

# An infrageneric classification of *Euglossa*, with notes on some features of special taxonomic importance (Hymenoptera; Apidae)

by

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**Abstract:** Several features of taxonomic importance in *Euglossa* are illustrated and/or discussed: the mid tibia velvet area, sternal "pockets" or tufts, the form of the hind tibia and the number of mandibular teeth, all features of the males, and tongue length, punctation, color and nest structure: *Euglossa* is divided into twelve species groups separated into four subgenera: 1) *Glossura* (groups I-V) includes all species with obtuse pronotal angles and with the anterior tuft of the mid tibia entire. These are slender (or very small), shiny bees with long or very long tongue and with the hind tibia triangular. 2) *Dasystilbe*, with a single species that combines features of *Glossura* and *Euglossella*. 3) *Euglossella*, which is limited to the *E. viridis* complex, bees with acute pronotal angles and with the anterior tuft of the mid tibia entire and very large. They are thick-bodied bees, often shaggy and shiny at the same time. 4) *Euglossa* (VIII-XII) is limited to the species with the anterior tuft of the mid tibia attenuate, notched or bilobed. These usually have the hind tibia rhomboid.

The brightly metallic bees of the genus *Euglossa* form an important element in the fauna of tropical American forests, but these fast-flying bees only occasionally fall victim to the general collector's net. The bees that are caught in this way are usually foraging females. Thus, for about two hundred years the classification of *Euglossa* was based primarily on features of the females. Within the last two decades, studies of orchid pollination and the resulting use of chemical "baits" have made available ample series of males. (Dodson *et al.*, 1969; Bennett, 1972). It is now evident that the males offer several features of great taxonomic value that are quite lacking in the females. This, coupled with the much greater amount of material now available, has contributed to something of a revolution in the classification of *Euglossa*. The twenty-five or so valid species known twenty years ago have more than doubled, and there are as many more species already collected and awaiting description. Central America, northern South America, and much of Brazil are now rather

well sampled, and collections from other areas are fairly extensive. While one may expect a number of new species, especially from the Venezuelan highlands, the upper Amazon, and Bolivia, the sampling of the genus is already quite enough to show a series of rather well-defined species groups. In the present paper I will discuss some features that are of special taxonomic importance, especially those that are found only in the males. Then I will present a revised subgeneric classification and delineate a number of species groups that have proven useful in the identification of *Euglossa*.

## FEATURES OF SPECIAL TAXONOMIC IMPORTANCE

**Mid tibia velvet area:** The external face of the male mid tibia is largely covered by an oblong or slightly reniform velvet area (Figs. 1 & 2). At the upper (basal) end of this area one finds one or two discrete tufts. These small tufts of hair have proven to be unusually useful in the taxonomy of *Euglossa*. Most disarticulated mid tibiae could easily be assigned to species groups and, with adequate comparative material, a large percentage could be identified to species. The posterior of the two tufts usually is small and more or less circular or oblong. In a few species this tuft shows two or three areas of different color or texture, and in a very few species (of group V\*) it may be divided into two discrete tufts. In some species this tuft is quite lacking, but it is usually represented at least by a depression. The anterior tuft is much more variable in size and shape. In the subgenera *Glossura*, *Dasystilbe* and *Euglossella* (as treated here) this tuft is quite entire, while in the subgenus *Euglossa* it is attenuate (more or less comma-shaped), notched or deeply lobed. In some species the anterior edge of the velvet area, itself, reaches quite to the rim of the depression which it occupies. In other cases, there is a narrow band of sparsely scattered short hairs along the anterior edge of the velvet area, and in a few species there is a wide band of sparse hairs (about half the width of the velvet area). This condition may be termed an "incomplete" velvet area.

**Sternal "pockets" or tufts:** Most male euglossas have two openings and/or tufts of hair on the second sternum (Figs. 1 & 3). In species group III (*Glossura* in the narrowest sense) and in *E. villosa* (group VI) these pockets are represented by diagonal slits which are filled and covered by tufts of long hairs (Fig. 3A). In species group V the "pockets" are either represented by more or less circular depressions, which include diagonal tufts of hair (Fig. 3B), or they are quite lacking. In most other species, these structures are represented by small and rather widely separated tufts of hair (Fig. 3C). Several species have quite large and confluent tufts of hair (Fig. 3D), but this condition seems to have limited systematic importance, since it occurs in isolated species of groups VII, VIII, and X, as well as the only species of groups I and IX. One may note, too, that the posterior margin of the second sternum is normally biconcave, but it is straight or nearly so in a few species. Nothing is known of the function of the sternal openings or tufts. The marked correlation between their absence and the absence of the posterior tuft of the mid tibia in group V suggests a functional relationship. We have noted that specimens of

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\* Roman numerals are used to refer to the twelve species groups that are delineated in the final portion of this paper.

