

## Two distinctive new species of halictine bees from high altitude in the New World tropics (Hymenoptera: Halictidae)

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Two new species of halictine bees are described. A distinctive new species from high altitude in Ecuador is described on the basis of a single male. It appears to fall within the genus *Caenohalictus* as presently understood, although this diverse genus is badly in need of revision and may not be monophyletic. The concept of *Mexalictus* is expanded to include a new subgenus, *Georgealictus*, which appears to be an epiponine wasp mimic with a petiolate abdomen and elongate propodeum. This new subgenus is the sister-group to the nominate subgenus of *Mexalictus*. *Mexalictus (Georgealictus) polybioides* is described on the basis of one male and two females, all from high altitude in the state of Chiapas, Mexico.

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On trouvera ici la description de deux nouvelles espèces d'halictes (Hyménoptères) dont l'une, qui vit en haute altitude en Équateur, est décrite à l'examen d'un seul mâle. Cette espèce semble appartenir au genre *Caenohalictus* tel qu'on le conçoit actuellement, mais il est vrai que ce genre très diversifié nécessite une révision importante et il est possible qu'il ne s'agisse pas d'un genre monophylétique. Le concept de *Mexalictus* est élargi pour permettre l'intégration d'un nouveau sous-genre, *Georgealictus*, mimétique d'une guêpe épiponine à abdomen pétiolé et propodeum allongé. Le nouveau sous-genre constitue le groupe soeur du sous-genre nominal *Mexalictus*. La description de *Mexalictus (Georgealictus) polybioides* est basée sur l'examen d'un mâle et de deux femelles, tous trouvés en haute altitude dans l'état de Chiapas, Mexique.

[Traduit par la rédaction]

### Introduction

In the course of studies of the higher level systematics of the bee tribe Halictini, some very distinctive specimens not easily assignable to previously recognised genera were discovered. These species are herein described, partly to facilitate phylogenetic studies currently in progress. The first species possesses numerous apomorphic character states but clearly falls within the agapostemonine group of genera (Roberts and Brooks 1987; see also Moure and Hurd 1987 and Cure 1989 for a full enumeration of genera and species included in this group). It is known from only one male specimen. The second new species is morphologically very similar to species of *Mexalictus* (Eickwort 1978) from which it differs in a suite of characteristics, several of which appear to be associated with mimicry of epiponine wasps. The new subgenus and the nominate subgenus are sister-groups. The new species is known from one male and two females.

The descriptions follow the format of Roberts and Brooks (1987). Measurements of body parts and pubescence are given relative to the width of the median ocellus: 1 o.d.

### *Caenohalictus robertsi* new species

**ETYMOLOGY:** The specific epithet honours the late Radclyffe B. Roberts, well known for his contributions to the systematics and biology of bees in the *Agapostemon* group of genera.

**TYPE:** Male holotype from ECUADOR, Pichincha Province, 46 km east of Quito, 4000 m, 1–7 August 1976, G.E. Shewell. The specimen is housed in the Canadian National Collection and is in excellent condition but with most of one mandible and most of one antenna missing.

### Description (Fig. 1)

Body length 11 mm, wing length 9 mm. General colour of head and mesosoma metallic blue, bright on head, dull with a tendency to black on scutum; labrum and apical 2/5 of clypeus

yellow; antennal scape dark metallic blue, legs and antennal flagellomeres black–brown; metasoma orange–red except for anterior 4/5 of T1 and basilateral maculae on T2–T4 purple–black; pubescence on head dark brown, white on gena; mesosomal pubescence black–brown dorsally fading to pale brown beneath wings and white ventrally; all long hairs plumose except those on mandible, eye, lower portion of clypeus, tibiae, tarsi, and dorsal surface of more apical metasomal segments; head and thorax granuloso-punctate with coarse, hair-bearing punctures among very dense and minute granulations. **Head** (Figs. 2 and 3): length to width ratio (length measured from tip of clypeal projection to posterior margin of vertex) 72:73. (1) Labrum (Figs. 5 and 6): no clear demarcation between basal area and apical triangular projection, so whole structure appears broadly heart-shaped with pointed apex; bulbously produced in lateral view with dorsal surface slightly concave; yellow, with 11 coarse setae on each side 1 o.d. (2) Clypeus (Figs. 2 and 3): yellow on lower 2/5, metallic blue above; with semicircular projection medially, 0.7 o.d. in length; length to tip of apical projection 3/4 distance between anterior tentorial pits; line between lower eye margins crosses middle of clypeus excluding the apical projection. (3) Interocular area: supraclypeus strongly raised immediately below antennal sockets; frontal line visible from lower edge of antennal insertions to median ocellus, raised for lower one-half; inner margin to orbits concave, depth of concavity 1 o.d.; punctuation above antennal sockets contiguous, punctuation smaller here than elsewhere; pubescence long, 2.0 o.d., shorter on summit of supraclypeus, 1.3 o.d.; area between antennae and ocelli with comparatively dense, unbranched, short hairs among long ones discernible only from some angles, 0.7 o.d. (4) Vertex: interocellar distance 1.4 o.d., ocellular distance 1.6 o.d.; vertex long, 2.3 o.d.; ocellular region flat; region behind ocelli flat, region behind compound eyes gently convex; area immediately above compound eye with dense,



FIGS. 1–4. Holotype of *Caenohalictus robertsi*. Fig. 1. Lateral habitus. Fig. 2. Face, to show the structure of the mandible, clypeus, labrum, and hairy compound eyes. Fig. 3. Head, lateral view, to show the labrum, clypeus, and hypostomal tooth. Fig. 4. Hind leg, to show the absence of modifications of the tibia and tarsus and the presence of a constriction between tarsomeres 1 and 2. Note that despite the constriction, these two tarsomeres are immovably fused. Scale bars = 1 mm.

