

A new species of *Andrena* (*Trachandrena*) from the Southwestern United States (Hymenoptera, Andrenidae)

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Academic editor: Jack Neff | Received 27 April 2020 | Accepted 31 May 2020 | Published 29 June 2020

<http://zoobank.org/21056983-AAB7-42A5-A08B-E61139F474C2>

Citation: Sheffield CS (2020) A new species of *Andrena* (*Trachandrena*) from the Southwestern United States (Hymenoptera, Andrenidae). *Journal of Hymenoptera Research* 77: 87–103. <https://doi.org/10.3897/jhr.77.53704>

Abstract

A new species of *Andrena* Fabricius, 1775, subgenus *Trachandrena* Robertson, 1902 is described and illustrated, *A. badfieldi* sp. nov., from Arizona, United States. The new species, presently known only from the female holotype, was collected in a Malaise trap in 1994, and remained unstudied until recently. In addition, *Trachandrena* is compared to similar subgenera in North America to assist in recognizing new members.

Keywords

Bee, new species, *Trachandrena*, North America, Arizona

Introduction

Andrena Fabricius, 1775 is one of the largest genera of bees, with 1,556 species (Ascher and Pickering 2020). Dubitzky et al. (2010) estimated that there are likely ca 2,000 species, suggesting there are many undescribed species, especially in Mesoamerica and in the dry regions of Central Asia. Though the genus is mainly Holarctic, it extends into Mesoamerica, parts of Africa and tropical Asia (Michener 2007).

The subgenus *Trachandrena* Robertson, 1902 is represented by 30 species globally (Gusenleitner and Schwarz 2002; Michener 2007), 24 of which occur in the

Nearctic region (LaBerge 1973). Robertson (1902) originally described *Trachandrena* as a genus and included many species still placed in the subgenus today, but also included *A. claytoniae* Robertson, 1891 (= *A. imitatrix* Cresson, 1872) and *A. crataegi* Robertson, 1893. Viereck (1917) initially, and incorrectly applied the name *Scapter* Lepeletier and Serville, 1828 (a genus of Colletidae) as a subgenus of *Andrena* for certain species, including among others *A. imitatrix* and *A. morrisonella* Viereck, 1917, but later (Viereck 1922) proposed *Scapteropsis* because he felt it differed significantly from the Old World species incorrectly assigned to *Scapter* (LaBerge 1971). Thus, Viereck (1924) recognized at least two subgenera of *Andrena* within Robertson's (1902) initial concept of *Trachandrena*. Cockerell (1929) provided further discussion on Robertson's (1902) *Trachandrena*, though in general supported Viereck's (1924) opinion of subgeneric rank status, and also felt Robertson's (1902) concept of *Trachandrena* likely involved multiple subgenera. For instance, Cockerell (1929) realized that the mainly eastern treatments of Robertson (1902) and Viereck (1924) were not fully representative of the western North American bee fauna and noted similarities of some of these to certain Old World species, sharing some characteristics with *Trachandrena*, but very distinct, particularly species with males that have a yellow clypeus. These taxa are now placed in the subgenus *Plastandrena* Hedicke, 1933, and most species in North America (excluding the mainly eastern *A. crataegi*) have males with a yellow clypeal maculation.

Lanham (1949) subsequently placed *Scapteropsis* into synonymy with *Trachandrena*, and proposed subgenus *Mimandrena* Lanham, 1949 (with type species *A. imitatrix*) for *Trachandrena*-like species which have a propodeal corbicula with plumose hairs internally, presumably not realizing (as per LaBerge 1971) that Viereck's *Scapteropsis* shared this feature (as indicated above, he included *A. imitatrix* in his subgenus). Lanham (1949), Mitchell T (1960) and LaBerge (1964) placed those species with simple internal hairs into the subgenus *Trachandrena*. Warncke (1968) later placed *Trachandrena* and *Mimandrena* into synonymy with the Old World subgenus *Biareolina* Dours, 1873, which is now considered monotypic (Michener 2007). LaBerge (1971) later reinstated *Scapteropsis* as a valid North American subgenus, placing *Mimandrena* into synonymy. Species which Warncke (1968) placed in *Biareolina* are now included in *Scapteropsis* (Nearctic only) or *Trachandrena* (Holarctic) (Michener 2007).

Robertson's (1902) concept of *Trachandrena* suggested close affinities of *Plastandrena*, *Scapteropsis* and *Trachandrena* which was supported in a recent morphology-based phylogeny (Dubitzky et al. 2010). In that work, *Trachandrena* was recovered as a taxon belonging to a larger clade (i.e., the *Trachandrena* clade) containing *Scapteropsis*, *Plastandrena*, *Agandrena* Warncke, 1968 and *Biareolina* (Dubitzky et al. 2010), the latter two subgenera absent from the Nearctic (Michener 2007). However, in an earlier phylogenetic analysis using mitochondrial and nuclear DNA sequences, *Scapteropsis* was not recovered as a monophyletic group, instead being interspersed within *Trachandrena*, with *Plastandrena* not as closely related (Larkin et al. 2006). The somewhat contrasting results from both studies (Larkin et al. 2006; Dubitzky et al. 2010) suggest that more analysis with more taxa included is required to resolve the relationship of *Trachandrena* to other subgenera.