*E. chalybeata*, *E. ignita*, and *E. imperialis* (all group III) that are drowned in McPhail traps usually have a white precipitate on sternum II, apparently extruded from these openings (Bennett, 1972).

**Hind tibia:** The inflated, hollow, hind tibia is a characteristic of all euglossine males, and the form of the hind tibia is an important generic feature. Within *Euglossa* there is considerable variation in the size and outline of this structure, and this is quite useful taxonomically, even if its three-dimensional form is a bit difficult to describe, or even to illustrate (Figs. 1 & 4). In the subgenera *Glossura*, *Dasystilbe* and *Euglossella* the hind tibia is rather triangular in outline, and it is usually acute. In most species of subgenus *Euglossa* the hind tibia is rather more rhomboid, with the posterior edge of the tibia strongly convex, especially distally. In addition, the thickness and the surface of the hind tibia are useful taxonomic features. The hind tibia is subtriangular with the hind margin curving to a narrowly acute apex in *E. charapensis* (group X), *E. melanotricha* (group XI), and *E. jamaicensis* (group XII? ).

**Length of tongue:** All euglossine bees are noteworthy for the great development of the labio-maxillary complex, but the tongue, when folded, varies from about a third of the body length to twice the body length. The subgenus *Glossura* is traditionally characterized by having the folded tongue much longer than the body.

**Number of mandibular teeth:** Female euglossas always have tridentate mandibles, but the males may have either 2 or 3 teeth on each mandible. Moure (1967, 1970) has treated all species with tridentate mandibles as members of the subgenus *Euglossella*. While this feature is undoubtedly useful, the case of *Euglossa viridissima* suggests that it may not be an adequate basis for a subgeneric distinction. This species appears to be polymorphic in the number of teeth. It is possible, of course, that there are two sibling species, and the number of teeth is the only distinction we have found between them. Either situation cautions against over-emphasizing the number of teeth as a taxonomic feature. Also, I have seen a very few specimens of *E. tridentata* with bidentate mandibles.

**Punctuation:** Punctuation is usually similar in males and females, though the scutum and terga may be somewhat more sparsely punctate in the female, or the terga of the female may have wider smooth marginal bands. The size and density of the punctuation is often a useful taxonomic feature and is especially useful in matching males and females.

**Color:** Except for parts of the head, males and females are quite similar in color, and this, like punctuation, is very useful in matching the sexes. The blue, green, and red or bronze colors of *Euglossa* are structural colors and may be modified by the physical condition of the chitin, especially by hydration or extreme desiccation. Although the color of the body is taxonomically useful, most of the larger species groups (except VIII) include a few blue and bronze species, as well as a number of green ones, so that body color alone is not a dependable guide to relationship.

In most female euglossas the head is quite green except around the mouthparts, but in males the front of the clypeus may be green, blue-green, or dark blue. This is a useful taxonomic feature and one that is easily seen in the field. In a

few species of group X, which have the clypeus and surrounding areas very dark blue, the females also have a blue clypeus. In most species, the mandibles, the malar area, and the ventrolateral angles of the clypeus are white in both males and females, and in males there is often a white bar adjacent to each compound eye, running from the malar area to the level of the antennal socket (Fig. 1). The presence or absence of this paracocular white marking is of some taxonomic value. Also, the males commonly have a white spot on each antennal scape.

