

**A new subgenus and species of *Oxaea* from Ecuador
(Hymenoptera: Andrenidae)**

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ABSTRACT. A new subgenus and species of *Oxaea* KLUG (Andrenidae: Oxaeinae) is described and figured from western Ecuador. *Oxaea* (*Alloxaea*) *brevipalpis* subg. n. *et* sp. n., is noteworthy for the retention of maxillary palpi (3-segmented), absence of metallic integumental coloration, and contrasting notal pubescence. A preliminary key to the species of *Oxaea*, exclusive of the *flavescens* group, is provided as an aid to identification as well as a stimulus for future research on the genus. *Mesoxaea* and *Notoxaea* are reinstated as genera distinct from *Protoxaea*.

KEY WORDS: Andrenidae, Anthophila, Apoidea, Ecuador, Oxaeinae, taxonomy.

INTRODUCTION

The bee subfamily Oxaeinae (Andrenidae) includes 21 structurally similar species of large (13–26 mm), robust, hairy bees which are restricted to warmer regions of the New World (Appendix) (Figs 1–9). Species diversity is highest in subtropical Mexico (11 species) and Brazil (nine described and at least two undescribed species: SILVEIRA et al. 2002), but four species range north to the southern United States and others are widely distributed in neotropical lowlands of South and Central America. Oxaeines are atypical andrenids since they are unusually large, possess modified antennae and wings, and have particularly



Figs 1–4. Dorsal aspects of representative oxaeine bees (females on left, males on right). 1, 2 – *Protoxaea gloriosa* (FOX); 3, 4 – *Mesoxaea nigerrima* (FRIESE).

profuse scopae. These characters are paralleled in stenotritine and caupolicanine colletids, leading some researchers to suggest a relationship between these taxa and the Oxaeinae.

The wings and antennae of oxaeines are even more similar to those of the Eastern Hemisphere andrenid genus *Melitturga* (Panurginae), but other characters preclude an exclusive relationship between these groups (ROZEN, 1965). Presently the oxaeines are considered the sister group to the Panurginae (ASCHER 2003, 2004; ENGEL 2001).

Oxaeines nest in the soil, often in aggregations, which under optimal conditions may include tens of thousands of burrows (COCKERELL, 1933). Although known nests of *Protoxaea* and *Mesoxaea* are solitary, communal nesting has been observed in species of *Oxaea*. Oxaeine nests have a deep main burrow from which branch several horizontal lateral burrows, each terminating in a single vertical cell. A presumed communal nest of *O. flavescens* is among the deepest recorded for bees and was likely excavated by multiple females belonging to successive generations (ROBERTS, 1973). Cell provisions consist of a semi-liquid, unshaped combination of pollen and nectar. Preferred pollen sources regularly visited by female oxaeines in both North and South America include *Solanum* (Solanaceae), *Cassia* and other legumes (Fabaceae), and *Larrea* (Zygophyllaceae). North American



Figs 5–8. Dorsal aspects of representative oxaeine bees (females on left, males on right). 5, 6 – *Notoxaea ferruginea* (FRIESE); 7 – *Oxaea festiva* SMITH (holotype); 8 – *Oxaea flavescens* KLUG.

oxaeines also collect pollen from *Heliocarpus* (Tiliaceae) and *Kallstroemia* (Zygophyllaceae). In South America *Oxaea flavescens* KLUG collects pollen from *Cochlospermum* (Cochlospermaceae), *Ouratea* (Ochnaceae), *Bellucia* (Melastomataceae), and potentially other genera adapted for buzz pollination by large bees (CAMARGO et al. 1984). Although many oxaeine pollen sources are nectarless and have poricidal anthers, others produce copious nectar and have normal anthers (e.g., *Larrea* and *Kallstroemia*); all produce copious amounts of pollen. Male sleeping aggregations may be characteristic of Oxaeinae, they have been reported for *Protoxaea* (LINSLEY & MACSWAIN 1972) and *Oxaea* (OLIVEIRA & CASTRO 2002).

HURD & LINSLEY (1976) provided an extensive historical review of taxonomic and biological studies and monographed the family, recognizing four genera: *Protoxaea* (Figs 1–2), *Oxaea* (Figs 7–8), *Mesoxaea* (Figs 3–4), and *Notoxaea* (Figs 5–6), the last two proposed to include species formerly placed in *Protoxaea*. Subsequent authors have considered *Mesoxaea* and *Notoxaea* as subgenera of *Protoxaea* (e.g., MICHENER 2000) but this likely renders *Protoxaea* paraphyletic, a possibility suggested by MICHENER (2000)

(vide etiam Appendix). Recent systematic publications on the subfamily are few and include a redescription of *O. rufa* FRIESE and new distributional records for *O. schwarzi* MOURE & SEABRA (MOURE, 1995), a range extension to Bolivia for *O. austera* GERSTÄCKER (BOUSEMAN 1978), description of new types of metasomal glands in *O. flavescens* KLUG (GUERINO & CRUZ-LANDIM 1999, 2002), description of unique rectal structures in *O. flavescens* (SERRÃO et al. 2004), and designation of a lectotype for the type species of *Oxaea* (ENGEL, 2006).

