
Revision of the orchid bee subgenus *Euglossella*
(Hymenoptera: Apidae), Part II:
The *viridis* and *mandibularis* species groups

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On the cover: The male holotype of *Euglossa (Euglossella) celiae* Hinojosa-Díaz & Engel, new species, from Colombia.

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Revision of the orchid bee subgenus *Euglossella* (Hymenoptera: Apidae), Part II: The *viridis* and *mandibularis* species groups

Ismael A. Hinojosa-Díaz¹ & Michael S. Engel^{2,3}

Abstract. The second and final part of a revision of the subgenus *Euglossella* Moure in the orchid bee genus *Euglossa* Latreille (Apinae: Euglossini) is presented here, redefining the species groups within it to comply with current morphological and molecular phylogenetic hypotheses. We present a fully illustrated account of the species comprising the newly defined *viridis* and *mandibularis* species groups, with comparable diagnoses for all species, keys to the new scheme of species groups within the subgenus, and keys for males and females to the species of the two groups here treated. The *viridis* group as presented here is composed of 12 species, five of them newly described — *Euglossa* (*Euglossella*) *celiae* Hinojosa-Díaz & Engel, new species, *E. (E.) subandina* Hinojosa-Díaz & Engel, new species, *E. (E.) cetera* Hinojosa-Díaz & Engel, new species, *E. (E.) cupella* Hinojosa-Díaz & Engel, new species, and *E. (E.) ashei* Hinojosa-Díaz & Engel, new species — and one resurrected from synonymy as *E. (E.) azurea* Ducke. *Euglossa* (*Euglossella*) *viridis* (Perty), *E. (E.) cyanea* Friese, *E. (E.) polita* Ducke, *E. (E.) perviridis* Dressler, *E. (E.) cyanura* Cockerell, and *E. (E.) granti* Cheesman comprise the remaining species within the group. Females of *E. perviridis* are described for the first time. The *mandibularis* group includes three species — *E. (E.) mandibularis* Friese, *E. (E.) bigibba* Dressler, and *E. (E.) perfulgens* Moure. In total, considering the six species previously included in the *decorata* group, the subgenus now includes a total of 21 species. New country records are presented for *E. viridis*, *E. perviridis*, and *E. mandibularis*. Notes on morphological variation and distribution are included as is a summary of known chemical attractants and floral substrates.

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INTRODUCTION

Knowledge of orchid bee (Apinae: Euglossini) diversity has increased greatly in the last five decades, mainly as a result of the use of synthetic attractants equivalent to floral fragrances from orchids pollinated by these species (Dodson *et al.*, 1969; Dressler, 1982a). Applying these compounds as baits resulted in a dramatic influx of specimens and a rapid accumulation of previously unknown species, and this process of discovery is ongoing (*e.g.*, Hinojosa-Díaz & Engel, 2007a, 2011a, 2011b, 2012a, 2012b; Nemésio, 2007, 2009; Nemésio & Engel, 2012; Hinojosa-Díaz *et al.*, 2011, 2012a, 2012b). Naturally, many important works on the systematics of the various orchid bee genera had been previously undertaken (*e.g.*, Moure, 1950, 1964, 1965, 1967a, 1967b, 1969, 1970), but once large series of species, both previously known and new, were obtainable, the concepts of all of the taxa involved could be critically evaluated and the circumscriptions of said groups be recast in a modern framework.

For the largest orchid bee genus, *Euglossa* Latreille, Dressler (1978) built a framework for the present-day classification, newly casting the subgenera and establishing a working foundation for a series of species groups within the largest of those taxa. Dressler (1978) recognized four subgenera in total — *Euglossa s.str.*, *Glossura* Cockerell, *Dasystilbe* Dressler, and *Euglossella* Moure — to which were subsequently added *Glossuropoda* Moure (Moure, 1989) and *Alloglossura* Hinojosa-Díaz & Engel (Hinojosa-Díaz & Engel, 2012b). Hinojosa-Díaz (2010) has provided some alterations to this system and a revised subgeneric classification is forthcoming. The subgenus *Dasystilbe* was revised by Hinojosa-Díaz *et al.* (2011) and *Alloglossura* by Hinojosa-Díaz & Engel (2012b). *Euglossella*, the subject of the present work, was partially revised by Hinojosa-Díaz & Engel (2011a), and that monograph is completed here.

The group today known as *Euglossella* was initially established by Perty (1833) as *Cnemidium* Perty and based on *Cnemidium viride* Perty, although it was quickly considered a synonym of or subordinate group within *Euglossa*. Perty (1833) only had males available for his species and contemporaneous authors suggested that his *C. viride* was merely the male of *Euglossa* (*Euglossa cordata* (Linnaeus) (*e.g.*, Erichson, 1841), a species to which it actually has no close relationship within the genus. The genus-group name proposed by Perty (1833) was preoccupied and, since *Cnemidium* had been suggested as a subgeneric name within the group, was subsequently replaced with *Euglossella* by Moure (1967b). In his foundational treatment of supraspecific groups within *Euglossa*, Dressler (1978) greatly refined the diagnosis and boundaries of *Euglossella* and tabulated the species known at that time. Subsequent to Dressler, sundry species were added to the subgenus although largely described in isolation (*e.g.*, Dressler, 1982b, 1985; Moure & Schlindwein, 2002; Hinojosa-Díaz & Engel, 2007a; Nemésio, 2007). The subgenus was fully diagnosed, its species groups of the time keyed, and a subset of the species revised by Hinojosa-Díaz & Engel (2011a). Whereas Dressler (1978) had included a single species group in *Euglossella* (the *viridis* group), Hinojosa-Díaz & Engel (2011a) divided it into two groups (the *viridis* and *decorata* groups), based mainly on differences in integumental coloration. Phylogenetic evidence provided by data from morphology (Hinojosa-Díaz, 2010) and DNA sequences (Ramírez *et al.*, 2010) set the basis for the proposal of a third species group (the *mandibularis* group), which is presented here. The *viridis* and *mandibularis* groups are revised here, and an updated and expanded key to all species groups in the subgenus is provided. Together with the earlier treatment of the *decorata* group (Hinojosa-Díaz & Engel, 2011a), this completes the revision of *Euglossella*.