Since LaBerge's (1973) revision of the subgenus *Trachandrena* in the Nearctic region no additional North American species have been recognized. Here a new species of *Trachandrena* is described from Arizona, United States. A diagnosis and full description of the female is provided. In addition, a partial key, modified from that of LaBerge (1973) is provided to allow females of the new species to be recognized from other species.

Materials and methods

For consistency with species treatments published elsewhere, the description generally follows the format used by LaBerge (1973). Other terminology and measurement methods follow that of Michener (2007); body length was measured as the sum of the length from the antennal base to the posterior propodeal surface and the length of the metasoma in lateral view. The following abbreviations are used: F = flagellomere, numbered from base to apex; pd = puncture diameter; T = metasomal tergum, and S = metasomal sternum, both numbered from the base to apex.

Photomicrography was undertaken with a Canon EOS 5D Mark II digital camera with an MP-E 65 mm 1:2.8 1–5× macro lens. Measurements were made with an ocular micrometer on a Nikon SMZ1000 stereomicroscope.

Taxonomy

Family Andrenidae Fabricius, 1775

Subfamily Andreninae Fabricius, 1775

Genus *Andrena* Fabricius, 1775

Andrena Fabricius, 1775: 376. Type species: *Apis helvola* Linnaeus, 1758, by designation of Viereck, 1912: 613.

Anthrena Illiger, 1801: 127, unjustified emendation of *Andrena* Fabricius, 1775.

Anthocharessa Gistel, 1850: 82, unjustified replacement for *Andrena* Fabricius, 1775.

Type species. *Apis helvola* Linnaeus, 1758, autobasic.

Subgenus *Trachandrena* Robertson, 1902

Trachandrena Robertson, 1902: 187, 189.

Type species. *Andrena rugosa* Robertson, 1891, by original designation.

Diagnosis. *Trachandrena*, particularly the females, are relatively easy to recognize among most other subgenera of *Andrena* in the Nearctic region based on the combina-



Figure 1. Dorsal enclosure of propodeum (i.e., propodeal triangle) of a female *Andrena rugosa* Robertson, the type species of *Trachandrena* Robertson.

tion of the coarsely rugose metapostnotum (i.e., propodeal triangle) (Fig. 1) and the generally coarse body sculpturing (being less strongly sculptured in most other subgenera), the structure of the metasomal terga, especially T2, which have broad apical marginal zones that usually extend $\frac{1}{2}$ the median length of the tergum (Fig. 2B) or more (Fig. 2A, C, D) (other subgenera in the Nearctic have narrower marginal zones), and the characteristic structure of the facial fovea, which is typically much narrower in the lower half (Fig. 3) (more parallel-sided for entire length in other Nearctic subgenera). As indicated above, in the Nearctic region *Trachandrena* is most similar to *Plastandrena* and *Scapteropsis*. In addition to both of these subgenera having terga with much narrower marginal zones (Fig. 4), both sexes of *Plastandrena* usually have weakly to strongly curved inner hind tibial spurs (Fig. 5A) whereas these are straight in *Trachandrena* (Fig. 5B), and the facial fovea of females of both subgenera are typically broad throughout. Males of *Scapteropsis* are difficult to distinguish from *Trachandrena* (Viereck 1924), though each has unique genital capsules (LaBerge 1971, 1973), the marginal zone of T2 is longer in *Trachandrena*, the antenna usually being slightly longer. Male *Trachandrena* also have S6 usually flat, not with a reflexed apical margin or with apicolateral teeth as in some *Plastandrena* (i.e., *A. crataegi*; LaBerge 1969; Michener 2007). In addition, most *Plastandrena* in North America, excluding *A. crataegi*, have the clypeus yellow or otherwise maculated (LaBerge 1969), not black as in *Trachandrena*.