short, unbranched hairs 0.5 o.d.; no occipital carina. (5) Gena: greatest width less than greatest breadth of eye in lateral view, ratio 8:11; convex with pale pubescence gradually increasing in length from 1 o.d. dorsally to 3 o.d. ventrally; row of short, dense hairs immediately behind compound eye 0.3 o.d., branched below, simple above; hypostomal area slightly concave, almost devoid of pubescence, with carina enlarged into a broad tooth at anterior third, 0.8 o.d. in length (Fig. 3). (6) Malar area: extremely short, 0.2 o.d. (7) Mandible (Fig. 2): long, attaining base of opposing mandible; in dorsal view sharply bent at midpoint; black basal to bend, red apically; central portion strongly, dorsoventrally compressed with inner and outer ridges on upper and lower surfaces, biconcave; apex laterally compressed, giving a twisted appearance; basiomedial tooth 1 o.d. long, 2.2× as long as basal width, arising from basal ridge; long, simple hairs on outer and ventral surfaces, 1.2 o.d. (8) Antenna: long, reaching to base of metasoma; scape long, reaching lateral ocellus; pedicel slightly broader than long; F1 quadrate; F2 2.3× as long as wide, parallel sided; remaining annuli twice as long as broad, slightly moniliform; dark brown, with scape and pedicel blackish with metallic highlights; lacking specialised tylar areas. *Mesosoma*: (9) Pronotum: lateral angle prominent but without ridge or carina; lateral ridge weak to posterior lobe; horizontal dorsal surface extremely short medially, less than 0.2 o.d.; area dorsal to lateral ridge

with mixture of long (2 o.d.) and short (0.5 o.d.) pubescence; only short pubescence ventral to ridge. (10) Mesoscutum: anterior margin convex in lateral view, slightly overhanging pronotum; anterior margin slightly bilobate in dorsal view; parapsidial lines extending anteriorly for 4/7 the length of the scutum; granulations weakest and colouration least metallic on posterior half of disc; granulations dense in anterior one-third; with long dark brown hairs, 2 o.d. (11) Mesoscutellum: punctures restricted to midline, posterior third, and anterior margin; disc black and shiny; with long dark brown hairs 2 o.d. (12) Metanotum: half as long as mesoscutellum, granulate, with very long dark brown hairs 2.5–3 o.d. (13) Mesepisternum: granulations very dense dorsally, less dense ventrally; with long hairs 2 o.d. pale brown above, whitish below. (14) Metepisternum: granulations very dense throughout; with long hairs 2 o.d., pale brown above whitish below. (15) Propodeum: medially as long as mesoscutellum and 3/4 as long as distance from metasomal insertion to summit; dorsal surface glabrous, impunctate, densely granulate with a sparse, faint network of rugae; lateral and posterior faces punctate on a less densely granular background; lateral carinae of posterior surface extending for only 1/4 height of propodeum. (16) Wings: dark brownish hyaline; veins dark brown; covered with short hairs 0.3 o.d.; first recurrent vein at extreme apex of second submarginal cell, practically interstitial with second transverse cubital; second

recurrent vein entering third submarginal cell 0.6 o.d. from apex; marginal cell pointed on wing margin, over 4× as long as greatest width; stigma over half as long as marginal cell, 4× longer than greatest breadth; five hamuli. (17) Tegula: brown with faint blue reflection in anterior half; microareolate and glabrous posteriolaterally, with stronger reticulations and small punctures elsewhere. (18) Foreleg: dark brown with faint green reflections on coxa; long, plumose pubescence on coxa 2 o.d., that on trochanter generally denser, shorter, less than 1.3 o.d.; femur with dense, whitish pubescence of various lengths becoming sparser distally; tibia and tarsus with golden hairs. (19) Midleg: as foreleg but without metallic reflections on coxa and with proximal pubescence of femur sparser and without short hairs. (20) Hind leg (Fig. 4): long, without any spurs or projections other than the usual apical tibial spurs; coxa with faint blue reflections; femur cylindrical, widest near middle, almost 4× as long as greatest width, with sparse, long pubescence anteriorly, moderately dense, shorter pubescence posteriorly, 1 o.d.; tibia 5.5× as long as greatest breadth, which occurs in apical 1/3, row of long black hairs along dorsal edge 2 o.d., similar vestiture on anterior surface, posteriorly with short dense whitish recumbent hairs 1 o.d., both apical spurs long, 3 o.d.; basitarsus 6.5× as long as wide, parallel sided, dorsal row of hairs sparser and longer than on tibia, 2.5 o.d., ventrally with dense golden hairs 1.5 o.d., posteriorly with dense, pale golden hairs 1 o.d.; constriction at fused junction of first and second tarsal segments (these did not articulate in the relaxed specimen), second segment 1/3 as long as basitarsus, tarsomeres 3–5 combined almost as long as basitarsus. *Metasoma*: (21) Terga: orange except for anterior 4/5 of T1 and apicolateral patches on T2–T4 purple brown and with faint purple reflections dorso-medially on T5; without lateral gradular carinae; T1 length subequal to apical width, ratio 22:21; subspiracular carina on basal 4/5 of T1, microareolate below this; basal 2/3 of T1, basal 1/3 of T2–T3, and entire surfaces of T4–T6 microareolate; T1 with branched brown hairs on anterior half and laterally 1.5–2 o.d., below subspiracular carina with these hairs white, shorter sparser hairs on disc 1 o.d.; T2 with sparse short brown hairs on disc 0.5 o.d., longer black ones laterally 1 o.d.; the long black hairs becoming longer, less branched, and more extensive on succeeding segments attaining 2.5 o.d. on T7, where some hairs are plumose; pygidial plate marked by semi-circular raised carina, glabrous. (22) Sterna: S1 metallic blue except apical 1/5 orange, with dense small punctures; remaining sterna orange; S2 with sparse white hairs 1 o.d., apex slightly and broadly emarginate; S3 with very few short white hairs 0.3 o.d., apex more strongly emarginate than S2; S4 (Fig. 7) broadly emarginate, longest at extreme sides, with transverse subapical ridge, triangular in longitudinal section, its apex 2 o.d. across, bearing 14 anteriorly directed stiff hairs, the outermost 2 on each side shorter and dark brown, 0.7 o.d., the rest amber, 1 o.d., ridge also with short white ventrally directed hairs just posterior to stiff ones, 0.5 o.d.; S5 (Fig. 8) with apical margin straight, with median subapical transverse row of black hairs and lateral–apical patches of similar hairs 1 o.d., all three hair patches situated on slight swellings; S6 (Fig. 9) apical margin bisinuate, slightly depressed apicomediaally, with black setae over posterior half except for the medial depression, these hairs directed apicomediaally except at extreme sides, hairs longest at sides, 1.5 o.d., becoming shorter medially, 0.3 o.d.; apical convex margin with transverse row of medially directed stiff hairs 0.7 o.d. (23) Termin-