**Nest structure:** Though not used as a primary taxonomic feature, nest structure correlates rather well with the species groups used here, as far as our very incomplete knowledge goes (see Zucchi, Camargo and Sakagami, 1969, for a review of published information). *Euglossa intersecta* (group I) and three species of group III are known to be cavity nesters (concealed nests, in the terminology of Zucchi, *et al.*), and as far as I know, they are communal, with several females (mother and daughters, or sisters) using the same cavity, and possibly quasisocial, with some degree of cooperation between the females sharing a nest. Four members of group V and one of group X are known to make free-standing resin nests (aerial nests), either subglobose or top-shaped and attached to twigs or to undersides of leaves, while another species of group X recently has been reared from a concealed nest (this, however, was built inside an aerial wasp nest and very similar to the aerial nest of a related species). These bees are always solitary. I do not have any information concerning the nests of groups II, IV, VI, or VII. Groups IX, XI (4 species), and XII (4 species) are, as far as known, cavity-nesting bees. While the daughter bees may build cells in the same cavity as the mother if it is large enough, I know of no observations that suggest there is any cooperation between the bees sharing a cavity. There is an old description of the nest of *E. analis* (group VIII) that indicates an underground (concealed) nest. The presence of both aerial and concealed nests in group X suggests that aerial nest construction may have evolved independently in two or more groups within *Euglossa*.

#### SUBGENERIC DIVISION OF *EUGLOSSA*

While the species groups which will be outlined below seem to be very natural groups, for the most part, the division of *Euglossa* into subgenera is less satisfactory (possibly a sign of a "good" genus). I have considered delineating as many as six subgenera and as few as two, and both extremes leave me quite dissatisfied. Finally, I have decided to remodel the subgenera *Glossura* and *Euglossella* and to describe one new subgenus for a species which is intermediate between these two groups.

The subgenus *Glossura* was first characterized by the very long mouthparts and by the biconvex scutellum. Moure (1967, 1969) has further characterized *Glossura* as having the labrum longer than wide, and has noted (personal communication) the presence of a characteristic keel on the inner face of the mid basitarsus. I interpret the biconvex scutellum, the basitarsal keel and the narrow labrum as features associated with large size, since these features occur in the larger species of group V, and the first two occur (separately) in large bees of other groups. By placing groups I through V in *Glossura*, it becomes a rather natural group, though diverse in some features. All are rather long-tongued bees, and most are relatively slender and shiny bees. The group is easily recognized in either sex.

One of the most clearly aberrant species in the genus is *E. intersecta* (group I). The color pattern, the eyelash-like fringe on the mid tibia, and even the form of the hind tibia, are quite unlike other euglossas, and suggest an alliance with *Euplusia*. The resemblance of *E. intersecta* to *Euplusia*, combined with its clear affinity to groups II and III, and to a lesser degree, to group VII, suggest that it is a link between *Euplusia* and *Euglossa* and that *Glossura* may be relatively primitive within *Euglossa*. *Euglossa intersecta* might well be made the type of a distinct subgenus, but *E. rugilabris* (group II) is quite intermediate in many features between *E. intersecta* and the members of group III.

Moure (1967, 1970) has grouped together all euglossas with tridentate mandibles in the male as subgenus *Euglossella*, but this seems to be a very diverse assemblage. Some species, such as *E. bursigera*, have the characteristic "pockets" of group V, while others agree with *E. analis* in all but tooth number, and *E. tridentata* is very similar to *E. cordata*, *E. variabilis* and, especially, *E. deceptrix*. The puzzling case of *E. viridissima* was mentioned above. If one limits *Euglossella* to those species which closely resemble *E. viridis* (group VII), then it becomes a very natural group, characterized by body form, acute pronotal angles, vestiture, punctuation elongate mid basitarsi and hind tarsi, and several other features. All members of this group have tridentate mandibles.

*Euglossa villosa* (group VI) seems clearly intermediate between *Glossura* and *Euglossella*; it is a thick-bodied, shaggy bee with a low clypeus, in form very like the members of *Euglossella*, yet, except for its aspect and the acute pronotal angles, its other features seem to align it with *Glossura*. It has bidentate mandibles and basitarsal keels; the punctuation of the terga is not elongate, and the sternal pockets are very like those of *E. piliventris*. I am treating this species as the type of a distinct subgenus, *Dasystilbe*, as this seems to be the only way to maintain *Glossura* and *Euglossella* as distinct groups. The name, meaning "shaggy mirror," refers to the seemingly improbable combination of thick, shaggy vestiture and shiny, mirror-like surface.

The subgenus *Euglossa* traditionally has been everything left over after the delineation of *Glossura* and *Euglossella*. As here delineated, all members of subgenus *Euglossa* have the anterior tuft of the mid tibia comma-shaped, notched or deeply divided, and most have the hind tibia rather rhomboid. The subgenus is now, I hope, somewhat more natural. Still, in group VIII one finds acute pronotal angle in most species and rather elongate punctures on the terga of some species. Both these features suggest a relationship with group VII, and it is not entirely clear that the subgenus *Euglossa* is a natural unit, even though all members share some key features. The remaining species groups, though, seem to be closely interrelated.