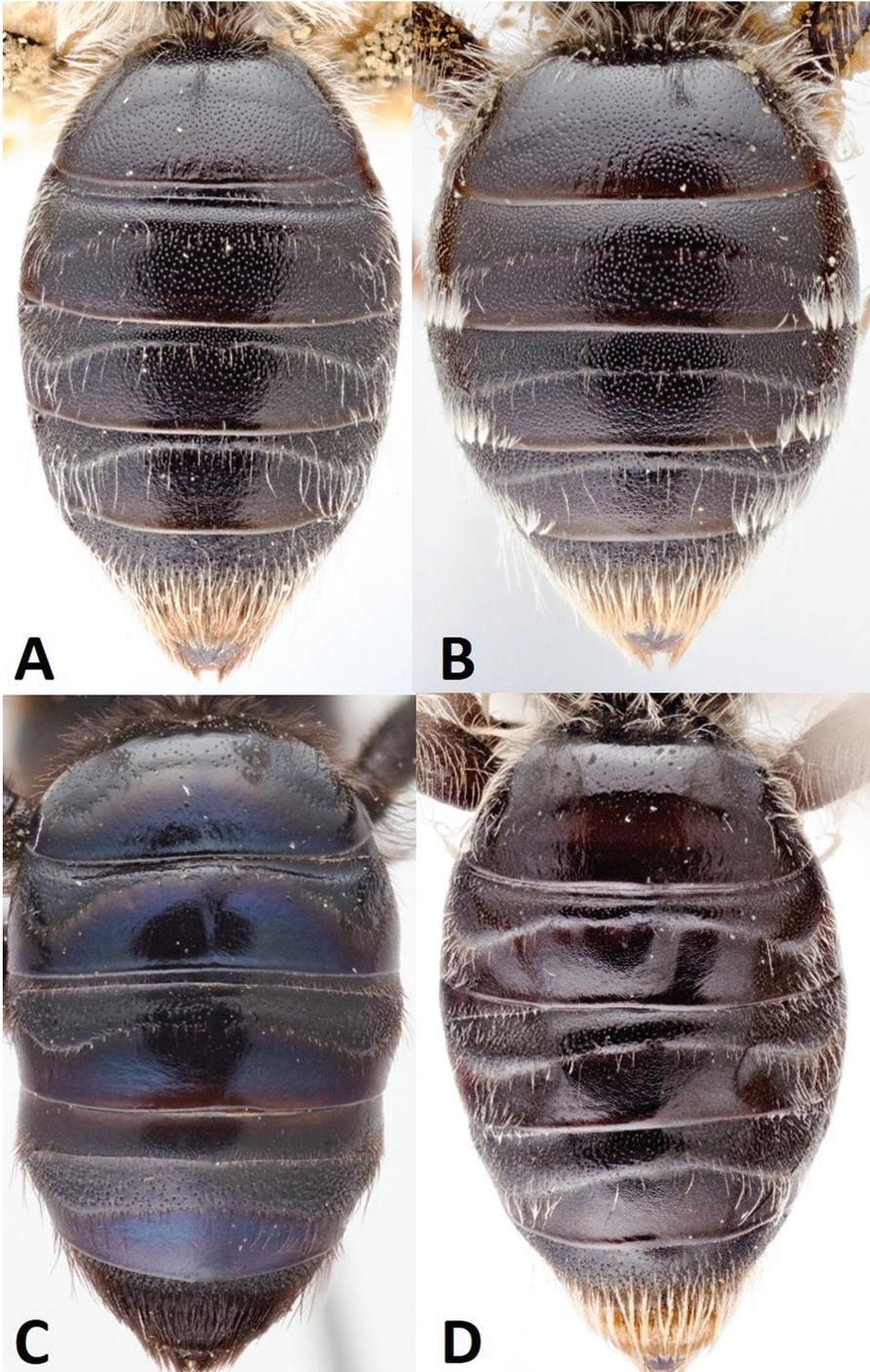


Figure 2. Dorsal surface of metasoma of female *Trachandrena*. **A** *Andrena rugosa*, the type species of the subgenus, with relatively wide apical impressed area of T2; **B** *A. hippotes* Robertson, with a relatively narrow apical impressed area of T2 (but still wider than basal area); **C** *A. cleodora* (Viereck); **D** *A. hadfieldi*, nov. sp. Both of the latter species have broad apical impressed areas of T2 which are impunctate.



Figure 3. Facial fovea of *Andrena rugosa*. The lower half of the facial fovea in *Trachandrena* is usually much narrower than the upper portion, though this species is the most extreme example.

***Andrena (Trachandrena) hadfieldi* sp. nov.**

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Material examined. *Holotype* female, USA, Arizona, Santa Cruz Co., Patagonia Sonorita Creek Reserve, 31.53N, 110.77W, 14.iv.1994, M[alaise] T[rap], B. Brown & E. Wilk / Royal Saskatchewan Museum Entomology RSKM_ENT_E-219414. The single specimen is housed at the Royal Saskatchewan Museum (RSKM) in Regina, Saskatchewan, Canada. The dataset for *Andrena hadfieldi* is archived with Canadansys (<http://community.canadansys.net/>) under resource title "A new *Trachandrena* from the Southwestern USA" and can be accessed using the following: <https://doi.org/10.5886/em2mri>.