Table 1. Classification of subgenus *Euglossella* Moure as presented by Hinojosa-Díaz & Engel (2011a) and herein.

Subgenus <i>Euglossella</i> Moure	
<i>decorata</i> species group	<i>viridis</i> species group
<i>E. apiformis</i> Schrottky	<i>E. ashei</i> Hinojosa-Díaz & Engel, n. sp.
<i>E. aurantia</i> Hinojosa-Díaz & Engel	<i>E. azurea</i> Ducke
<i>E. cosmodora</i> Hinojosa-Díaz & Engel	<i>E. celiae</i> Hinojosa-Díaz & Engel, n. sp.
<i>E. decorata</i> Smith	<i>E. cetera</i> Hinojosa-Díaz & Engel, n. sp.
<i>E. perpulchra</i> Moure & Schindwein	<i>E. cupella</i> Hinojosa-Díaz & Engel, n. sp.
<i>E. singularis</i> Mocsáry	<i>E. cyanea</i> Friese
	<i>E. cyanura</i> Cockerell
<i>mandibularis</i> species group	<i>E. granti</i> Cheesman
<i>E. bigibba</i> Dressler	<i>E. perviridis</i> Dressler
<i>E. mandibularis</i> Friese	<i>E. polita</i> Ducke
<i>E. perfulgens</i> Moure	<i>E. subandina</i> Hinojosa-Díaz & Engel, n. sp.
	<i>E. viridis</i> (Perty)

The *viridis* group, as newly defined here, encompasses 12 species, five proposed as new and one resurrected from synonymy. The newly proposed *mandibularis* group comprises three species. We include comments throughout on morphological details, peculiarities, variation, type status, and distribution for each species, with new country records provided for three species and the previously unknown female of one is described for the first time. In total this work brings the diversity of *Euglossella* up to 21 described species (Table 1). Records of chemical attractants and floral associations, as documented on labels of material examined, are tabulated in tables 2 and 3, respectively (only those species with relevant information were included).

Specimens of *Euglossella* are among the least frequently collected within the genus, even when employing synthetic fragrances as baits. Accordingly, it is this subgenus that is less fully understood in terms of its diversity, encompassing everything from their basic biology and variation among populations to the association of sexes and proper circumscription of species. Such a reality hampers any comprehensive understanding of the group. Nonetheless, we believe no such great strides will be made without a systematic treatment to act as the gateway to further research. Although largely descriptive in nature, descriptions such as those presented here test basic hypotheses of species circumscription and document abiding patterns of variation (Grimaldi & Engel, 2007; Engel, 2011; Gonzalez *et al.*, 2013), and hopefully shall provide a more rigorous framework for advancing our knowledge of the subgenus.

MATERIAL AND METHODS

Specimens examined for the present study are deposited in the following institutions and personal collections arranged alphabetically (acronym cited in parenthesis): American Museum of Natural History, New York, New York, USA (**AMNH**); Berry Brosi Lab Collection, Department of Environmental Sciences, Emory University, Atlanta, Georgia, USA (**BBROSI**); Claus Rasmussen personal collection, Denmark (**CRAS**);

Table 2. Summary of available information on chemical attractants for the examined specimens of species of the *viridis* group of *Euglossella* Moure. Not all species are listed as not all have such information available. All records correspond to male specimens.

Chemical baits	<i>E. viridis</i> (Perty)	<i>E. azurea</i> Ducke	<i>E. celiae</i> , n. sp.	<i>E. cyanea</i> Friese	<i>E. subandina</i> , n. sp.	<i>E. polita</i> Ducke	<i>E. perviridis</i> Dressler	<i>E. cyanura</i> Cockerell	<i>E. granti</i> Cheesman
2-Phenylethyl acetate									X
Anisyl acetate			X				X		
Cineole								X	
Eugenol	X						X		
Ips dienol					X			X	
Methyl salicylate		X							
Methyl salicylate/ eucalyptus oil (mix)								X	
p-cresol					X			X	
p-cymene							X		
p-dimethoxybenzene		X							
Skatole		X							
<i>Stanhopea anfracta</i> (fragrance sample)					X				
Terpinen-4-ol								X	
Vanillin			X			X			

Table 3. Summary of available information on floral substrates for the examined specimens of species of the *viridis* and *mandibularis* groups of *Euglossella* Moure. Not all species are listed as records were not available for all taxa. All records correspond to male specimens, except the one marked with an asterisk (*) for *Euglossa* (*Euglossella*) *cyanura* Cockerell which was taken from a female.

