur distinctly longer than process; facial markings white (Fig. 34) *A. marginata* Smith
 – Proventral surface of metabasitarsus with proximal spine developed as large triangular flange that extends nearly to metabasitarsal apex (Figs 39, 40); anterior (=outer) metatibial spur situated near apex of large proventral process (Figs 39, 40), spur shorter than process; facial markings yellow (Fig. 36) *A. californica* Cresson
- 4(3) Facial markings white (e.g., Figs 10, 13, 22, 34); metatibial and metabasitarsal structures variable but not as below 5
 – Facial markings yellow (Fig. 57); metatibia with proventral process narrow and shorter than anterior (=outer) metatibial spur, which articulates from process (Fig. 42); metabasitarsus retrodorsal surface arched in proximal half, then tapering straight to apex (Fig. 42); metabasitarsal proximal proventral process a short, narrowly triangular spine, somewhat obscured by surrounding setae (Figs 41, 42) *A. vallorum* (Cockerell)
- 5(4) Metabasitarsus with proventral surface strongly concave (outline crescent-moon shaped) and apical proventral spine prominent, retrodorsal surface arched along length, proximal proventral process a large flange, as long as or longer than posterior (=inner) metatibial spur (Figs 43–48) 6
 – Metabasitarsus with proventral surface shallowly concave to nearly straight, proximal proventral process a variably sized flange to short, broad triangular projection, shorter than posterior (=inner) metatibial spur 7
- 6(5) Proventral process of metatibia tapering to acute or narrowly knoblike apex beyond articulation of spur (Figs 43–45), posterior (=inner) metatibial spur shorter than anterior (=outer) metatibial spur; mesoscutum dull microareolate between scattered punctures *A. signata* Brooks
 – Proventral process of metatibia broad and somewhat blunt beyond articulation of spur (Figs 46–48), posterior (=inner) metatibial spur as long as or longer than anterior (=outer) metatibial spur; mesoscutum smooth, shiny between more abundant punctures *A. pueblo* Orr
- 7(5) Metatibial and metabasitarsal proventral processes prominent and easily observed amid surrounding pubescence (Figs 2, 3, 15, 16, 49–54) 8
 – Metatibial and metabasitarsal proventral processes short, largely obscured by surrounding pubescence and therefore difficult to observe (Figs 23, 24), particularly latter, which is present merely as a slight triangular angle (Fig. 24) *A. kellieae* sp. n.
- 8(7) Mesoscutal disc dull matt and tessellate to microareolate (e.g., Fig. 65), punctures of central disc scattered to virtually absent compared to dense punctures elsewhere; metatibial and metabasitarsal structures variable but not as below 9
 – Mesoscutal disc shining and smooth to faintly and finely imbricate between punctures, punctures denser (e.g., Fig. 66), although sometimes sparser anteriorly and/or medioposteriorly on disc; metatibial and metabasitarsal structures as in Figs 52–54 *A. linsleyi* Timberlake
- 9(8) Metatibia with short spine or knob-like projection proximal and adjacent to articulation of posterior (=inner) metatibial spur (Figs 16, 51, 50); metabasitarsus with retrodorsal surface noticeably arched in proximal half, then tapering straight to apex (Figs 15, 16, 49–51); proximal proventral process of metabasitarsus large, transverse width longer than apical width of metabasitarsus (Figs 15, 16, 49); metasomal terga II–IV with