Herein we present the description of a distinctive new subgenus and species of *Oxaea* from western Ecuador and provide a preliminary key to the species, hopefully stimulating further systematic work on the genus.

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SYSTEMATICS

Family: Andrenidae LATREILLE 1802

Subfamily: Oxaeinae ASHMEAD 1899

Genus: *Oxaea* KLUG 1807

Alloxaea subgen. n.

Type species

Oxaea (Alloxaea) brevipalpis ASCHER, ENGEL & GRISWOLD sp. n.

Diagnosis

The presence of reduced, three-segmented maxillary palpi differentiates this species from all previously described *Oxaea* species, which lack maxillary palpi, and from all

species of *Protoxaea*, *Mesoxaea*, and *Notoxaea*, which possess fully-developed, six-segmented maxillary palpi. The black, weakly metallic tergal integument differs conspicuously from the intensely metallic green integument of the *flavescens* group, which includes the most commonly collected *Oxaea* species, and from the red integument of *O. rufa* Friese and *Notoxaea*. Contrast between pale pubescence of the mesoscutellum with dark pubescence of the mesoscutum is unique within the subfamily. The unknown female should be readily identifiable, since it presumably possesses short maxillary palpi and a pattern of pubescence resembling that of males.

Etymology

The new genus-group name is a combination of *allos* (Gr., meaning “near”) and *Oxaea*, type genus of the subfamily.

Oxaea (Alloxaea) brevipalpis sp. n.

(Figs 9–15)

Diagnosis

As for the subgenus (*vide supra*).

Description

♂: Typical oxaeine bee, agreeing with characters common to males of previously described *Oxaea* species, except as indicated: Total body length 17 mm; total forewing length approximately 13 mm [difficult to measure due to wear]. Head wider than long (width 5.25 mm, length 4.50 mm). Intertegular distance 4.2 mm. Compound eyes moderately converging above, separated on vertex by slightly greater than distance between outer margins of hind ocelli (closest approximation of compound eyes dorsally 1.4 mm, distance between outer margins of hind ocelli 1.26 mm; lower inner orbital distance 3.0 mm); inner margins of compound eyes nearly straight, not convex, not strongly incurved dorsally. Gena at broadest (one-third from venter of compound eye) slightly narrower than width of compound eye, strongly narrowed dorsally (to slightly more than flagellar width). Mandible with apex simple, attenuate; margin with slight angle medially. Maxillary palpus short (0.36 mm), three-segmented, first segment longest, third shortest (ratio 10:5:3). Metasomal S8 acutely bidentate, with deep apical emargination; apical projection nearly one-half width of broad disc. Gonobase narrow, ring-like. Penis valve simple, carinate medioapically, with mediolateral patch of hairs arising at midpoint where penis valve narrows toward apex. Gonocoxite slender, with strong, somewhat projecting medioventral angle at midpoint.



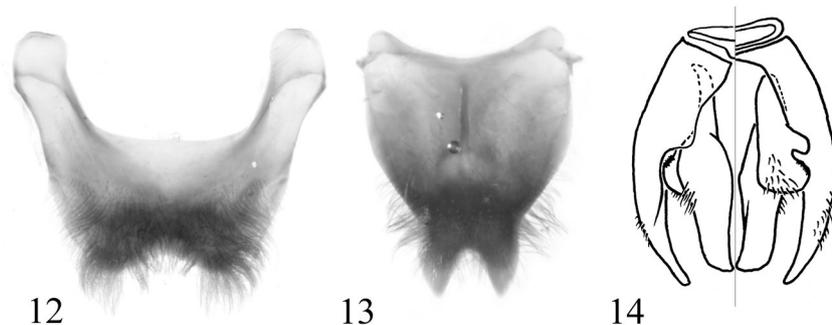
Figs 9–11. Male of *Oxaea (Alloxaea) brevivalpis* subgen. et sp. n. 9 – lateral aspect, 10 – facial aspect, 11 – dorsal aspect (note strikingly white mesoscutellar setae).