Floral substrate	<i>E. viridis</i> (Perty)	<i>E. subandina</i> , n. sp.	<i>E. cyanura</i> Cockerell	<i>E. granti</i> Cheesman	<i>E. mandibularis</i> Friese	<i>E. perfulgens</i> Moure
<i>Ananas comosus</i>						X
<i>Anthurium ochranthum</i>			X			
<i>Catasetum</i> sp.				X		
<i>Cycnoches egertonianum</i>			X			
<i>Gongora aromatica</i>		X				
<i>Gongora maculata</i> var. <i>latibasis</i>			X			
<i>Gongora tricolor</i>			X			
<i>Peristeria lindenii</i>		X				
<i>Peristeria</i> sp.		X				
<i>Psychotria</i> sp.			X*			
Rubiaceae sp.	X					
<i>Solanum</i> sp.					X	
<i>Spathiphyllum</i> sp.			X			

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labels for each specimen separated by double slashes (/), and rows within labels separated by a semicolon in italics (;), all preceded by the number of specimens sharing the label information and the corresponding sex, and followed by the acronym of the repository. Primary types were examined for nearly all proposed names in *Euglossella*, and for the two exceptions we had suitable images of the types upon which to rely and for one we obtained secondary types as well (in both of these cases the names were synonyms of older names). We provide some resolution to long-standing confusion regarding the status of lectotypes for *E. (Euglossella) cyanea* Friese and *E. (E.) polita* Ducke.

Morphological terminology is based on that provided by Engel (2001a), Michener (2007), Hinojosa-Díaz & Engel (2008), and Hinojosa-Díaz (2008); some procedures establishing facial metrics follow Brooks (1988). The overall format of the species descriptions is based on that for other species of *Euglossa* as presented by Hinojosa-Díaz & Engel (2007a, 2011a, 2011b, 2012b), Hinojosa-Díaz *et al.* (2011, 2012b). Standard diagnoses for each species are presented for ease of comparison, containing to the extent possible the same sets of characters. The species are presented in a sequence deemed relevant for morphological comparison, with an extended description for *E. (E.) viridis* (Perty), type species of the subgenus, and the remaining species referenced back to this more extensive account. Statements about morphological features and distribution for all the taxa treated here are based on those specimens examined directly and the label information associated with each, otherwise the reference is cited. Photomicrographs were prepared with a Canon EOS 7D digital camera and an Infinity K-2 long-distance microscope lens, except those of the type of *E. (E.) granti* Cheesman. Multilayer images were produced by using the software CombineZP. Measurements were made using an ocular micrometer on an Olympus SZX12 stereomicroscope.

SYSTEMATICS

Genus *Euglossa* Latreille
Subgenus *Euglossella* Moure

Cnemidium Perty, 1833: 148, *nomen praecuratum* (nec Goldfuss, 1826). Type species: *Cnemidium viride* Perty, 1833, monobasic. Synonymized with *Euglossa* by Erichson (1841, p. 213).
Euglossa (Euglossella) Moure, 1967b: 401, *nomen novum pro Cnemidium* Perty, 1833. Type species: *Cnemidium viride* Perty, 1833, autobasic.

DIAGNOSIS (after Hinojosa-Díaz & Engel, 2011a): Mid-sized metallic bees, with rather robust habitus; both sexes with tridentate mandibles and pronotal dorsolateral angles projected as acute prong or lamella; female metabasitarsus trapezoidal with noticeably narrow distal margin; male mesotibia with two tufts, anterior tuft ellipsoidal, occupying about one-third of outer mesotibial surface, posterior tuft rounded in a variety of shapes; male mesobasitarsus characteristically elongate and slender, distal mesotarsomeres (particularly second mesotarsomere) unmodified; inner surface of male metafemur with ventral margin distinctively straight; male metatibia scalene triangular, metatibial organ slit basal and distal sections separated by a constriction distinctively narrower than width of contiguous basal section, basal section ellipsoidal, distal section separated from ventral margin of metatibia by less than its own length; ventral margin of inner metatibial surface with a blunt projection adjacent to spur attachment; male metabasitarsus roughly rectangular, ventral margin roughly straight in respect to sagittal body plane, appearing truncate and without noticeable

projections of posterior margin. Eighth metasomal sternum of male with lateral edges of posterior section deeply invaginated, lobes strongly projected; posterior margin of apical process of gonocoxite oblique (inner-posterior corner displaced posteriad); lateral area of gonostylar process of gonocoxite truncate; spatha surface with longitudinal striae; dorsal sector of lateral section of gonostylus convex, covered with distinctive plumose setae, gonostylar ventral lobe thumb-like.

Key to species groups of *Euglossella*

NOTE: This revised and expanded key to species groups within *Euglossella* supersedes the one presented by Hinojosa-Díaz & Engel (2011a) as their original 'viridis' group is here split into two distinctive groups of species.

- 1. Pronotal dorsolateral angle orthogonal to acute, slightly projected; mesoscutellum with a large central concavity, creating two mid-lateral cusps, clearly noticeable in males (Figs. 117, 133), in females present in depressed contour of mesoscutellar tuft (Figs. 119, 139); lower interorbital distance at least 1.10 times as wide as upper interorbital distance; malar area longer than diameter of mid-flagellar articles *mandibularis* group
- Pronotal dorsolateral angle noticeably projected as a lamella; mesoscutellar surface even, at most with a narrow, shallow, longitudinal depression, females not having a noticeable depressed contour to mesoscutellar tuft (e.g., Figs. 7, 36, 84, 94); lower and upper interorbital distances equal, subequal, or upper distance about 1.10 times as wide as lower distance; malar area shorter than diameter of mid-flagellar articles [subequal in *E. (E.) cosmodora* Hinojosa-Díaz & Engel] 2
- 2(1). Integument of entire body strongly and brightly metallic blue, green, or purple (or combinations of these); tegula metallic (usually concolorous with mesoscutum), never completely translucent (at most translucent on margins); metasomal terga with dense, strong punctation; lower and upper interorbital distances equal or subequal [most species with upper distance at most 1.03 times lower, except males of *E. (E.) polita* Ducke with lower distance 1.08 times upper] *viridis* group
- Integument of head and mesosoma with dominant basal brown to dark brown coloration, shaded by a varying degree of metallic iridescence, particularly green, cyan, and coppery; integument of metasoma varying from golden orange to dark brown with very faint metallic hue or iridescence; tegula hyaline translucent with faint metallic hue; punctures on metasomal terga usually shallow; upper interorbital distance about 1.10 times as wide as lower distance *decorata* group