- semitranslucent apical margins not covered by white setae, white present apically on dark tergal discs but such setae suberect to erect and wispy, not covering apical margins (Fig. 11) 10
- Metatibia without spine or knob-like projection proximal to articulation of posterior (=inner) metatibial spur (Fig. 3); metabasitarsus with retrodorsal surface weakly arched (Fig. 3); proximal proventral process of metabasitarsus shorter, transverse width about as long as apical width of metabasitarsus (Figs 2, 3); metasomal terga II–IV with semitranslucent apical margins covered by decumbent to appressed, long, white, minutely branched setae forming bands, setae arising from apex of disc at transition to semitranslucent margin (Fig. 1) *A. buchmanni* sp. n.
- 10(9) Head, mesosoma, and metasomal tergum I with pale ochraceous setae (Figs 55, 56); metatibia with short knoblike projection proximal to articulation of posterior (=inner) metatibial spur (Figs 51, 50); tergal apical margins typically semitranslucent brown to light brown (Fig. 55) *A. phaceliae* Brooks
- Head, mesosoma, and metasomal tergum I with light cinereous (light ashy grey) setae (Fig. 11); metatibia with short spine proximal to articulation of posterior (=inner) metatibial spur (Figs 16); tergal apical margins semitranslucent pale to white (Fig. 11) *A. cinerula* sp. n.
- 11(1) Clypeus and labrum black, without integumental markings (e.g., Figs 9, 14, 30, 59) .. 12
- Clypeus with white inverted T-shaped integumental marking (Fig. 58); labrum with variably shaped white marking *A. signata* Brooks
- 12(11) Metasomal terga I–IV with opaque white, off-white, or pale yellow apical integumental bands (Figs 61, 62) 13
- Metasomal terga I–IV without opaque integumental bands, apical margins semitranslucent (Figs 8, 12, 29, 60, 67, 69, 71, 73) 14
- 13(12) Pubescence of head and mesosoma largely cinereous intermixed with abundant fuscous setae (Fig. 61) *A. marginata* Smith
- Pubescence of head and mesosoma largely pale ochraceous to tan, with less prominent fuscous setae intermixed (Fig. 62) *A. californica* Cresson
- 14(12) Metasomal terga II–V with apical margins semitranslucent pale to white, contrasting with otherwise dark brown to black tergal surfaces (Figs 8, 12, 29, 60, 69, 71, 74) 15
- Metasomal terga II–V with apical margins semitranslucent brown to light brown (Fig. 67) *A. phaceliae* Brooks
- 15(14) Mesoscutal disc shining and smooth to faintly and finely imbricate between dense punctures (Fig. 66), punctures nearly contiguous, although sometimes sparser anteriorly and/or medioposteriorly on disc revealing interpuncture integument 16
- Mesoscutal disc dull matt and pronouncedly tessellate to microareolate (Fig. 65), punctures of central disc scattered, sparse, or even virtually absent compared to denser punctures elsewhere 18
- 16(15) Tegula translucent dark brown to brown (Fig. 63), uncommonly light brown 17
- Tegula translucent yellowish (Fig. 64) *A. vallorum* (Cockerell)
- 17(16) Mesoscutellum with numerous dark fuscous setae on anterior half amid more dominant lighter setae *A. linsleyi* Timberlake
- Mesoscutellum without or at most with a few dark fuscous setae on anterior half amid more dominant lighter setae *A. pueblo* Orr
- 18(15) Metasomal terga II–IV with semitranslucent apical margins not covered by dense, white, plumose setae forming distinct bands (Figs 12, 29), white setae simple, longer setae suberect to erect and wispy or sometimes appressed and extending over margins but not as distinct bands obscuring margins, shorter setae appressed to suberect; short simple setae of tergal discs white to off-white, rarely intermixed fuscous 19
- Metasomal terga II–IV with semitranslucent apical margins covered by decumbent to appressed, long, white, minutely branched setae forming at most diffuse bands (Fig. 8), setae arising from apex of disc at transition to semitranslucent margin; short simple setae of tergal discs entirely fuscous *A. buchmanni* sp. n.



Figs 33–36. — Species of *Anthophoroides* Cockerell & Cockerell, ♂♂: 33, Lateral habitus, *Anthophora* (*Anthophoroides*) *marginata* Smith; 34, Facial view of *A. (A.) marginata*; 35, Lateral habitus, *A. (A.) californica* Cresson; 36, Facial view of *A. (A.) californica*.



Figs 37–42. — ♂ metatibiae and metabasitarsi of species of *Anthophoroides* Cockerell & Cockerell: 37, *Anthophora* (*Anthophoroides*) *marginata* Smith, prolateral view; 38, *A. (A.) marginata*, retrolateral view; 39, *A. (A.) californica* Cresson, prolateral view; 40, *A. (A.) californica*, retrolateral view; 41, *A. (A.) vallorum* (Cockerell), prolateral view; 42, *A. (A.) vallorum*, retrolateral view.



Figs 43–48. — ♂ metatibiae and metabasitarsi of species of *Anthophoroides* Cockerell & Cockerell: 43, *Anthophora* (*Anthophoroides*) *signata* Brooks, prolateral view; 44, *A. (A.) signata*, retrolateral view; 45, *A. (A.) signata*, oblique proventral view; 46, *A. (A.) pueblo* Orr, oblique proventral view; 47, *A. (A.) pueblo*, prolateral view; 48, *A. (A.) pueblo*, retrolateral view.



Figs 49–54. — ♂ metatibiae and metabasitarsi of species of *Anthophoroides* Cockerell & Cockerell: 49, *Anthophora* (*Anthophoroides*) *phaceliae* Brooks, prolateral view; 50, *A. (A.) phaceliae*, retrolateral view; 51, *A. (A.) phaceliae*, oblique proventral view; 52, *A. (A.) linsleyi* Timberlake, oblique proventral view; 53, *A. (A.) linsleyi*, prolateral view; 54, *A. (A.) linsleyi*, retrolateral view.