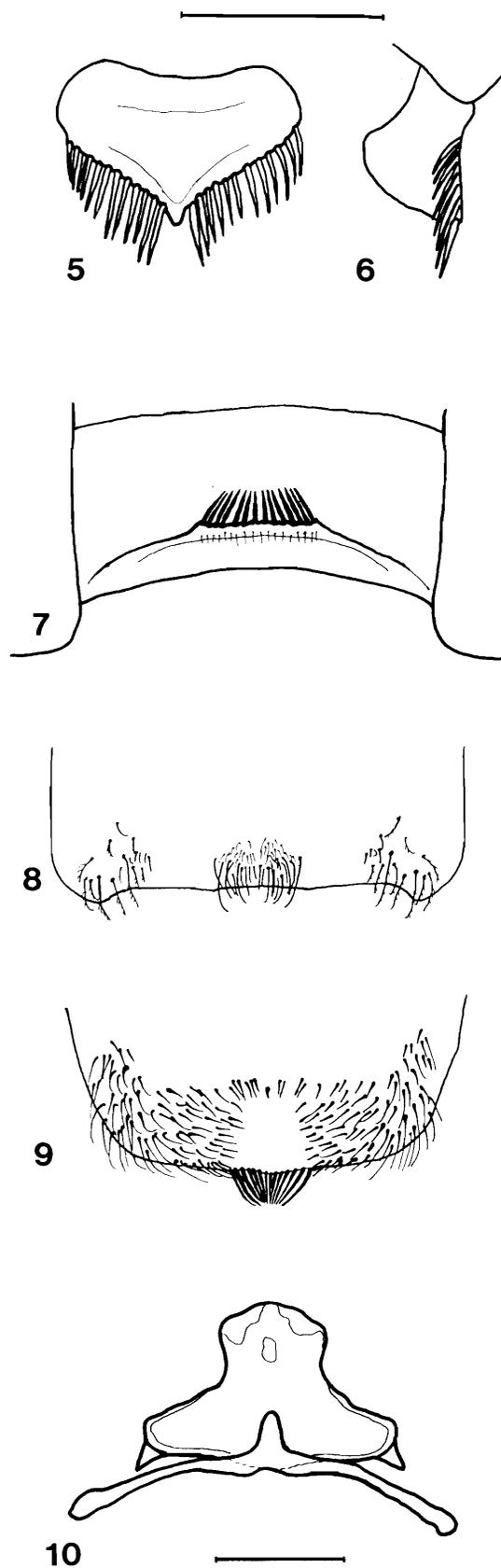
alia (Figs. 10–12): S7 transverse with median apical projection; S8 with broad apical process with slightly concave lateral edges and rounded apex; gonobase transverse over twice as broad as greatest length, median dorsal thickening well defined; gonocoxite as broad as long, with semicircular excavation near midpoint of posterior margin, this with minutely roughened surface, area immediately behind with faint transverse striae, otherwise gonocoxite without striations; volsella with strong semicircular ridge at apical third, strongly concave distal to this; gonostylus massive, almost entirely hiding penis valves in lateral view, with keeled dorsal medial surface, large boss basally on outer surface, with dense tuft of long hairs externally, these shorter ventrally, 1 o.d., becoming longer and recurved dorsally, 3 o.d.; inner surface of apical portion of gonostylus bearing narrow ventral process 1 o.d.; central portion of gonostylus with membranous appendage arising from inner margin, appendage broad dorsally where it extends above level of rest of genitalia and has a crenate posterior margin; appendage with narrower, shorter extension posteroventrally, tapering and with transverse ridges giving the appearance of a ram's horn; appendage bearing dense short setae medially, which become sparser dorsally, absent on lower portion; retrorse lobe short and truncate, not membranous, glabrous; penis valves laterally compressed with strong dorsal keel, without inferior basal process.

#### Discussion

This species is a member of the *Agapostemon* group of genera, which occurs from southern Canada to Chile and Argentina but with greatest diversity in cooler parts of the neotropics (Roberts and Brooks 1987; these authors also provide a putative synapomorphy list for this group of genera). In Roberts and Brooks' (1987) key, which is to Mesoamerican taxa only, *Caenohalictus* comes out in a couplet that includes the statement "Hind tarsomeres 1 and 2 articulated, free." All specimens of *Caenohalictus* I have seen (from over 20 different species) have the junction between tarsomeres 1 and 2 narrowed in such a way that it would appear to be capable of articulation. However, when relaxed specimens were manipulated, I found the second tarsomere to be fused and immobile in all specimens. Thus, *Caenohalictus robertsi* and other *Caenohalictus* species will key out correctly if this character is treated superficially, if the couplet is changed to read "appears articulated," and if the other key characters (of the propodeum and clypeus) are used.

Full characterisation of *Caenohalictus* is difficult, as it is a diverse, probably paraphyletic assemblage containing hairy-eyed, *Agapostemon*-like bees that cannot readily be assigned to other named genera. The type species of *Caenohalictus*, *C. trichiothalmus* (Vachal) (Moure and Hurd 1987), almost lacks a dorsal propodeal surface (Michener 1979) and is thus quite unlike *C. robertsi*, which has the dorsal surface as long as the mesoscutellum (as indeed do all Mesoamerican *Caenohalictus* species and the great majority of South American species). The short propodeum appears to be an important character, one that is shared by and is a potential synapomorphy for *C. trichiothalmus*, *Paragapostemon*, *Rhinotula*, *Agapostemonoides*, and *Dinagapostemon*. Regrettably, then, the type species of this genus is clearly atypical in comparison with the vast majority of species presently referred to *Caenohalictus*.

The new species differs from all others in the *Agapostemon* group of genera in having a rounded process on the clypeal margin and unusually modified mandibles and genitalia. It lacks



FIGS. 5–10. Features of *Caenohalictus robertsi*. Fig. 5. Labrum, anterior view. Fig. 6. Labrum, lateral view. Fig. 7. Fourth sternum. Fig. 8. Fifth sternum. Fig. 9. Sixth sternum. Fig. 10. Sterna 7 and 8. Scale bars = 0.5 mm.

the derived characters used to diagnose some of the other genera, such as the swellings and spurs on the hind legs that typify *Dinagapostemon* and the rough cuticular sculpturing and apical tergal hair bands of *Pseudagapostemon*.

