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Agapostemonine Bees of Mesoamerica (Hymenoptera: Halictidae)

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ABSTRACT

This work revises Mesoamerican genera and species of agapostemonine Halictini, excepting the recently revised *Agapostemon* and the largely South American *Caenohalictus* and *Habralictus*. An illustrated key and diagnoses are provided for all eight agapostemonine genera occurring from northern México to northern South America. The new monotypic genus, *Agapostemonoides*, is described. The monotypic genera *Rhinetula* and *Paragapostemon* are redescribed. *Dinagapostemon* is raised to generic rank. Cladistic relationships of the *Dinagapostemon* species and of its sister group *Paragapostemon* are analyzed. New species are: *Agapostemonoides hurdi*, *Dinagapostemon costaricensis*, *goneus*, *mentor*, *mexicanus*, *orestes*, and *uyacanoides*. New combinations include *D. sicheli*, *gigas*, and *uyacanus*. The following names are here recognized as new junior synonyms (valid names in brackets): *Rhinetula serraticornis* Friese [= *Dinagapostemon gigas* (Friese)]; *Agapostemon bruneri* Crawford and *Halictus* (*Paragapostemon*) *podager* Vachal [= *Paragapostemon coelestinus* (Westwood)]; *Rhinetula rufiventris* Friese [= *Rhinetula denticrus* Friese].

INTRODUCTION

This work is intended to contribute to knowledge of the bees of México as part of the *Programa Cooperativo sobre la Apifauna Mexicana* (PCAM). The chief purposes are: (1) description or redescription of Mesoamerican (northern México to eastern Panamá) genera and species; (2) determination of synonymies; (3) presentation of keys and illustrations to facilitate identification, and (4) indication of cladistic relationships of the *Dinagapostemon* species.

In recent years much progress has been made in elucidating taxonomic structure of the subfamily Halictinae. Michener (1978)

recognized the distinctive tribe Nomiodini from the Eastern Hemisphere. Eickwort (1969a, b) revised the tribe Augochlorini from the Western Hemisphere, recognizing it as distinct from the cosmopolitan Halictini. He informally recognized what he termed the "*Agapostemon* group" in the Halictini. We agree that agapostemonines are distinct from such American Halictini as *Halictus* s.l., *Lasioglossum* s.l., and *Sphecodes*. Unfortunately, we have been unable to find a character which consistently delimits agapostemonines from other Halictini. In the present study we treat agapostemonines as a distinct group but stopped short of according them status of a tribe.

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We include the following genera among agapostemonines: *Agapostemon* Guérin-Méneville (1844), *Agapostemonoides* new genus, *Caenohalictus* Cameron (1903), *Dinagapostemon* Moure and Hurd (1982), *Habralictus* Moure (1941), *Paragapostemon* Vachal (1903), *Pseudagapostemon* Schrottky (1909), *Rhinotula* Friese (1922), *Ruizantheda* Moure (1964).

South American agapostemonines are poorly known. We have seen a number of undescribed genera and are uncertain of the affinities of *Ruizanthedella* (Moure, 1964) and *Zikaniella* Moure (1941). Evaluation of these genera will have to await a study of South American agapostemonines.

Agapostemon and *Habralictus* are the only agapostemonines reported from islands of the Caribbean. The only Caribbean *Habralictus* species, *H. claviventris* (Ashmead), was described from St. Vincent in 1900. There are 17 Caribbean species of *Agapostemon*. An additional 21 species are known from Mesoamerica. *Agapostemon* has been revised by Roberts (1972) and is not treated in detail in the present study.

According to Michener (1979) and from Mesoamerican material we have studied, *Caenohalictus* has undescribed representatives in México and Costa Rica. *Habralictus metallicus* (Friese), *H. tradux* (Vachal) and *H. xanthinus* (Cockerell) are the only species of this genus described from Mesoamerica (Moure and Hurd, in press). Because the overwhelming majority of *Caenohalictus* and *Habralictus* species are South American (Alfken, 1932; Moure, 1941), we do not describe Mesoamerican representatives of these genera in the present study.

Many agapostemonine taxa are represented in collections by one or a very few specimens. Doubtless more taxa remain to be described. We hope that collectors will pay special attention to this group; they would do well to focus their efforts on elevations over 2,000 m and to look for females at dawn and dusk. *Rhinotula* is attracted to lights (Janzen, 1968), and light traps at high altitudes might attract *Dinagapostemon*. Little is known of the biology

of Mesoamerican agapostemonines. We hope that others will undertake such studies, particularly on details of communal nesting behavior.

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METHODS

For ease of comparison, descriptions of species follow the format and character numbering system used by Roberts (1972). These numbers do not correspond to the character numbers used in our cladistic analysis. The bees we studied are relatively rare in collections and existing descriptions are generally inadequate. We have therefore provided a detailed description of one species in each genus. Other species are described only insofar as they differ from this one species.

We have generally followed the morphological terminology of Michener (1944) except for the new terms (Fig. 1) of *subspiracular carina* (ventrolateral line of Eickwort, 1969b) on metasomal tergum 1 of all halictids, *apicolateral carina* on metasomal tergum 1 of most halictids and *lateral gradular carina* on terga of some halictids.

We depart from the usual terminology applied to the position of structures on legs and follow Roberts (1972). Michener (1978) and others refer to surfaces of legs of bees as "inner" and "outer." This system is morphologically inconsistent because the "inner" region of the posteriorly directed hind leg faces the body while the homologous area of the anteriorly directed foreleg faces outward. Other inconsistencies of the terms "inner" and "outer" become apparent when one considers that the femur and tibia on a single leg are oriented differently from one another. For the sake of morphological consistency, we prefer to think of legs as cylindrical lateral projections orthogonal

to a sagittal section of the bee, irrespective of their actual orientation. Thus, we can refer to homologous surfaces as dorsal, ventral, anterior or posterior. Outer and inner hind tibial spurs are, for example, anterior and posterior hind tibial spurs respectively.

Absolute size of various structures is not as important as proportional size. Thus, we have expressed length (unless otherwise indicated) of structures as proportions of easily measured (or estimated) features such as the median ocellar diameter (od). Thus an expression like "pubescence 4 od" means that the hairs are four times as long as the median ocellar diameter. We use the abbreviations S for sternum and T for tergum when referring to segments of the metasoma, e.g., S1 means the first sternum of the metasoma. We have abbreviated male and female as M and F in the data for each species. Abbreviations of names of depositories of specimens are indicated in the Acknowledgements.

CHARACTERIZATION OF AGAPOSTEMONINE BEES

We find no one character state which is both necessary and sufficient to separate *Agapostemon* and allied genera from members of the *Halictus/Lasioglossum* group. Thus, we recognize agapostemonines as a polythetic group of Halictini. Most agapostemonines are easily recognized by a combination of characters (Table 1). Some of these agapostemonine characteristics are behavioral (nest architecture and social organization) or ecological (distribution) and do not lend themselves to keys. As noted in the footnotes to Table 1, some non-agapostemonine Halictini possess certain characteristics of agapostemonines, and certain agapostemonine species are difficult to place because they lack some of the most distinctive features of the group.

CLADISTIC ANALYSIS

We think it premature to put forth a hypothesis on cladistic relationships of included taxa except for species of *Dinagapostemon* and *Paragapostemon*. The cladogram for those genera was made with aid of the computer program PAUP (Swofford, 1984). The rest of the nonparasitic Halictini (including other agapostemonine gen-

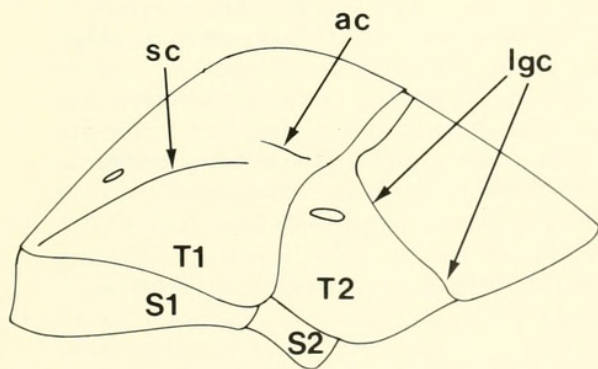


FIGURE 1. Side view of first two segments of metasoma of male *Rhinotula denticrus*. ac, apicolateral carina of T1; lgc, lateral gradular carina; sc, subspiracular carina [ventrolateral line of Eickwort (1969b)]; S, sternum; T, tergum.

era) with strong wing venation, including genera from both Eastern and Western Hemispheres, was considered as the outgroup using ordered, unweighted characters (i.e., 0 = primitive, 1 = derived, 2 or greater = more highly derived characters of a transformation series). Characters 12, 23, 25, etc., (see Fig. 2) were used in the analysis to establish the monophyly of the *Paragapostemon-Dinagapostemon* clade and to bring attention to those characters useful in assessing relationships among agapostemonine genera.

Table 2 is a list of 27 variables relevant to *Dinagapostemon* and *Paragapostemon*. Table 3 shows the raw data. Unique characters for taxa were apomorphies; none agreed with the outgroup, suggesting a plesiomorphy. A cladistic study of the whole agapostemonine group showed that *Dinagapostemon* and its sister group are among the most derived genera (Brooks, unpublished).

Dinagapostemon and *Paragapostemon* share nine apomorphies and each has four unique autapomorphies which distinguish the two genera (Fig. 2). Species of *Dinagapostemon* are quite distinct from one another except *D. mexicanus*, *sicheli*, *uyacanoides*, and *uyacanus*, all of which have a patch of long curved setae on the apicolateral margin of S5 (character 18) of males. This group of four species as well as *D. gigas* and *goneus* is further united by the hind tibia of males which possesses a basiventral tooth but is not swollen apically. *D. orestes* lacks five apomorphies present in other species of *Dinagapostemon*; these involve modifications of S4 and S7 and the membranous gonostylar appendage in males. Table 2 includes abbreviated notes on the distribution of variables of characters and the bases for our judgments of polarity (evolutionary direction).

TABLE 1. CHARACTERS OF AMERICAN GROUPS OF HALICTINAE.

CHARACTERS	AUGOCHLORINI	AGAPOSTEMONINES	OTHER HALICTINI
DISTRIBUTION	Western Hemisphere	Western Hemisphere	Cosmopolitan
DIVERSITY	warm	cool	Paleartic
MAXIMUM	Neotropics	Neotropics	
SOCIAL	solitary or	solitary or	solitary or
STRUCTURE	eusocial ¹	communal	eusocial ²
NEST	cells next to	cells far from	cells next to
ARCHITECTURE	main burrow, single or in clusters	main burrow, single or in series	main burrow single or in clusters ³
COLOR: HEAD AND THORAX	shiny metallic, rarely black	shiny metallic, rarely black	black, often weakly metallic ⁴
COLOR: MALE METASOMA	without yellow maculae	often with yellow maculae	without yellow maculae ⁵
MALE HIND TARSOMERES	basal pair articulated	basal pair usually fused	basal pair usually articulated
MALE SPICULUM	present	present in some	absent
MALE VENTRAL RETRORSE GENITALIC LOBE	absent	usually present	usually present
MALE PYGIDIAL PLATE	absent	present	present
FEMALE T5	slit	entire	entire

According to George C. Eickwort (pers. comm.) the following characters occur in certain atypical species of the groups indicated by the footnote numbers: 1, semisocial; 2, semisocial or communal; 3, far from gallery or cells in series; 4, shiny metallic; 5, with yellow maculae.

TABLE 2. VARIABLES USED IN CLADISTIC ANALYSIS OF *DINAGAPOSTEMON* AND *PARAGAPOSTEMON*. (Apomorphy stated first, plesiomorphy in brackets; characters marked with an asterisk establish monophyly of the *Paragapostemon-Dinagapostemon* clade and denote characters useful in studying the cladistic relationships of other agapostemonine bees.)

1. Malar area well developed, about half as long as wide. [Malar area more or less linear, much less than half as long as wide.] Lengthening of the malar area has occurred several times in Halictini and is an apomorphy. This character is variable in the agapostemonine genus *Caenohalictus*, some species of which have strongly developed malar areas.
2. Antennal flagellum of male modified, sinuate. [Antennal flagellum of male normal, linear.] This peculiar modification of the male antenna is an obviously unique autapomorphy.
- *3. Eyes with hair. [Eyes bare or with minute scattered hairs.] *Halictus* and its relatives have eyes bare or with minute scattered hairs; thus, hair on eyes is a derived feature. Most *Agapostemon* have presumably lost eye hair (Brooks, unpublished) but many, especially females, have short, scattered hairs on the eyes.
- *4. Propodeum in profile with horizontal basal zone short, about one third as long as declivous surface (1). Propodeum in profile entirely to almost entirely declivous (2). [Propodeum in profile with horizontal basal zone long, about half as long as declivous surface.] Primitive halictids as well as most short-tongued bees have the propodeum angulate in profile with distinct dorsal and declivous surfaces. The evolutionary trend has been toward the entire propodeum becoming declivous, losing the dorsal component.
- *5. Hind femur of male with one or more teeth. [Hind femur of male simple.] This attribute has arisen many times in the Halictidae and is obviously a derived feature but is variable in *Agapostemon*. Such teeth, swellings and ridges, quite probably used in gripping the female during copulation, are found on the femur, tibia and basitarsus but occurrence on one part of the leg is not necessarily correlated with occurrence elsewhere on the leg.
- *6. Hind femur of male greatly swollen. [Hind femur of male little swollen if at all.] For discussion see character 5.
7. Hind tibia of male with posteroventral basal tooth. [Hind tibia of male without posteroventral basal tooth.] For discussion see character 5.
8. Hind tibia of male swollen apically. [Hind tibia of male not swollen apically.] For discussion see character 5.
9. Posteroventral surface of hind tibia of male with well defined carina (Fig. 17j). [Posteroventral surface of hind tibia of male without well defined carina.] This apomorphy occurs in *Dinagapostemon* but has arisen independently in some *Agapostemon*.
- *10. First and second hind tarsomeres swollen and with one or two sharp to blunt teeth. [First and second hind tarsomeres normal, slender and without teeth.] An obvious unique apomorphy uniting *Dinagapostemon* and *Paragapostemon*.
- *11. Posterior hind tibial spur of female with six or more large spatulate teeth. [Posterior hind tibial spur of female with three to five large spatulate teeth.] Polarity is based on other strong-veined halictines; those with large teeth have few such teeth.
- *12. Stigma moderate in size such that ratio of stigmal length to distance from apex of stigma to apex of marginal cell is 0.6-0.8 (1). Stigma small, such that the above ratio is about 0.5 (2). [Stigma large, such that the above ratio is larger than 0.8.] Among bees there has been an evolutionary trend toward shortening the stigma as well as the marginal cell. Since marginal cell length is practically unchanged among agapostemonine bees, stigmal length presumably reflects this apomorphic change evident by a smaller ratio. It should be noted that this trend may only reflect an increase in body size, since small-bodied bees have relatively large stigmas and large-bodied bees have relatively small ones (Danforth, 1987).
13. T2-T4 with well developed lateral gradular carinae. [T2-T4 without or with very weak lateral gradular carinae.] Well developed lateral gradular carinae are found in *Paragapostemon* and *Rhinotula* but are lacking in most other genera and the outgroup.
14. S4 of male apicoventrally bent. [S4 of male flat.] This derived character is found in all *Dinagapostemon* except *D. orestes*. In most Halictinae S4 of males is flat like S3.
15. Apical margin of S4 of male with large spines. [Apical margin without large spines.] This apomorphy has arisen repeatedly in Halictini but among agapostemonines is limited to most *Dinagapostemon*.
16. Subapical margin of S4 of male with large spines. [Subapical margin without large spines.] See discussion for character 15.
17. Apical margin of S5 of male distinctly emarginate. [Apical margin of S5 of male entire or nearly so.] We are not certain as to polarity of this character but most members of the outgroup have the apical margin of S5 entire.

18. Apicolateral margin of S5 of male with a patch of long curved setae. [Apicolateral margin of S5 of male simple, without a patch of long curved setae.] This character apparently has arisen many times since it is not uncommon among relatives of *Halictus* but most members of the outgroup lack such setae.
19. Medioapical lobe of S7 of male with much long branched hair. [Medioapical lobe of S7 of male, if present, without hair or with a few small simple hairs.] Most Halictini have little or no hair on the medioapical lobe of S7. Among agapostemonine bees almost all *Dinagapostemon* have the apomorphy.
20. Apex of S8 of male with two acute projections separated by an emargination. [Apex of S8 of male with two or three blunt lobes.] This apomorphy, not found in *Halictus* or its relatives, occurs in *Caenohalictus*.
21. S8 of male with spiculum. [S8 of male without spiculum.] One of the diagnostic characters of Halictini is the general loss of the spiculum, but it has presumably been regained apomorphically in five genera of agapostemonine bees.
22. Apex of S8 of male broad and trilobed, with an acute median lobe and blunt lateral lobes. [Apex of S8 of male narrow, entire or bilobed.] This unique apomorphy is characteristic of *Paragapostemon*.
23. Gonostylus of male with elongate membranous appendage. [Gonostylus without elongate membranous appendage.] An elongate membranous gonostylar appendage is an apomorphy not seen in *Halictus* or its relatives.
24. Elongate membranous appendage of gonostylus of male with one serrate edge. [Elongate membranous appendage, if present, simple.] See discussion for 23.
- *25. Male genitalia with ventral retrorse lobe. [Male genitalia without ventral retrorse lobe.] We are uncertain as to the polarity of this character. The ventral retrorse lobe is found in some members of the outgroup but may be an apomorphy among agapostemonines.
26. Gonocoxite with striae. [Gonocoxite without striae.] A striate gonocoxite is unusual (although *Sphecodes* and some species of *Halictus* have the striations) and is probably an apomorphy which many agapostemonines possess, though we are not completely certain.
27. S5 of male with V shaped patch of hair apicomediaally. [S5 of male simple.] This apomorphy is unique to *D. mentor*.

TABLE 3. DATA USED IN CLADISTIC ANALYSIS OF *PARAGAPOSTEMON* AND *DINAGAPOSTEMON*.

VARIABLE NO.- (see Table 2)	1	2	3	4	5	6	7	8	9	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
<i>Paragapostemon</i>	1	0	1	1	1	1	0	1	0	1	1	1	1	0	0	0	0	0	0	1	1	1	0	1	0	0
<i>D. sicheli</i>	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0
<i>D. uyacanus</i>	0	1	1	1	1	1	1	0	1	1	?	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0
<i>D. mexicanus</i>	0	1	1	1	1	1	1	0	1	1	?	1	0	1	1	1	1	1	0	0	0	1	1	1	1	0
<i>D. uyacanoides</i>	0	1	1	1	1	1	1	0	1	1	?	1	0	1	1	1	1	1	0	1	0	0	1	1	1	0
<i>D. orestes</i>	0	1	1	1	1	1	0	1	1	1	?	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0
<i>D. gigas</i>	0	1	1	1	1	1	1	0	1	1	?	1	0	1	1	0	1	0	1	0	0	0	1	1	1	0
<i>D. mentor</i>	0	1	1	1	1	1	0	1	1	1	?	1	0	1	1	1	1	0	1	0	0	0	1	1	1	1
<i>D. goneus</i>	0	1	1	1	1	1	1	0	1	1	?	1	0	1	1	1	1	0	1	0	0	0	1	1	1	0

NOTE: Missing data are indicated by “?”.

KEY TO AGAPOSTEMONINE
GENERA OF MESOAMERICA

1. Females: 12 antennal segments;
hind leg with scopa 2
- Males: 13 antennal segments; hind
leg lacking scopa 8
- 2(1). Eye clothed with erect hairs at least

— half as long as diameter of median
ocellus 3

— Eye glabrous or with minute hairs
much less than half as long as
diameter of median ocellus . . . 7

— T1 with apicolateral carina (Fig.
1); T2-T4 with lateral gradular
carinae (Figs. 1, 7f); metasoma
lacking metallic coloration.

— *Rhinetula*

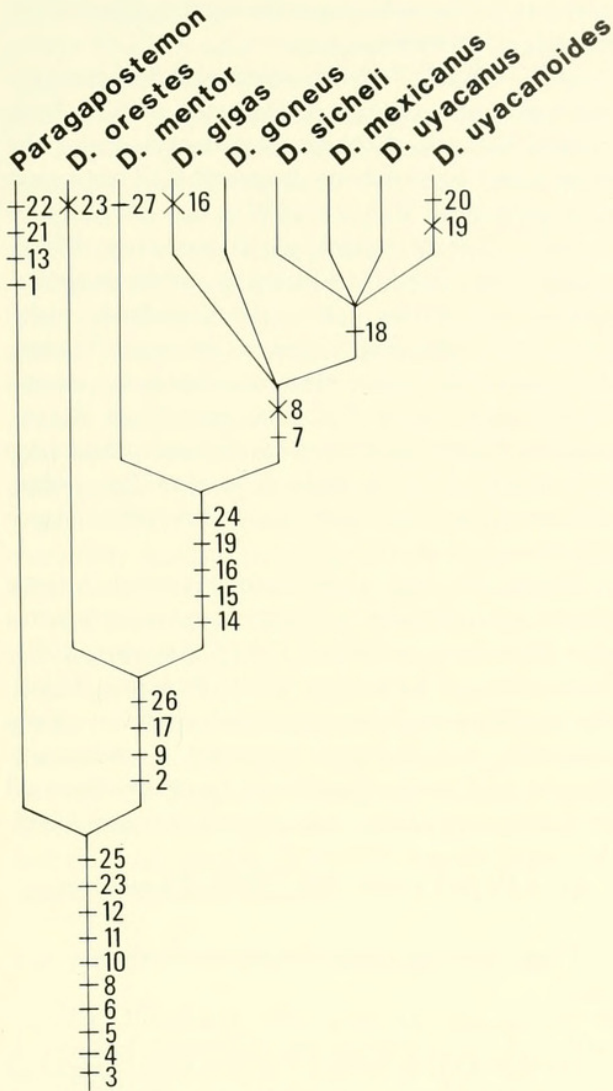


FIGURE 2. Cladogram of *Paragapostemon* and *Dinagapostemon*; bars indicate apomorphies, crosses indicate reversals.