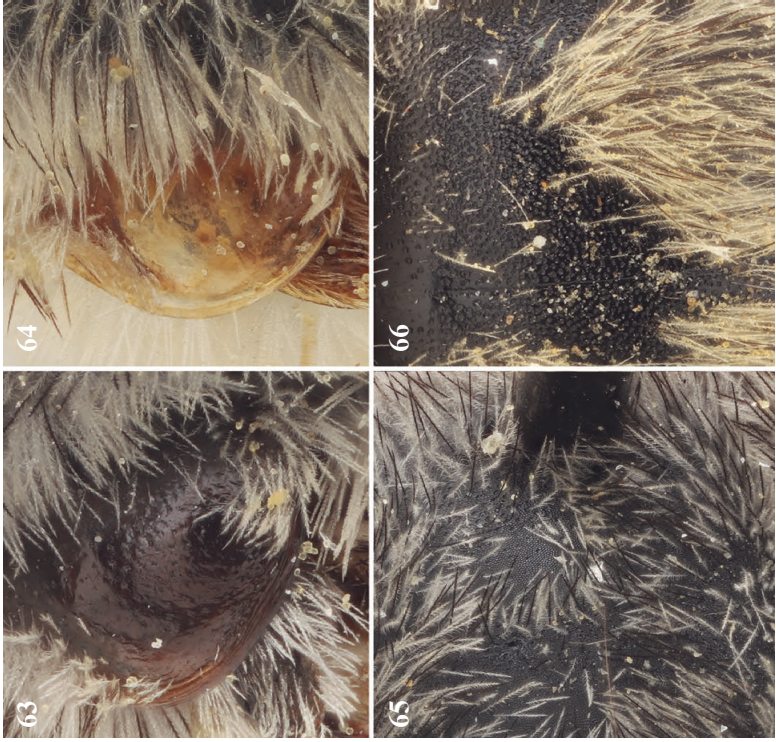
Figs 55–57. — Species of *Anthophoroides* Cockerell & Cockerell, ♂♂: 55, Lateral habitus of *Anthophora* (*Anthophoroides*) *phaceliae* Brooks; 56, Facial view of *A. (A.) phaceliae*; 57, Facial view of *A. (A.) vallorum* (Cockerell).



Figs 58–60. — Species of *Anthophoroides* Cockerell & Cockerell, ♀♀: 58, Facial view of *Anthophora* (*Anthophoroides*) *signata* Brooks; 59, Facial view of *A. (A.) californica* Cresson; 60, Lateral habitus of *A. (A.) signata*.