This subgeneric classification is offered with some diffidence. It is based entirely on external features, and it is, at best, cobbled together by a botanist. The features of the genitalia are, as yet, little used in *Euglossa*, though the details have proven useful in distinguishing sibling species in *Euglossa* and the related genera *Euplusia* and *Eulaema*. In the future the study of these and other less obvious features may broaden the basis for the classification of *Euglossa*. Also, it is hoped that more data on nest structure will become available, and we may yet identify the proper chemical baits to collect large series of groups VI and VII, as well as a few species of groups XI and XII which are not or only rarely attracted to cineole, vanillin and other known attractants. Thus, I am optimistic about the possibility of this classification being re-evaluated and revised within a few decades.

attempt to group similar bees together. Since the mid tibial tufts correlate so well with other features, these have provided a very useful feature, both for assigning unidentified bees to species group, and for matching specimens within the groups. I have tried where possible to refer to each species group by a name which is descriptive of the group, except in groups III and XII, where I have used the names of the type species of the respective subgenera, to avoid any possibility of confusion.

## OUTLINE OF THE REVISED CLASSIFICATION

### A. Subgenus *Glossura* Cockerell

Mid tibia: anterior tuft entire, triangular, oblong or ovate; hind tibia: triangular and usually acute; teeth 2 or 3; sternal tufts of various sorts; pronotal angles obtuse; usually slender, shiny bees, tongue long or very long; scutellar tuft of female moderately large. Type species: *E. piliventris* Guérin

- I. *E. intersecta* Latreille – mid tibia: anterior tuft oblong-cuneate, entire with 2 parts of different color and texture; velvet area with a “eyelash” anterior fringe (as in *Euplusia*), hairs of velvet area sparse distally; hind tibia very narrowly triangular, acute; teeth 2; mid basitarsus with an internal keel and a posterior lobe; sternal tufts large and confluent (without diagonal slits); front basitarsus with a prominent fringe of long, pale hairs; malar area with a black tooth-like lobe projecting below the insertion of mandible; head and abdomen green or golden green, thorax dark blue-purple.
- II. *E. rugilabris* Moure – mid tibia: tufts subequal, posterior tuft subtriangular, anterior subcircular; velvet area largely of sparse hairs; mid basitarsus thickened distally, with a large posterior lobe; teeth 2; sternal tufts small and widely separated; scutellum with a very small median depression (1 undescribed species).
- III. *piliventris* group (*Glossura* in the strictest sense) – mid tibia: posterior tuft often larger than anterior; mid basitarsus with an internal keel; teeth 2; sternal pockets diagonal slits with tufts of long hairs; scutellum usually with a wide median depression (biconvex).  
Described species: *chalybeata* Friese, *flammea* Moure, *ignita* Smith, *imperialis* Cockerell, *piliventris* Guérin (1 undescribed).
- IV. *E. stellfeldti* Moure – mid tibia: anterior tuft much larger than posterior; mid basitarsus with internal keel; teeth 2; sternal tufts small and widely separated; scutellum shallowly biconvex (1 undescribed species).
- V. *bursigera* group – mid tibia: anterior tuft entire, posterior tuft subequal to anterior, smaller or quite lacking, sometimes divided into 2 lobes; hind tibia triangular; teeth 2 or 3; sternal pockets semicircular depression or quite lacking.

Described species: *allosticta* Moure, *asarophora* Moure, *bursigera* Moure, *crassipunctata* Moure, *dodsoni* Moure, *gorgonensis* Cheesman, *nigrosignata* Moure, *sapphirina* Moure (17 undescribed).

B. Subgenus *Dasystilbe*, new subgenus

Mid tibia: anterior tuft entire, large and extending above the posterior tuft; hind tibia triangular, acute; teeth 2; sternal pockets short diagonal slits; basitarsal keel present; pronotal angles acute; scutellum without a median depression; scutellar tuft of female very large; thick-bodied, rather shaggy bee.