Although *C. robertsi* is only known from the unique type specimen, many species in related genera are also extremely rare in collections. For example, Roberts and Brooks (1987) stated that only one of the eight species of *Dinagapostemon* had been collected on more than three occasions and three species are known only from male holotypes. Bees in this group appear to be very early morning fliers. Consequently, further early morning collecting may result in the discovery of many more interesting taxa of agapostemonine bees in Mesoamerica and the neotropics.

#### *Georgealictus* new subgenus

TYPE SPECIES: *Mexalictus* (*Georgealictus*) *polybioides* new species.

DIAGNOSIS: As described for *Mexalictus* except 10–11 mm in length; nonmetallic brown; propodeum with anterior dorsal surface steeply sloping to horizontal disc, posterior surface sloping strongly posteriorly; abdomen petiolate, with T1 longer than broad; male with short pygidial area, sternal margins entire, S4 with slightly recumbent apical hair fringe, gonostylus deeply bifid; female inner hind tibial spur serrate, with over 25 teeth.

#### *Mexalictus* (*Georgealictus*) *polybioides* new species

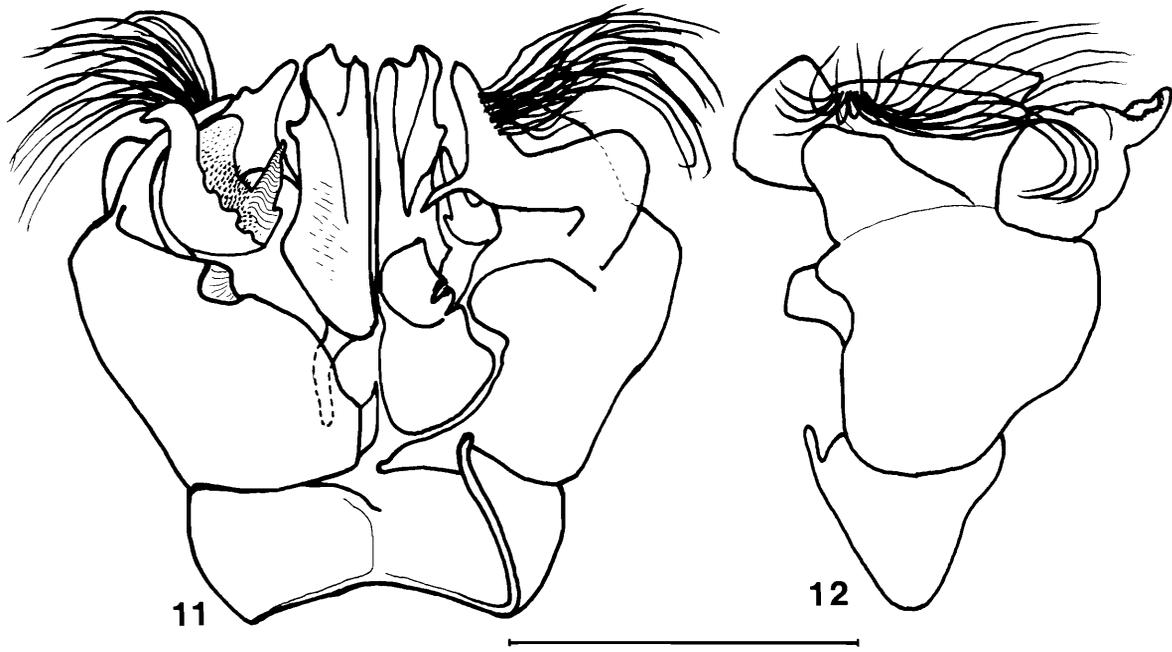
ETYMOLOGY: The subgeneric name honours Dr. George C. Eickwort for his systematic and behavioural studies of halictine bees and his gregarious personality. The specific epithet refers to the similarity of this species to epiponine wasps of the genus *Polybia*.

TYPES: Male holotype and female allotype from MEXICO, Chiapas Province, Yerba Buena, 20 mi (32 km) north of Bochil, 6500 ft (1982 m), 9–10 June 1969, W.R.M. Mason. A paratype female was collected from the same area, at an altitude of 7000 ft (2135 m), the label bears the habitat description "cloud for." and was collected by the late W.R.M. Mason on 10 June 1969. All specimens are housed in the Canadian National Collection, Ottawa. The holotype lacks the right antenna (flagellar segments 1–6 are mounted on the data label), the disc of the mesoscutellum, the apical tarsomere of the right hind leg, and the apical three tarsomeres of the right foreleg. The wings are very abraded, although the body pubescence appears intact except in the clypeal region. The allotype is in excellent condition; the sole paratype is an old specimen with abraded wings, mandibles, and facial pubescence.

#### Description

##### Male (Fig. 13)

Body length 10 mm, wing length 8 mm. Head, mesoscutum, mesoscutellum, and apical metasomal terga dark brown; pronotum, metanotum, propodeum, thoracic pleura, and most of T1 and T2 orange–brown; legs and apices of T1 and T2 golden brown. Pubescence golden, darker brown on mesoscutum, face, and vertex, mixed long erect and short appressed hairs on terga. *Head* (Fig. 14): round, ratio of length to breadth 67:66. (1) Labrum (Fig. 16): with basal elevation extending across basal area and slightly emarginate medially; with short, broad triangular apical projection 4× as wide as long, bearing apical fimbria of golden setae less than 0.5 o.d. laterally, 1.2 o.d.



Figs. 11 and 12. Genitalia of *Caenohalictus robertsi*. Fig. 11. Dorsal view on left, ventral view on right. Fig. 12. Lateral view. Scale bar = 1 mm.