Diagnosis. The female of *Andrena hadfieldi* is unique among *Trachandrena* in the Nearctic region in having very wide (i.e., at least 2/3 of the median tergal length) marginal zones of T2–T4 which are shiny and impunctate (Fig. 2D), a feature shared only with *A. cleodora* (Viereck) (Fig. 2C). *Andrena hadfieldi* is smaller than *A. cleodora* (9 mm, versus 10–13 mm body length in *A. cleodora*), and differs from *A. cleodora* in hav-

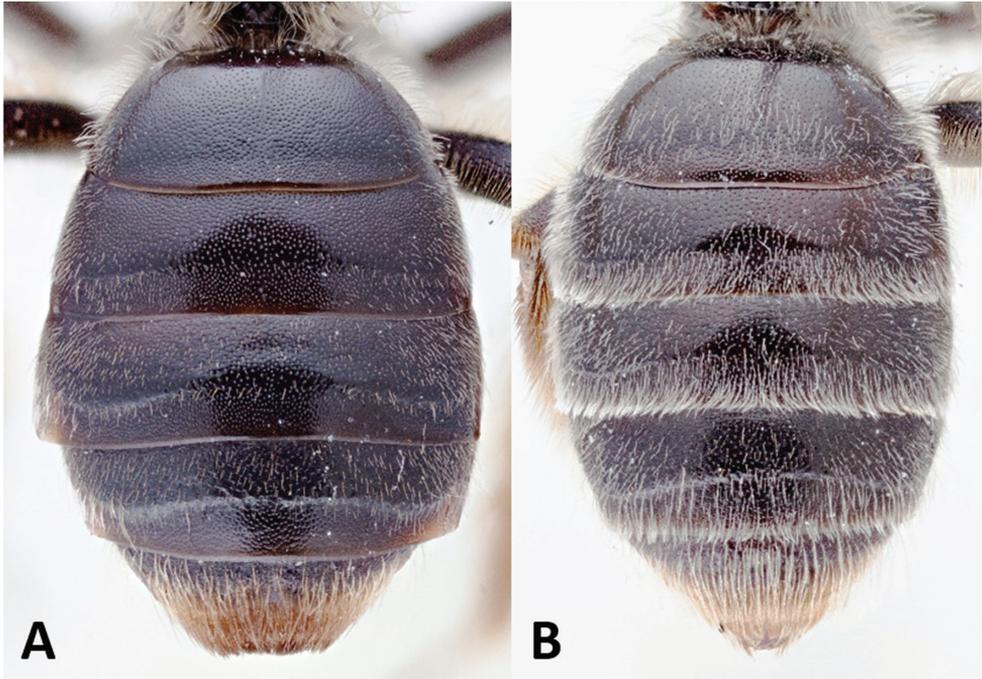


Figure 4. Dorsal surface of metasoma of female **A** *Plastandrena* Hedecike, *Andrena crataegi* Robertson, and **B** *Scrapperopsis* Viereck, *A. kalmiae* Atwood. Both subgenera differ from *Trachandrena* Robertson in having the apical impressed area of T2 narrower than the basal area.

ing the terga black (Fig. 2D) instead of black with strong metallic bluish reflections (Fig. 2C), and in having entirely pale pubescence, including the scopa (Figs 6, 7); the hair on the metasoma (Fig. 2C) and scopa of *A. cleodora* are black, and the pubescence of the dorsum of thorax is yellowish to red (subspecies *cleodora*; widespread in western North America) or entirely black (subspecies *melanodora* Cockerell; known from southern California). The structure of the pubescence on the dorsum of the thorax also differs between these two species, being long, very thin, and weakly plumose in *A. hadfieldi* (Fig. 6), but shorter and densely plumose, almost scale-like, in *A. cleodora* (Fig. 8). The process of the labrum in *A. hadfieldi* is more than 3× as wide basally as long medially (Fig. 9A); in *A. cleodora* the labral process is larger, subtriangular, with the base 2.5× as wide as the medial length (Fig. 9B). The body surface sculpture of *A. hadfieldi* is much finer than for *A. cleodora*; as examples, the face of *A. hadfieldi* is generally more finely and sparsely punctate, with shiny interspaces > two pd on the lower paraocular area (Fig. 10A), while in *A. cleodora* the lower paraocular area is more coarsely and closely punctate (interspaces < pd) (Fig. 10B); the surface of the propodeal corbicula is smooth with a few short rugae in *A. hadfieldi* (Fig. 11A), while coarsely rugose in *A. cleodora* (Fig. 11B).

The male of *A. hadfieldi* is unknown.

Description. Holotype, female (Figs 6, 7, 9A, 10A, 11A, 12). Body length 9 mm; head length 1.9 mm; head width 2.5 mm; intertegular width 2.1 mm; fore wing length 6.9 mm.