VI. Type (and only) species: *E. villosa* Moure

C. Subgenus *Euglossella* Moure

Mid tibia: posterior tuft present, anterior tuft larger, entire, somewhat acute above; hind tibia triangular, acute; teeth 3; sternal tufts usually small and widely separated (large and confluent in *E. polita*); basitarsal keel lacking; pronotal angles acute; scutellum usually without a median depression (shallowly biconvex in *E. mandibularis*); punctuation of terga usually elongate; mid basitarsus long and narrow, hind tarsi very long; scutellar tuft of female very large; thick-bodied, shiny, usually rather shaggy bees.

Type species: *E. viridis* (Perty)

VII. Described species: *cyanea* Friese, *cyanura* Cockerell, *decorata* Smith, *granti* Cheesman, *mandibularis* Friese, *perfulgens* Moure, *polita* Ducke, *singularis* Mocsary, *viridis* (Perty) (probably several undescribed, but all as yet poorly sampled).

D. Subgenus *Euglossa*

Mid tibia: anterior tuft notched, comma-like (attenuate and curved) or bilobed; hind tibia subtriangular and obtuse, or usually rhomboid; teeth 2 or 3; sternal tufts small and widely separated (large and confluent in *championi*, *villosiventris* and *viridissima*); pronotal angles obtuse (except some species of group VIII); bees generally only moderately shiny or shaggy; tongue always shorter than body; scutellar tuft of female small or lacking.

Type species: *E. cordata* (Linnaeus)

VIII. *analis* group – mid tibia: posterior tuft usually reduced or lacking, anterior tuft shallowly notched or attenuate; hind tibia usually rhomboid; teeth 2 or 3; paraocular white markings present; dark blue-violet bees with the terminal terga usually green or bronze.

Described species: *analis* Westwood, *cognata* Moure, *mixta* Friese, *villosiventris* Moure (4-5 undescribed).

- IX. *E. viridissima* Friese – mid tibia: anterior tuft smaller than posterior, comma-like; velvet area markedly incomplete anteriorly; hind tibia triangular, obtuse; teeth 3 or 2; paraocular white markings present.
- X. *cybelia* group – mid tibia: anterior tuft comma-like with distal portion larger, or reniform with subequal lobes; hind tibia usually subtriangular, obtuse, teeth 2; paraocular white markings usually lacking; clypeus and surrounding area dark blue.  
Described species: *championi* Cheesman, *charapensis* Cockerell, *cybelia* Moure, *dressleri* Moure, *maculilabris* Moure, *nigropilosa* Moure (1 undescribed).
- XI. *purpurea* group – mid tibia: anterior tuft with two distinct lobes, these often unequal, the lower lobe usually with longer and paler hairs, often appearing as an appendage attached to the upper lobe (in a few species the lower lobe is indistinct and the complete tuft rather triangular); hind tibia rhomboid, often quite large and convex; paraocular white markings usually present; scutellum usually convex above.  
Described species: *alleni* Moure, *aureiventris* Friese, *hansoni* Moure, *heterosticta* Moure, *igniventris* Friese, *melanotricha* Moure, *purpurea* Friese, *townsendi* Cockerell (16 undescribed).
- XII. *cordata* group – mid tibia: anterior tuft more or less reniform, deeply divided into subequal lobes, or the lower lobe larger; hind tibia usually rhomboid, usually smaller than in group XI; paraocular white markings usually present; scutellum usually with a median depression above.  
Described species: *azureoviridis* Friese, *cordata* (Linnaeus), *cyanaspis* Moure, *deceptrix* Moure, *despecta* Moure, *erythrochlora* Moure, *hemichlora* Cockerell, *jamaicensis* Moure (?), *tridentata* Moure, *ultima* Moure, *variabilis* Friese (7 undescribed).