- T1 without apicolateral carina; T2-T4 without lateral gradular carinae or, if carinae present, then metasoma brilliant metallic blue to green 4
- 4(3'). Hairs on eye subequal to ocellar radius; T2-T4 lacking metallic coloration and with distinct yellow bands *Agapostemonoides*
- Hairs on eye subequal to ocellar diameter; metasomal terga usually with metallic coloration basally and lacking distinct yellow bands . . . 5
- 5(4'). Posterior hind tibial spur with 3 teeth; propodeum glabrous dorsally and about twice as long as metanotum when viewed from above *Caenohalictus*

- Posterior hind tibial spur with 6-11 teeth; propodeum hairy dorsally (except for triangle) and subequal in length to metanotum when viewed from above. 6
- 6(5'). Metasomal terga brilliant metallic blue or green; T2-T4 with distinct lateral gradular carinae (as in *Rhinotula*, Fig. 7f) *Paragapostemon*
- Metasomal terga with metallic coloration absent or reduced to inconspicuous basal bands; terga without lateral gradular carinae *Dinagapostemon*
- 7(2'). Posterior surface of propodeum enclosed by distinct carina; body length at least 7 mm; metasomal terga metallic or black to amber, rarely with yellow bands *Agapostemon*
- Posterior surface of propodeum without distinct marginal carina; body length at most 6 mm; metasoma black to brown, commonly with distinct yellow maculae or bands, never metallic *Habralictus*
- 8(1'). Eye clothed with erect hair at least half as long as diameter of median ocellus 9
- Eye glabrous or with minute hair much less than half as long as diameter of median ocellus . . . 13
- 9(8). T2-T4 with lateral gradular carinae (as in Figs. 1, 7f) 10
- Metasomal terga without lateral gradular carinae 11
- 10(9). Metasoma brilliant metallic green or blue dorsally; propodeum in side view angulate with distinct dorsal and posterior surfaces *Paragapostemon*
- Metasoma without metallic coloration; propodeum in side view declivous without distinct dorsal surface. *Rhinotula*
- 11(9'). Hind tarsomeres 1 and 2 fused; propodeum hairy dorsally (except for propodeal triangle) and shorter than metanotum when viewed from above; clypeus yellow on lower 0.75 12

- Hind tarsomeres 1 and 2 articulated, free; propodeum glabrous dorsally and nearly twice as long as metanotum when viewed from above; clypeus with yellow restricted to lower margin
 *Caenohalictus*
- 12(11). T2, T3, and/or T4 with basal or basilateral yellow maculae; hind femur not swollen and lacking posteroventral tooth (Fig. 15e)
 *Agapostemonoides*
- Metasomal terga without yellow maculae; hind femur swollen and with posteroventral tooth (Figs. 15a-d) *Dinagapostemon*
- 13(8'). Metasoma normal, length to apical breadth of T1 is about 0.9, with yellow bands on black to amber terga or, if yellow bands absent, then hind femur swollen, its length to breadth about 1.5; body length at least 6.6 mm *Agapostemon*
- Metasoma very slender, length to apical breadth of T1 is about 1.9, terga brown, commonly without yellow bands; hind femur slender, its length to breadth about 3.7; body length at most 5.2 mm
 *Habralictus*

AGAPOSTEMON Guérin-Ménéville

Agapostemon Guérin-Ménéville, 1844, p. 448.
Type species: *Apis (Andrena) femoralis* Guérin-Ménéville, 1844 (= *Apis viridula* Fabricius, 1793). Monobasic.

DIAGNOSIS: Female head and thorax metallic green and metasoma black, metallic green or amber, or rarely body all black; male head and thorax metallic green and metasomal terga basally yellow, apically black, brown or amber or rarely body all black; eye glabrous or with minute hair much less than 1.0 od; legs of male yellow with some metallic green maculae, rarely all black, hind femur and tibia swollen or slender; hind tarsomeres 1 and 2 of male fused; propodeum with dorsal surface about one-half length of declivous surface; declivous surface enclosed by sharply defined carina; T2-T4 without lateral gradular carinae; T1 of male micro-

areolate below subspiracular carina; gonocoxite usually with striae.

DISCUSSION: Most widespread of the agapostemonine genera, *Agapostemon* ranges from central Canada through Mesoamerica and the Caribbean to northern Argentina. This genus was revised by Roberts (1972) and includes 43 species. Fifteen species are known from Mesoamerica: *A. angelicus* Cockerell, *ascius* Roberts, *atrocaeruleus* Friese, *cockerelli* Crawford, *erebus* Roberts, *intermedius* Roberts, *leunculus* Vachal, *melliventris* Cresson, *mexicanus* Roberts, *nasutus* Smith, *peninsularis* Roberts, *rhopalocera* Smith, *splendens* (Lepeletier), *texanus* Cresson, and *tyleri* Cockerell. Of these, only *A. atrocaeruleus*, *erebus*, *mexicanus*, and *rhopalocera* are restricted to Mesoamerica.

Nesting biology of this genus is better known than that of other agapostemonines (Abrams and Eickwort, 1980 and 1981; Eickwort, 1981; Eickwort and Eickwort, 1969; Roberts, 1969). Both solitary and communal behavior have been reported, but eusocial behavior is unknown. Insofar as known, species of *Agapostemon* are all polylectic and their scopae are unspecialized.

AGAPOSTEMONOIDES New Genus

Type species: *Agapostemonoides hurdi* new species.

DIAGNOSIS: About 7-8 mm long; head and thorax metallic green, metasoma of male black with terga basally yellow, metasoma of female with terga dimorphic, either T1 black, T2-T5 on basal third yellow and apical two-thirds amber and T6 amber or T1 all black or with two yellow spots and T2-T5 on basal third yellow and apical two-thirds black and T6 black; malar space linear; hair on eye short, less than 1.0 od; legs of male black, hind basitarsus with tooth, hind tarsomeres 1 and 2 fused; propodeum with distinct dorsal surface about half length of declivous surface; declivous surface enclosed by well defined carina; T2-T4 without lateral gradular carinae, lateral area below subspiracular carina on T1 of male mirror-like, without microsculpturing; S4 of male with six appressed, anteriorly directed, mediosubapical setae; gonocoxite with striae; apex of S8 of male narrowed and weakly trilobed.

DISCUSSION: This monotypic genus is probably closest to *Agapostemon*. Little is known of its habits. Drs. David Roubik, George Eickwort, and RWB have collected females on floral spikes of *Piper* (Piperaceae). Pollen grains of *Piper* are unusually small and, like other bees

which utilize *Piper* as a pollen source (Roberts, 1971; Roberts and Vallespir, 1978), females of *Agapostemonoides* have very slender, highly branched scopal hairs on the hind femora, trochanters and metasomal sterna. We suspect that this bee is oligolectic on *Piper* and most common in moist forests at low to intermediate elevations where these plants abound.

There are two distinct female color phases with no intermediates. The metasoma may be either black with yellow maculae, as in the holotype, or amber with yellow maculae. The phases are sympatric and often collected together. We are unable to find any morphological differences among females or males. Thus, we regard this as intraspecific variation. Similar variation occurs in some *Agapostemon* species (Roberts, 1972) and other agapostemonines.

The seemingly disjunct distribution of this species (Costa Rica and Panamá vs Perú and Bolivia) may not be real. The moist eastern slopes of the mountains between Panamá and Bolivia have not been well collected. We were not able to find any significant morphological differences between the male collected in Bolivia, the female from Perú and those collected in Central America.

Agapostemonoides hurdi new species

ETYMOLOGY: We dedicate this species to a devoted student of the Apoidea, the late Paul D. Hurd, Jr.

TYPES: Male holotype (KU) from PANAMÁ, COLÓN PROV.: Pipeline Road, km 8 near Gamboa (Canal Zone), 28 March 1981, on *Piper*, R. W. Brooks. Female allotype and 1F paratype labeled as holotype but 2 May 1981 (RWB). Additional paratypes, all from PANAMÁ: COLÓN PROV.: 30 km SE of Colón (Santa Rita Ridge), 13 May 1981, on *Psychotria*, R. W. Brooks, 1F, 2M (RWB); Parque Nacional Soberanía, Pipeline Road, N of Gamboa, 9 Oct. 1981, D. Roubik, 5F (STRI); same data except collected at km 8 (type locality), on 8 Oct. 1982, collection no. 114, (1F STRI, 2F KU); same data but no host plant, 8 Dec. 1980 between 1000-1200 h, 2F (STRI); same data but no host plant, 11 Feb. 1982, collection no. 112, 1F (STRI); same data but collected 6 Apr. 1981, on *Piper*, R. W. Brooks, 1M (RWB); same data but no host plant, collected at km 13, 13-25 Aug. 1979, 2F (STRI); same data but collected 12 Sept. 1980, on *Piper*, 4F (STRI). PANAMÁ PROV.: Cerro Campana, near Capira, 12 Apr. 1980, D. Roubik (2M KU, 5M STRI); same data but collected 7 Sept. 1981, collection no. 3, 1F (STRI); same data but collected at 1000 m, 7 May 1981, on *Clethra lanata*, 7M (RWB). SAN BLAS PROV.: 1.3 km W of Mulatupo Sasardí, 10

Sept. 1981, collection no. 9, D. Roubik, 1F (STRI).

ADDITIONAL SPECIMENS: *BOLIVIA:* DPTO. SANTA CRUZ: 5 km W of Buena Vista, 400 m, 18 Feb. 1976, R. B. Roberts, 1M (REM). *COSTA RICA:* CARTAGO PROV.: Turrialba, 600 m, 17 July-29 Aug. 1965, G. C. and K. Eickwort, 1M and 4F (CU); same data except 12 Sept. 1964, R. B. and G. Roberts, 4M (REM). SAN JOSÉ PROV.: Santiago de Puriscal, 1000 m, C. D. Michener, 4M (KU). *PERÚ:* HUÁNUCO PROV.: Huánuco Dpto.: Tingo María, Dec. 1949, H. A. Allard, 1F (USNM).

DESCRIPTION: *MALE* (Figs. 3i, 4a, 6a, 10a, 14a, 15e, 17k, 18a, 19a-b). General color of head and thorax bright metallic green with yellow on clypeus, labrum and mandibles, metasoma brownish black with yellow bands, length about 7 mm. **HEAD** (Figs. 4a, 6a): Pubescence white on gena and around antennal sockets, amber to brown elsewhere. (1) Labrum: Yellow basally, becoming transparent amber distally; distal margin with fimbria of golden hairs 0.8 od. (2) Clypeus: Yellow on lower 0.4, metallic above; large punctures separated by several times their diameters; pubescence 0.8 od centrally, becoming longer (1.8 od) peripherally. (3) Interocular area: Flat above antennal sockets and with distinct supraclypeal bulge below antennal sockets; punctures minute and contiguous above antennal sockets, becoming coarser below; pubescence erect, nearly as long as scape medially, becoming short laterally and ventrally. (4) Vertex: Metallic; ocellar separation 0.4 od, lateral ocellus 1.7 od from eye, surface between eye and lateral ocellus concave, region behind ocelli gently convex and bordered posteriorly by preoccipital carina; minute contiguous punctures anteriorly and laterally, becoming rugose posteriorly; pubescence 1.3 od. (5) Gena: Metallic; area behind eye slightly concave; weakly striate; hypostomal carina 3.3 times as long as width of proboscis fossa; pubescence 3.5 od posteromedially, becoming shorter anteriorly and laterally. (6) Malar area: Amber; 0.2 od between eye and mandibular base. (7) Mandible: Yellow with apical third transparent reddish brown; without tooth or ridges; sparse golden hairs 2.5 od proximally, becoming shorter distally. (8) Antenna (Fig. 3i): Scape, pedicel and dorsum of flagellum piceous, flagellum amber ventrally. **THORAX:** Metallic green; pubescence amber dorsally, becoming creamy laterally, posteriorly and ventrally. (9) Pronotum: Lateral angle prominent but lacking sharp edge anteriorly, posterior lobe rounded; minutely rugose; pubescence 2.0 od on posterior lobe, becoming short ventrally and anteriorly. (10) Mesoscutum: Anterior margin abruptly declivous; uniformly covered with deep, contiguous punc-

tures; pubescence 0.8 od, uniformly distributed. (11) Mesoscutellum: Punctures like those on mesoscutum but slightly coarser and with small, shiny, impunctate area near midline; pubescence 2.5 od centrally. (12) Metanotum: Coarsely rugose; pubescence like that of mesoscutellum. (13) Mesepisternum: Rugose anteroventrally, becoming contiguously punctate posterodorsally; pubescence 1.4 od. (14) Metepisternum: Finely rugose; pubescence 1.5 od. (15) Propodeum: Punctate anteriorly, becoming coarsely rugose posteriorly and dorsally, posterior surface enclosed by prominent carina, large medial groove on posterior surface nearly reaching carina dorsally; pubescence 0.7 od laterally, becoming 1.6 od posteromedially. (16) Wings: Clothed with minute, brown hairs about as long as diameter of adjacent veins distally, becoming longer (0.4 od) proximally, veins and stigma dark brown, 7-9 hamuli on hind wing. (17) Tegula: Transparent brown, often metallic anteromedially; covered with small appressed hairs anteriorly, glabrous posteriorly. (18) Fore-

leg: Coxa metallic laterally; pubescence 2.2 od. Trochanter dark amber; pubescence 2.0 od dorsolaterally, shorter anteroventrally. Femur amber; pubescence branched and 1.6 od posteroventrally, simple and 0.9 od anterodorsally, glabrous anteroventrally and posterodorsally. Tibia yellowish amber anteriorly, becoming dark amber to black posteriorly; pubescence simple, 1.9 od anteriorly, 0.4 od posteriorly, short elsewhere; strigilis with transparent velum and yellowish amber malus 2.0 od long. Tarsus yellowish amber; basitarsus 0.8 as long as tarsomeres 2-5 together; covered with bristles 0.6-1.4 od. (19) Middle leg: Similar to foreleg but coxa nonmetallic. Tibial spur 1.5 od long and basitarsus 1.1 times as long as tibia. (20) Hind leg (Figs. 15e, 17k): Color and pubescence similar to those of foreleg. Femur with posteroventral tooth. Tibia with anterior spur 2.2 od and posterior spur 2.7 od. Tarsus with fused tarsomeres 1 + 2 1.4 times as long as tarsomeres 3-5 together. METASOMA: (21) Terga: Brown to black with yellow bands or markings basally on

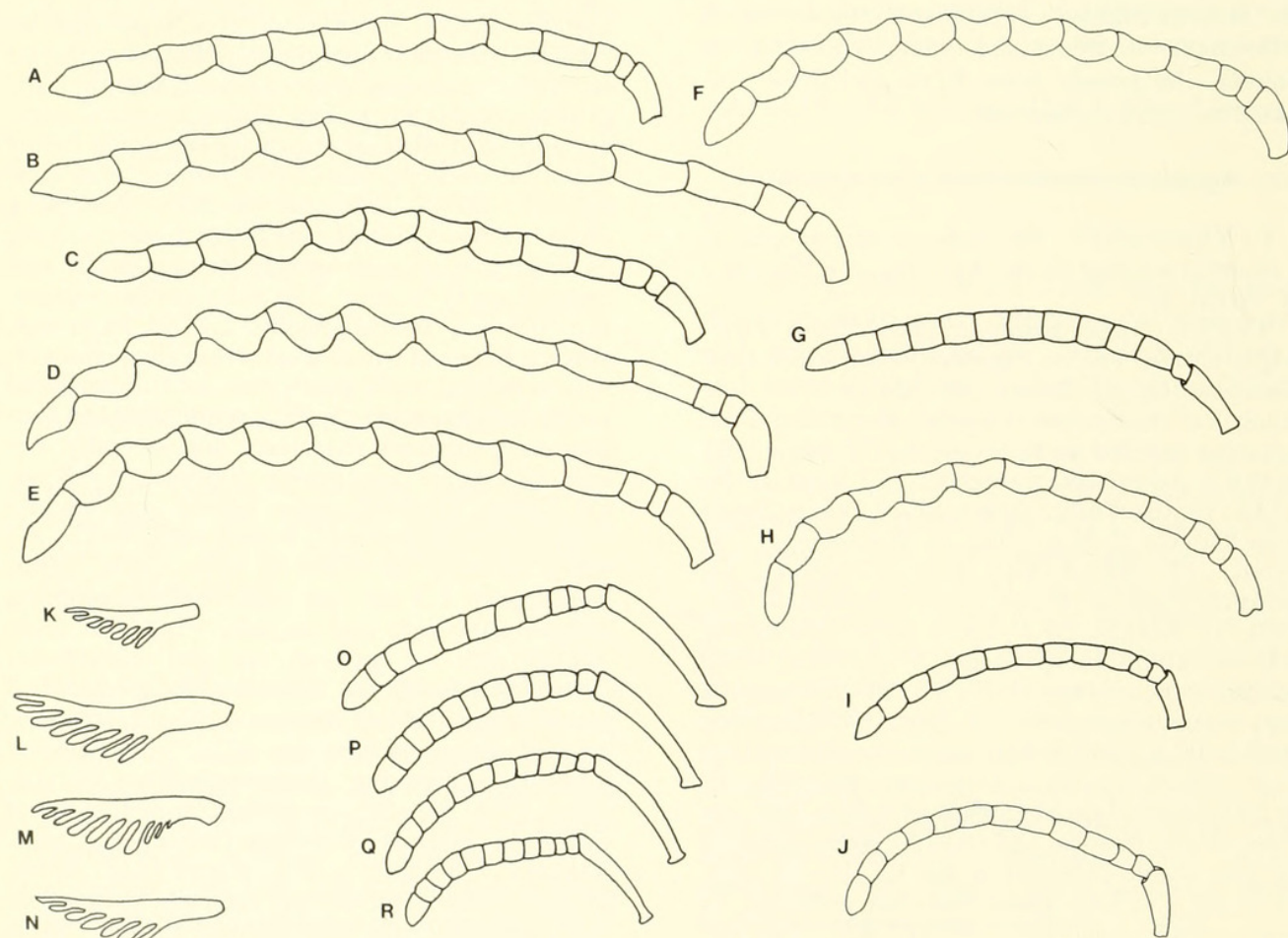


FIGURE 3. A-K, male antennae; L-O, female posterior hind tibial spurs; P-S, female antennae. A, *Dinagapostemon gigas*; B, *D. mentor*; C, *D. mexicanus*; D, *D. orestes*; E, *D. uyacanus*; F, *D. sicheli*; G, *Paragapostemon coelestinus*; H, *Dinagapostemon goneus*; I, *Agapostemonoides hurdi*; J, *Rhinotula denticrus*; K, *Agapostemonoides hurdi*; L, *Dinagapostemon sicheli*; M, *Paragapostemon coelestinus*; N, *Rhinotula denticrus*; O, *Dinagapostemon sicheli*; P, *Paragapostemon coelestinus*; Q, *Rhinotula denticrus*; R, *Agapostemonoides hurdi*.

T2-T3, T2-T4 or T2-T5. T1 with large deep punctures separated by about their diameter on all but posterior margin, punctures progressively smaller on subsequent terga, pygidial plate with rounded margin (Fig. 14a); pubescence 1.2 od and white anteriorly on T1, be-

coming 2.0 od and brown on T6. (22) Sterna (Fig. 10a): Amber with short, white, appressed pubescence. S4 with 4-5 small, appressed, anteriorly directed spines centrally (difficult to see). S7 and S8 (Fig. 18a). (23) Genitalia (Figs. 19a-b).

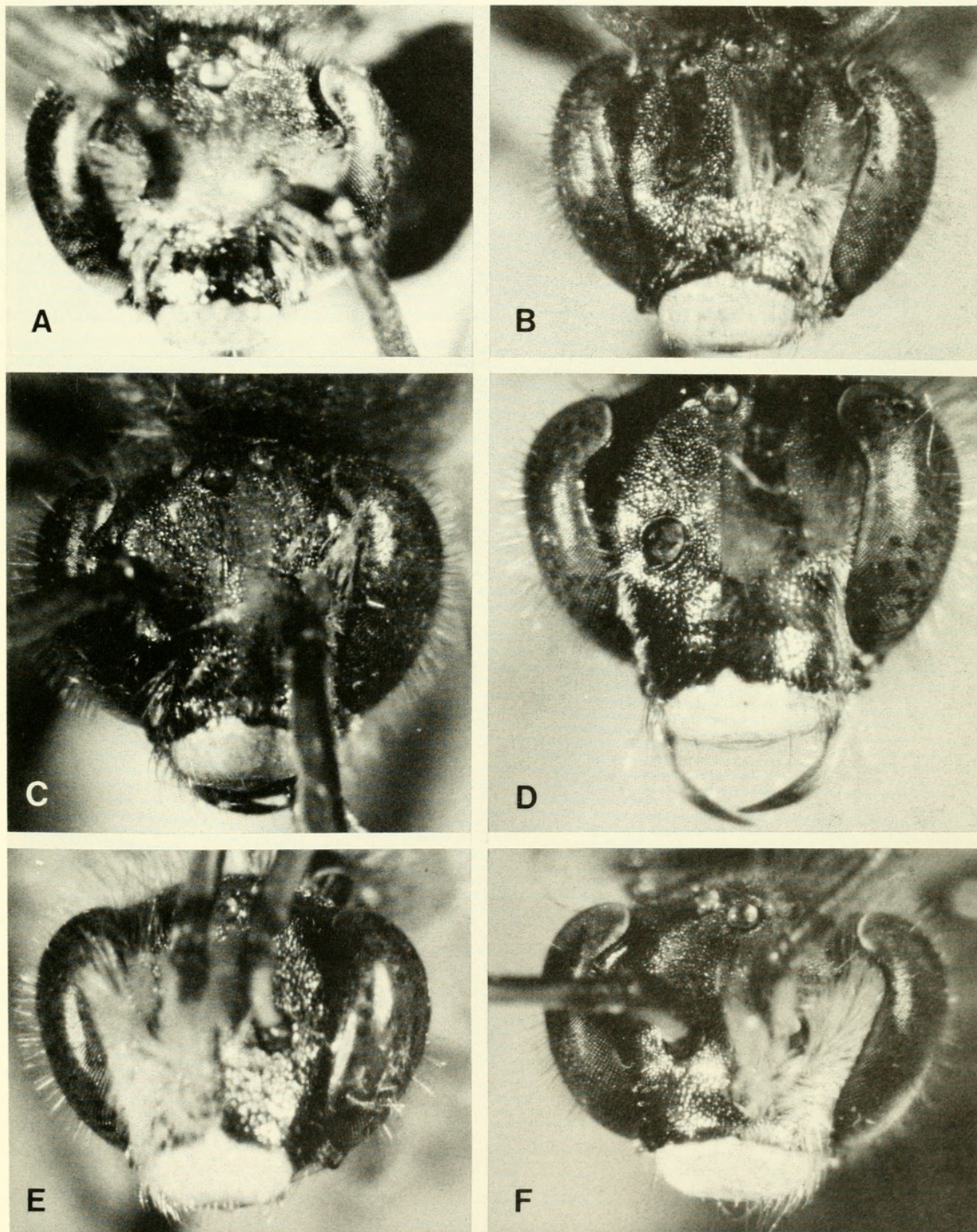


FIGURE 4. Male heads in front view. **A**, *Agapostemonoides hurdi*; **B**, *Dinagapostemon goneus*, holotype; **C**, *D. gigas*, lectotype; **D**, *D. mentor*, holotype; **E**, *D. mexicanus*, holotype; **F**, *D. orestes*, holotype.