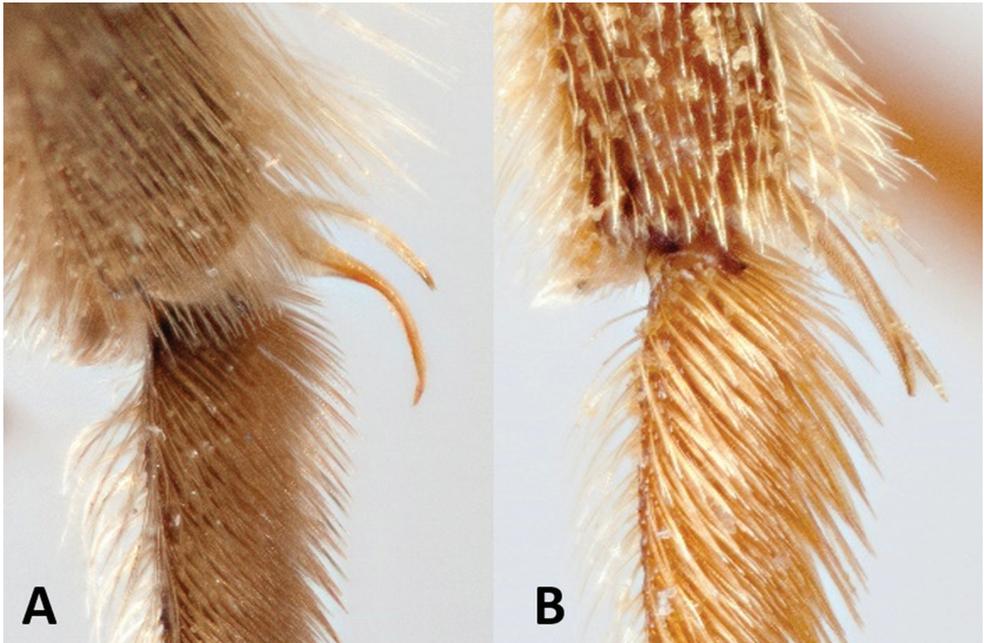


Figure 5. Inner hind tibial spur of **A** *Plastandrena*, *Andrena crataegi*, and **B** *Trachandrena*, *A. hippotes*.



Figure 6. Holotype female of *Andrena (Trachandrena) hadfieldi*. Lateral view.



Figure 7. Holotype female of *Andrena (Trachandrena) hadfieldi*. Dorsal view.

Colour. Black except as follows: F3-F10 dark reddish-brown below; tegula moderately translucent, brown, becoming reddish brown in posterior half; wing membranes slightly infumate, veins yellowish-brown; legs dark brown, apical tarsal segments reddish brown.

Structure. Labrum with process trapezoidal, more than three times as wide at base as long medially, apical edge entire (Fig. 9A). Clypeus with coarse, close round to irregular shaped punctures, becoming finer apically, interspaces shiny and linear, less than 0.5 pd, without obvious median impunctate line but with a small shiny subapical boss extending for less than 1/5th median length of clypeus (Fig. 10A). Supraclypeal area with distinct round punctures separated by 0.5 pd, surface rather shiny (Fig. 10A). Mandible short, extending beyond middle of labrum by about 1/4 its length in repose. Malar space extremely short (Fig. 10A). Lower paraocular area shiny with small punctures separated by > two pd (Fig. 10A). Face above antennal socket with rugulae extending to ocelli, without obvious punctures. Facial fovea long, extending from middle level of lateral ocellus to basal edge of clypeus; lower portion narrow, from below level of antennal socket about 1/3 as wide as upper portion, outer edge slightly incurved from inner margin of compound eye just above level of antennal socket, this area



Figure 8. Dorsal thoracic surface of *Andrena* (*Trachandrena*) *cleodora*, showing the short, thick pubescence.

smooth, shiny and impunctate (Fig. 10A). Compound eye just over three times as long as broad in frontal view, inner margin converging slightly toward mandibles. Genal area in profile about as broad as compound eye, surface shiny with minute punctures separated by 2 pd, posterior half dull with reticulate shagreening, without apparent punctures except near base of mandible. Vertexal area above lateral ocellus subequal to one ocellar diameter, dulled by crowded punctures and dense reticulate shagreening. Antennal scape length equal to combined length of F1-F3; F1 about 1.5 times as long as broad at apex, and 1.5 times longer than F2; F2-F5 quadrate, F6-F9 about 1.2 times longer than broad, F10 more elongate, about 1.5 times longer than broad.