medially. (2) Clypeus: slightly shorter than distance between anterior tentorial pits; line between lower eye margins crosses clypeus at basal one-third; evenly convex throughout with short median apical depression; slightly emarginate apically; with large punctures on a microareolate field, interspaces subequal to puncture diameter. (3) Interocular area: supraclypeus convex in lateral and apical views, microsculpture stronger than on clypeus, punctures as dense as on clypeus except for median longitudinal portion impunctate; granulate, not shiny; frontal line detectable from between antennal bases to median ocellus, raised for lower one-half; inner orbits weakly concave, greatest depth of concavity 0.7 o.d.; facial pubescence longest and most plumose between antennal insertions and eye 1.5 o.d., pubescence between antennae and ocelli varies in length from 0.2 to 1 o.d.; punctures on lower face separated by slightly less than their diameter, becoming smaller and denser towards antennae and contiguous between antennae and ocelli; microsculpture only discernible lateral to clypeus, intermediate in strength between that of clypeus and supraclypeus. (4) Vertex: interocellar distance 1.3 o.d., ocellocular distance 1.5 o.d.; vertex short, 1.1 o.d.; ocellocular area flat; area behind ocelli flat, behind compound eyes convex; pubescence as on upper face; punctures small and dense. (5) Gena: shorter than greatest breadth of eye in lateral view, ratio 23:27; punctures becoming less dense towards postgenae, interspaces 1.5× puncture diameter; shinier than face; pubescence longest near middle, 2 o.d., interspersed with short, appressed hairs; hypostomal carina simple; hypostomal area flat with punctures separated by twice their diameter or more, granulate, not shiny. (6) Malar area: linear, 0.2 o.d. (7) Mandible: long, apex level with clypeal tooth on opposing side; dark brown becoming orange-red apically, without teeth. (8) Antenna: dark brown, apical fifth of pedicel contrasting orange-brown, first flagellar segment uniform dark brown, remaining segments slightly paler apically than elsewhere; lacking specialised tylar areas; scape attaining median ocellus; pedicel as broad as long, first flagellar segment shorter than breadth, ratio 6:7; second

flagellar segment slightly shorter than first along medial surface, slightly longer externally; remaining segments with length and breadth subequal. *Mesosoma*: (9) Pronotum: lateral angle prominent but without ridge or carina; lateral ridge weak to posterior lobe; horizontal dorsal surface extremely short medially, less than 0.2 o.d., with sharp median horizontal sulcus extending onto sloping anterior surface; pubescence along dorsal ridge up to 2 o.d., on anterior surface minute. (10) Mesonotum: abruptly convex anterior margin, barely overhanging pronotum; with weak median sulcus anteriorly; parapsidial lines weak, extending 2/3 length of mesoscutum; dull with dense, strong microareolate microsculpture; punctures small and difficult to discern; pubescence of variable length but less than 1 o.d., longer hairs brownish, shorter ones paler. (11) Mesoscutellum: disc broken off in the only specimen, with microsculpture less strong and punctures more easily discernible than on mesoscutum anteriorly and posteriorly. (12) Metanotum: surface sculpture as on mesoscutum; pubescence long, up to 2 o.d., brown. (13) Mesepisternum: surface minutely roughened with shallow punctures separated by more than their own diameter; with golden pubescence short dorsally, 0.5 o.d., becoming longer ventrally to 2 o.d. (14) Metepisternum: microreticulate with some faint longitudinal striae; weakly punctate; with short white pubescence 0.5 o.d. (15) Propodeum (Fig. 13): dorsal surface as long as mesoscutellum. 2/3 as long as posterior surface; anterior edge of dorsal surface strongly sloping up to metanotum, horizontally flat on disc, curving abruptly to posteriorly sloping posterior surface; lateral carinae on posterior surface restricted to lower 1/3, diverging; lateral surfaces flat, not sloping outwards anteriorly towards metepisternum or ventrally towards coxal articulations; sloping anterior dorsal surface longitudinally striate, rest of dorsal and whole of lateral surfaces strongly microareolate, giving a granulose appearance, posterior surface with weaker microsculpture and slightly shiny; dorsal surface glabrous, lateral surfaces with short white pubescence along anterior margin, 0.5 o.d., longer pale golden hairs elsewhere up to 2 o.d.; posterior surface with longer pubes-



FIGS. 13–15. *Mexalictus polybioides*. Fig. 13. Male holotype, lateral habitus, to show petiolate first metasomal segment. Fig. 14. Face of male. Fig. 15. Face of female paratype. Scale bars = 1 mm.

cence increasing in length from 1 o.d. dorsally to 1.5 o.d. ventrally, with shorter pubescence throughout less than 1 o.d. (16) Wings: amber fading to hyaline posteriorly and apically, most veins and posterior margin of stigma dark golden brown,

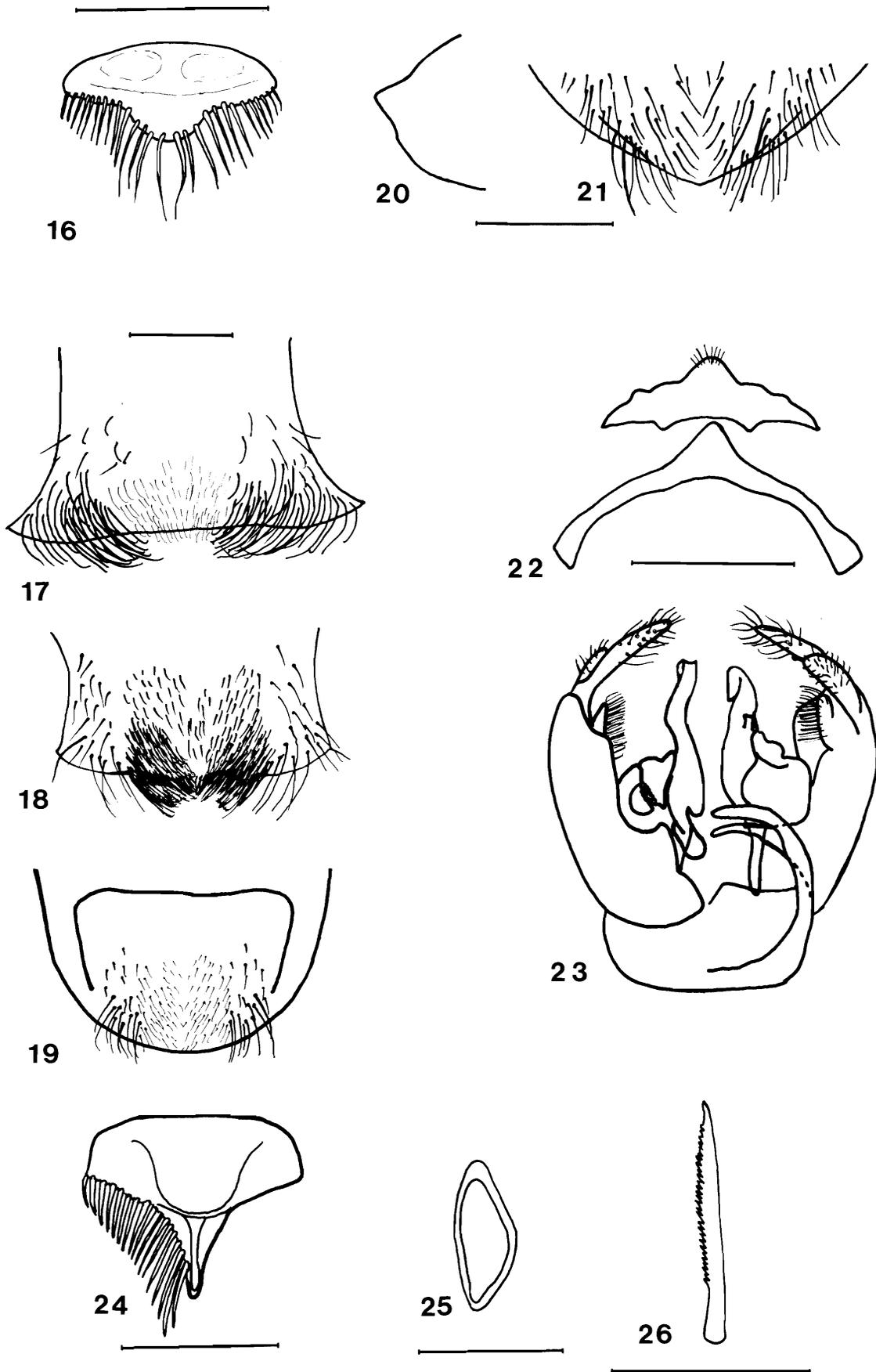
most of stigma and costal vein orange-brown; covered with minute hairs; first recurrent vein entering second submarginal cell near extreme apex, almost interstitial with second intercubital vein; marginal cell almost 4× as long as greatest width,