FEMALE (Figs. 3k, r, 5f, 9a, 13a-b). Unless otherwise described, female like male. General color of head and thorax metallic greenish black, metasoma black or brownish yellow with yellow bands basally on T2-T4 or T2-T5, pubescence brownish black, length about 8 mm. **HEAD** (Figs. 5f, 9a): Pubescence white on gena and around antennal sockets, brownish black elsewhere. (1) Labrum: Dark amber; basal area prominent, convex and rough medially, becoming concave and smooth anterolaterally, margin flanged; distal process with distal, median keel, conspicuous lateral projection and marginal fimbria of amber upturned bristles. (2) Clypeus: Black with metallic tints on dorsal and lateral margins, coarsely punctate; pubescence scattered, 0.5-3.3 od, fimbria of bristles bent ventrad (2.4 od) between lateral teeth on distal margin. (3) Interocular area: Finely rugose; pubescence 1.0 od between antennal sockets, longer (3.4 od) laterally. (4) Vertex: Ocellar separation 0.8 od, lateral ocellus 2.4 od from eye. (5) Gena: Area behind eye convex; finely striate; hypostomal carina 1.4 times as long as proboscis fossa; pubescence 1.7 od postero-medially, becoming shorter anteriorly and laterally. (7) Mandible: Amber; with subapical tooth; sparse, brown hair 3.9 od proximally, becoming shorter distally. (8) Antenna (Fig. 3r): Piceous, becoming amber on underside and apex of flagellum. **THORAX**: (11) Mesoscutellum: Punctures finer than those of mesoscutum, without shiny impunctate areas. (14) Metepisternum: Fine horizontal rugae. (16) Wings: 8-11 hamuli on hind wing. (18-20) Legs: Brown to black; pubescence typical of female Halictinae but with comb of close set black bristles 1.4 od on posterior margin of fore tarsus and with scopal hairs very finely branched and present on fore and mid trochanters in addition to usual location on hind leg; posterior spur on hind tibia with 5-6 flattened teeth (Fig. 3k). **METASOMA**: (21) Terga: With yellow bands basally on T2-T4 or T2-T5, background brownish yellow or black (Figs. 13a-b); surface impunctate but dull and nonreflective; pubescence short (1.4 od) and pale anteriorly on T1, short black bristles laterally on all terga and in transverse band on subapical third on T3-T5 though often interrupted medially on T3 and T4, bristles long (2.9 od) in vicinity of amber or black prepygidium. (22) Sterna: Amber with

moderately dense, branched hairs forming secondary scopa.

CAENOHALICTUS Cameron

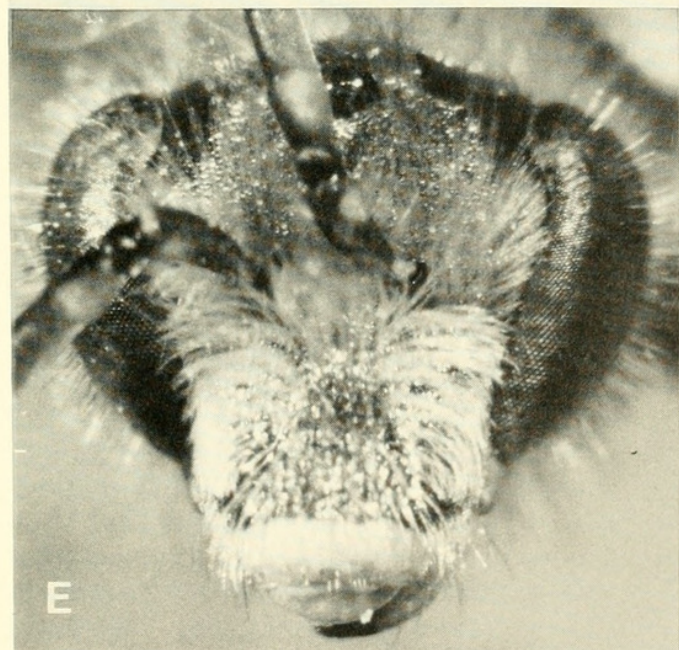
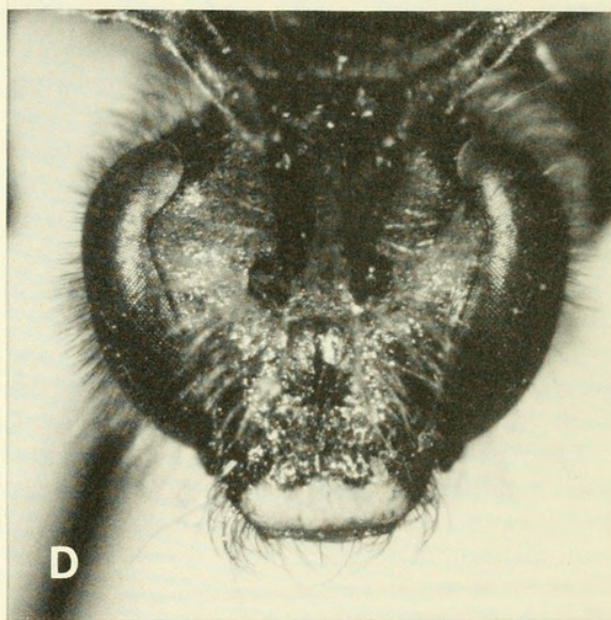
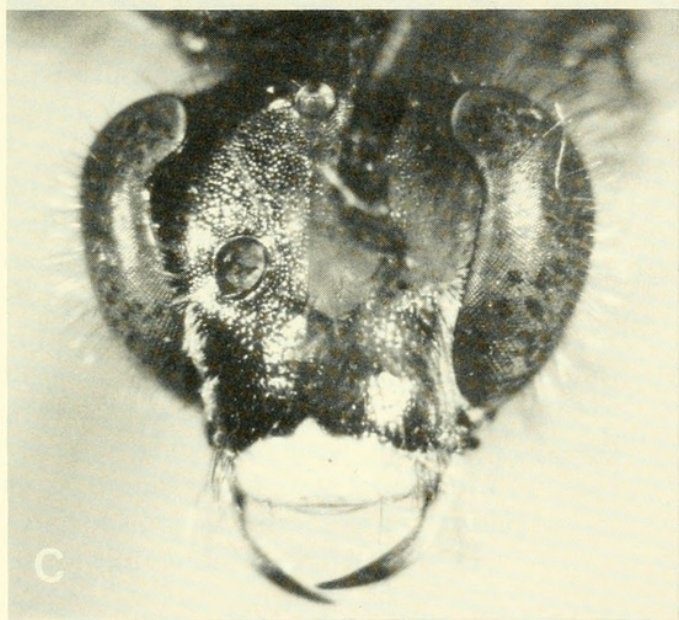
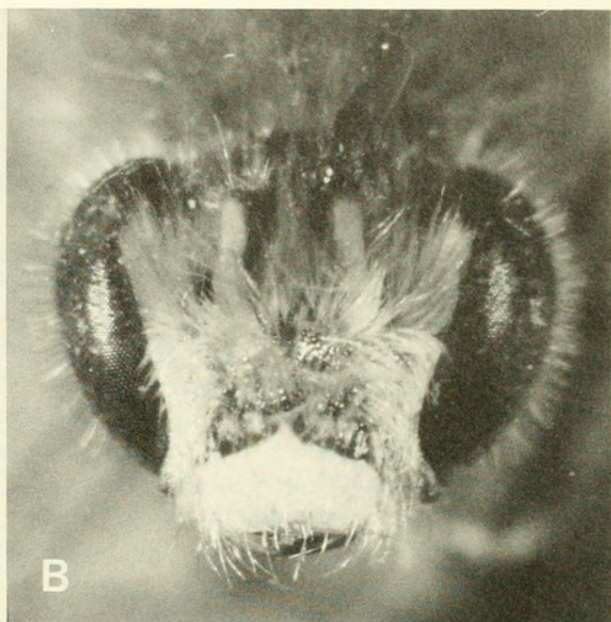
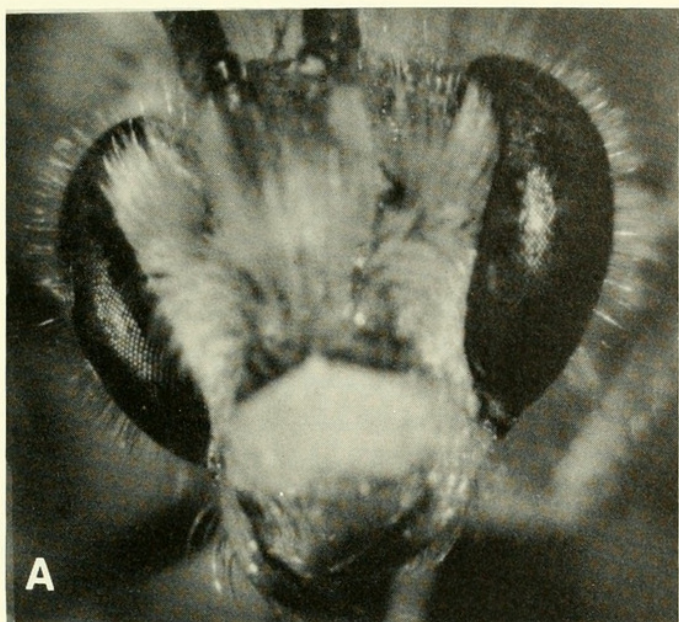
Caenohalictus Cameron, 1903, p. 231. Type species: *Caenohalictus trichiothalmus* Cameron, 1903. Monobasic.

DIAGNOSIS: Length about 4-11 mm; female head and thorax metallic green to blue or brassy, rarely metallic red or non-metallic black to dark brown; terga of metasoma with slight metallic green to blue highlights basally to brilliant metallic; sterna dark non-metallic; eyes with hair at least 1 od, often 2 or 3 od; male like female except often labrum and apical third or less of clypeus bright to pale yellow; some species have normal females but males with prolonged faces; hind tibia of male almost parallel-sided, rarely apically expanded, hind tarsomeres 1 and 2 of male articulated; propodeum with dorsal surface about as long as declivous surface which is not enclosed by carinae, propodeal triangle apically shining, almost mirror-like with some basal longitudinal striae, to dull and closely punctate; metasomal terga lacking lateral gradular carinae (usually true of smaller species, 4-6 mm) to T2-T5 with well developed lateral gradular carinae (usually found in species from 7-11 mm in length); T1 of male microareolate below subspiracular carina; striae absent on gonocoxite.

DISCUSSION: Species of *Caenohalictus* are widespread in México (Michener, 1979), occurring southward from the states of San Luis Potosí and Nayarit. There is one described species from Honduras [*C. elachion* (Vachal), (Moure and Hurd, in press)] and several undescribed species from México and Costa Rica.

The nests of *C. rostraticeps* [reported as a *Halictus* by Claude-Joseph (1960)] and *C. eberhardorum* (Michener, Breed, and Bell, 1979) have been found. The former constructs cell clusters while the latter places single cells at the ends of long laterals. The question of degree of sociality found in *Caenohalictus* is the same as *Habralictus*. Lone females or small communal colonies are found in vertical banks, sometimes in dense aggregations. In a nest containing two or more bees, all females have enlarged ovaries so they may be quasisocial or only communal.

FIGURE 5. A-E, male heads in front view; F, female head in front view. **A**, *Dinagapostemon sicheli*; **B**, *D. uyacanus*; **C**, *D. mentor*, holotype; **D**, *Rhinetula denticrus*; **E**, *Paragapostemon coelestinus*; **F**, *Agapostemonoides hurdi*.



DINAGAPOSTEMON Moure and Hurd new status

Paragapostemon (*Dinagapostemon*) Moure and Hurd, 1982, p. 46. Type species: *Halictus* (*Agapostemon*) *sicheli* Vachal 1901. Original designation.

DIAGNOSIS: Length about 11-14.5 mm; metallic green or blue to nonmetallic brown to amber; malar space linear; hair on eye more than 1.0 od; antenna of male crenulate to sinuate, flagellomere 1 about equal in length to flagellomere 2 in female; legs of male dark brown to black with some amber and occasional metallic hue, hind leg swollen with femoral, tibial and basitarsal teeth, hind tarsomeres 1 and 2 fused; propodeum almost entirely declivous with practically no dorsal surface; T2-T4 with no lateral gradular carinae; lateral area below subspiracular carina on T1 of male mirror-like with some fine areolate sculpturing; gonocoxite with striae, gonostylus with long membranous appendage serrate along outer edge; apex of S8 of male entire to bilobed.

DISCUSSION: Members of this genus were formerly included in *Paragapostemon*. We believe the following differences warrant recognition of *Dinagapostemon* as a separate genus. In contrast to *Paragapostemon*, *Dinagapostemon* has more complex male genitalia (Figs. 19c-h, 20a-j), sinuate [not "twisted in a spiral" (Moure and Hurd, 1982)] male antennae (Figs. 3a-f, h), toothed male hind femora (Figs. 15a-d, f, 16a, c), and lacks distinct lateral gradular carinae on anterior metasomal terga of both sexes. No *Dinagapostemon* females have the brilliant metallic metasomal terga of *Paragapostemon*.

Dinagapostemon species have been collected in moist montane habitats between 1,000 and 2,400 meters elevation. Nothing is known of their habits. Three of the species are known from single males. Although we are reluctant to describe species from unique specimens, the rarity of these bees leaves us little choice. The disjunct nature of their habitat leads us to expect that further exploration of moist highland areas will yield additional species.

Association of sexes, often a difficult problem in agapostemonines, has proved intractable in *Dinagapostemon*. Excepting *D. gigas* and *D. sicheli*, males and females have not been taken from the same localities. Females vary considerably in color of integument and pubescence. Variation is almost as great within localities as between localities. It is quite likely that there are undescribed species among females we have exam-

ined, but we have decided not to describe them without associated males (except *D. costaricensis*) because: (1) we are unable to distinguish them on the basis of stable morphological characters; (2) some of them may be conspecific with described males.

Dinagapostemon sicheli is fully described because it is least rare and both sexes are known.

KEY TO SPECIES OF DINAGAPOSTEMON

1. Males; antenna with 11 flagellomeres; scopa absent 2
- Females; antenna with 10 flagellomeres; scopa present
. *costaricensis*, *gigas*, *sicheli*
- 2(1). Margin of S4 appressed, not bent ventrally (Fig. 10f) or margin bent ventrally with only one row of long curved spines 3
- Margin of S4 bent ventrally with two rows of hooked spines (Figs. 10e, g, h) 4
- 3(2). Margin of S4 bent ventrally, with single row of low curved spines; anterior hind tibial spur less than 0.5 as long as posterior spur, posteroventral surface of hind tibia with basal tooth *gigas*
- Margin of S4 appressed, not bent ventrally, without spines; anterior hind tibial spur more than 0.75 as long as posterior spur; posteroventral surface of hind tibia without basal tooth. *orestes*
- 4(2'). Scape piceous ventrally; S5 without tuft of hairs emerging from beneath posterolateral margin of T5 (Fig. 10c) 5
- Scape yellow to amber ventrally; S5 with tuft of 3-6 long, golden, lateral hairs which curl anterad from beneath posterolateral margin of T5 (Fig. 10g) 6
- 5(4). Hind trochanter without conspicuous ventral projection (Fig. 14k); fused hind tarsomeres 1 + 2 with ventral tooth closer to base than apex (Fig. 17b); thorax metallic green dorsally and blue laterally *goneus*
- Hind trochanter with conspicuous ventral projection (Fig. 14l); fused

- hind tarsomeres 1 + 2 with ventral tooth closer to apex than base (Fig. 17c); thorax metallic green dorsally and laterally. *mentor*
- 6(4'). Thorax metallic green or bluish green dorsally and laterally; distilateral angle of gonostylus with setae subequal in length to width of penis valve. 7
- Thorax metallic green dorsally and blue laterally; distilateral angle of gonostylus with setae less than 0.3 as long as width of penis valve apex (Figs. 20a, b) *mexicanus*
- 7(6). Hind trochanter with ventral keel 0.35-0.40 as deep as long (Fig. 14q); penis valve with narrow dorsal crest (Fig. 20i). 8
- Hind trochanter with ventral keel 0.45-0.50 as deep as long (Fig. 14p); penis valve with broad dorsal crest (Fig. 20f). *sicheli*
- 8(7). Medioapical projection of S7 with several long, branched hairs (Fig. 18h); apex of S8 with two large obtuse lobes (Fig. 18h) . . . *uyacanus*
- Medioapical projection of S7 without hair (Fig. 18i); apex of S8 with two small acute lobes (Fig. 18i) *uyacanoides*

Dinagapostemon sicheli (Vachal)
new combination

Halictus (*Agapostemon*) *sicheli* Vachal, 1901, p. 77.

Male lectotype (MNH).

Nomia tacita Cameron, 1902, p. 376. Male holotype (BMNH).

TYPES: Male lectotype of *Halictus sicheli*, here designated, is "du Mexique" as recorded on the label and in the description by Vachal (1901).

The male holotype of *Nomia tacita* is labeled New Mexico, Cameron, 1902. Although the label gives the locality as New Mexico, this species has not been collected near New Mexico. In all probability, the label is in error (Hurd and Linsley, 1976). Genitalia glued to label are not those of *Nomia tacita* although genitalia have been removed from the specimen. Genitalia associated with the specimen appear to be from a specimen of *Paragapostemon coelestinus* (Westwood).

DISTRIBUTION: This is the only species of *Dinagapostemon* which has been collected on more than three occasions. Even so, only six people have collected specimens since 1871. Most of 41 known specimens are from eastern México. MÉXICO: VERACRUZ: 7 km S of Coatepec, 5 Aug. 1962, on *Cucurbita*, R. F. Smith, 1 F (UCB); Córdoba, 1867, O. Sichel, 1 M (BMNH); 3.2 km W of Fortín de la Flores, on *Cucurbita martinezi*, 23 Jul. 1962, 0706 h, D. Janzen, R75-2, 1 F (UCB) and R75-0, 1 F (KU); same as preceeding locality but 6 Aug. 1962, P. D. Hurd, Jr., on mint, 1 F (UCB); Jalapa, 6 Jun. 1871, Bilimek col., 1 M (NMV); Jalapa, 28 Sept.-3 Oct. 1961, R. and K. Dreisbach, 2 M (MSU and KU); 8 km S of Jalapa, 5 Aug. 1962, on *Cucurbita moschata*, P. D. Hurd, Jr., 1 F (UCB); Orizaba, Biart, 1 F (BMNH); Orizaba, 1867, O. Sichel, 3 M (BMNH); Orizaba, 5 May 1871, Bilimek, 2 M and 2 F (NMV); Orizaba, 25 Jul. 1956, R. and K. Dreisbach, 1 M (MSU); Orizaba, 12-22 Aug. 1961, R. and K. Dreisbach, 3 M (MSU); Teocelo, Santa Rosa, 14 Aug. 1982, J. S. Moure and R. Ayala, 1 M (UNAM). OAXACA: 38.6 km S of Valle Nacional, 1700 m, 24-25 Jul. 1970, E. Fisher and P. Sullivan, 1 M (LACM). TAMAULIPAS: Rancho Cielo, 11.2 km W of Gómez Farias, 4-6 Nov. 1972, J. E. Gillasp, 2 M (UTAH). Fourteen additional specimens in the British Museum collected in 1867 (Sichel collection); 9 M and 5 F without localilty data. We have seen other specimens from unspecified localities in México: 1 M, 1868, Bollard col. (OX); 7 M (NMV).