decorata species group

DIAGNOSIS (after Hinojosa-Díaz & Engel, 2011a): The *decorata* group includes species than can be recognized from other *Euglossella* (i.e., the *viridis* and *mandibularis* species groups) by the combination of the following features: Pronotal dorsolateral angle noticeably projected as a lamella; integument of head and mesosoma with predominantly brown to dark brown coloration and a varying degrees of metallic green, cyan, or coppery iridescence, tegula hyaline translucent with faint metallic hue (species of *Euglossella* in the other two groups have an opaque tegula concolorous with the mesoscutum), integument of metasoma varying from golden-orange to dark brown

with faint metallic hue or iridescence; punctures on metasomal terga usually shallow; upper interorbital distance 1.10 times as wide as lower distance; malar area noticeably shorter than diameter of mid-flagellar articles, appearing subequal (although still shorter) in *E. (E.) cosmodora* Hinojosa-Díaz & Engel; mesoscutellar disc with an even surface, not noticeably depressed. Species in the group can be found in the Guianas, the Amazon Basin, and surrounding areas in Colombia, Venezuela, Ecuador, Peru, Bolivia, and Brazil, reaching areas of cerrado and Atlantic forests in southeastern Brazil.

INCLUDED SPECIES (after Hinojosa-Díaz & Engel, 2011a): *Euglossa (Euglossella) apiformis* Schrottky, *E. (E.) aurantia* Hinojosa-Díaz & Engel, *E. (E.) cosmodora*, *E. (E.) decorata* Smith, *E. (E.) perpulchra* Moure & Schlindwein, and *E. (E.) singularis* Mocsáry (Table 1). The *decorata* group was revised by Hinojosa-Díaz & Engel (2011a) and that work should be sought for a key to the species.

viridis species group

DIAGNOSIS: Species included in the *viridis* group can be recognized from other species of *Euglossella* (i.e., the *decorata* and *mandibularis* species groups) by the combination of the following features: Pronotal dorsolateral angle noticeably projected as a lamella; entire body typically strongly metallic with bright green, purple, blue, and/or mixture and variations of these colors; strong integumental sculpturing, particularly on metasomal terga (strong deep punctures); lower and upper interorbital distances equal or subequal, in most species either distance at most 1.03 times as wide as other, except males of *E. polita* have a lower distance 1.08 times as wide as upper; malar area noticeably shorter than diameter of mid-flagellar articles; mesoscutellar disc with an even surface, not noticeably depressed, or at most with a narrow and shallow, longitudinal depression in males, while females do not show a noticeable depressed contour to mesoscutellar tuft. Species in the group can be found from southeastern Mexico to the Choco corridor in Colombia and Ecuador, the Guianas, the Amazon Basin from Colombia, Venezuela, Ecuador, Peru, Bolivia, and Brazil, reaching the Parana and Atlantic forests in southeastern Brazil.

INCLUDED SPECIES: *Euglossa (Euglossella) viridis*, *E. (E.) azurea* Ducke, *E. (E.) celiae* n. sp., *E. (E.) cyanea*, *E. (E.) subandina* n. sp., *E. (E.) polita*, *E. (E.) perviridis* Dressler, *E. (E.) cetera* n. sp., *E. (E.) cupella* n. sp., *E. (E.) ashei* n. sp., *E. (E.) cyanura* Cockerell, and *E. (E.) granti* (Table 1).

Key to species of the *viridis* species group

NOTE: Females in the genus *Euglossa* have a notoriously conservative morphology, such that females of closely-related species are difficult to distinguish on a purely morphological basis. In most cases there is no better way to assign a specific name to female specimens than by association with males from the same area where a given female was collected. With these limitations in mind, the female portion of the key (starting with couplet 10) is provided as a preliminary, albeit less than satisfactory, way of accounting for females in the *viridis* group. Females for *E. polita* are known but were not included as specimens were not available for examination during the course of this work (but refer also to comments provided for that species, *vide infra*).

1. Male: antenna with 11 flagellar articles; metasoma with seven exposed terga; metatibia inflated bearing organ slit (setose-lined opening) 2
- Female: antenna with 10 flagellar articles; metasoma with six exposed terga; metatibia with well-developed and expanded corbicula 10