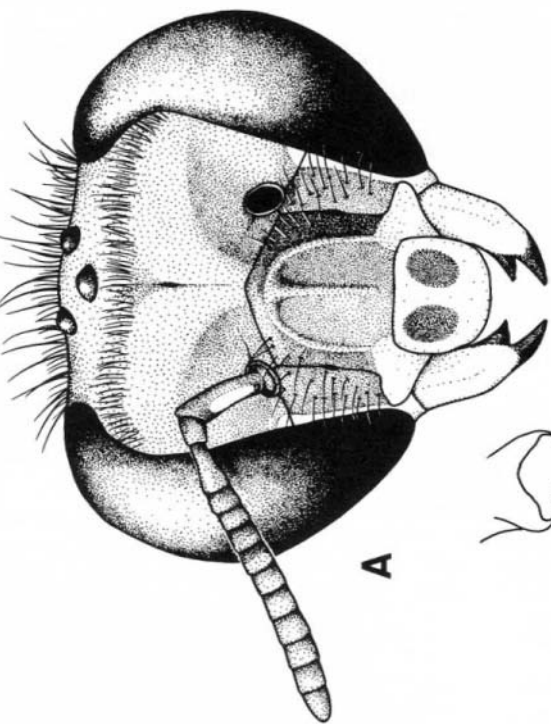
#### ACKNOWLEDGEMENTS

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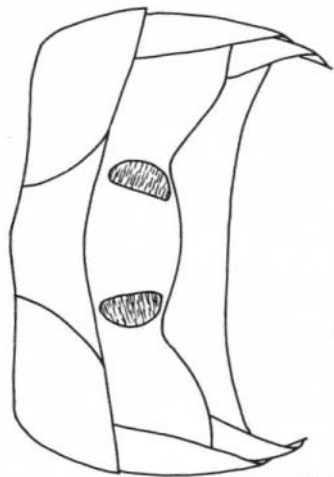
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Fig. 1 A) Face of bidentate male *Euglossa*. B) Basal part of abdomen in ventral view, showing the position of the tufts on sternum II. C) Right mid tibia, showing velvet area (stippled) and tufts (darker). D) Left hind tibia, showing the rhomboid form typical of the subgenus *Euglossa*.

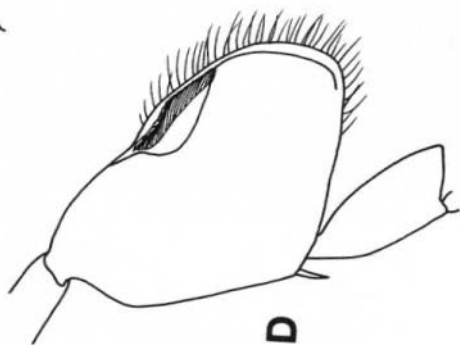




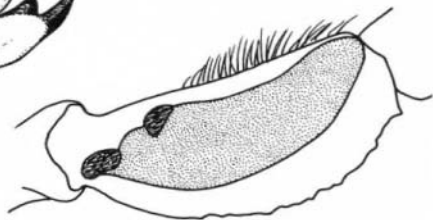
A



B



D



C

## RESUMEN

Se describen e ilustran varias características de importancia taxonómica de las abejas *Euglossa*: el área aterciopelada de la tibia intermedia, los "bolsillos" o mechones del esternón II, la forma de la tibia trasera y el número de dientes mandibulares, todas características de los machos, el esculpido de la quitina, el color, el largo de la lengua, y la estructura del nido. *Euglossa* se divide en cuatro subgéneros, con 12 grupos de especies: 1) *Glossura* (grupos I-V) incluye todas las especies con ángulos pronotales obtusos y con el mechón delantero de la tibia intermedia entero. Estas son abejas delgadas (o muy chicas), de brillo metálico, con la lengua larga o muy larga y con la tibia trasera triangular. 2) *Dasystilbe*, con una sola especie que combina características de *Glossura* y *Euglossella*. 3) *Euglossella*, que se limita al complejo de *E. viridis*, abejas con ángulos pronotales agudos, y con el mechón anterior de la tibia intermedia entero y muy grande. Son abejas de cuerpo grueso, con frecuencia muy peludas y metálicas a la vez. 4) *Euglossa* (VIII-XII) se limita a las especies en las cuales el mechón anterior de la tibia intermedia es atenuado, muescado o bilobado. Estas tienen la tibia trasera romboide en la mayoría de las especies.