DESCRIPTION: MALE (Figs. 3f, 5a, 7a, 10g, 14g, p, 16a, 17f, 18g, 20e-g). General coloration metallic green. Length about 12.5 mm. HEAD (Figs. 5a, 7a): Pubescence creamy to pale yellow. (1) Labrum: Yellow, impunctate, distal margin with fimbria of golden hairs 0.7 od. (2) Clypeus: With yellow at midline occupying 0.8 clypeal length, yellow extending above basal margin of elevated, beveled, flattened area; punctures large, shallow and widely separated; pubescence simple and short (0.8 od) centrally, becoming branched and longer (1.9 od) dorsally and laterally. (3) Interocular area: Metallic except for piceous paraocular strip 0.5 od wide ventrally and 1.0 od wide dorsally; surface concave in paraocular area and below median ocellus, distinct supraclypeal bulge below and between antennal sockets, prominent medial tooth (frontal tubercle) just below antennal sockets; punctures minute and contiguous

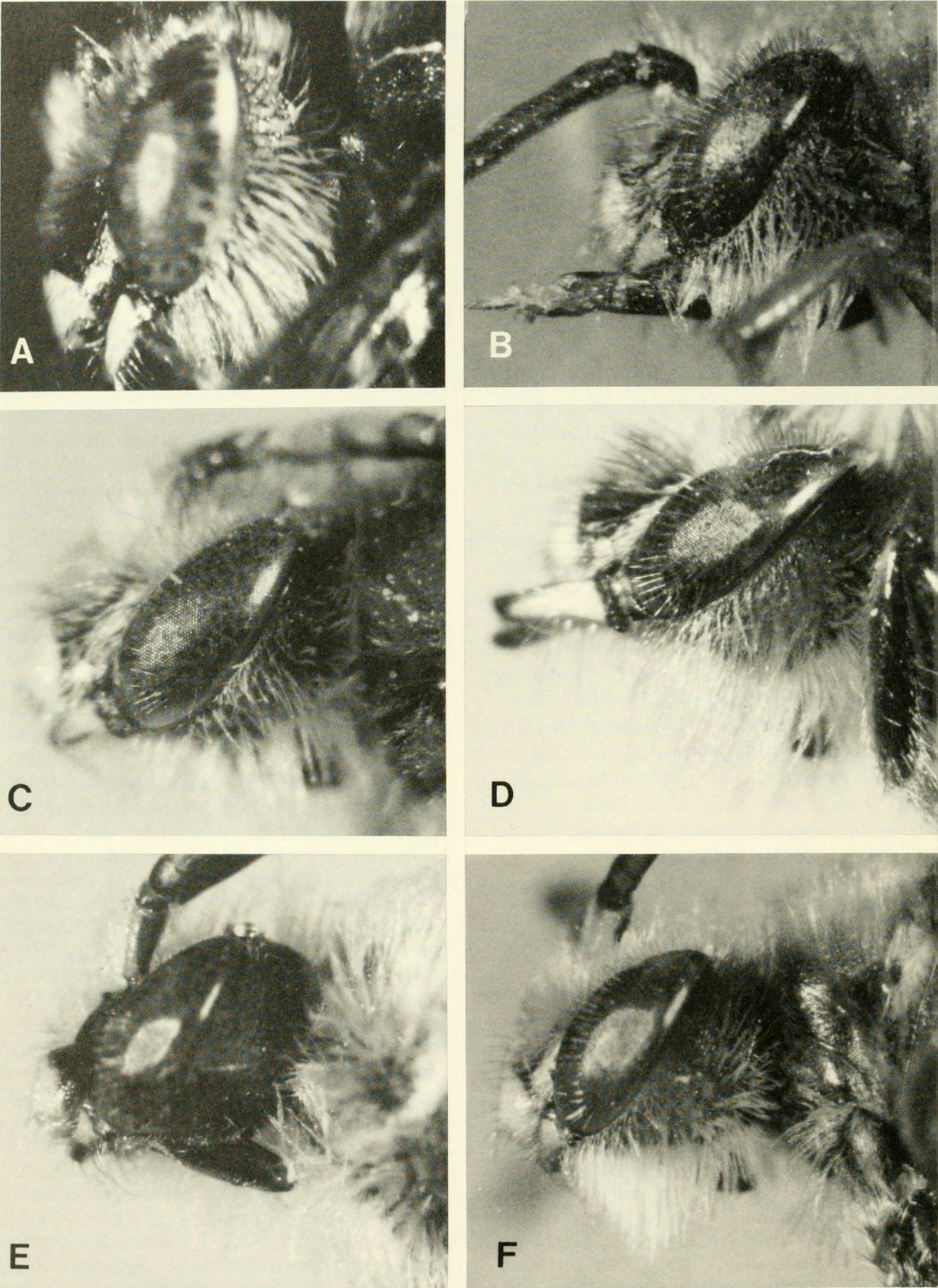


FIGURE 6. Male heads in side view. **A**, *Agapostemonoides hurdi*; **B**, *Dinagapostemon gigas*, lectotype; **C**, *D. goneus*, holotype; **D**, *D. mentor*, holotype; **E**, *D. mexicanus*, holotype; **F**, *D. orestes*, holotype.

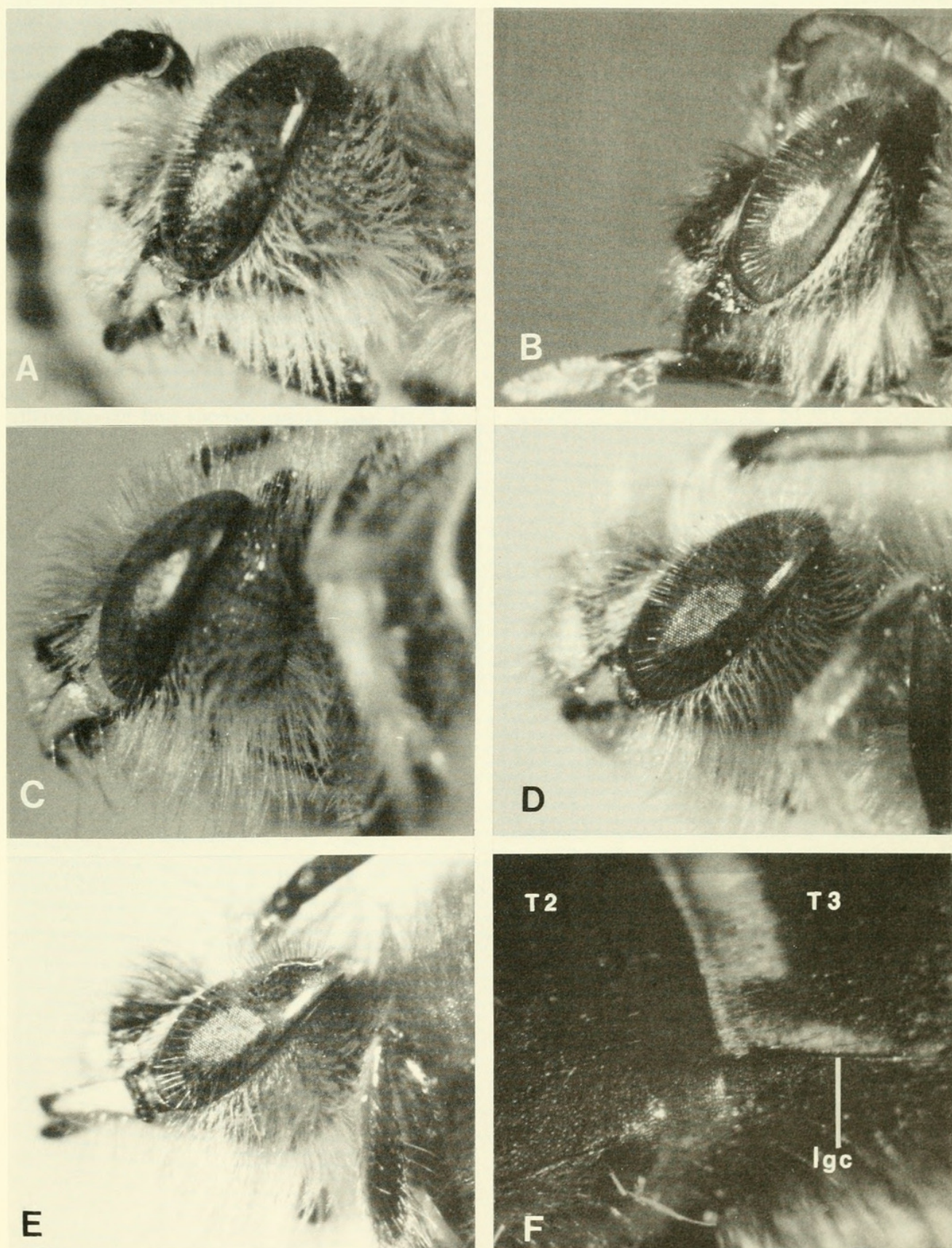


FIGURE 7. Male heads in side view (except F). A, *Dinagapostemon sicheli*; B, *D. uyacanus*; C, *Paragapostemon coelestinus*; D, *Rhinotula denticrus*; E, *Dinagapostemon mentor*, holotype; F, T2-T3 of *Rhinotula denticrus* male in lateral view, lgc, lateral gradular carina.

above antennal sockets, becoming coarser below; pubescence erect, dense and as long as scape medially (usually obscures median tooth below antennae), becoming short, feathery and appressed in paraocular area. (4) Vertex: Metallic; ocellar separation 0.6 od, lateral ocellus 2.1 od from eye, surface between eye and lateral ocellus distinctly concave, region posterior to ocelli rising only slightly before descending steeply to weak preoccipital carina; punctures minute, contiguous anteriorly and laterally, low widely spaced rugae behind ocelli; pubescence 1.0 od between ocelli, becoming longer posteriorly and shorter ventrally and laterally. (5) Gena: Metallic; area behind eye slightly concave and weakly striate, hypostomal carina 1.8 times as long as width of proboscoidal fossa; pubescence 3.8 od posteromedially, becoming shorter anteriorly and laterally. (6) Malar area: Yellow with amber; 0.3 od between eye and mandibular base; glabrous. (7) Mandible: Yellow, distal 0.4 transparent reddish brown; without tooth or ridges; sparse golden hairs 3.7 od proximovertrally becoming shorter distally. (8) Antenna (Fig. 3f): Scape yellow ventrally and piceous dorsally, pedicel and dorsum of flagellum piceous, flagellum amber ventrally; flagellum twice as long as head width, first flagellomere half as long as other individual flagellomeres, flagellomeres 4-11 conspicuously sinuate (Fig. 3f). THORAX: Metallic green; pubescence yellow to amber dorsally, becoming creamy laterally, posteriorly and ventrally. (9) Pronotum: Lateral angle and posterior lobe rounded; minutely rugose; pubescence 2.5 od. (10) Mesoscutum: Uniformly covered with small, deep, contiguous punctures; pubescence 1.7 od, uniformly distributed. (11) Mesoscutellum: Punctures like those of mesoscutum but slightly coarser; pubescence like that of mesoscutum. (12) Metanotum: With rugae in addition to punctures like those of mesoscutum; pubescence longer than that of mesoscutum (3.8 od). (13) Mesepisternum: Fine rugae anteriorly becoming contiguous punctures posteriorly; pubescence 2.5 od. (14) Metepisternum: Contiguously punctate or finely rugose; pubescence like that of mesepisternum. (15) Propodeum: Moderately coarse to minute, contiguous punctures laterally and posteriorly, becoming coarsely rugose dorsomedially, with medial groove on lower 0.7 of posterior surface. (16) Wings: Pubescence about as long as diameter of adjacent wing veins distally, becoming 0.5 od proximally; veins and stigma dark brown, 10-13 hamuli on hind wing. (17) Tegula: Transparent amber, sometimes with metallic tints anteromedially; minutely

punctate; pubescence dense, 0.8 od anteriorly, becoming shorter posteriorly. (18) Fore leg: Coxa metallic; pubescence moderately dense, 2.7 od. Trochanter brown to black; pubescence sparse, laterally 1.2 od. Femur brown with amber ventrally on distal 0.6; pubescence sparse, 1.0 od dorsally, shorter anteriorly and posteriorly and absent ventrally. Tibia amber, sometimes brown posteriorly; strigilis with transparent velum and amber malus, 3.8 od long; pubescence amber, 1.2 od posteriorly, becoming shorter dorsally and anteriorly, absent ventrally. Tarsus pale amber; distal tarsomeres together 0.8 as long as basitarsus; pubescence amber, 1.4 od dorsally, becoming shorter and more dense ventrally. (19) Middle leg: Similar to fore leg, tibial spur simple and 2.6 od long, tarsus piceous and exceptionally long and slender with basitarsus 1.1 times as long as tibia and 0.8 as long as tarsomeres 2-5 together. (20) Hind leg (Figs. 16a, 17f): Piceous, coxa with metallic tints; pubescence 2.1 od anteriorly and posteriorly, absent dorsally and ventrally. Trochanter (Fig. 14p) with large, thin ventral keel. Femur swollen, ventrally flattened area minutely ridged and terminating distally in a tooth followed by a concavity and second smaller tooth; pubescence 3.1 od proximodorsally, becoming shorter elsewhere and absent ventrally. Tibia with flat, minutely ridged ventral area and small tooth proximally which coincides with gap between femoral teeth, anterior spur 2.7 od long and posterior spur 5.5 od long (as long as fused tarsomeres 1 + 2); pubescence 0.6 od and scattered anteriorly, becoming dense, short and directed distad posteriorly. Tarsus with fused tarsomeres 1 + 2 1.4 times as long as tarsomeres 3-5 together; pubescence like that of other tarsi except for dense brush of distally directed bristles 1.1 od on posterior surface of basitarsus. METASOMA: (21) T1-T4 or T1-T5 each metallic anteriorly, becoming piceous posteriorly and often with transparent posterior margins, transparent brown ventrolaterally; T5-T7 or T6-T7 entirely piceous. T2-T4 with postgradular area depressed, concave and with distinct premarginal ridge 2.0 od from posterior margin. T7 with distinct pygidial plate (Fig. 14g). Punctures in postgradular areas like those of mesoscutum but smaller and shallower on premarginal ridge and separated by their diameters posterior to premarginal ridge. Pubescence cream-colored, 2.5 od anteriorly, becoming 1.0 od posteriorly. (22) Sterna (Fig. 10g): S1 with metallic tints anteriorly and amber to brown posteriorly; posterior margin concave medially; medial pubescence

sparse, 2.8 od. S2-S3 dark amber to brown; pubescence confined to visible apical half, sparse medially, moderately dense laterally, 0.9 od. S4 with posterior margin concave and thickened so as to appear to have two edges; dorsal edge (closest to S5) with 9-13 stout spines hooking abruptly ventrad (spines absent medially), ventral edge with fimbria of stiff, amber hairs curving gently dorsad, 0.6 od laterally to 1.7 od medially. S5 with posterior margin concave laterally as well as medially; broad V shaped band of amber hairs (1.7 od) directed posteriorly (V open posteriorly and extending anteriorly from posterolateral margin), tuft of 3-5 long (6.0 od), golden hairs on extreme lateral margin hooking anterolaterally and con-

cealed basally by ventrolateral region of T5 (hairs most easily seen in dorsal view). S6 dark brown to amber, flat; pubescence sparse, short (0.5 od), and directed posteromedially. S7 and S8 (Fig. 18g). (23) Genitalia (Figs. 20e-g).

FEMALE (Figs. 3l, o, 8c, 9b, 12b). Agrees with description of male except, general coloration of head and thorax black with variable iridescence of metallic green to blue to purple varying with position in relation to light source, metasoma amber to dark brown and usually with metallic basally on T2-T4. Pubescence only 0.6-0.8 as long as in male. **HEAD** (Figs. 8c, 9b): Metallic coloration strongest in genal and interocular regions; pubescence cream-colored to amber. (1) Labrum: Dark amber to black;

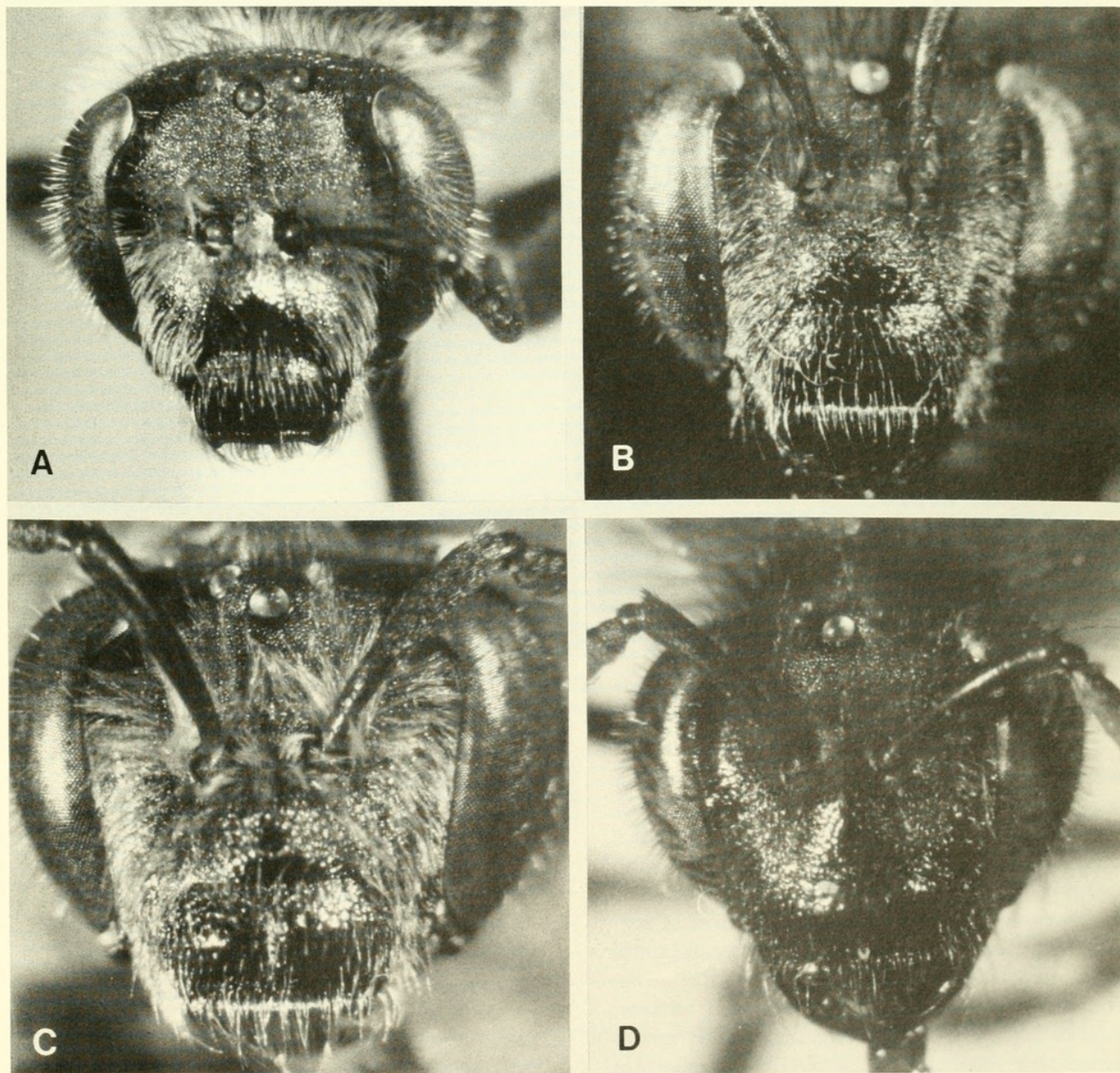


FIGURE 8. Female heads in front view. A, *Paragapostemon coelestinus*; B, *Rhinotula denticrus*; C, *Dinagapostemon sicheli*; D, *D. costaricensis*.

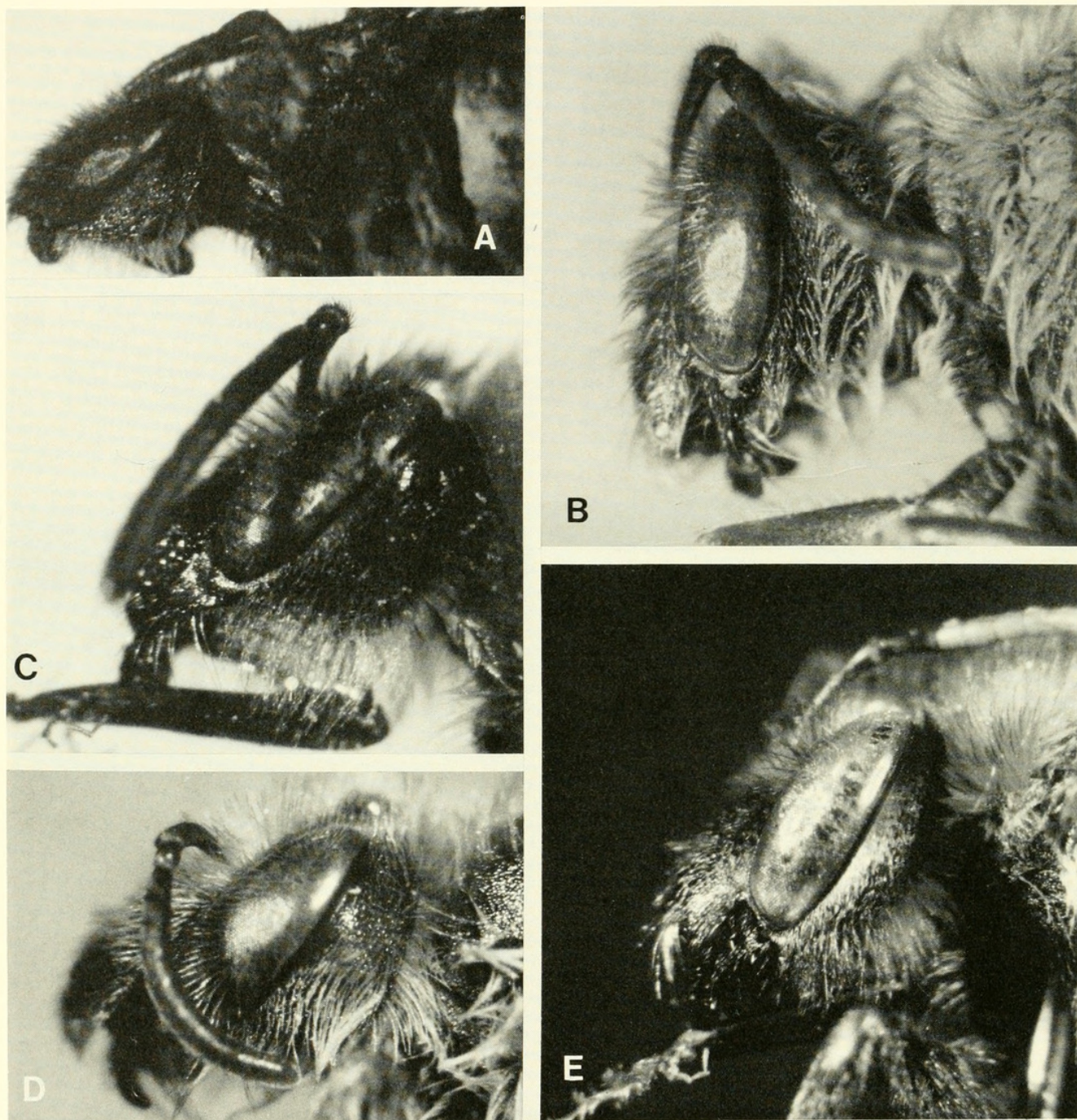


FIGURE 9. Female heads in side view. A, *Agapostemonoides hurdi*; B, *Dinagapostemon sicheli*; C, *D. costaricensis*; D, *Paragapostemon coelestinus*; E, *Rhinotula denticrus*.

basal area prominent, convex distally, concave proximally, irregularly rough and enclosed by flange; distal process with prominent distomedial keel, conspicuous lateral projection and marginal fimbria of amber, upturned bristles. (2) Clypeus: Coarsely punctate; fimbria of amber downturned bristles (3.0 od) between lateral teeth on distal margin. (3) Interocular area: Without medial tooth below antennal sockets; pubescence shorter than scape medially, not so dense and feathery as to obscure paraocular area. (5) Gena: Convex behind eye, finely striate. (7) Mandible: Amber to dark brown,

with subapical tooth. (8) Antenna (Fig. 30): Piceous with flagellum amber below. THORAX: Legs brown to black; pubescence like that of other female Halictinae; posterior spur of hind tibia with 6-8 teeth (Fig. 31). METASOMA: (21) Terga (Fig. 12b): Pale yellowish amber to black, often with metallic tints basally on T2-T4; premarginal ridges and postgradular depressions less distinct than those of male; prepygidial fimbria of dense golden pubescence. (22) Sterna: Amber to black with moderately dense, erect pubescence 2.6 od.