- 2(1). Second metasomal sternum modified with two well developed and contiguous cowled slits (*sensu* Roubik, 2004), slits facing posteriorly, running almost orthogonal to sagittal body plane (Fig. 65) [easternmost Amazon Basin (Pará State, Brazil)] *E. (E.) polita* Ducke
- . Second metasomal sternum modified with two integumental elevations and setal patches, but never possessing slits 3
- 3(2). Second metasomal tergum with punctures on mesal section of disc large (maximum length at least 0.40x mid-ocellus diameter), noticeably elongate longitudinally, similar to punctures on third to seventh terga (progressively larger on these) (Figs. 104, 116) [Mexico to Pacific lowlands of Colombia and Ecuador] 4
- . Second metasomal tergum with punctures on mesal section of disc small to medium sized (maximum length no more than 0.30x mid-ocellus diameter), punctiform to moderately elongate, punctures on third to seventh terga variously sized (Figs. 9, 79) [South America east of the Andes (Guianas, Amazon Basin, Parana and Atlantic forests)] 5
- 4(3). Vestiture dominated by yellow-fulvous setae, especially noticeable on mesosoma, where they form a dense cover on mesepisternum, mesoscutum and mesoscutellum; setae on mesoscutum and mesoscutellum structurally equivalent to those on mesepisternum, *i.e.*, plumose, with numerous, well-developed branches (Figs. 105–106) [Pacific lowlands of Colombia and Ecuador] *E. (E.) granti* Cheesman
- . Vestiture dominated by pale-fuscous setae; setae on mesoscutum structurally similar to those on mesepisternum only on anteriormost section, remaining areas of mesoscutum and entirety of mesoscutellum with setae bearing minute branches, almost appearing simple (Figs. 92–93) [southeastern Mexico to Panama] *E. (E.) cyanura* Cockerell
- 5(3). Mesepisternum densely punctate on lateral-facing surface, punctures on central and lower surfaces contiguous (no noticeably smooth areas between them), becoming slightly sparser towards ventral part where they are separated by no more than one puncture diameter (slightly sparser around subpleural signum) (Fig. 78); integument green throughout, with golden-bronzy iridescence and few blue-green highlights (Figs. 67–68) [Peruvian Amazon (Madre de Dios, Huanuco), northern Bolivia, and Rondônia State, Brazil] *E. (E.) perviridis* Dressler
- . Mesepisternum less densely punctate on lateral-facing surface, punctures on central surface separated by noticeably smooth areas (even if small), punctures on lower surface and ventral part separated by more than one puncture diameter (Figs. 6, 22, 48); integumental coloration varied, including green and blue-purple in different arrangements and combinations [Amazon Basin and contiguous areas to north, south, and east] 6
- 6(5). Mesotibial anterior tuft length comparable to width of mid-section of velvety area (microtrichia covering outer surface) (Fig. 145); integument of dorsal areas of body dominated by blue-purple coloration, especially noticeable (always present) on mesoscutellum and first to fourth metasomal terga (Figs. 16, 23), other areas green with a mixture of blue highlights [widespread in Amazon Basin and contiguous areas to north, south, and east] *E. (E.) azurea* Ducke
- . Mesotibial anterior tuft length clearly exceeding width of mid-section of vel-

- vety area (Figs. 144, 146–148); integument of dorsal areas of body exhibiting different degrees of combinations of green and blue-purple coloration [Amazon Basin and contiguous areas to north, south, and east] 7
- 7(6). Mesepisternum densely punctate (moderately in a few specimens) on lateral-facing surface, punctures on central surface separated by no more than two-thirds of one puncture diameter, becoming denser towards pronotal lobe and hypoepimeral area where they are rather contiguous (Fig. 6) [widespread in Amazon Basin and contiguous areas to north, south, and east] *E. (E.) viridis* (Perty)
- . Mesepisternum moderately punctate on lateral-facing surface, punctures on central surface leaving noticeable polished areas between them, some of these areas as large as two or three puncture diameters, puncture density increasing towards pronotal lobe and hypoepimeral area where punctures are separated by half to one puncture diameter (Figs. 35, 48, 57) [northwestern Amazon Basin and low to middle elevations of east side of Andes] 8
- 8(7). Mesotibial anterior tuft mid-width equivalent to width of contiguous section of velvety area (Fig. 146); punctures on central surface of mesepisternum separated by no more than one-half a puncture diameter, surfaces close to pronotal lobe and hypoepimeral area with punctures separated by no more than one-half a puncture diameter (Fig. 35) [northwestern Amazon Basin] *E. (E.) celiae* Hinojosa-Díaz & Engel, n. sp.
- . Mesotibial anterior tuft mid-width wider than contiguous section of velvety area (Fig. 147); punctures on central surface of mesepisternum separated by two to three puncture diameters, surfaces close to pronotal lobe and hypoepimeral area with punctures separated by one puncture diameter (Figs. 48, 57) [low to middle elevation areas contiguous to eastern side of Andes] 9
- 9(8). Medium-sized bees, average body length 12.27 mm, average metasomal width (at its widest section) 5.15 mm; metasoma on average 7% wider than head, appearing noticeably wider than remainder of body as observed in dorsal view (Fig. 38) [middle elevations on eastern areas of Andes of Bolivia and Peru] *E. (E.) cyanea* Friese
- . Comparatively smaller bees, average body length 10.61 mm, average metasomal width (at its wider section) 4.61 mm; metasoma on average 2.5% wider than head, appearing almost as wide as head in dorsal view (Fig. 51) [low to middle elevations on eastern foothills of Andes of Ecuador]
..... *E. (E.) subandina* Hinojosa-Díaz & Engel, n. sp.
- 10(1). Bees from Central America and Pacific lowlands of Colombia and Ecuador 11
- . Bees from Amazon Basin and contiguous areas to north, south, and east 12
- 11(10). Vestiture dominated by yellow-fulvous setae, especially noticeable on mesosoma, where they form a dense cover on mesepisternum, mesoscutum, and mesoscutellum; setae all over mesoscutum and mesoscutellum structurally equivalent to those on mesepisternum, *i.e.*, plumose, with numerous, well-developed branches (Figs. 107–108) [Pacific lowlands of Colombia and Ecuador] *E. (E.) granti* Cheesman
- . Vestiture dominated by pale-fuscous setae; setae on mesoscutum structurally similar to those on mesepisternum only on anteriormost section, remaining areas of mesoscutum and entire mesoscutellum with setae bearing minute branches, appearing almost simple (Figs. 94–95) [southeastern Mexico to Panama] *E. (E.) cyanura* Cockerell