Gonostylus scarcely exceeding penis valves, weakly differentiated by reduced sclerotization, slender, hairs short, apex curved medially. Male terminalia and genitalic capsule depicted in figures 12–14. Color of integument generally black, pale maculations absent, integument reddened to varying degrees on clypeal disc, frons, inner margin of compound eye, antenna, legs, metasoma (especially premarginal zones of terga, ventrolateral surface of T2, apical marginal zone of T5); following areas strongly reddened:

mandible at apex and midpoint, clypeal apex, labrum narrowly at base and apex, pretarsal claws in apical half, genital capsule; following areas tan: scape at base and apex, F1 at extreme base, mouthparts largely, strigil, basal half of pretarsal claws, aedeagus, gonostylus; metasoma shiny, with weak, metallic green reflections. Forewing membrane moderately, rather uniformly infuscated brownish throughout, slightly darker apically; hind wing weakly infuscated. Wing veins, tegula brown.

Labral surface shining, median ridge absent, punctures strong, moderately close sublaterally, impunctate medially. Clypeus tessellate, densely, coarsely punctate laterally, disc more sparsely punctate, punctures separated by several puncture widths medially. Mesoscutum anteriorly with surface roughened, granular; punctures coarse, dense in anterior half, especially behind notaulices, finer, more widely spaced (separated by about a puncture width) posteriorly in middle. Metasomal T1–T4 entirely, finely, strongly, uniformly punctate; integument between punctures very finely reticulate.

Vestiture of head, mesosoma, and T1 dense, erect; setae elongate, those of metanotum slightly exceeding median length of sclerite. Metasomal T5–T6 with setae arising from apex of disc elongate, forming a dense uniform brush, curved apically. Vestiture generally gray to brown, except mesoscutellum white. The following areas darker, brown: mesoscutum, dorsal half of head, pleura dorsally, disc of T1, T2–T4 entirely, T5 basomedially. The following areas paler, gray to pale brown: lower lateral surface of clypeus, lower paraocular area, S6–S8; anterior surface of T1, T5–T6 apically, T7. Metanotum with many setae whitened apically. Inner surface of pro- and mesotarsus with dense golden-brown setae.



Figs 12–14. Male terminalia of *Oxaea* (*Alloxaea*) *brevipalpis* subgen. et sp. n. 12 – seventh metasomal sternum, 13 – eighth metasomal sternum, 14 – genitalic capsule (left side is dorsal aspect, right side is ventral aspect).

Type material

Holotype ♂, Ecuador, Porto Viejo [Portoviejo, Manabí Province], X-68 [October, 1968], *ex: Sesamum indicum* L. [Pedaliaceae]. No collector indicated, probably Pedro Alcivar (*vide* Additional material, *infra*). The holotype is deposited in the U.S.D.A. Bee Biology and Systematics Laboratory, Utah State University, Logan. Three ♂♂, same data holotype in the U.S.D.A. Bee Biology and Systematics Laboratory, Utah State University, Logan. One ♂ each, same data as holotype, in the Division of Entomology, University of Kansas Natural History Museum, Lawrence, and the Division of Invertebrate Zoology, American Museum of Natural History, New York.

Additional material

One ♂ [light morph], Colombia [likely mislabeled, the actual collecting locality is likely Ecuador], Porto Viejo, IX [September]-20-1968, Pedro Alcivar, *ex: Sesamum indicum*. Deposited in the U.S.D.A. Bee Biology and Systematics Laboratory, Utah State University, Logan. As noted, the specimen is very likely mislabeled as coming from Colombia. Two shipments of bees were received in 1969 for identification from Pedro Alcivar A., "Investigador Agropacuaria, Estacion Exp. Portoviejo, Apartado No. 100, Portoviejo, Ecuador". The first consisted solely of the *Oxaea* described herein, the second a single male *Oxaea* (of the light morph) and several other bees. The other bees from the second shipment were also collected by Alcivar from *Sesamum* and were labeled in the same hand, leading us to strongly suspect that this individual was accidentally mislabeled as having come from Colombia.

Variation

Specimens vary in the coloration of their vestiture and integument. The male erroneously labeled as having been collected in Colombia differs from the holotype and paratypes in having generally paler pubescence (Fig. 15); yellow to brown rather than gray to brown. It further differs in having a paler, more reddish-brown integument, particularly the sterna. Conspicuous variation in coloration of the vestiture is well-known to occur in *Protoxaea gloriosa* (FOX) leading COCKERELL (1934) to describe pale specimens of this species as subspecies *pallida*.



Fig 15. Male of *Oxaea* (*Alloxaea*) *brevipalpis* subgen. et sp. n., light morph.