Dinagapostemon costaricensis new species

ETYMOLOGY: The name refers to its type locality in Costa Rica.

TYPES: Female holotype and one female paratype deposited in KU; other paratypes in LACM. Holotype from COSTA RICA: PUNTARENAS PROV.: Monteverde, 1500 m, January 1978, visiting *Ipomoea*, L. A. Real. Nine para-

types from same locality were collected 15-18 August 1976 by E. M. Fisher from flight trap with cineole bait.

DESCRIPTION: FEMALE (Figs. 8d, 9c, 12c-d). Similar to *D. sicheli*, differing as follows. Length about 12.5 mm. Head and thorax with slight metallic blue highlights, legs (except amber distitarsi) and metasoma dark, nonmetallic. T1-T6 varying from all black to amber (Figs.

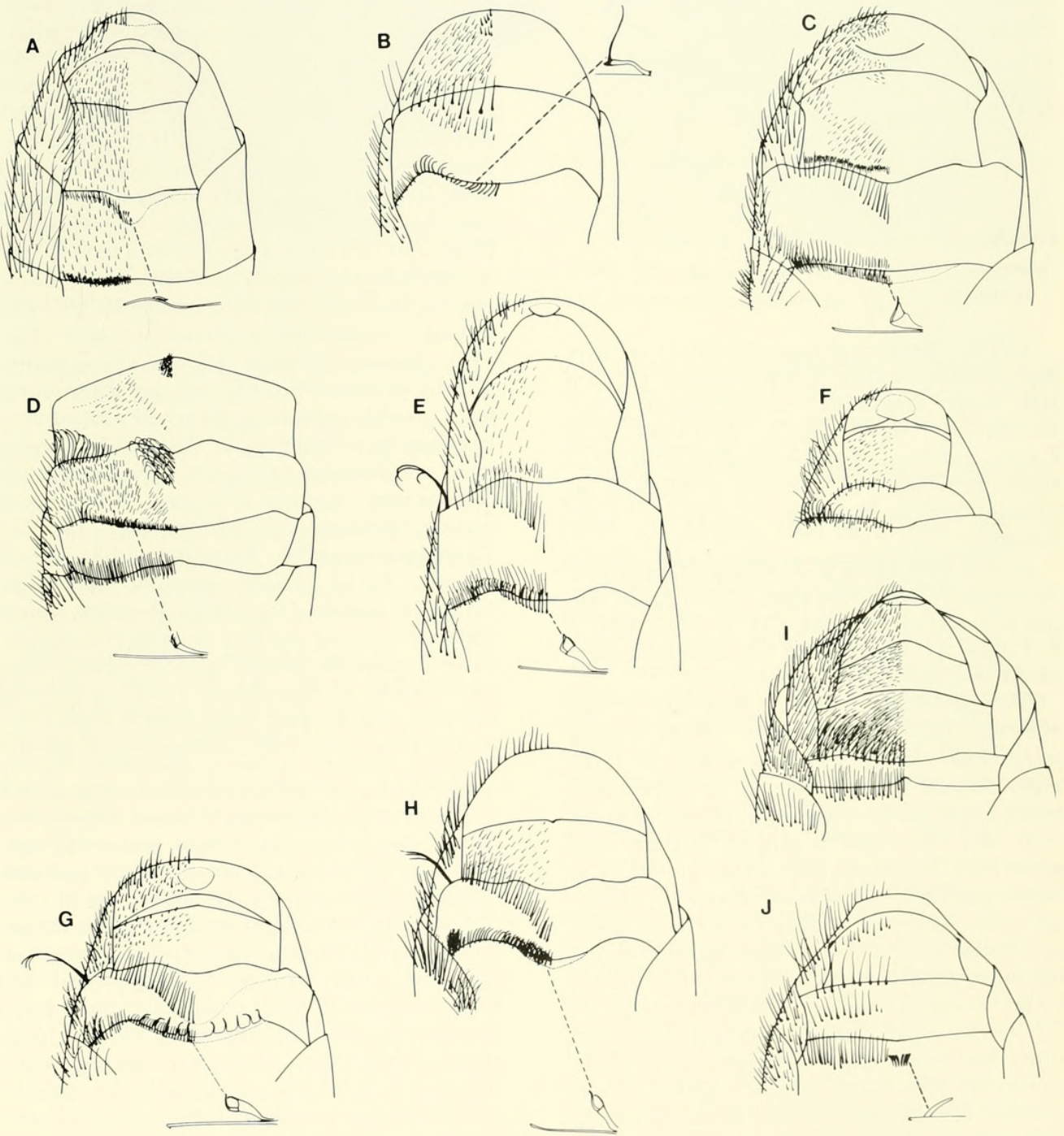


FIGURE 10. Apices of male metasomas in ventral view; A-E, G-H, J, also include side view of S4. A, *Agapostemonoides hurdi*; B, *Dinagapostemon gigas*; C, *D. goneus*; D, *D. mentor*; E, *D. mexicanus*; F, *D. orestes*; G, *D. sicheli*; H, *D. uyacanoides*; I, *Paragapostemon coelestinus*; J, *Rhinetula denticrus*.

12c-d). Hair dark fuscous, becoming paler on ventral and lower lateral surfaces of body. HEAD (Figs. 8d, 9c): Hair dark on head except pale on gena. THORAX: Hair fuscous except pale on ventral surface of fore tibia and fore tarsus; middle femur with basiventral brush amber; hind leg with hair on coxa, trochanter, and femoral corbícula pale, penicillus amber, ventral hair pale on tarsomeres 3-5. Posterior hind tibial spur with 7-11 teeth. METASOMA (Figs. 12c-d): Hair dark except terga with basal bands of pale hair (Fig. 12c) and ventral surface with hair all pale except apex of S6 with dark hair. Terga weakly shining, not dull like T1-T3 of *D. sicheli*.

***Dinagapostemon gigas* (Friese)
new combination**

Corynura gigas Friese 1911, pp. 454-455.

Rhinetula serraticornis Friese 1922, p. 584. New synonym.

TYPES: Both male types (ZMHU) are here designated lectotypes. The lectotype of *Corynura gigas* from "Columbia" [*sic*], Popayán [overwritten by "R. Casier"], 24-9-1908, Cali Cauca, Fassl leg., was presumably collected in Cauca Province. The lectotype of *Rhinetula serraticornis* is from Popayán, "Columbia" [*sic*], Lehman.

ADDITIONAL SPECIMENS: COLOMBIA: ANTIOQUIA PROV.: Rionegro, 2100 m, on *Eupatorium scabrum*, R. Añes, 3M, J. Cano, 4 M, 1 F; Caldas, G. Sierra, 1 M (all additional specimens at UNC except 1 M at KU).

DESCRIPTION: MALE (Figs. 3a, 4c, 6b, 10b, 12a, 14f, o, 15b, 17a, 18b, 19c-d). Similar to *D. sicheli*, differing as follows: Length 11-12 mm. Thorax metallic coppery to dark green becoming green laterally and ventrally, or green with blue to purple highlights laterally and posteriorly; metasoma pale amber anteriorly to black posteriorly (*R. serraticornis* type), or coppery green to green dorsally on T1 with apical and lateral margins black, basal metallic region becoming progressively narrower (often hidden by preceding tergum) on T2-T6, and absent on T7; sterna except apical margin of S6 sometimes amber (*C. gigas* lectotype). Legs dark, sometimes with amber on apical half of femur, anterior face of fore and mid tibiae, distitarsi, and posterior hind tibial and tarsal surfaces. HEAD (Figs. 4c, 6b): Pubescence creamy between eyes and on gena, becoming amber on vertex, eyes, clypeus, and labrum. (2) Clypeus: Yellow area smaller, occupying only elevated

beveled area, and less flattened; pubescence simple, dark to light amber. (3) Interocular area: Metallic green with coppery tints; pubescence around antennae less dense. (4) Vertex: Metallic green with coppery tints; lateral ocellus 1.8 od from eye. (8) Antenna (Fig. 3a): Lacking yellow on scape; flagellum 2.3 times as long as head width. THORAX: Green to dark green with coppery tints, especially anteriorly on mesoscutum, lateral and posterior surfaces green, or green with blue to purple highlights. (11) Mesoscutellum: With shiny lateral areas where punctures are small and weak. (16) Wings: 9-10 hamuli on hind wing. (18) Fore leg: Tibia with malus 3.1 od long, tarsus with tarsomeres 2-5 together as long as basitarsus. (19) Middle leg: Similar to fore leg, tibial spur simple, 2.0 od long, basitarsus as long as tibia and almost as long as tarsomeres 2-5 together. (20) Hind leg (Figs. 15b, 17a): Coxa piceous with faint metallic coloration anteriorly and with large, distoventral, conical projection; trochanter piceous, lacking conspicuous projection or keel (Fig. 14o); femur all black to amber becoming piceous proximoventrally and on distoventral tooth, swollen with large flattened ventral area terminating in distal tooth followed by second much smaller tooth; tibia with anterior spur 2.5 od long and posterior spur long (8.0 od) and curved. METASOMA: (21) Terga (Fig. 12a): T1-T3 translucent amber, T4 amber with basal half piceous, T5-T7 piceous; pygidial plate (Fig. 14f). (22) Sterna (Fig. 10b): Anterior sterna amber, becoming piceous on posterior sterna. S4 with posterior margin broadly concave with row of about 38 stout spines 1.6 od, projecting ventrally and hooking posteriorly at apices. S7 and S8 (Fig. 18b). (23) Genitalia (Figs. 19c-d).

FEMALE: Metallic coloration dark green with coppery highlights. HEAD: Pubescence dark except pale on paraocular area and gena. THORAX: Pubescence fuscous except pale on margin of pronotal lobe, lateral surface of propodeum, hind coxa and trochanter; amber on metanotum, lateral margins of mesoscutum and scutellum, inner surfaces of fore tibia and tarsus, mesofemoral brush, mesotibial comb, hind femoral flocculus and inner surface of hind tarsus. METASOMA: Black with narrow basal bands of dark metallic green on T2-T4; pubescence dark except pale on basal half of T1 and narrow basal bands on T2-T4.

***Dinagapostemon goneus* new species**

ETYMOLOGY: The name *goneus* means progenitor. This species is dedicated to the late

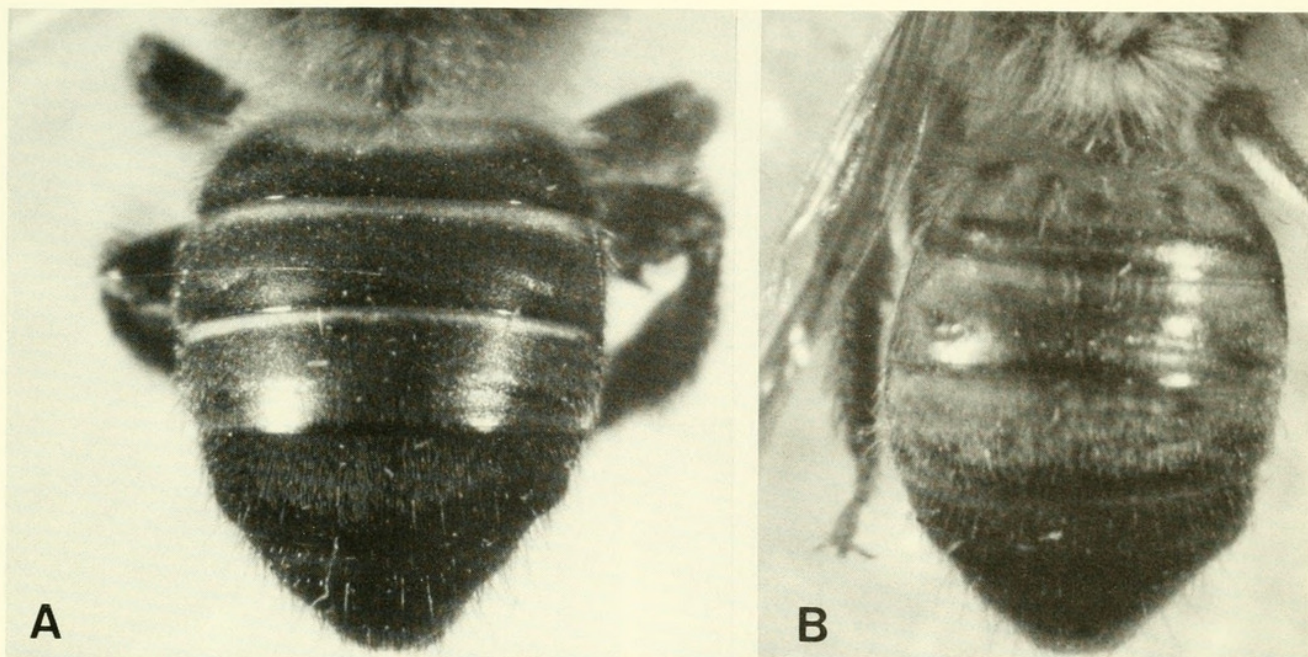


FIGURE 11. Male metasomas of *Rhinotula* dorsal view. A, Central American form with narrow basal amber band on T2 and T3; B, Peruvian form with broad amber bands on T1-T3.

H. Radclyffe Roberts, Jr., entomologist and father of the senior author.

TYPES: Male holotype (MCZ) and the male paratype (AMNH) are from *ECUADOR*: PICHINCHA PROV.: Tandapi, 1400 m (L. E. Peña). The holotype is labeled 15/20-VI-65, while the paratype is labeled 55 km SW of Quito on road from Machachi to Santo Domingo, VI-18-1965. Probably the two specimens of this southernmost species were collected together.

DESCRIPTION: MALE (Figs. 3h, 4b, 6c, 10c, 14b, k, 15a, 17b, 18c, 19e-f). Differs from *D. sicheli* as follows: Length 11-12 mm. Metallic purple laterally and ventrally on thorax in contrast to metallic green on thoracic dorsum. Pubescence brown on dorsal regions of head and thorax. **HEAD** (Figs. 4b, 6c): (8) Antenna (Fig. 3h): Scape entirely piceous. **THORAX:** (18) Fore leg: Tarsus brown to black. (20) Hind leg (Fig. 15a): Coxa with subapical ventral tooth; trochanter with blunt, apical, posteroventral tooth but lacking distinct ventral keel (Fig. 14k); tibia with posterior spur shorter than fused tarsomeres 1+2 together (Fig. 17b). **METASOMA:** (21) Terga: Pygidial plate slightly truncate (Fig. 14b). (22) Sterna (Figs. 10c): S4 with stout hooked spines medially as well as laterally on posterior margin. S5 lacking lateral tuft of long golden hairs. S7 and S8 (Fig. 18c). (23) Genitalia (Figs. 19e-f).

Dinagapostemon mentor new species

ETYMOLOGY: The name of *mentor* means

loyal friend and wise counselor. We dedicate this species to Charles D. Michener, mentor in the scientific odysseys of the authors and many other students of Apoidea.

TYPE: Male holotype (KU) from *PANAMÁ*: CHIRIQUÍ PROV.: 6 km N of Bouquete (*sic*), Cerro Pate Macho, 1000 m, 25 Apr. 1981, D. Roubik. The locality is spelled "Boquete."

DESCRIPTION: MALE (Figs. 3b, 4d, 5c, 6d, 7e, 10d, 14c, l, 15d, 17c, 18d, 19g-h). Differing from *D. sicheli* as follows: Length 14.7 mm. Punctures slightly smaller and shallower. Pubescence brown dorsally on head and thorax, brown to black on metasomal terga and amber elsewhere. **HEAD** (Figs. 4d, 5c, 6d, 7e): Pubescence dark brown on metallic portion of clypeus and on interocular region above and below antennal sockets. (1) Labrum: Shorter, with longer hairs (1.0 od) forming marginal fimbria. (3) Interocular area: Lacking concavity below median ocellus; punctures below antennal sockets separated by several times their diameters. (8) Antenna (Fig. 3b): Piceous, without yellow ventrally on scape or amber ventrally on flagellum; flagellum 2.3 times as long as head width. **THORAX:** (18) Fore leg: Tarsus yellow; basitarsus as long as tarsomeres 2-5 together. (19) Middle leg: Extraordinarily long and slender (about 10 mm in length). Tarsus amber to yellow; basitarsus 1.2 times as long as tibia and 0.9 times as long as tarsomeres 2-5 together. (20) Hind leg (Figs. 15d, 17c): Trochanter with thick, bluntly pointed keel ventrally (Fig. 14l). Femur with distal teeth less acute and with

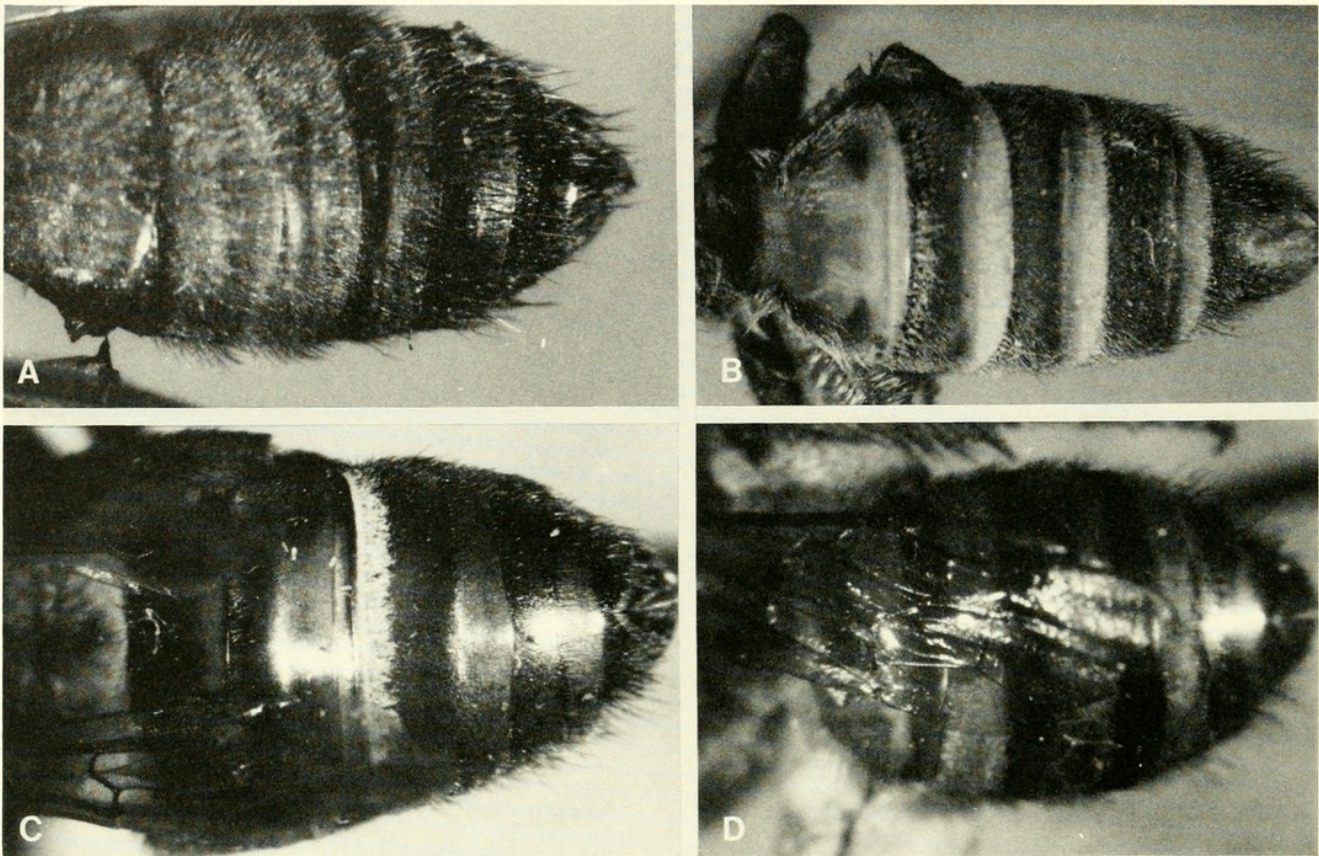


FIGURE 12. Metasomas of *Dinagapostemon* in dorsal view. **A**, Male *D. gigas*, lectotype; **B**, Female *D. sicheli*; **C**, Female *D. costaricensis*, dark form; **D**, Female *D. costaricensis*, amber form.

broad posteroproximal tooth. Tibia concave distoventrally and with broad, apical tooth anteroventrally; anterior spur 3.2 od long, posterior spur 3.8 od long and much shorter than fused tarsomeres 1+2 together. METASOMA: (21) Terga: Piceous and shiny with metallic blue-green basally on T1-T4 or T1-T5; pygidial plate large (Fig. 14c). (22) Sterna (Fig. 10d): Black with amber pubescence. S4 with posterior margin concave, bordered with minute brush of hairs ventrally, 2 spines projecting ventrally and hooking medially about 1.0 od lateral to center

(Fig. 10d), 3-4 posterolateral spines projecting posteriorly and hooking medially. S5 with small, dense, V shaped brush of hairs centrally and lacking lateral tuft of long, golden hairs. S6 with low medial ridge clothed in short black bristles projecting posteriorly. S7 and S8 (Fig. 18d). (23) Genitalia (Figs. 19g-h).