- 12(10). Mesepisternum moderately punctate on lateral-facing surface, punctures on central surface separated by 1–2 puncture diameters, leaving some noticeably smooth integument between, puncture density increasing towards pronotal lobe and hypopimeral area where punctures appear almost contiguous (Fig. 41) [middle elevations on eastern areas of Andes in Bolivia and Peru] *E. (E.) cyanea* Friese
- . Mesepisternum moderately to densely punctate on lateral-facing surface, punctures on central surface separated by at most by one puncture diameter (generally less), becoming denser towards pronotal lobe and hypopimeral area where they are rather contiguous (Figs. 26, 70, 81, 85) [Amazon Basin and contiguous areas to north, south, and east] 13
- 13(12). Integument green to blue-green as a basal color, dorsal parts of body mainly blue to blue-purple, particularly mesoscutellum and first through third or fourth metasomal terga (Figs. 25–26) [widespread in Amazon Basin and contiguous areas to north, south, and east] *E. (E.) viridis/azurea*
- . Integument green throughout, with golden-bronzy and blue-green iridescence 14
- 14(13). Metasoma about 7% wider than head capsule (Figs. 69, 84) 15
- . Metasomal width comparable to that of head capsule (metasoma at most 2% wider) (Figs. 80, 88–89) 16
- 15(14). Metabasitarsus barrel-shaped, anterior and posterior margins noticeably convex (Fig. 87) [Santa Elena, Bolivar State, Venezuela]
..... *E. (E.) cupella* Hinojosa-Díaz & Engel, n. sp.
- . Metabasitarsus with anterior margin convex and posterior margin straight (Fig. 76) [southwestern Amazon Basin in Peru] *E. (E.) perviridis* Dressler
- 16(14). Scape with noticeable yellow macula on distal third of lateral surface (Fig. 82); metabasitarsus with anterior margin appearing straight (or at most with subtle convexity) (Fig. 83) [Puerto Ayacucho, Amazonas State, Venezuela]
..... *E. (E.) cetera* Hinojosa-Díaz & Engel, n. sp.
- . Scape uniformly brown with no yellow markings (Fig. 90); metabasitarsus with anterior and posterior margins convex (posterior with subtle convexity) (Fig. 91) [French Guiana and Amapá State, Brazil]
..... *E. (E.) ashei* Hinojosa-Díaz & Engel, n. sp.

Euglossa (Euglossella) viridis (Perty)
(Figs. 1–15, 144, 164, 170)

Cnemidium viride Perty, 1833: 149 [♂]. Holotype ♂ (ZSSM, *visum*).

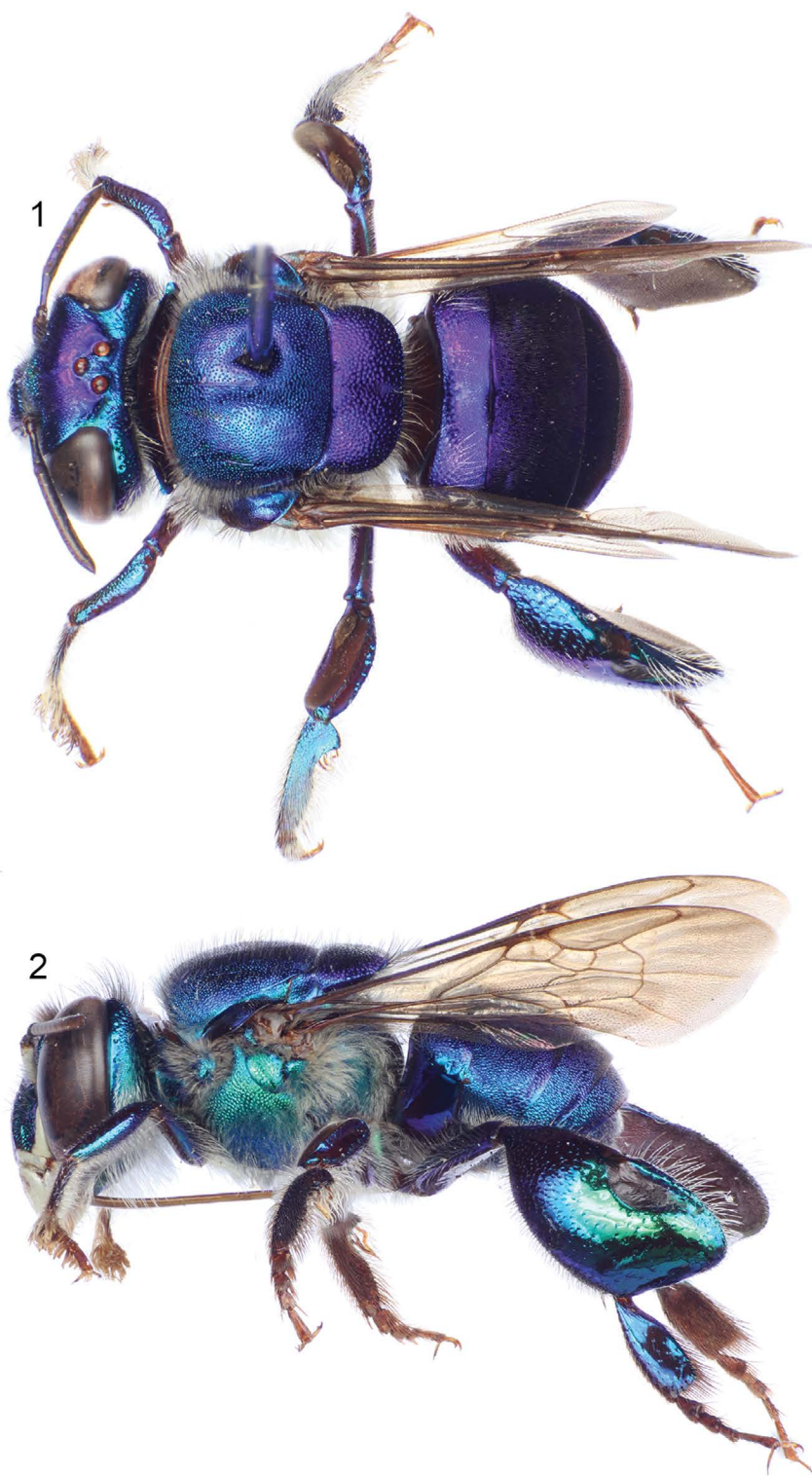
Euglossa (Cnemidium) viridis (Perty): Hedicke, 1936: 75.