Pronotum somewhat shiny, with distinct punctures dorsally, separated by about two pd, laterally mostly impunctate with surface somewhat dull. Mesoscutum with large, round deep punctures, between parapsidal lines and posteromedially separated mostly by $\frac{1}{2}$ to one pd, anteriorly and laterally separated by less than $\frac{1}{2}$ pd, becoming somewhat rugosopunctate along anterior edge (Fig. 7), surface dull, reticularly shagreened. Scutellum similarly punctured though punctures slightly sparser anteriorly, and surface mostly shiny. Metanotum dull and tessellate laterally, becoming somewhat shiny and punctate medially. Metapostnotum with rather shallow but distinct rugae, these somewhat irregular (Fig. 12); dorsolateral and posterior surfaces of propodeum moderately coarsely rugosopunctate, tessellate, dull; propodeal corbicular surface moderately shiny, tessellate, with a few short rugae (Fig. 11A). Mesepisternum coarsely rugose and somewhat shiny. Metepisternum surface smooth, with a slight shine. Fore femur with base round in outline. Posterior hind tibial spur straight. Tarsal claws with a small subbasal tooth.

T1 shiny and largely impunctate, with basal area (= disc) punctures obscure, shallow, sparse, separated by ≥ 5 pd; marginal zone impunctate and shiny, occupying about

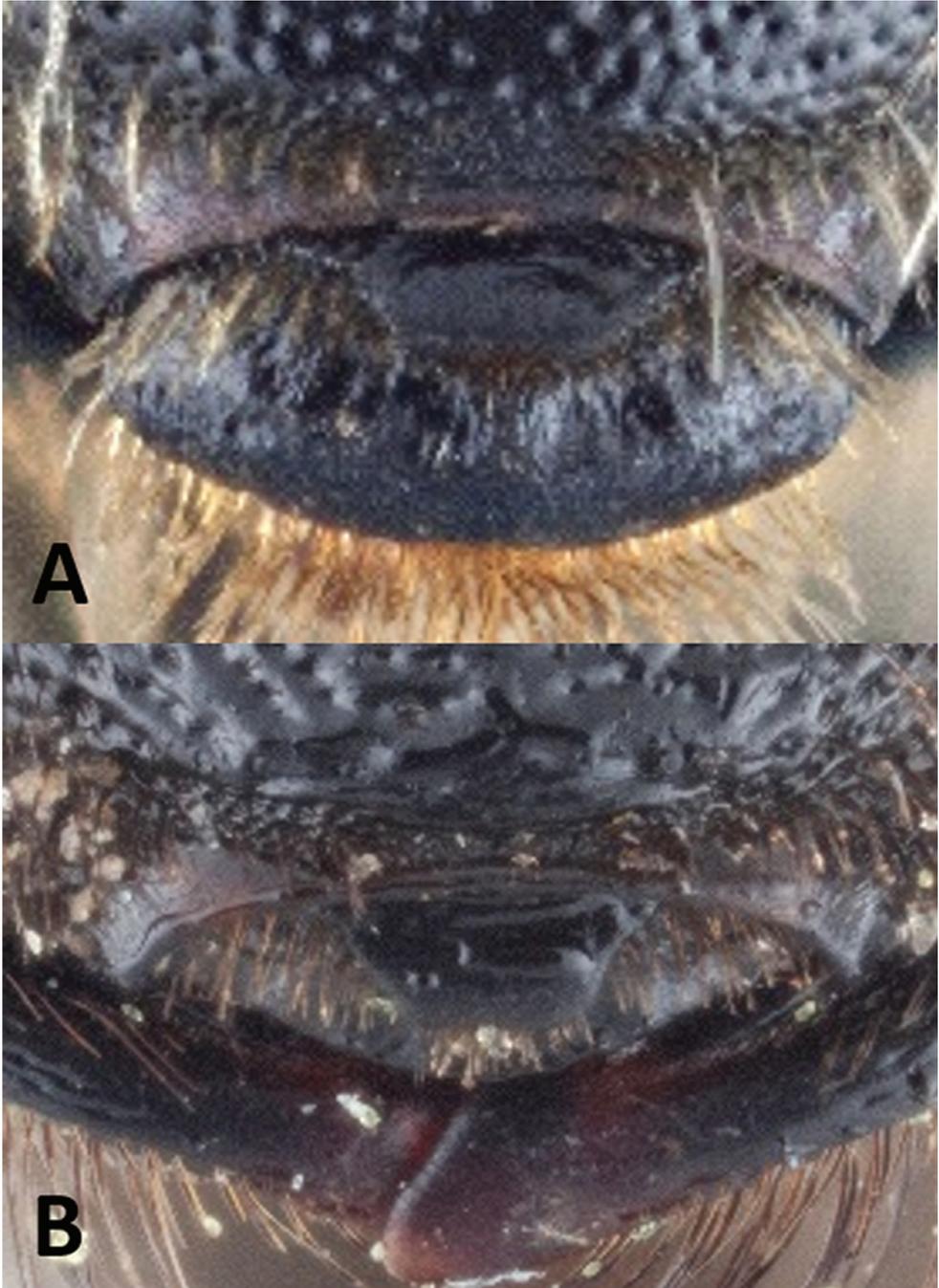


Figure 9. Labral process of **A** *Andrena (Trachandrena) hadfieldi*, and **B** *A. (Trachandrena) cleodora*.