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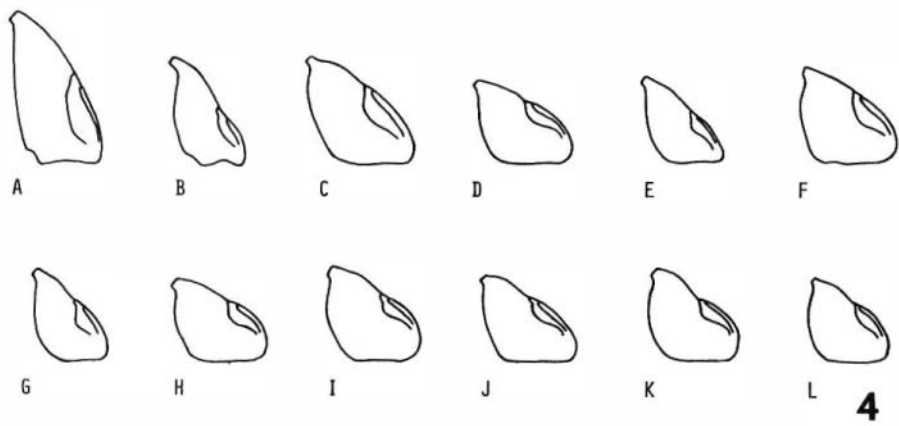
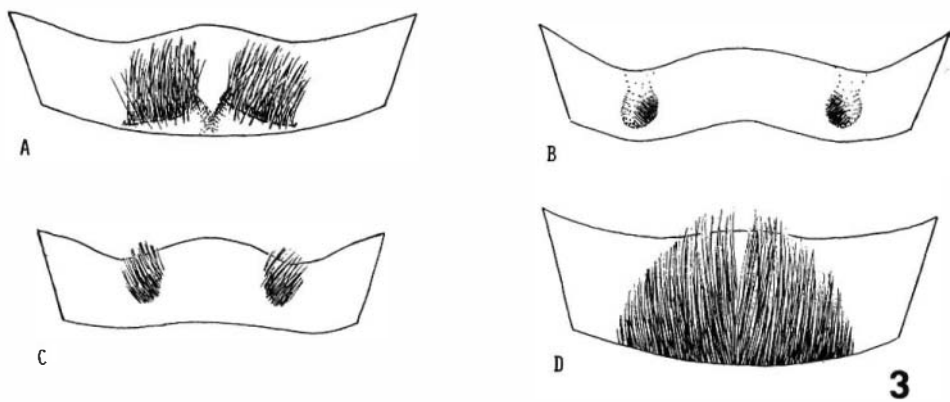
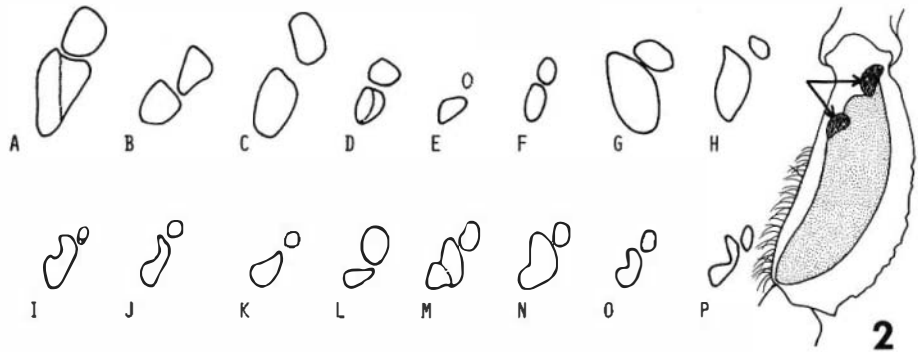
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Fig. 2. Outlines of the tufts from the left mid tibia of representative *Euglossa* species, all drawn with the aid of a camera lucida, and at about the same scale. A) *E. intersecta*; B) *E. rugilabris*; C) *E. piliventris*; D) *E. bursigera*; E) *E. allosticta*; F) *E. stellfeldi*; G) *E. villosa*; H) *E. viridis*; I) *E. analis*; J) *E. cybelia*; K) *E. dressleri*; L) *E. viridissima*; M) *E. purpurea*; N) *E. townsendi*; O) *E. cordata*; P) *E. ultima*.

Fig. 3. The second sternum, showing the characteristic "pockets," or tufts. A) *E. imperialis*; B) *E. bursigera*; C) *E. cordata*; D) *E. championi*.

Fig. 4. The outline of the left hind tibia of the male of representative *Euglossa* species, drawn with the aid of a camera lucida, and at about the same scale. A) *E. intersecta*; B) *E. rugilabris*; C) *E. piliventris*; D) *E. bursigera*; E) *E. stellfeldi*; F) *E. villosa*; G) *E. viridis*; H) *E. analis*; I) *E. cybelia*; J) *E. viridissima*; K) *E. purpurea*; L) *E. cordata*.



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