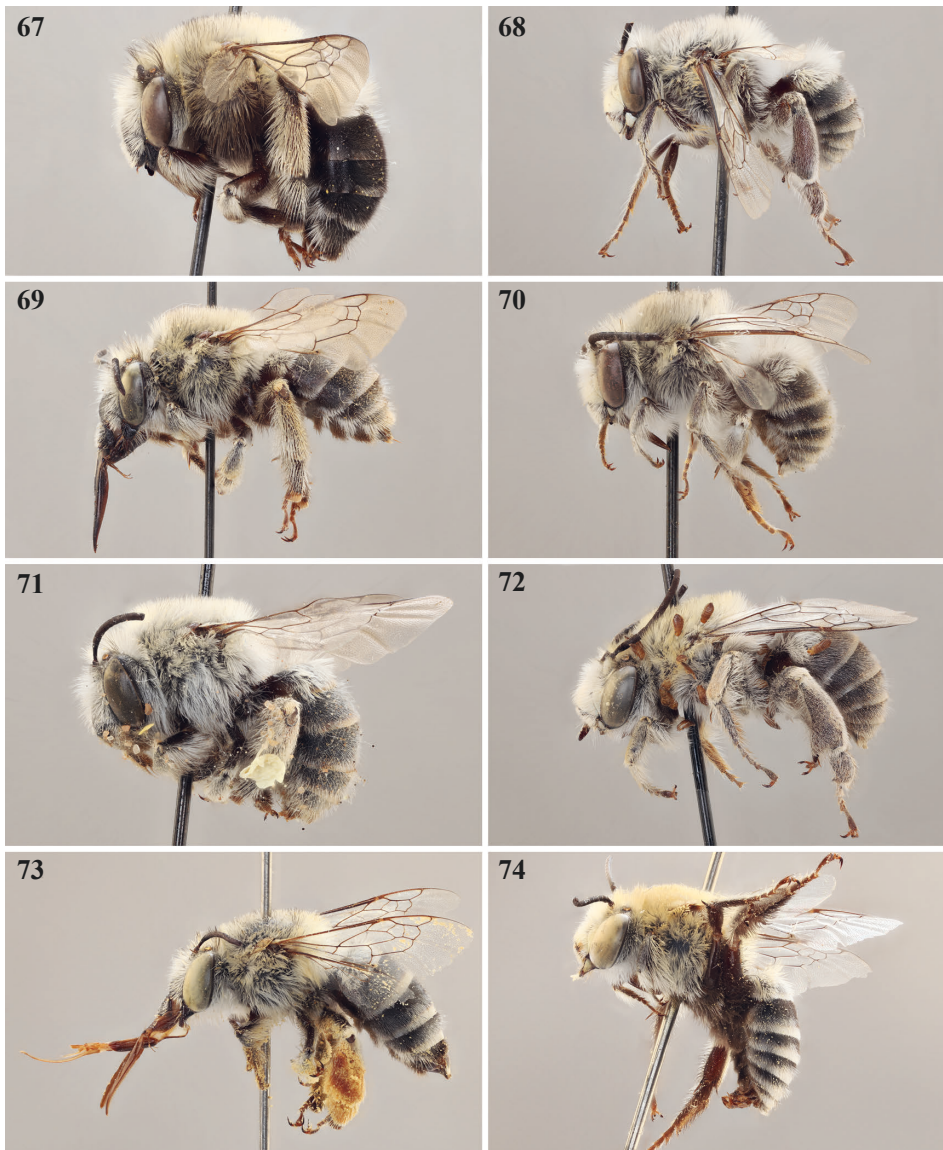


Figs 61–62. — Species of *Anthophoroides* Cockerell & Cockerell, ♀♀: 61, Lateral habitus of *Anthophora* (*Anthophoroides*) *marginata* Smith; 62, Dorsal habitus of *A. (A.) californica* Cresson.



Figs 63–66. — Details of *Anthophoroides* Cockerell & Cockerell, ♀♀: 63, Tegula of *Anthophora* (*Anthophoroides*) *marginata* Smith; 64, Tegula of *A. (A.) vallorum* (Cockerell); 65, Detail of mesoscutal integument of *A. (A.) marginata*; 66, Detail of mesoscutal integument of *A. (A.) linsleyi* Timberlake.

- 19(18) Setae of mesoscutum and mesoscutellum largely cinereous, with intermixed fuscous and paler setae; short setae of disc of metasomal tergum II largely white (particularly when viewed in profile), uncommonly with fuscous intermixed mediobasally *A. cinerula* sp. n.
- Setae of mesoscutum and mesoscutellum largely pale ochraceous to tan, with intermixed fuscous and paler setae; short setae of disc of metasomal tergum II largely light fuscous (particularly when viewed in profile), with fewer white setae intermixed *A. kelliiae* sp. n.



Figs 67–74. — Lateral habitus of species of *Anthophoroides* Cockerell & Cockerell, ♀♀ at left, ♂♂ at right: 67, *Anthophora* (*Anthophoroides*) *phaceliae* Brooks; 68, *A. (A.) signata* Brooks; 69, 70, *A. (A.) linsleyi* Timberlake; 71, 72, *A. (A.) pueblo* Orr; 73, 74, *A. (A.) vallorum* (Cockerell).

ACKNOWLEDGEMENTS

I am grateful to Stephen L. Buchmann for much helpful information regarding *A. buchmanni* and for the initial impetus to undertake this brief account of *Anthophoroides*; to Victor H. Gonzalez, Zachary H. Falin, Kellie K. Magill Engel, and Andrés F. Herrera Motta for assistance during the project; and to the late Charles D. Michener and George W. Byers for their many kindnesses, friendship, and support of my career and research while I was in Kansas.

REFERENCES

- Brooks, R.W.** 1988. Systematics and phylogeny of the anthophorine bees (Hymenoptera: Anthophoridae; Anthophorini). *University of Kansas Science Bulletin* **53**(9): 436–575.
- Engel, M.S.** 2001. A monograph of the Baltic amber bees and evolution of the Apoidea (Hymenoptera). *Bulletin of the American Museum of Natural History* **259**: 1–192.
- Engel, M.S., Herhold, H.W., Davis, S.R., Wang, B. & Thomas, J.C.** 2021. Stingless bees in Miocene amber of southeastern China (Hymenoptera: Apidae). *Journal of Melittology* **105**: 1–83.
- Michener, C.D.** 2007. *The Bees of the World* [2nd Ed]. Baltimore: Johns Hopkins University Press.
- Orr, M.C., Griswold, T., Pitts, J.P. & Parker, F.D.** 2016. A new bee species that excavates sandstone nests. *Current Biology* **26**(17): R792–R793.
- Orr, M.C., Pitts, J.P. & Griswold, T.** 2018. Revision of the bee group *Anthophora* (*Micranthophora*) (Hymenoptera: Apidae), with notes on potential conservation concerns and a molecular phylogeny of the genus. *Zootaxa* **4511**: 1–193.