$3/5^{\text{th}}$ of median length of tergum, a few sparse minute punctures visible at extreme lateral edge, surface smooth (Fig. 2D). T2 with marginal zone clearly longer than basal area (about $3/4^{\text{th}}$ medial with); basal area shiny with punctures separated by one pd, a

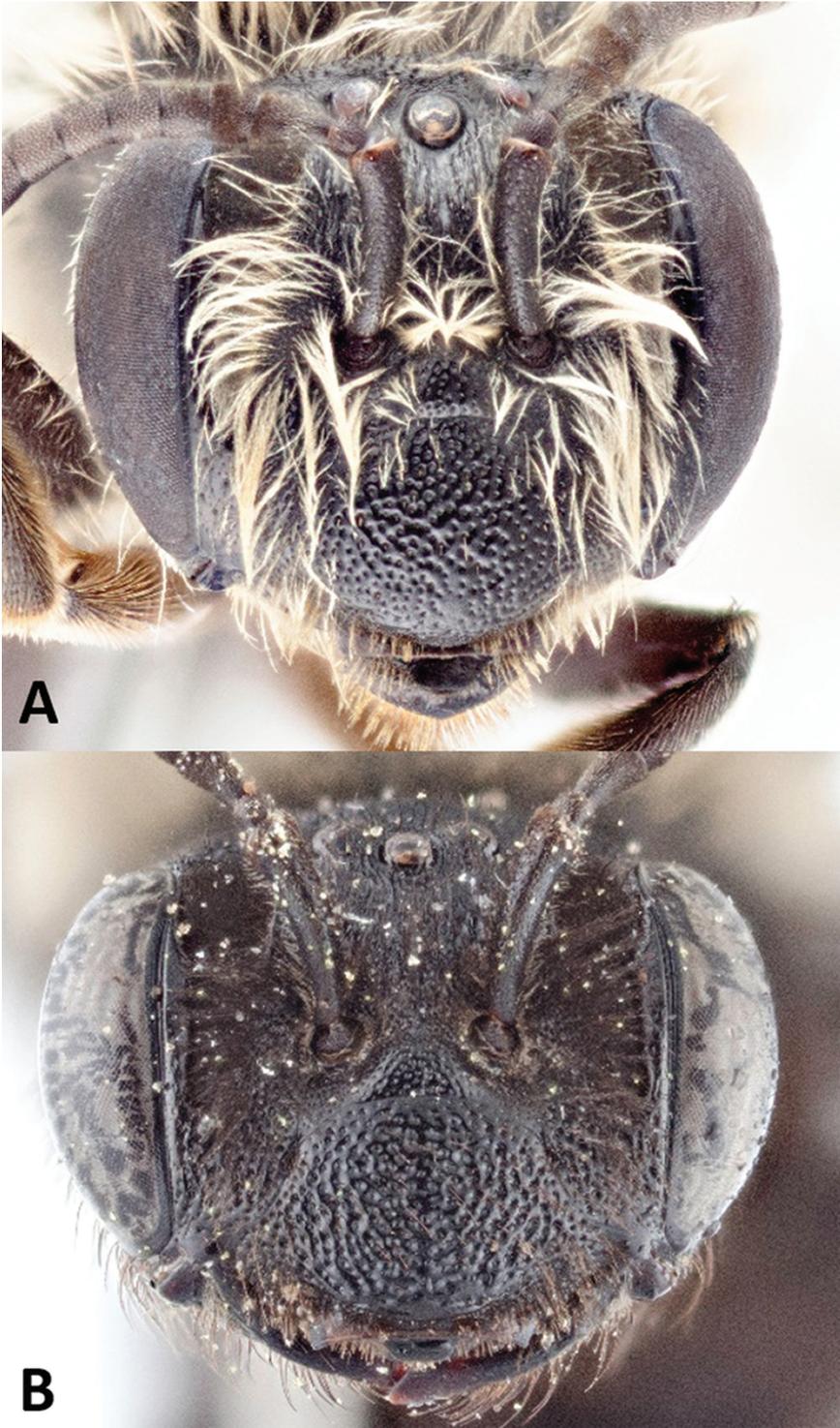


Figure 10. Face of **A** holotype female of *Andrena (Trachandrena) hadfeldti*, and **B** *A. (Trachandrena) cleodora*.



Figure 11. Propodeal corbicula of **A** *Andrena (Trachandrena) hadfieldi* showing long plumose hairs on the dorsal and posterior surface, no hairs on the anterior margin, and long simple internal hairs, and the rather smooth surface, and **B** *A. (Trachandrena) cleodora*, with the surface coarsely rugose.