apex narrowly rounded against wing margin; stigma almost  $3\times$  as long as greatest width; 5 hamuli. (17) Tegula: golden brown; weakly, closely, and minutely punctate throughout, with microsculpture on anterior  $2/3$ . (18) Foreleg: all pubescence pale golden; coxa and trochanter with pubescence of varying length from less than 0.5 to 2 o.d., shorter pubescence denser on proximal region of trochanter; femur with most pubescence longer than 1 o.d.; tibia with mostly shorter pubescence anteriorly and posteriorly; basitarsus with dense pubescence anteriorly, 0.7 o.d., sparser longer pubescence elsewhere, 1 o.d. (19) Middle leg: as in foreleg. (20) Hind leg: as foreleg, dense, very pale golden pubescence on posterior surface of tibia and basitarsus; spurs 2.2 o.d.; femur  $4\times$  as long as greatest breadth; tibia  $5\times$  as long as greatest breadth; basitarsus  $5\times$  as long as greatest breadth, as long as remaining tarsomeres combined, broadly joined to second tarsomere but not fused; entire leg without unusual spurs or swellings. *Metasoma*: (21) Terga: brown, T1 and T2 with translucent areas, so that underlying internal structures give the following colouration: T1 orange-brown, yellow laterally, on apical  $1/3$  and on reflexed margins; T2 orange-brown in apical  $1/3$ , translucent yellow anterior to spiracle, brown elsewhere; petiolate, with T1 longer than wide, ratio 15:11; T1 gently convex in lateral view; metasoma widest at posterior margin of T3; T1 weakly microareolate, surface shiny, microsculpture stronger on remaining terga, dull with no distinct punctures; T1 with sparse pale brown erect pubescence 0.5–1.2 o.d.; remaining terga with sparse erect dark brown pubescence 1 o.d. among dense recumbent golden hairs 0.5 o.d.; T7 mostly convex, pygidial area short, flat, and obtusely pointed in dorsal view, weakly defined by setose carina along posterior margin of tergum, without glabrous area (Figs. 20 and 21). (22) Sterna (Figs. 17–19): apical margins of sterna 1–5 straight; S1 yellow with brown basiomedial patch, S2 golden brown, remaining sterna brown; S1 with sparse erect golden pubescence 1 o.d.; S2 with similar but longer pubescence 1.5 o.d. on apical half and with recumbent shorter denser pubescence along apical margin 0.7 o.d., glabrous on basal half; S3 similar to S2 but with pubescence on disc brown and longer 2 o.d., apical recumbent fringe of golden hairs denser and extensive, covering apical  $1/5$  of segment and longer, 1 o.d.; S4 with apical fringe of golden recurved hairs, longest  $1/4$  sternum width from lateral margin, directed medially, 2 o.d., shortest hairs medially 0.5 o.d., directed posteriorly; S5 with central circular area of very short medially directed pubescence, 0.3 o.d., posterolaterally becoming longer and darker to give an apical fringe with a V-shaped emarginate border with lateral hairs 2 o.d., innermost ones only 0.3 o.d.; S6 with convex apical margin; without apical fringe but with apicolateral patches of dark hairs 1.7 o.d., remaining pubescence progressively shorter towards glabrous midline, directed medially. (23) Terminalia (Figs. 22 and 23): S7 with a broadly triangular apical projection; S8 with basal apodemes either side of midline, posterior margin with weak lateral projections and broad semicircular median projection bearing short hairs; gonobase with posterior ventral margin entire, ventrally extensive, as long as gonocoxite, dorsal midline defined only weakly on anterior  $1/3$ ; gonocoxite with medial emargination defined anteriorly by a weakly acute, rounded projection, apex rounded in both dorsal and lateral views; gonostylus bifid with dorsal lobe weakly spatulate,  $1.5\times$  as long as greatest width, with hairs up to 0.7 o.d. in length; ventral lobe half as long as dorsal one, parallel-sided in basal half, rounded apically, with minute hairs; inner margin of