Dinagapostemon mexicanus new species

ETYMOLOGY: This species is named for the nation of México in which it is found.

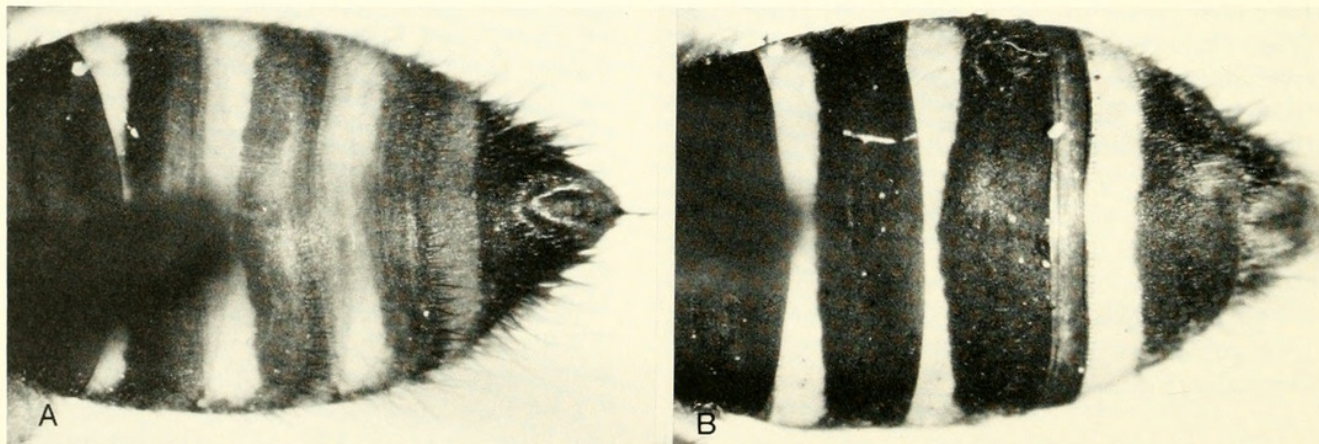


FIGURE 13. Metasomas of female *Agapostemonoides hurdi*. **A**, Amber form; **B**, Dark form.

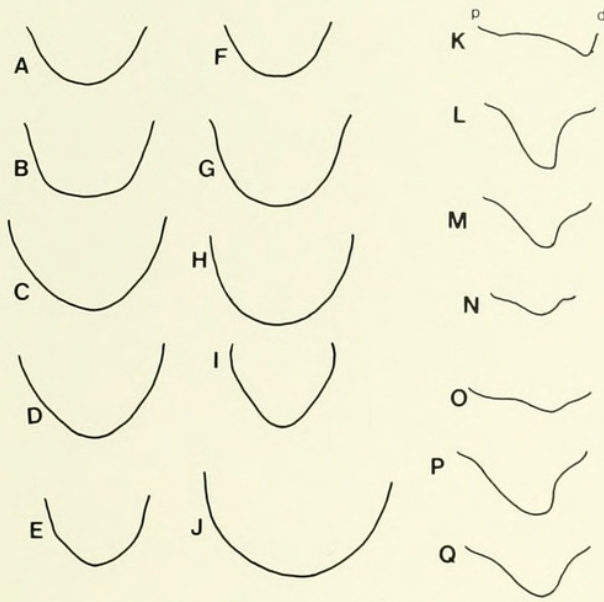


FIGURE 14. Outline of male pygidial plate in dorsal view (A-K); profile of ventral keels of male hind trochanters (L-S); p, proximad and d, distad. **A**, *Agapostemonoides hurdi*; **B**, *Dinagapostemon goneus*; **C**, *D. mentor*; **D**, *D. orestes*; **E**, *D. mexicanus*; **F**, *D. gigas*; **G**, *D. sicheli*; **H**, *D. uyacanus*; **I**, *Paragapostemon coelestinus*; **J**, *Rhinotula denticrus*; **K**, *Dinagapostemon goneus*; **L**, *D. mentor*; **M**, *D. mexicanus*; **N**, *D. orestes*; **O**, *D. gigas*; **P**, *D. sicheli*; **Q**, *D. uyacanus*.

TYPES: Male holotype (UNAM) and 2 male paratypes from **MÉXICO:** GUERRERO: Puente del Rey, 8 km S of El Paraiso, 29 Oct. 1983, R. Ayala. Additional paratypes from the same state: El Paraiso, 23 km "Carr., Pto. del Gallo" (Carretera, Puerto del Gallo), 20 Oct. 1983, R. Ayala, 6 M (UNAM), 2 M (KU); El Faisanal, 25 Oct. 1984, R. Ayala, 1 M (UNAM). **MORELOS:** 3 mi (4.8 km) N of Cuernavaca, 4 Apr. 1959, 7500 feet (2286 m), H. E. Evans and D. M. Anderson (CU).

DESCRIPTION: MALE (Figs. 3c, 4e, 6e, 10e, 14e, m, 15c, 17d, 18e, 20a-b). Differing from *D. sicheli* in its slightly smaller size (11 mm in length) and in characters mentioned below. **HEAD** (Figs. 4e, 6e): (8) Antenna (Fig. 3c): With flagellum less strongly sinuate. **THORAX:** Metallic green dorsally, becoming blue to bluish purple laterally. (20) Hind leg (Figs. 15c, 17d): Trochanter with ventral keel only 0.35 times as deep as long (Fig. 14m). **METASOMA:** (21) Terga: T7 with pygidial plate somewhat more pointed (Fig. 14e). (22) Sterna (Fig. 10e): S7 and S8 (Fig. 18e). (23) Genitalia (Figs. 20a-b): Distilateral angle of gonostylus with setae less than 0.3 as long as apical width of penis valve.

Dinagapostemon orestes new species

ETYMOLOGY: The name *orestes* means mountaineer, a reference to the montane habitat of this species.

TYPE: Unique male holotype (KU) from **COSTA RICA:** PUNTARENAS PROV.: 6 km S of San Vito, 8°42'N, 83°0'W, 25-28 Apr. 1967, D. F. Viers.

DESCRIPTION: MALE (Figs. 3d, 4f, 6f, 10f, 14d, n, 15f, 17e, 18f, 20c-d). Differing from *D. sicheli* in its slightly smaller size (11 mm in length) and in characters mentioned below. **HEAD** (Figs. 4f, 6f): Metallic green, becoming brassy on supraclypeal area and between subantennal sutures and bluish on gena; pubescence white, tinged with amber at vertex. (2) Clypeus: Yellow at midline occupying lower 0.9 clypeal length, metallic green above. (8) Antenna (Fig. 3d): Flagellum 2.5 times as long as head width. **THORAX:** Metallic green with brassy tints dorsally, metallic pinkish purple laterally and metallic blue-green ventrally; pubescence amber dorsally, creamy laterally and white below. (12) Metanotum: Rugose. (15) Propodeum: Nearly smooth laterally, becoming coarsely rugose medially. (18) Fore leg: Femur and tibia amber anteroventrally becoming brown posterodorsally, strigilis 3.9 od long. Tarsus brown. (19) Middle leg: Tibial spur 3.0 od long, tarsus not exceptionally long or slender, basitarsus 0.8 times as long as tibia and 0.9 times as long as tarsomeres 2-5 together. (20) Hind leg (Figs. 15f, 17e): With faint metallic tints on coxa and femur, otherwise dark amber to piceous. Coxa concave and shiny ventrally. Trochanter smooth and shiny ventrally, with weakly developed keel or tooth (Fig. 14n). Femur with ventral flattened area shorter than that of *D. sicheli*. Tibia with smooth ventral concavity bordered by large anteroventral distal ridge, anterior spur 2.9 od long, posterior spur 3.4 od long (shorter than basitarsus). Tarsus with fused tarsomeres 1 + 2 1.2 times as long as tarsomeres 3-5 together. **METASOMA:** (21) Terga: Dull brown to piceous with thin basal orange bands on T2-T3, with basal flecks of orange on T4; surfaces of terga without transverse ridges or concavities, punctation fine, continuous and uniform from base to posterior margin of each segment, pygidial plate large and projecting ventrad of S6 (Fig. 14d). (22) Sterna (Fig. 10f): S3 with low, shiny, Y-shaped ridge medially (Y opens posteriorly) and tuft of posteriorly directed hairs posterolaterally. S4 with lateral tuft of hooked hairs on posterolateral margin visible in dorsal view, becoming row of fine spines on posteromedial margin.

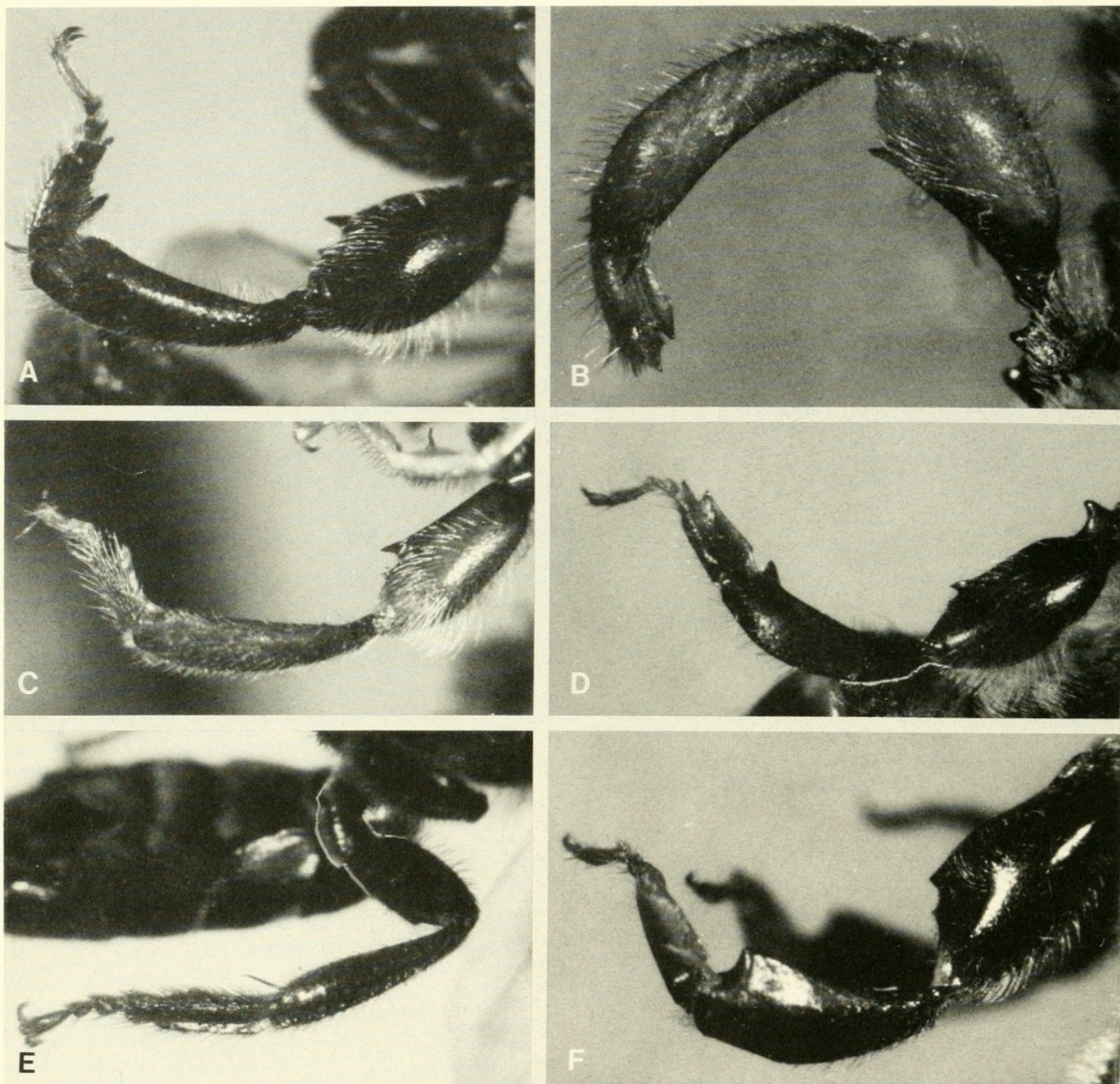


FIGURE 15. Male hind legs in anterior view, D and E slightly retouched to show structure. **A**, *Dinagapostemon goneus*, holotype; **B**, *D. gigas*, lectotype; **C**, *D. mexicanus*, holotype; **D**, *D. mentor*, holotype; **E**, *Agapostemonoides hurdi*; **F**, *Dinagapostemon orestes*, holotype.

S5 with group of short posteromedial, dark brown hairs. S7 and S8 (Fig. 18f). (23) Genitalia (Figs. 20c-d).

***Dinagapostemon uyacanoides* new species**

ETYMOLOGY: The name *uyacanoides* indicates this species' similarity to *D. uyacanus*.

TYPE: Unique male holotype (USNM) from EL SALVADOR: Monte Cristo, 7-9 May 1958, O. L. Cartwright.

DESCRIPTION: **MALE** (Figs. 10h, 17j, 18i). Extremely close to *D. uyacanus*, differing only in the following attributes. **HEAD**: Coppery

highlights between bases of antennae and ocelli. **THORAX**: Coppery highlights on entire thorax, especially on longitudinal median area of meso-scutum, scutellum and metanotum. **METASOMA**: S7 without hair on median apical projection (Fig. 18i). S8 (Fig. 18i) with small acute apical and apicolateral lobes.

***Dinagapostemon uyacanus* (Cockerell)
new combination**

Caenohalictus uyacanus Cockerell, 1949, p. 442.

TYPE: Male holotype (USNM) from HONDURAS: Top of Uyaca Peak, near Tegucigalpa, March 9, G. Cisneros.

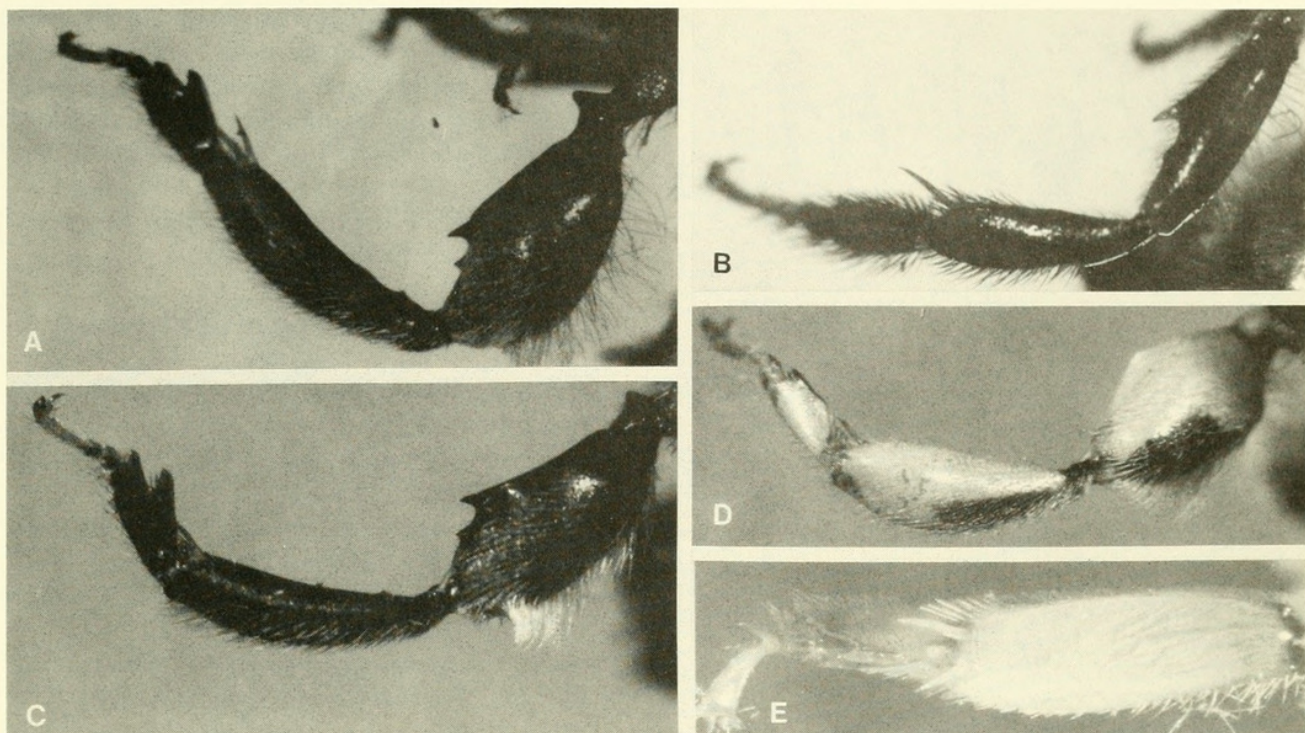


FIGURE 16. Male hind legs in anterior view (except E), B slightly retouched to show structure. A, *Dinagapostemon sicheli*; B, *Rhinotula denticrus*; C, *Dinagapostemon uyacanus*; D, E, *Paragapostemon coelestinus*, anterior and ventral views, respectively.

ADDITIONAL SPECIMENS: GUATEMALA: RETALHULEU PROV.: Helvetia, 1000 m, San Sebastian, 21-22 Apr. 1931, J. Bequaert (MCZ) 3 M.

DESCRIPTION: MALE (Figs. 3e, 5b, 7b, 14h, q, 16c, 17g, 18h, 20h-j). Similar to *D. sicheli*, differing as follows: THORAX: (20) Hind leg (Figs. 16c, 17g): Trochanter with ventral keel 0.35-0.40 times as deep as long (Fig. 14q). METASOMA: (22) Sterna: S7-S8 (Fig. 18h). (23) Genitalia (Figs. 20h-j): Penis valve with narrow dorsal crest (Fig. 20i).

HABRALICTUS Moure

Habralictus Moure, 1941, p. 59. Type species: *Habralictus flavopictus* Moure, 1941. Original designation.

DIAGNOSIS: Length 5-6 mm. Female head and thorax metallic green to brassy or dark with metallic green to brassy highlights, sometimes thorax with metallic highlights restricted to pronotum; clypeus usually with yellow spot; metasoma and legs black to dark brown, sometimes all dark, rarely all amber, usually with complete or medially interrupted basal yellow bands that are widest at lateral margins, bands sometimes reduced to small basolateral spots; eyes in male and female glabrous, rarely with

hair, hair if present less than 0.5 od; male with mandible, labrum and apical half to two-thirds of clypeus bright yellow; pronotal lobe usually with yellow spot, legs with extensive yellow maculations; hind tarsomeres 1 and 2 articulated; metasoma very slender and elongate like that of *Neocorynura*, black to dark brown, sometimes all dark or with complete basal bands of yellow on T2-T4 similar to but less extensive than those of female, yellow usually restricted to small basolateral spots on T2-T3 or T2-T4; propodeum with dorsal surface half to two-thirds length of declivous surface which is not enclosed by carinae; metasomal terga without lateral gradular carinae; T1 of male microareolate below subspiracular carina; gonocoxite with striae fine to absent.

DISCUSSION: This genus is widespread, ranging from Guerrero, México, to southern Brasil. It contains 20 described species (Moure and Hurd, in press), three of which occur in Mesoamerica [*H. xanthinus* (Cockerell) in Panamá, *H. metallicus* (Friese) in Costa Rica and *H. tradux* (Vachal) in México]. Nesting biologies and sociality of *H. canaliculatus* Moure in Brasil (Michener and Lange, 1958) and *H. bimaculatus* Michener in Colombia (Michener, Breed and Bell, 1979) have been investigated. These species are solitary to communal or possibly quasisocial, with no castes; all females have

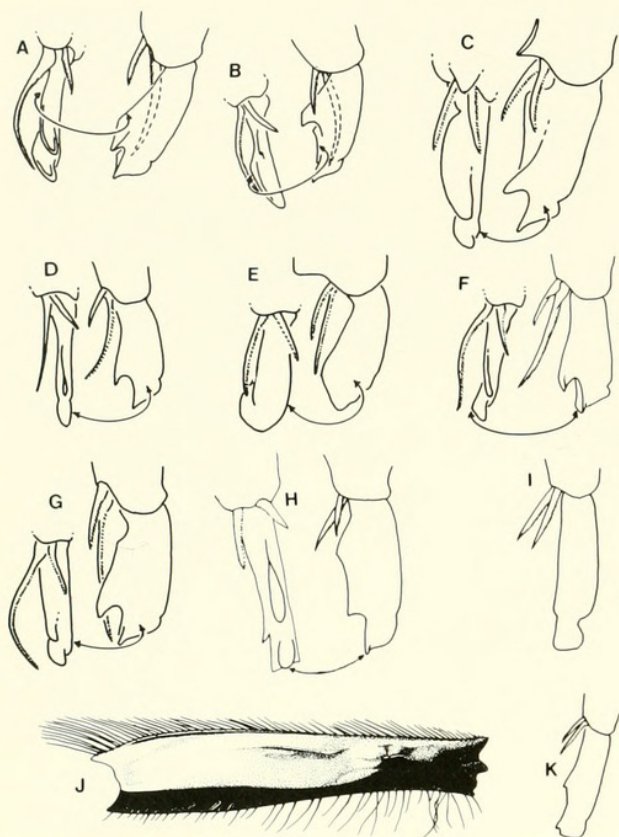


FIGURE 17. Male hind tarsomeres 1+2 showing spurs of hind tibiae (A-H); left drawing is ventral view and right drawing is anterior view (arrows point to identical points in the two views). Anterior view of hind tarsomeres 1+2 (I, K). Ventral view of hind tibia (J). A, *Dinagapostemon gigas*; B, *D. goneus*; C, *D. mentor*; D, *D. mexicanus*; E, *D. orestes*; F, *D. sicheli*; G, *D. uyacanus*; H, *Paragapostemon coelestinus*; I, *Rhinotula denticrus*; J, *Dinagapostemon uyacanoides*; K, *Agapostemonoides hurdi*.

enlarged ovaries. They nest aggregatively in earthen banks and probably are all polylectic for they possess unspecialized scopae.