Figure 12. Holotype female of *Andrena (Trachandrena) badfieldi*. Dorsal view, propodeal enclosure.

narrow dull impunctate area adjacent to gradulus; marginal zone smooth, shiny and impunctate (Fig. 2D). T3-T4 similar to T2 but marginal zone of T4 shorter, about $3/5$ th of median length of tergum (Fig. 2D). T5 with basal area broader than marginal zone, basal area tessellate, with distinct punctures separated by 2–3 pd, becoming closer adjacent to marginal zone (Fig. 2D); marginal zone dull, largely obscured by prepygidial fringe (Fig. 2D). Pygidial plate U-shaped with rounded apex about $1/2$ as wide as base, with sharply pointed, internal, raised triangular area on median surface. S2-S5 with surface somewhat shiny, punctures uniformly dense, separated by 1 pd; S2 with a medial U-shaped depression.

Vestiture. Generally white to pale yellowish (Figs 6, 7), somewhat reddish on mandible and apical margin of labrum. Propodeal corbicula with long plumose hairs on dorsal and posterior edges, lacking anterior hairs, with long simple hairs internally (Fig. 11A). Trochanteral flocculus complete. Tibial scopal hairs long and simple. Prepygidial fimbria and T6 with reddish brown hairs (Fig. 2D). Terga lacking apical fasciae except reduced to small lateral patches of sparse hairs on T2 and T3 (Fig. 2D); a few long pale subappressed hairs arising laterally from the premarginal line and overlaying marginal zone (Fig. 2D). T1 with sparse pale hairs laterally and on declivitous anterior surface (Fig. 2D). S2 to S5 with sparse, pale, elongate plumose hairs apically, these becoming longer laterally (i.e., $1/2$ length of succeeding segment).

Male unknown.

Distribution. United States, southern Arizona.

Etymology. It is a privilege to name this new species after Canadian astronaut Col. Chris Hadfield for his many achievements as a pilot, astronaut, author, lecturer, and science educator.

Partial key to species of *Trachandrena* (modified from LaBerge 1973)

- 4(2) T2 with basal area (i.e., visible base of tergum to gradulus) less than half as long medially as apical area and often less than one-third as long (Fig. 2A, C, D) ... **5**
 – T2 with basal area (i.e., visible base of tergum to gradulus) more extensive, at least half as long medially as apical area and often longer (Fig. 2B) **14**
- 5(4) Mesoscutum with posteromedian area impunctate, or punctures separated by two or three or more pd; face above antennal socket rugose; metasoma often red ***Andrena striatifrons* Cockerell**
 – Mesoscutum with posteromedian area punctate, punctures usually separated by one or two pd, if by more than two pd, then face above antennal socket punctate or rugosopunctate, not strongly rugose; metasoma black or mostly so **6**
- 6(5) Metasomal hairs entirely black or dark brown (Fig. 2C); leg hairs, including tibial scopa, brown to black or largely so **7**
 – Metasomal hairs largely pale in color (Fig. 2D); at least scopal hairs and often leg hairs entirely pale in color (Fig. 6) **7a**
- 7(6) T2-T4 with apical areas impunctate, often with metallic blue reflections (Fig. 2C); face above antennal socket with coarse longitudinal rugae, especially in upper half ***Andrena cleodora* (Viereck)**
 – T2-T4 with apical areas with fine but distinct punctures, without strong metallic blue reflections; face above antennal socket with rugae weak or absent, usually with deep punctures with interspaces shiny, or weakly shagreened.....
 ***Andrena cupreotincta* Cockerell (in part)**
- 7a(6) T2-T4 with apical areas impunctate (Fig. 2D) ... ***Andrena hadfieldi* sp. nov.**
 – T2-T4 with apical areas distinctly punctate (Fig. 2A)... **8 (in LaBerge 1973)**

Discussion

Nothing is known about the biology of this species as it is known only from the holotype female which was collected in a Malaise trap. However, like other *Trachandrena* in the Nearctic region, this is a vernal species that probably visits spring flowering trees and shrubs (LaBerge 1973). It is hoped that by publishing a full description of the new species and a partial key to the *Trachandrena* in North America that includes this species, that additional specimens, including the male, will be discovered in other entomology collections or through survey work. The American Southwest is one of the most diverse regions for bees globally (Michener 1979, 2007), so it is likely that many other bee species await recognition.

Acknowledgements

I am grateful to Prof. Laurence Packer, York University, Toronto, Canada for comments on an early draft of this manuscript. I also appreciate the assistance of Dr. Robert Minckley (University of Rochester, Rochester, NY), Dr. John L. Neff (Central Texas Melittological Institute, Austin, TX), and Dr. Doug Yanega (University of California, Riverside, CA) for searching their respective collections for additional specimens.

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