Euglossa affinis Dominique, 1898: 58 [♂?]. Lectotype ♂ (MHNN, type examined through photographs). Synonymy by Rasmussen *et al.* (2007).

DIAGNOSIS: Labiomaxillary complex in repose reaching first to second metasomal sternum; upper and lower interorbital distances equal (Fig. 3); malar area short (less than 0.25 mm, noticeably shorter than diameter of mid-flagellar articles) (Fig. 3); pronotal dorsolateral angle projected as a lamella; mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 4, 144); mesobasitarsal posterior keel acutely projected (Fig. 8); sec-

ond metasomal sternum with two simple meso-lateral tufts; width of metasoma and head only marginally different (less than 1.05 times) (Fig. 1); head mainly green with some blue areas (Fig. 3); paraocular marks trapezoidal, lower width about two-thirds length of lower lateral part of clypeus (Figs. 2–3); scape with ivory spot covering almost entire anterior surface (Fig. 3); mesosoma (except mesoscutellum) mainly dark green with blue-purple intergradations and bronzy iridescence (Figs. 1–2), mesoscutellum blue-purple (Fig. 7); first to third metasomal terga mainly blue, remaining terga progressively green (Fig. 9); mesoscutellum densely punctate, especially antero-mesally (contiguous punctures) (Fig. 7); central area of mesepisternum densely punctate (punctures separated by no more than two-thirds a puncture diameter) (Fig. 6); metasomal terga densely imbricate-punctate evenly (Fig. 9); mesosoma vestiture dominated by pale-fuscous setae (Figs. 1–2, 6–7); eighth metasomal sternum posterior section very narrow as a slender cylinder (Figs. 11–12); gonocoxite dorsal process about as wide as long (Fig. 13); gonostylar lateral section with well-developed secondary lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve (Figs. 15, 164).

DESCRIPTION: ♂: **Structure.** Total body length 10.66 mm (9.64–11.79; n=4); labio-maxillary complex in repose reaching second metasomal sternum (Fig. 2). Head length 2.38 mm (2.22–2.44; n=4), width 4.29 mm (4.15–4.41; n=4); upper interorbital distance 1.95 mm (1.89–2.00; n=4); lower interorbital distance 1.95 mm (1.93–2.00; n=4); upper clypeal width 1.07 mm (1.04–1.11; n=4) (measured between dorsolateral angles of clypeus); lower clypeal width 1.83 mm (1.79–1.86; n=4) (measured at widest section of lower lateral parts); clypeal protuberance 0.54 mm (0.50–0.64; n=4) [following measurement method of Brooks (1988)]; medial and paramedial clypeal ridges sharp, paramedial ridges oblique with respect to medial ridge, forming a trapezoidal clypeal disc (raised section between paramedial ridges); labrum wider than long, length 0.88 mm (0.82–0.96; n=4), width 1.03 mm (1.00–1.07; n=4) (Fig. 3); medial labral ridge sharp; paramedial labral ridges weak, oblique, present in proximal two-thirds of labrum; labral windows ovoid, occupying proximal half of labrum; interocellar distance 0.29 mm (0.26–0.31; n=4); ocellocular distance 0.54 mm (0.50–0.57; n=4); first flagellar article longer [0.55 mm (0.54–0.57; n=4)] than second and third flagellar articles combined [0.37 mm (0.36–0.39; n=4)]; length of malar area 0.16 mm (0.14–0.17; n=4). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.35 mm (3.21–3.50; n=4); mesoscutal length 2.57 mm (2.43–2.64; n=4); mesoscutellar length 1.19 mm (1.14–1.21; n=4); posterior margin of mesoscutellum appearing truncate along most of its length (laterally rounded) (Fig. 7); mesotibial length 2.12 mm (2.07–2.14; n=4); mesobasitarsal length 2.16 mm (2.14–2.21; n=4), width 0.67 mm (0.64–0.71; n=4) (measured at proximal posterior keel), posterior keel projected in an acute angle, with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing straight (slightly convex) (Fig. 8); metatibia triangular (scalene triangular) (Fig. 5), maximum thickness 1.19 mm (1.14–1.21; n=3); metatibial anterior margin length 3.12 mm (3.00–3.29; n=3), ventral margin length 2.09 mm (2.07–2.14; n=3), postero-dorsal margin length 4.23 mm (4.11–4.43; n=3); metatibial organ slit dorsal and outer sections well defined with a junction narrower than contiguous width of dorsal section [as described for subgenus by Hinojosa-Díaz & Engel (2011a)]; outer section of metatibial organ slit lanceolate, maximum width occupying about one-third of metatibial outer surface width, anterior margin strongly convex (Fig. 5); dorsal section of metatibial organ slit rhomboid, length 0.62 mm (0.61–0.64; n=3); metabasitarsal length 2.00 mm, mid-width 0.74 mm (0.71–0.79; n=3); metabasitarsal ventral border