PARAGAPOSTEMON Vachal

Halictus (Paragapostemon) Vachal, 1903, pp. 89, 96. Type species: *Halictus (Paragapostemon) podager* Vachal 1903 (= *Nomia coelestina* Westwood, 1875), designated by Cockerell, 1905, p. 354.

DIAGNOSIS: About 9-12 mm in length; metallic green to blue; malar space about half as long as wide; hair on eye more than 1.0 od; flagellomere 1 distinctly longer than flagellomere 2 in female; legs of male mostly yellow with some green maculae, hind leg swollen, with femoral and basitarsal teeth, hind tarsomeres 1 and 2 fused; propodeum almost entirely de-

clivous with little dorsal surface; T2-T4 with well developed lateral gradular carinae; lateral area below subspiracular carina on T1 of male microareolate; gonocoxite without striae; S8 of male distinctly trilobed at apex, spiculum present.

DISCUSSION: *Paragapostemon* is the sister group to *Dinagapostemon* (Fig. 2).

Paragapostemon coelestinus (Westwood)

Nomia coelestina Westwood, 1875, p. 220. Male holotype (OX).

Nomia caelestina; Dalla Torre, 1896, p. 164 (unnecessary emendation).

Agapostemon bruneri Crawford, 1901, p. 160. Male lectotype (NU). New synonym.

Nomia cillaba Cameron, 1902, p. 376. Male lectotype (BMNH).

Halictus (Paragapostemon) podager Vachal, 1903, pp. 89, 96. Male lectotype (MNHN). New synonym.

TYPES: Male holotype of *Nomia coelestina* (dark metallic blue form) has no legible locality data but Westwood (1875) records it from México. The male lectotype of *Agapostemon bruneri* (bright metallic green form), here designated, is labeled as from Tlalpam, México, L. Bruner. "Tlalpam" is probably a misspelling of Tlalpan, D. F. The male lectotype of *Nomia cillaba* (bright metallic green form; B. M. Type No. 17.a.1220a), here designated, is the same specimen that J. S. Moure labeled as a lectotype in 1957; to our knowledge he did not publish this designation. It is labeled New Mexico, P. Cameron. Cameron (1902) records the species from the Santa Fé District, New Mexico, but the locality is incorrect (Hurd and Linsley, 1976, pp. 46-47). The male lectotype of *Halictus podager* (bright metallic green form), here designated, is labeled "Meztill, États-Unis, 1867, O. Sichel." The meaning of United States on the label is unknown and the word Meztill might mean México or a village in México since this is strictly a Mexican species.

DISTRIBUTION: Mexican plateau and as far south as Oaxaca between 1800 m and 2700 m from July through November. Blue form prevalent at higher altitudes (2340-2682 m) and green form somewhat lower (1890-2590 m).

ADDITIONAL SPECIMENS: **MÉXICO:** COLIMA: Colima, 2 M (UNAM). DISTRITO FEDERAL: Colonia Lindavista 2 M (UNAM); México City, 2340 m, 8 M, 2 F (CU), 3 M (LACM), 1 M (MSU), 1 M (REM), 1 F (KU); Pedregal, 11 M (KU). DURANGO: 6.4 km NE of El Salto,

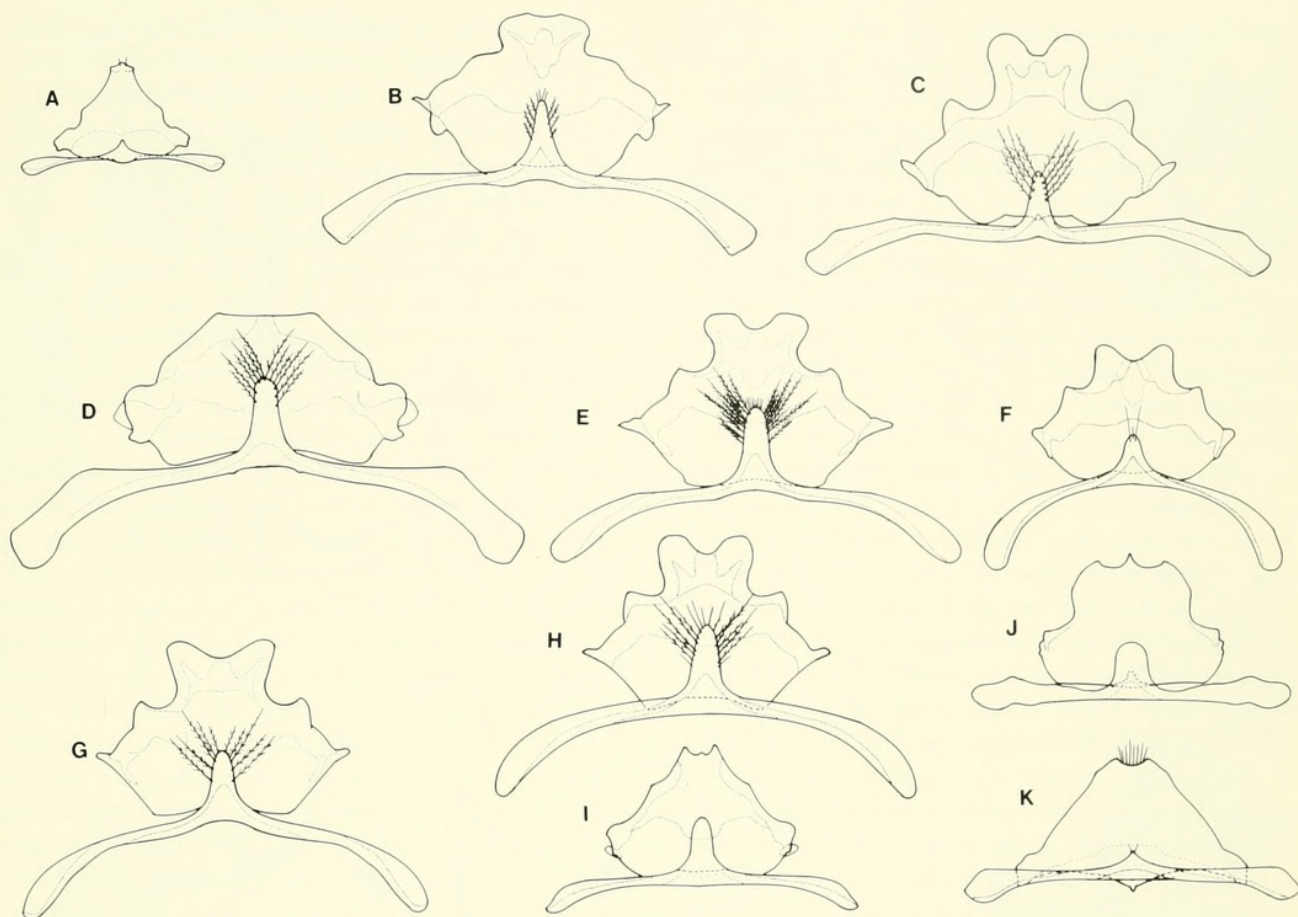


FIGURE 18. Male S7 and S8. **A**, *Agapostemonoides hurdi*; **B**, *Dinagapostemon gigas*; **C**, *D. goneus*; **D**, *D. mentor*; **E**, *D. mexicanus*; **F**, *D. orestes*; **G**, *D. sicheli*; **H**, *D. uyacanus*; **I**, *D. uyacanoides*; **J**, *Paragapostemon coelestinus*; **K**, *Rhinetula denticrus*.

2591 m, 2 M (AMNH). GUANAJUATO: Roigüe, 1 M (LACM). GUERRERO: 8 km S, 3.2 km E of Chilpancingo, 1 M (REM). HIDALGO: 8.1 km W of Pachuca, 2408 m, 4 M, 1 F (REM); 17.7 km E of Pachuca, 2454 m, 7 M (REM); Tepeapulco, 2 M (UTAH); 9.7 km E of Tulancingo, 2103 m, 9 M (KU); 11.3 km S of Tulancingo, 2286 m, 58 M (KU); Zimapán, 1951 m, 1 M (OSU). JALISCO: Mazamitla, 1 M (KU); 6.4 km W of Mazamitla, 2073 m, 1 M (AMNH); 11.3 km S of Mazamitla, 1 F (KU); Tepatitlán, 1 M (UTAH). MÉXICO: Amecameca, 2682 m, 1 M (CU), 1 M (MSU); Atlacomulco, 2591-2682 m, 9 M, 2 F (KU), 5 M (LACM), 1 M (MSU), 2 M (OSU); Chapingo, 5 M (KU), 1 M (UTAH); 86 km E of Tlalpan, 2 M (KU); 34 km W of Toluca, 2591 m, 1 M (MCZ); 38.9 km NW of Toluca, 4 M (KU). MICHOACÁN: Morelia, 4 M (KU, LACM, MSU, and OSU); 74 km W of Morelia, 1996 m, 1 M (OSU); Lago Patzcuaro, 2073 m, 1 M (OSU); Tancítaro, 2100 m, 1 M on *Ipomoea*, 4 M, 2 F (UNAM); 27.4 km W of Tuxpan, 2255 m, 1 F (OSU); 41.8 km W of Tuxpan, 2423 m, 1 M, 2 F (OSU). MORELOS: Cuernavaca, 1 M.

NUEVO LEÓN: 85.3 km S of Saltillo, 1 M (KU). OAXACA: Huajuapán de León, 1 M (KU); Monte Albán, 1 M (KU); 11.4 km N of Yanhuatlán, 2408 m, 1 M (LACM). PUEBLA: 59.6 km N of San Hipalito, 6 M (UCB). SAN LUIS POTOSÍ: El Águila, 1 F (UCB); 22.5 km E of San Luis Potosí, 1890 m, 1 M (OSU); 24.1 km E of San Luis Potosí, 1981 m, 1 M (OSU). TLAXCALA: 16.1 km N of Apizaco, 2377 m, 29 M (REM). VERACRUZ: Banderilla, 1 M (LACM); Perote, 2590-2743 m, 1 M (KU); 6.4 km S of Perote, 55 M (UCB). ZACATECAS: Río Grande, 2 M (UTAH); Saín Alto, 1 M (UTAH).

HABITS: There are only two flower records for females of this species. One was collected on squash (*Cucurbita*) and two on cactus (*Opuntia*). That both these plants have extremely large pollen grains may be of some significance. Males have been collected sleeping in flowers of prickly poppy (*Argemone*) by RBR. They have also been collected at *Brickellia*, *Flourensia*, *Ipomoea*, *Lopezia racemosa*, and *Sphaeralcea*. That we have seen 254 males and only 11 females in collections leads us to suspect that females are

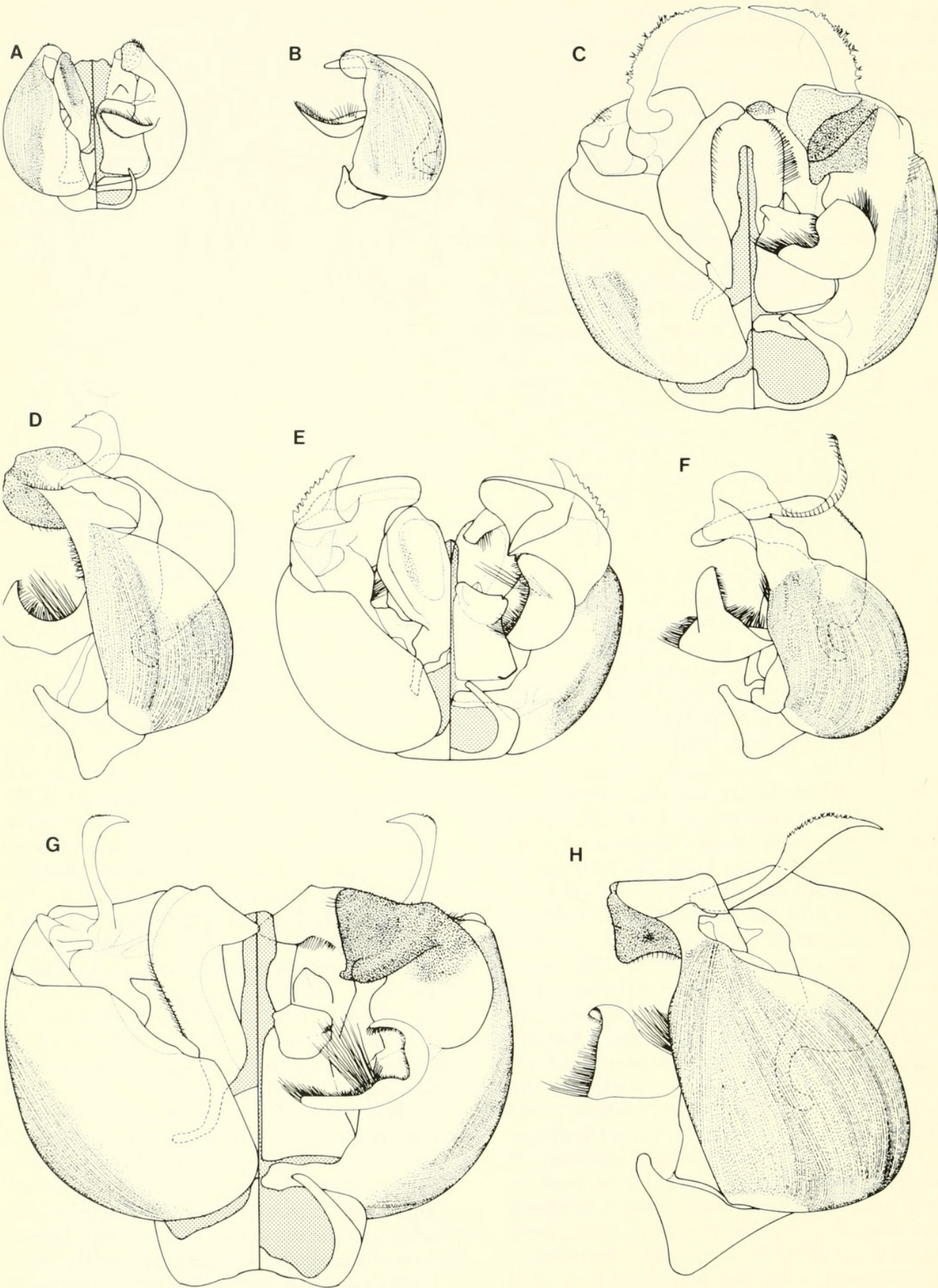


FIGURE 19. Male genitalia in dorsoventral and side views; left half is dorsal, right half is ventral in divided drawings. All drawn to same scale. **A-B**, *Agapostemonoides hurdi*; **C-D**, *Dinagapostemon gigas*; **E-F**, *D. goneus*; **G-H**, *D. mentor*.

either matinal and/or crepuscular or are oligolectic on a rarely encountered host.

DESCRIPTION: *MALE* (Figs. 3g, 5e, 7c, 10i, 14i, 16d-e, 17h, 18j, 20k-l). General color bright metallic green or purplish blue. Length 9-12 mm. **HEAD** (Figs. 5e, 7c): Pubescence cream-colored, pale amber on eyes. (1) Labrum: Yellow; central region with small punctures separated by 2-3 times their diameter; distal margin with fimbria of golden hairs 0.8 od. (2) Clypeus: With yellow at midline occupying lower 0.4 clypeal length, metallic above; hairs 1.0 od and separated by 2-3 times width of basal punctures. (3) Interocular area: Metallic except for piceous paraocular strip 1.0 od wide; surface flat above antennal sockets and with distinct supraclypeal bulge below sockets; punctures minute and contiguous above antennal sockets, becoming coarser below; pubescence erect, nearly as long as scape medially, becoming short laterally and ventrally. (4) Vertex: Metallic; ocellar separation 0.8 od, lateral ocellus 2.1 od from eye, surface between eye and lateral ocellus concave, region posterior to ocelli sloping dorsally before abruptly turning ventrally (not carinate); minute contiguous punctures around ocelli, becoming coarser posteriorly; pubescence 2.4 od. (5) Gena: Metallic; area behind eye concave; weakly striate, hypostomal carinae 2.5 times as long as width of proboscoidal fossa; pubescence 2.0 od posteromedially, becoming shorter anteriorly and laterally. (6) Malar area: Yellow; 1.0 od between eye and mandibular base; pubescence sparse, very short and directed ventrally. (7) Mandible: Yellow with apical 0.25-0.35 transparent, reddish brown; without tooth or ridges; sparse, golden hairs 2.4 od proximoventrally, becoming shorter distally. (8) Antenna (Fig. 3g): Scape, pedicel and dorsum of flagellum piceous (scape sometimes marked with yellow), flagellum amber ventrally. **THORAX:** bright metallic green or purplish blue; pubescence amber dorsally, cream-colored laterally and posteriorly, becoming white ventrally. (9) Pronotum: Lateral angle and posterior lobe rounded; minute, subcontiguous punctures laterally, becoming slightly coarser dorsomedially; pubescence fairly dense, 2.1 od. (10) Mesoscutum: Uniformly covered with small, deep, contiguous punctures; pubescence 1.5 od, uniformly distributed. (11) Mesoscutellum: Punctures like those on mesoscutum but slightly coarser; pubescence like that of mesoscutum. (12) Metanotum: Punctures coarser than those of mesoscutellum; pubescence like that of mesoscutellum. (13) Mesepisternum: Coarsely punctate to finely rugose;

pubescence 2.4 od. (14) Metepisternum: Finely, horizontally rugose; pubescence 2.8 od. (15) Propodeum: Covered with small, contiguous punctures and with broad, deep, posteromedial groove terminating dorsally in short, transverse ridge; pubescence 2.6 od laterally, becoming 1.6 od posteromedially. (16) Wings: Clothed with minute brown hairs about as long as diameter of adjacent veins distally, becoming longer (0.5 od) proximally, veins and stigma dark brown, 8-10 hamuli on hind wing. (17) Tegula: Transparent brown with anterior third metallic; minute, widely scattered punctures; glabrous posterolaterally but with dense hairs anteriorly 1.5 od. (18) Fore leg: Coxa metallic laterally, becoming piceous medially; pubescence 2.2 od. Trochanter piceous dorsally and yellow ventrally; pubescence dorsolateral, 1.5 od distally, becoming 0.5 od proximally. Femur yellow with dorsal region piceous and metallic; pubescence dorsal, 1.8 od. Tibia yellow with brown to black longitudinal stripe posteriorly; strigilis with transparent velum and yellow malus 2.8 od long. Tarsus yellow; basitarsus about as long as tarsomeres 2-5 together; covered with golden bristles 0.5-1.2 od. (19) Middle leg: Similar to fore leg. Tibial spur 2.2 od long and basitarsus 0.75 as long as tibia. (20) Hind leg (Figs. 16d-e, 17h): Coxa metallic with yellow ventrally; pubescence 2.3 od anteriorly, becoming shorter posteriorly and absent dorsally. Trochanter piceous with yellow ventrally; pubescence 1.3 od anteriorly and posteriorly but absent dorsally and ventrally. Femur yellow with piceous markings, becoming metallic above; swollen but flattened posteriorly and with sharp edge on distal half of posteroventral margin; pubescence 2.8 od dorsally, shorter anteriorly, absent ventrally and posterocentrally. Tibia with anterior spur 2.0 od long and posterior spur 2.7 od long; pubescence 2.8 od and scattered anteriorly, becoming dense, short and directed distad posteriorly. Tarsus with fused tarsomeres 1 + 2 1.5 times as long as tarsomeres 3-5 together; pubescence like that of other tarsi except for dense brush of distally directed bristles 0.9 od on posterior surface of basitarsus. **METASOMA:** (21) Terga: Bright metallic green or purplish blue with piceous premarginal ridge and transparent posterior margin, ventrolateral region transparent brown, pygidial plate yellow to piceous; T2-T4 with gradulus extending posterolaterally so as to form small lateral flanges, pregradulus raised but postgradular area depressed and concave; T1-T4 with distinct premarginal ridge 2.0 od from posterior tergal margin; T7 with distinct subtriangular pygidial plate (Fig. 14i)

and medial notch in ventral (distal) margin; punctures in postgradular area like those of mesoscutum but smaller and shallower on pre-marginal ridge; pubescence cream-colored, 2.0 od anteriorly, becoming 1.1 od posteriorly. (22) Sterna (Fig. 10i): S1 metallic anteriorly and transparent amber posteriorly; posterior margin concave medially; medial pubescence sparse, 2.0 od. S2-S3 pale amber to brown with posterior margin transparent; scattered pubescence 1.5 od and separated by 0.6 od. S4 pale amber to black with faint metallic hue; posterior margin broadly concave with gradulus bowed rearward medially and separated from distal margin by 1.0 od, surface concave distal to gradulus but becoming convex posterolaterally; pubescence moderately sparse, hairs fringing gradulus 0.5 od, hairs up to 1.6 od posterolaterally, 6-8 submarginal, stout, hooked spines laterally 1.6 od with shorter and less conspicuous spines medially. S5 brown to black proximally, metallic laterally, amber to brown distomedially; distal margin convex, surface slightly concave medially, becoming convex laterally; pubescence directed posteromedially, 1.2 od posterolaterally, becoming shorter anteromedially. S6 brown to black anteriorly and laterally, becoming amber to yellow posteromedially, surface slightly concave medially and convex laterally; pubescence in central region appressed, directed medially and 2.0 od, becoming erect and 1.3 od laterally. S7 and S8 (Fig. 18j). (23) Genitalia (Figs. 20k-l).