Etymology

The specific epithet is a combination of the Latin words *brevis* (meaning, “short”) and *palpus* (meaning, “feeler”) and is a reference to one of the most distinctive features of the species; *i.e.*, its short maxillary palpi.

Ecology

Specimens were collected on sesame (*Sesamum indicum* L., native to the Old World tropics), presumably a nectar source. Months of collection are September and October, prior to the rainy season of December-June in Manabí Province. The area surrounding Portoviejo was originally covered in dense humid lowland tropical forests, but these have largely been cleared, undoubtedly greatly diminishing the habitat available for this species.

Preliminary Key to Species of *Oxaea*

Species of the *flavescens* group, *i.e.*, the bright metallic green species, are not keyed herein pending clarification of the species and critical examination of type material.

1. Female2
 —Male6

2. Terga bright metallic green*flavescens* group
 —Terga weakly metallic3
3. Terga largely red*O. rufa* FRIESE
 —Terga dark, not red4
4. Maxillary palpi present, three-segmented; mesoscutellum with pale setae contrasting with darker mesoscutal setae (western Ecuador, females unknown, characters inferred from males)*O. brevipalpis* sp. n.
 —Maxillary palpi absent; mesoscutum and mesoscutellum with hairs concolorous (Brazil)5
5. Pubescence in large part golden-yellow (Paraná)*O. mourei* GRAF
 —Pubescence mostly black (females unknown, characters inferred from males; extrapolating for males, *O. schwarzi* may possess more shining apical zones on T1–T4, not invaded by punctures)*O. schwarzi* MOURE & SEABRA (Bahia), *O. alvarengai* MOURE & URBAN (Mato Grosso)
6. Terga with bright metallic green apical bands*flavescens* group
 —Terga at most weakly metallic, not bright green7
7. Terga dark, not red8
 —Terga largely red (Brazil)*O. rufa* FRIESE
8. Maxillary palpi absent (Brazil); mesoscutum and mesoscutellum with setae concolorous9
 —Maxillary palpi present, three-segmented; mesoscutum with pale setae contrasting with darker mesoscutellar setae (western Ecuador)*O. brevipalpis* sp. n.
9. Compound eyes not nearly meeting above, less strongly convergent, separated by approximately the distance between lateral ocelli; T1–T4 with apical zones broadly impunctate, shiny10
 —Compound eyes nearly meeting above, separated by much less than width of an ocellus; T1–T4 and T6 with apical zones invaded by punctures (Mato Grosso)*O. alvarengai* MOURE & URBAN
10. Pubescence in large part golden-yellow; compound eyes weakly divergent in uppermost portion (Paraná)*O. mourei* GRAF
 —Pubescence mostly black; compound eyes strongly convergent above (Bahia)*O. schwarzi* MOURE & SEABRA

DISCUSSION

Within *Oxaea* the presence of bright green metallic terga or tergal bands is a conspicuous synapomorphy of a clade including the following species: *O. austera*, *O. festiva* SMITH, *O. flavescens*, *O. fuscescens*, and *O. stenocoryphe* MOURE. This clade, the *flavescens* species group, is further defined by the following derived characters: labrum and basal antennal segments of male yellow; penis valve simple, narrow, elongate, greatly exceeding gonostylus; gonostylus undifferentiated, lacking setae. Within the *flavescens*

group, *O. austera* and *O. stenocoryphe* are very closely allied. Although typical specimens of *O. austera* from southern Brazil and northeastern Argentina can be reliably distinguished from typical *O. stenocoryphe* from northwestern Argentina based on differences in punctuation and setal color, similar specimens from Bolivia, Peru, and Paraguay differ from both described species so cannot be identified with certainty. At this point it is not clear if these should be included in an expanded *O. austera*, with *O. stenocoryphe* as a junior subjective synonym, or if this species subgroup includes undescribed, cryptic species. New distributional records for these and other oxaeine species, as well as the *Oxaea* cleptoparasite *Thalestria*, have been recorded in the online specimen databases of the University of Kansas Natural History Museum's Division of Entomology (www.nhm.ku.edu/ksem/collect/collections.html) and the American Museum of Natural History Bee database, and are mapped online at www.discoverlife.org. The Brazilian *O. schwarzi*, *O. alvarengai* MOURE & URBAN, and *O. mourei* GRAF may comprise the *schwarzi* species group (GRAF, 1992), a potential clade. The unique presence of reduced maxillary palpi in *O. brevipalpis* perhaps supports its placement as sister to other *Oxaea* species. *Oxaea brevipalpis* differs significantly from previously described species and could be regarded as generically distinct. For the moment, however, we retain this species within *Oxaea* in a broad sense. Certainly a detailed revision and cladistic analysis of *Oxaea* is needed to more rigorously test these phylogenetic hypotheses and, in particular, to establish the phylogenetic position of the non-metallic Brazilian species (especially *O. rufa*) which we have not studied in great detail. It is hoped that our preliminary speculation will stimulate such a study.