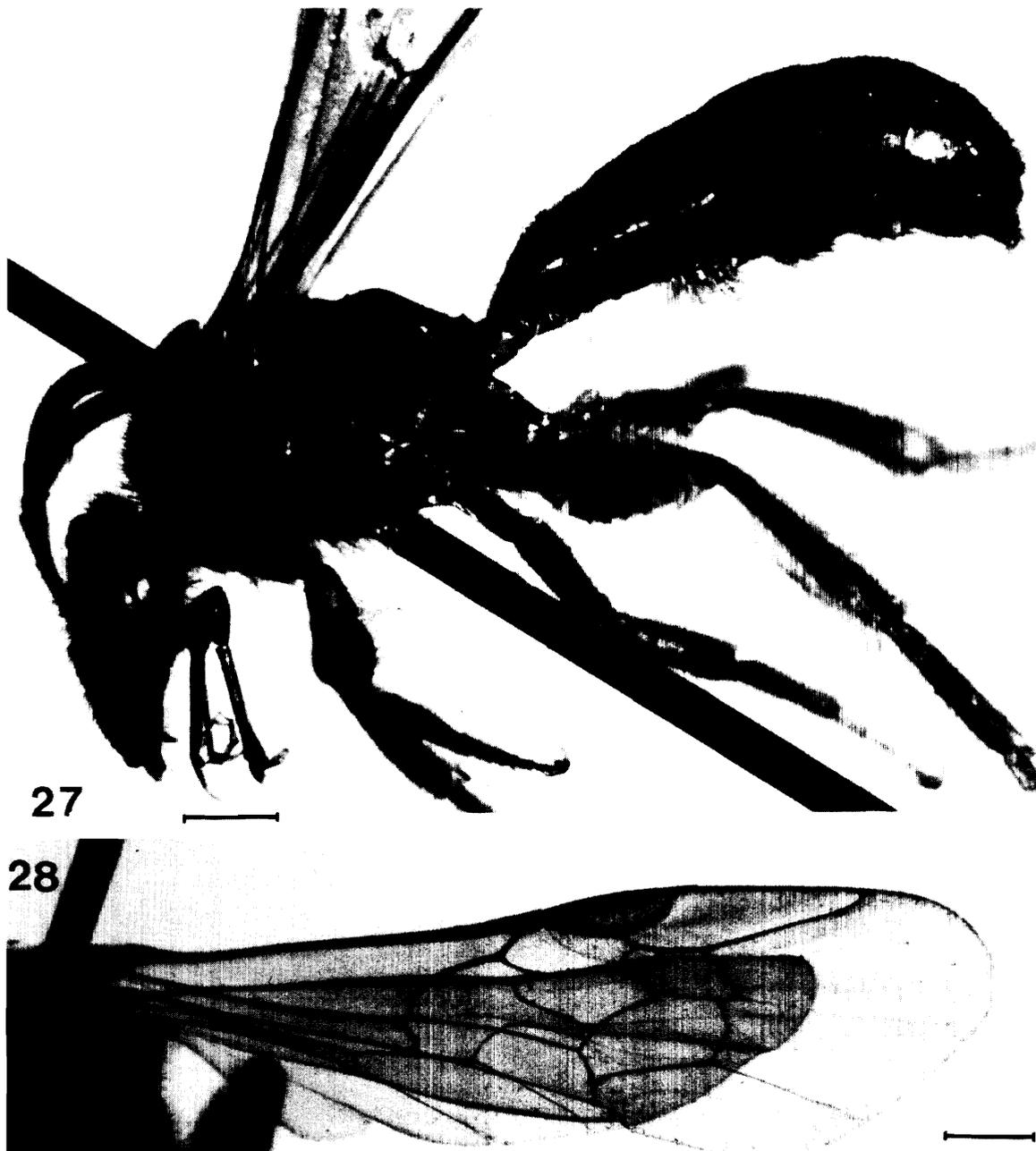
gonostylus with basal process 0.8 o.d. in length, with coarse, medially directed hairs, 0.5 o.d.; volsellae strongly curved at midpoint so that apical  $1/3$  points anteromedially; penis valves simple, inferior basal process flat, twice as long as basal width.

#### *Female* (Fig. 27)

Body length 11 mm, wing length 9.5 mm. Agrees with description of male except as follows: *Head* (Fig. 15): Round, ratio of length to breadth 74:75. (1) Labrum (Fig. 24): basal subrectangular area twice as broad as long, with basal elevation U-shaped in frontal view,  $0.6\times$  labral width at its widest point, apex of elevation extremely feebly emarginate in dorsal view; long, keeled apical projection  $1.6\times$  as long as basal width, bearing apical fimbria of golden setae 0.5 o.d. laterally, 1.2 o.d. medially. (2) Clypeus: as long as distance between anterior tentorial pits; line between lower eye margins crosses clypeus at midlength; with an apical transverse depression bearing row of long setae subapically, 1.5 o.d. laterally to 2 o.d. medially; pubescence of surface up to 2 o.d.; microsculpture more developed than in male, giving less shiny appearance; punctures more variable in size and often more elongate than in male, especially near apex. (3) Interocular area: punctures less dense than on clypeus, separated by twice puncture diameter; inner orbits concave, depth of concavity 0.9 o.d.; facial pubescence between 0.7 and 1.0 o.d. (5) Gena: much narrower than greatest breadth of eye, ratio 14:19; pubescence shortest just behind eye, 0.5 o.d., longer posteriorly, up to 2 o.d. (7) Mandible: with weak inner tooth. (8) Antenna: first three antennal segments wider than long, ratio 4:3. *Mesosoma*: (9) Pronotum: median sulcus weak, not extending onto sloping anterior surface; pubescence along dorsal ridge up to 1.5 o.d. (10) Mesonotum: without median sulcus anteriorly, although a differently sculptured median line present. (11) Mesoscutellum: microsculpture less strong than on mesoscutum, some hairs along posterior margin long, up to 2.5 o.d. (12) Metanotum: surface sculpture as on mesoscutum; pubescence long, up to 2.2 o.d. (13) Mesepisternum: surface smoother than in male, with pubescence longer, from 1.0 o.d. dorsally to 2.5 o.d. ventrally. (14) Metepisternum: with a few long hairs dorsally, 1.5 o.d., with minute hairs elsewhere. (15) Propodeum: dorsal surface  $7/8$  as long as scutellum,  $1.75\times$  as long as mesoscutellum,  $7/9$  as long as posterior surface. (16) Wings (Fig. 28): mostly colourless in allotype, with amber marginal and basal cells; first recurrent vein entering second submarginal cell near apex. (18) Foreleg: pubescence longer than in male, up to 2.5 o.d. on coxa, trochanter, and ventrally on femur; dorsal and posterior surfaces of femur with pubescence shorter than 1 o.d. (19) Middle leg: much as for foreleg but with patch of dense hairs basally up to 1 o.d. long. (20) Hind leg: with long dense scopal hairs extending onto anterior surface of coxa, tibia with spines set among pubescence dorsally 1 o.d., strongly developed apical basitibial brush; spurs 3 o.d.; basitibial plate acute, carinate on all sides,  $1/7$  length of tibia (Fig. 25); inner hind tibial spur serrate, just as outer spur, with over 25 teeth (Fig. 26). *Metasoma*: (21) Terga: brown with reflexed portions and apical  $1/3$  of T1 and T2 yellow; petiolate with T1 longer than wide, ratio 10:9; T1 with sparse dark-brown erect pubescence 0.5–1.5 o.d.; remaining terga with sparse erect dark-brown pubescence less than 1 o.d. among dense recumbent brown hairs 0.5 o.d. (22) Sterna: S1 yellow, S2 and S3 yellow basally, orange-brown apically, S4–S6 orange-brown; S2 with scopa of plumose hairs up to 3 o.d. long; S3–S5 with unbranched hairs up to 2.5 o.d.