FEMALE (Figs. 3m, p, 8a, 9d). Agrees with description of male except lacking yellow markings, pubescence only 0.4-0.8 times as long as that of male, and the following. **HEAD** (Figs. 8a, 9d): (1) Labrum: Dark amber; basal area prominent, irregularly rough and enclosed by flange; distal process with prominent distomedial keel and marginal fimbria of amber upturned bristles. (2) Clypeus: Fimbria of amber downturned bristles (2.8 od) between lateral teeth on distal margin. (4) Vertex: Area between eyes and ocelli not as concave as in male, region behind ocelli more gently rounded than in male. (5) Gena: Area behind eye not concave. (7) Mandible: Amber to dark brown, with subapical tooth. (8) Antenna (Fig. 3p). **THORAX**: (16) Wings: Hamuli 8-14. (18-20) Legs: Brown, coxae metallic dorsally; pubescence typical of female Halictinae; posterior spur of hind tibia with 7-8 teeth (Fig. 3m). **METASOMA**: (21) Terga: Premarginal ridges and postgradular depressions less distinct than those of male; prepygidial fimbria golden. (22) Sterna: Amber

to black except S1 metallic anteriorly; pubescence moderately dense, erect, 3.2 od.

RHINETULA Friese

Rhinetula Friese, 1912, p. 185. Type species: *Rhinetula denticrus* Friese, 1922, designated by Sandhouse, 1943, p. 596.

DIAGNOSIS: Brown with green to blue metallic hue on upper half of face and thorax, T2-T4 with basal amber band (Peruvian populations with terga mostly amber); metasoma nonmetallic; malar space linear; hair on eye about 1.0 od; legs of male dark, hind leg with two femoral teeth (median one long and acute, subapical one obtuse and small) hind tarsomeres 1 and 2 fused; propodeum entirely declivous, propodeal triangle weakly defined; T2-T4 with well developed lateral gradular carinae, lateral area below subspiracular carina on T1 of male mirror-like without microsculpturing, metasoma of male similar in shape to that of female, a little longer than wide, S4 of male with 5-8 suberect, anteriorly-directed, mediosubapical spines; gonocoxite with striae, gonostylus with small simple membranous appendage; S8 of male apically narrowed and bilobed.

DISCUSSION: *Rhinetula* is the only agapostemonine in which the male metasoma is similar in shape to that of the female, that is, only a little longer than wide. In addition, the lateral area below the subspiracular carina on T1 of the male is mirror-like without microsculpturing. All other male agapostemonines have narrow, elongate metasomas, and lateral areas below subspiracular carinae that are microareolate on T1. Furthermore, all other male agapostemonines have long antennae reaching posteriorly past the propodeal triangle; in *Rhinetula* they are short, like those of the female, not reaching the mesoscutellum.

Rhinetula denticrus Friese

Rhinetula denticrus Friese, 1922, p. 583. Male lectotype (ZMHU).

Rhinetula rufiventris Friese, 1922, p. 584. Male holotype (ZMHU). New synonym.

TYPES: Male lectotype of *Rhinetula denticrus*, here designated, is from *COSTA RICA*: San Carlos, 1902. It is likely that the San Carlos (9°14'N, 83°35'W), near the border of the Provinces of San José and Puntarenas, is the type locality. Male holotype of *Rhinetula rufiventris* is from *BOLIVIA*: Tarata, 1900.



FIGURE 20. Male genitalia in dorsoventral and side views unless otherwise stated; left half is dorsal, right half is ventral in divided drawings. All drawn to same scale. c, crest of penis valve, s, setae. **A-B**, *Dinagapostemon mexicanus*; **C-D**, *D. orestes*; **E-G**, *D. sicheli* (F, dorsoapical view of apex of penis valve); **H-J**, *D. uyacanus* (I dorsoapical view of apex of penis valve); **K-L**, *Paragapostemon coelestinus*; **M-N**, *Rhinotula denticrus*.

DISTRIBUTION: This species is found in wet forests from Honduras to Bolivia.

ADDITIONAL SPECIMENS: **COSTA RICA:** CARTAGO PROV.: Turrialba, 12 Aug. 1964, R. B. and M. G. Roberts, 1 M (REM). **HEREDIA PROV.:** Finca La Selva, 152 m, 25 Apr. 1979, on *Cassia*, 0815-0915 h, D. R. Perry, 1 M (LACM); Puerto Viejo, 14 Mar. 1976, D. H. Janzen, 1 M (KU). **PUNTARENAS PROV.:** Golfito, 11 Jul. 1957, A. Menke, 1 M (LACM). **SAN JOSÉ PROV.:** San José, 21 Feb. 1962, A. Wille, 1 M (KU). **HONDURAS:** ATLÁNTIDA PROV.: Tela,

Lancetilla, 6 Apr. 1923, T. H. Hubbell, 1 M (KU). **PANAMA:** COLÓN PROV.: Barro Colorado Island, 15 Mar.-4 May 1963, C. W. and M. E. Rettenmeyer, 18 M, 17 F (KU), 14 Jul. 1965, E. M. Fisher, 1 M (RWB), 24 Jul. 1963, M. E. Irwin and D. Q. Cavagnaro, 2 M (UCB); 7 km N on Pipeline Road near Gamboa, 28 Apr. 1975, M. L. Siri, 1 M (RWB); Canal Zone, Jul.-Aug. 1915, D. E. Harrow, 1 M (ANSP); 30 km SE of Colón, Santa Rita Ridge, 10 Apr. 1981, R. W. Brooks, 2 F (RWB). **PANAMÁ PROV.:** Cerro Campana, near Capira, 11 Aug.

1957, D. H. Janzen, 2 F (KU); 9 km N of El Llano, 7 Jan. 1981, on *Croton panamensis*, 1 M (LACM); 15 km N of El Llano, 7 May 1981, on *Psychotria*, R. W. Brooks, 1 M (RWB). **PERÚ:** HUÁNUCO PROV.: Huánuco Dpto., Tingo María, Monzon Valley, 12 Oct.-23 Dec. 1954, E. T. Schlinger and E. S. Ross, 8 M (CAS), 1 M (KU).

HABITS: The only females we have seen were those collected in Panamá by C. W. and M. E. Rettenmeyer on Barro Colorado Island, by D. H. Janzen at Cerro Campana, and by RWB 30 km SE of Colón (Santa Rita Ridge). Those collected by RWB were flying low along the side of a leaf-covered road, exposed to full sun, near midday and were presumably searching for suitable nest sites. Those collected by the Rettenmeyers were taken at a light between 0545 and 0615 h. Three males were taken at the same light. Females collected by Janzen were taken at a black light (Janzen, 1968). The male collected by RBR was taken by sweeping vegetation at midday. The male taken by RWB was taking nectar at *Psychotria* at midday. From this evidence, we believe that both sexes are usually matinal and that males may rest on vegetation or occasionally forage during the day.

DESCRIPTION: *MALE* (Figs. 1, 3j, 5d, 7d, f, 10j, 11a-b, 14j, 16b, 17i, 18k, 20m-n). Head and thorax dark metallic bluish black; metasoma pale amber to dark brown with yellow to amber bands on terga. Length 8.8-11.2 mm. Pubescence generally amber dorsally, becoming white ventrally. **HEAD** (Figs. 5d, 7d): Pubescence cream-colored, becoming dark brown at vertex as well as below and behind compound eye. (1) Labrum: Cream-colored; impunctate; distal margin with fimbria 1.0 od. (2) Clypeus: Cream-colored on lower half, amber to piceous above; convex; coarse punctures scattered throughout with rugae dorsally and laterally; pubescence simple and short (0.7 od) centrally, becoming longer (2.2 od) dorsolaterally. (3) Interocular area: Faintly metallic, especially laterally; surface concave in paraocular area and below median ocellus, low supraclypeal bulge below and between antennal sockets, indistinct median tooth (frontal tubercle) just below antennal sockets; coarse, contiguous punctures above antennal sockets but coarse punctures separated by at least their diameters below antennal sockets; pubescence between antennal sockets short (2.0 od), white and densely branched, mixed with long (3.5 od), brown, sparsely branched hairs; pubescence long and brown above antennal sockets (later-

ally), and below short, appressed and white, obscuring paraocular area. (4) Vertex: Piceous or faintly metallic; ocellar separation 0.5 od, lateral ocellus 1.8 od from eye, surface between eye and lateral ocellus distinctly concave, region behind ocelli scarcely rising before descending steeply to weak preoccipital carina; deep, moderate sized, contiguous punctures ventral to ocelli, becoming coarsely rugose posteriorly; pubescence 2.5 od between ocelli, becoming shorter anteriorly and laterally. (5) Gena: Faintly metallic purple to blue; convex behind eye; very faintly striate, hypostomal carina 1.45 times as long as width of proboscis fossa; pubescence 3.8 od posteromedially, becoming shorter anteriorly and laterally. (6) Malar area: Amber to brown, 0.3 od between eye and mandibular base; pubescence white, short and dense. (7) Mandible: Amber; without teeth or ridges; sparse, golden hairs 3.1 od proximally, becoming shorter distally. (8) Antenna (Fig. 3j): Brown to amber below, darker dorsally; flagellum 1.10 times head width, basal flagellomere 0.8 times as long as other individual flagellomeres, flagellomeres not sinuate. **THORAX:** Dull metallic bluish black to purplish black, legs amber to black. (9) Pronotum: Lateral angle and posterior lobe rounded; minutely rugose; pubescence short, appressed, white and flocculose, obscuring surface, and scattered, long plumose amber hairs (2.0 od). (10) Mesoscutum: Uniformly covered with small, deep, contiguous punctures; pubescence short, white and inconspicuous at margins and mixed with long plumose, amber hairs (2.4 od). (11) Mesoscutellum: Punctures like those of mesoscutum but slightly coarser; pubescence like that of mesoscutum. (12) Metanotum: Finely rugose; pubescence like that of mesoscutum but long hairs 3.6 od. (13) Mesepisternum: Finely rugose; pubescence like that of mesoscutum but amber on upper half and white on lower half. (14) Metepisternum: Finely rugose; pubescence 2.6 od. (15) Propodeum: Minutely rugose to contiguously punctate, posteromedial groove small. (16) Wings: Pubescence about as long as diameter of adjacent veins distally, becoming 0.6 od proximally, veins and stigma amber to brown, hamuli 10-12. (17) Tegula: Transparent amber; pubescence 2.0 od anteriorly, absent posteriorly. (18) Fore leg: Pale to dark brown; pubescence moderately dense, 2.8 od. Trochanter brown; pubescence 3.2 od posteriorly, shorter dorsolaterally. Femur light amber anteriorly, becoming dark amber posteriorly; pubescence 2.5 od posteriorly, becoming shorter anteriorly. Tibia like

femur but pubescence shorter (1.2 od posteriorly) and simple, strigilis with transparent velum and amber malus 2.2 od long. Tarsus pale to dark amber; tarsomeres 2-5 together 1.1 times as long as basitarsus; pubescence pale amber, short and dense ventrally, becoming darker and longer (6.5 od) dorsally. (19) Middle leg: Similar to fore leg, tibial spur simple (6.6 od long), tarsus amber to black, basitarsus equal in length to tibia and to tarsomeres 2-5 together. (20) Hind leg (Figs. 16b, 17i): Coxa amber to piceous; pubescence 3.4 od anteriorly and posteriorly, becoming shorter ventrally and absent dorsally. Trochanter amber; pubescence 1.2 od. Femur amber to piceous; somewhat swollen and with large, sharp, ventral tooth on mid section followed distally by concavity and second smaller blunt tooth; pubescence 3.1 od dorsally, becoming shorter elsewhere. Tibia amber to piceous; anterior spur 3.4 od long, posterior spur 3.7 od long (half as long as fused tarsomeres 12 together); pubescence 2.1 od and scattered anteriorly, becoming dense, short and directed distad ventrally. Tarsus with fused tarsomeres 12 0.6 times as long as tarsomeres 3-5 together; dense brush of distally directed bristles 1.3 od posteriorly on basitarsus, slightly longer anteriorly. METASOMA: (21) Terga (Figs. 11a-b): Pale amber (at least on anterior face of T1) to brownish black, with brownish yellow bands basally on T2-T3 or T1-T4; T1-T3 or T1-T4 with small lateral gradular carina (Figs. 1, 7f), postgradular area nearly flat with postgradular depression and premarginal ridge indistinct, T7 with broad but distinct pygidial plate (Fig. 14j); punctures contiguous and small on T1, becoming smaller and scattered on subsequent terga; pubescence on anterior face of T1 1.8 od, amber and branched, simple dark hairs laterally on T2-T7 and centrally on T3-T7 or T4-T7, short on anterior terga, becoming longer (6.9 od) on posterior terga. (22) Sterna (Fig. 10j): Amber; pubescence 7.0 od on S2, becoming shorter on posterior sterna, S4 with 5-8 medial spines hooking anteriorly. S7 and S8 (Fig. 18k). (23) Genitalia (Figs. 20m-n).

FEMALE (Figs. 3n, q, 8b, 9e). Agrees with description of male except as follows. **HEAD** (Figs. 8b, 9e): Without cream-colored markings on clypeus and labrum. (1) Labrum: Dark amber to black; basal area prominent, convex distomedially, concave proximally and laterally, irregularly rough and enclosed by flange; distal process broad and flat apically, lacking distomedial keel and lateral projections but with amber marginal fimbria of upturned bristles. (2) Clypeus: Coarsely punctate; fimbria of amber

bristles directed ventrad (5.1 od) between lateral teeth on distal margin. (3) Interocular area: Without medial tooth (frontal tubercle) below antennal sockets; pubescence shorter than scape medially, not so dense and feathery as to obscure paraocular area. (5) Gena: Convex behind eye. (7) Mandible: With subapical tooth. (8) Antenna (Fig. 3q). **THORAX**: (15) Propodeum: Posterior surface with minute contiguous punctures and nearly enclosed by carina, posterodorsal surface with rugae radiating from metanotum; pubescence on posterior surface mixture of short appressed hairs and long (3.0 od) erect hairs. (18-20) Legs: Brown; pubescence typical of female Halictinae but distal tarsomeres of fore leg with slender, apically sinuate hairs; posterior spur of hind tibia with 6-8 flattened teeth (Fig. 3n). **METASOMA**: (21) Terga: Punctures slightly smaller than those of male, distinct lateral gradular carinae on T1-T4 or T1-T5; pubescence on anterior surface of T1 pale, minutely branched and 1.2 od, pubescence not discernible from posterior of T1 to anterior of T4, erect bristles on T4 and T5 black and 8.0 od. (22) Sterna: Pale yellowish amber anteriorly, darker posteriorly; pubescence long (5.9 od) and pale on anterior terga, becoming short (2.0 od) and dark posteriorly.

LITERATURE CITED

- Abrams, J. and G. C. Eickwort. 1980. Biology of the communal sweat bee *Agapostemon virescens* (Hymenoptera: Halictidae) in New York State. *Search Agric.* 1: 1-20.
- . 1981. Nest switching and guarding by the communal sweat bee *Agapostemon virescens* (Hymenoptera, Halictidae). *Insectes Sociaux* 28: 105-116.
- Alfken, J. D. 1932. Die Chilenischen Arten der Gattung *Caenohalictus* Cam. *Archiv für Naturgesch.* (NF)1: 654-659.
- Cameron, P. 1902. Descriptions of new genera and species of American Hymenoptera. *Trans. Amer. Entomol. Soc.* 28: 369-377.
- . 1903. Descriptions of new species of Hymenoptera taken by Mr. Edward Whymper on the "Higher Andes of the Equator." *Trans. Amer. Entomol. Soc.* 29: 225-238.
- Claude-Joseph, F. 1926. Recherches biologiques sur les Hyménoptères du Chili (Mellifères). *Ann. Sci. Nat., Zool. Biol. Animale* (10)9: 113-268. [Translated by M. Etcheverry and A. Valenzuela into Spanish as: Investigaciones biológicas sobre himenópteros de Chile (Melíferos) de Claude Joseph. *Publ. del Centro*

- de Estudios Entomológicos, Univ. de Chile, No. 1: 1-60, pls. 1-18 (1960).]*
- Cockerell, T. D. A. 1949. Bees from Central America, principally Honduras. *Proc. United States Nat. Mus.* 98: 429-490.
- Crawford, J. C., Jr. 1901. North American bees of the genus *Agapostemon* Guérin. *Proc. Nebraska Acad. Sci.* 7: 156-165.
- Dalla Torre, C. G. de. 1986. *Catalogus Hymenopterorum* 10: viii + 643 pp., Leipzig.
- Danforth, B. N. 1987. The evolution of hymenopter wing size. M.A. Thesis, Univ. Kansas, Lawrence, 116 pp.
- Eickwort, G. C. 1969a. Tribal positions of Western Hemisphere green sweat bees, with comments on their nest architecture (Hymenoptera: Halictidae). *Ann. Entomol. Soc. Amer.* 62: 652-660.
- . 1969b. A comparative morphological study and revision of the augochlorine bees (Hymenoptera: Halictidae). *Univ. Kansas Sci. Bull.* 48: 325-524.
- . 1981. Aspects of the nesting biology of five nearctic species of *Agapostemon* (Hymenoptera: Halictidae). *Jour. Kansas Entomol. Soc.* 54: 337-351.
- Eickwort, G. C. and K. R. Eickwort. 1969. Aspects of the biology of Costa Rican halictine bees. I. *Agapostemon nasutus* (Hymenoptera: Halictidae). *Jour. Kansas Entomol. Soc.* 42: 421-452.
- Fabricius, J. C. 1793. *Entomologia Systematica Emendata et Aucta*. Copenhagen, Christ. Gottl. Proft., Vol. 2, 519 pp.
- Friese, H. 1911. Neue Bienen aus Sud-Amerika (Hym.). *Deutsche Entomol. Zeitschr.* 1911: 453-457.
- . 1922. Eine neue Bienengattung aus Sudamerika: *Rhinotula* (Apidae). *Zool. Jahrb., Abt. für Syst. Geog. Biol. der Tiere* 45: 581-586.
- Guérin-Ménéville, F. E. 1844. *Iconographie du règne animal de G. Cuvier...*, *Insects*, Vol. 3: 447-448.
- Hurd, P. D., Jr. and E. G. Linsley. 1976. The bee family Oxaeidae with a revision of the North American species (Hymenoptera: Apoidea). *Smithsonian Contrib. Zool.* 220: 1-75.
- Janzen, D. H. 1968. Notes on nesting and foraging behavior of *Megalopta* (Hymenoptera: Halictidae) in Costa Rica. *Jour. Kansas Entomol. Soc.* 41: 342-350.
- Michener, C. D. 1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). *Bull. Amer. Mus. Nat. Hist.* 82: 158-326.
- . 1978. The classification of halictine bees: Tribes and Old World nonparasitic genera with strong venation. *Univ. Kansas Sci. Bull.* 51: 501-538.
- . 1979. New and little-known halictine bees from Colombia (Hymenoptera: Halictidae). *Jour. Kansas Entomol. Soc.* 52: 180-208.
- Michener, C. D., M. D. Breed, and W. J. Bell. 1979. Seasonal cycles, nests, and social behavior of some Colombian halictine bees (Hymenoptera: Apoidea). *Rev. Biol. Trop.* 27: 13-34.
- Michener, C. D. and R. B. Lange. 1958. Observations on the behavior of Brazilian halictid bees, III. *Univ. Kansas Sci. Bull.* 39: 473-505.
- Moure, J. S. 1941. Apoidea neotropica - III. *Arquivos Mus. Paranaense* 1: 41-99.
- . 1964. Two new genera of halictine bees from the Araucanian subregion of South America (Hymenoptera: Apoidea). *Jour. Kansas Entomol. Soc.* 37: 265-275.
- Moure, J. S. and P. D. Hurd, Jr. 1982. On two new groups of neotropical halictine bees (Hymenoptera, Apoidea). *Dusenya* 13: 46.
- Moure, J. S. and P. D. Hurd, Jr. In press. *Catalog of the Western Hemisphere Halictidae*. Smithsonian Press, 1192 MS pp.
- Roberts, R. B. 1969. Biology of the bee genus *Agapostemon* (Hymenoptera: Halictidae). *Univ. Kansas Sci. Bull.* 48: 689-719.
- . 1971. Biology of the crepuscular bee *Ptiloglossa guinnae* n. sp. with notes on associated bees, mites and yeasts. *Jour. Kansas Entomol. Soc.* 44: 283-294.
- . 1972. Revision of the bee genus *Agapostemon* (Hymenoptera: Halictidae). *Univ. Kansas Sci. Bull.* 49: 437-590.
- Roberts, R. B. and S. R. Vallespir. 1978. Specialization of hairs bearing pollen and oil on the legs of bees (Hymenoptera: Apoidea). *Ann. Entomol. Soc. America* 71: 619-627.
- Sandhouse, G. A. 1943. The type species of the genera and subgenera of bees. *Proc. United States Nat. Mus.* 92: 519-619.
- Schrottky, C. 1909. Nuevos himenópteros sudamericanos. *Rev. Mus. La Plata* 16: 137-149.
- Vachal, J. 1901. Contributions hyménoptériques, V. - Hymenoptera mellifera americana nova. *Ann. Soc. Entomol. France* 70: 77-82.
- . 1903. Étude sur les *Halictus* d'Amérique (Hym.). *Miscellanea Entomol.* (Narbonne) 11: 89-104, 121-136.
- Westwood, J. O. 1875. Descriptions of some new species of short-tongued bees belonging to the genus *Nomia* of Latreille. *Trans. Entomol. Soc. London* 1875: 207-222, 2 pls.



1987. "Agapostemonine bees of mesoamerica (Hymenoptera: Halictidae)."
The University of Kansas science bulletin 53, 357–392.

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