The five bright metallic green species of the *flavescens* group are widely distributed in Neotropical lowlands north to Veracruz, Mexico and south to northern Argentina (e.g., Salta, Misiones). Most, if not all, South American records are from east of the Andes. *Oxaea rufa* and the three species of the *schwarzi* group are endemic to Brazil, whereas *O. brevipalpis* is from lowland western Ecuador. The only known locality for the newly described species (Portoviejo, Manabí Province, Ecuador) is located between the mesic Chocó endemic region of northwestern Ecuador and southwestern Columbia, and the xeric Tumbesian endemic region of southwestern Ecuador and northwestern Peru. A distinctive bee fauna associated with xeric habitats likely exists in southwestern Ecuador as suggested by the collection in March, 1996 of an undescribed species of *Callonychium* (*Paranychium*) (Panurginae: Calliopsini) in El Oro Province (Isla Jambelí) (NB: this is the first record of *Callonychium* for Ecuador: ASCHER unpubl. data). Unfortunately, the diverse and distinctive bee fauna of the Andean countries has yet to be adequately surveyed (e.g., GONZALEZ & ENGEL 2004), preventing a detailed assessment of distributional patterns across the region. It is interesting to note that *Thalestria*, an obligate cleptoparasite of *Oxaea*, has been recorded from northern-most Chile (MOLDENKE, 1976; TORO, 1986) suggesting that *Oxaea* may occur there as well, but the putative locality (Buena Vista, Tarapacá) cannot be found and the specimen in question (found in the AMNH but evidently property of SEMC) is almost certainly mislabeled.

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APPENDIX

The following is a hierarchical classification and checklist of Oxaeinae. We have broken the paraphyletic *Protoxaea* into distinct genera (following HURD & LINSLEY, 1976). *Mesoxaea* and *Notoxaea* are more closely allied to *Oxaea* as evidenced by the apically emarginate male S8, exceedingly short, ring-like gonobase, and reduced gonostylar setae. Within this group *Notoxaea* is perhaps most closely related to *Oxaea s.lato* owing to the relatively broad apical process of the male S8, which is usually half as broad as, or broader than, the sternal disc. However, this relationship is not certain as the conspicuous tufts of long setae on T6 of male and T5 of female *Mesoxaea* and *Notoxaea* is a potential synapomorphy uniting these genera. *Oxaea s.lato* is supported by the reduction of the maxillary palpi and the projections bordering the medioapical emargination of male S8 being acute to subacute.

Subfamily Oxaeinae ASHMEAD 1899

Genus *Protoxaea* COCKERELL & PORTER 1899*Protoxaea australis* HURD & LINSLEY 1976*Protoxaea gloriosa* (FOX 1893)*Protoxaea micheneri* HURD & LINSLEY 1976Genus *Mesoxaea* HURD & LINSLEY 1976*Mesoxaea arizonica* (COCKERELL 1936)*Mesoxaea clypeata* HURD & LINSLEY 1976*Mesoxaea nigerrima* (FRIESE 1912)*Mesoxaea rufescens* HURD & LINSLEY 1976*Mesoxaea tachytiformis* (CAMERON 1901)*Mesoxaea texana* (FRIESE 1898)*Mesoxaea vagans* (FOX 1893)Genus *Notoxaea* HURD & LINSLEY 1976*Notoxaea ferruginea* (FRIESE 1898)Genus *Oxaea* KLUG 1807Subgenus *Alloxaea* ASCHER, ENGEL & GRISWOLD subgen. n.*Oxaea (Alloxaea) brevipalpis* ASCHER, ENGEL & GRISWOLD sp. n.Subgenus *Oxaea* KLUG 1807The *rufa* group*Oxaea (Oxaea) rufa* FRIESE 1899The *schwarzi* group*Oxaea (Oxaea) alvarengai* MOURE & URBAN 1963*Oxaea (Oxaea) mourei* GRAF 1992*Oxaea (Oxaea) schwarzi* MOURE & SEABRA 1962The *flavescens* group*Oxaea (Oxaea) austera* GERSTÄCKER 1867*Oxaea (Oxaea) festiva* SMITH 1854*Oxaea (Oxaea) flavescens* KLUG 1807*Oxaea (Oxaea) fuscescens* SICHEL 1865*Oxaea (Oxaea) stenocoryphe* MOURE 1947