FIGS. 16–26. Features of *Mexalictus polybioides*. Fig. 16. Male labrum. Figs. 17. Male sternum 4. Fig. 18. Male sternum 5. Fig. 19. Male sternum 6. Fig. 20. Male seventh gastral tergum in profile, with pubescence omitted. Fig. 21. Pygidial area of male. Fig. 22. Sterna 7 and 8 of male. Fig. 23. Genitalia of male, dorsal view on left, ventral view on right. Fig. 24. Labrum of female. Fig. 25. Basitibial plate of female. Fig. 26. Inner hind tibial spur of female. Scale bars = 0.5 mm.



Figs. 27 and 28. Female *Mexalictus polybioides*. Fig. 27. Habitus of female paratype. Fig. 28. Wing of female allotype. Scale bars = 1 mm.

**VARIATION:** The paratype differs from the allotype primarily in some colouration characteristics. The paratype is generally darker, lacks the pale apical band to T2, has S2–S6 dark red to brown, slightly darker legs than the allotype, with some dark hairs on the hind legs, and most of the wings suffused with dark yellow. The latter feature may be due to the greater age of this specimen (which has abraded wings and the mandibles worn down to the inner tooth).

#### Discussion

This species is clearly a member of the genus *Mexalictus*, with which it shares the following suite of characteristics in the male: short antenna; basal apodemes to S8; large, ventrally entire gonobase; anteromedially directed apex to the volsella and bifid gonostylus with basal–medial process. Of these characters, the short antennae, well-developed basal apodemes

to S8, and form of the volsella appear derived in relation to other genera of Halictini found in the New World, such as those of the *Agapostemon* group discussed above, *Halictus*, and the *Lasioglossum* group of genera. The plesiomorphic states for these characters are long antennae in the male, poorly developed or absent basal apodemes to S8, and a posteriorly directed apex to the volsella. The ventrally entire gonobase is probably plesiomorphic, and polarisation of the form of the gonostylus is an extremely complex task (see below). The females are similar to *Mexalictus* in the protruding epistomal lobe, structure of the labrum, strong outer wing veins, serrate inner hind tibial spur, acute basitibial plate, and absence of apical tergal hair bands. Although the presence of strong apical wing veins is clearly plesiomorphic, the polarity for the remaining characters is difficult to determine within the diverse tribe Halictini. Both sexes differ from *Mexalictus* in their nonmetallic

brown colouration, denser thoracic microsculpture, much larger size, broader head, and petiolate abdomen. The male genitalia are similar to those of the nominate subgenus except that the gonostyli are comparatively longer and narrower, the anterior margin of the medial excavation of the gonocoxite is acutely produced, the posterior margin of S7 is more acute, the margin of S8 is more strongly produced, and the pygidial area is shorter and less strongly concave and bears stronger setae throughout. The hind tibial spur of the female bears approximately twice as many serrations in *Georgealictus* as in *Mexalictus*. It is difficult to assess the polarity of most of these differences between the subgenera. However, the small body size and reduced surface microsculpture appear derived in the nominate subgenus in comparison with *Georgealictus* and other Halictini, such as the *Agapostemon* group, *Halictus*, and the *Lasioglossum* group of genera, bees that are generally larger with comparatively strong microsculpture. Thus, although it is superficially very distinctive, *Georgealictus* is morphologically very similar to *Mexalictus*, and is described here as a new subgenus which is a sister-group of the nominate subgenus.

Several genera of Halictini contain members that appear to be mimics of epiponine wasps. *Georgealictus* can be separated from mimetic *Lasioglossum* and *Evyllaenus* species by strong apical wing veins in the female and short antennae, genitalic characters, and sternal vestiture in the male. It differs from *Ptilocleptis* in the scopa of the female, absent in this cleptoparasitic genus (Michener 1978), and by the form of the propodeum in both sexes, which, in the parasite, has a short, distinctly longitudinally striate dorsal surface, the lateral and posterior surfaces being covered with dense, short, plumose pubescence. Epiponine mimics are also found among the Augochlorini (e.g., some species of *Neocorynura*), from which *Georgealictus* can be differentiated by the complete absence of metallic colouration and the usual morphological characteristics; Augochlorines lack a pygidial area and reflexed apical margin of T7 in males and possess a deeply cleft apical margin to tergum 5 in females.

*Mexalictus* is a member of the group of halictine genera with strong apical wing venation but which do not belong to the *Agapostemon* group (Roberts and Brooks 1987; Moure and Hurd 1987). The phylogenetic relationships among these strong-veined taxa and those with weakened venation (*Lasioglossum*, including its various controversial subgenera, and *Homalictus*) remain obscure. Many of the characteristics used to diagnose *Mexalictus* appear to be plesiomorphies; even the genitalic

characters are difficult to polarize. Nonetheless, it remains a readily identifiable taxon with an extremely limited geographic range, being found at high altitude from southern Arizona to northern Guatemala.

The basal inner process of the gonostylus is almost identical in both subgenera of *Mexalictus*. Eickwort (1978) referred to this structure as the parapenial lobe, and Michener (1978) noted its occurrence in cleptoparasitic genera of the *Sphecodes* group. Its position appears similar to that of the membranous appendage in various agapostemonine bees and the fleshy lobe found in some *Halictus* species, and it may be homologous with these structures. It is clear that the establishment of homology among the various gonostylar appendages will be important for the elucidation of halictine phylogeny at the generic level.

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