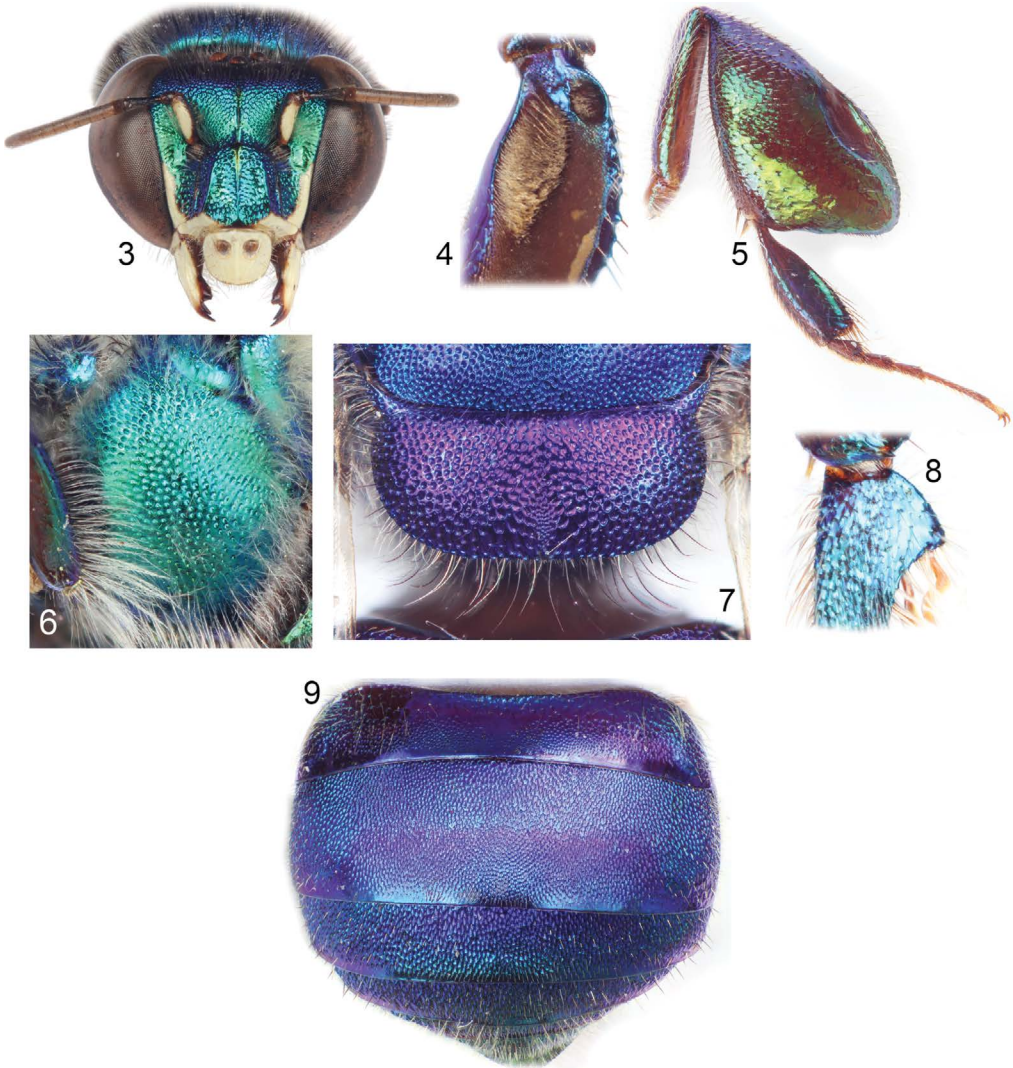


Figures 1–2. *Euglossa (Euglossella) viridis* (Perty), male. 1. Dorsal habitus. 2. Lateral habitus.

truncate. Forewing length 8.32 mm (8.21–8.57; n=4); jugal comb with 7–11 (n=4) blades; hind wing with 16–20 (n=4) hamuli. Maximum metasomal width 4.45 mm (4.29–4.57; n=4); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. Head mainly green (except as described below), vertex blue especially on ocellar triangle, also with some blue highlights along subantennal sulcus and upper section of epistomal sulcus (between subantennal sulci); paraocular ivory marks well developed, trapezoidal, lower width about two thirds of length of lower lateral part of clypeus; lower lateral part of clypeus ivory, amber-translucent at margin; labrum ivory, posterior and lateral margins as well as labral windows amber-translucent (anterior margin very narrowly amber-translucent); malar area ivory, brown on narrow areas on acetabular and condylar joints; mandible ivory on outer surface, teeth and inner surface brown; antenna brown, lighter on anterior surface of flagellum; scape with ivory spot covering most of area on anterior surface (Fig. 3). Prothorax, mesoscutum, tegula, mesepisternum, metepisternum, and propodeum mainly dark green, intergrading to blue-purple (more noticeable on mesoscutum, tegula, and propodeum); mesepisternum with faint bronzy iridescence towards preomalar area, markedly on smooth mesial surface and preomalar spot (Figs. 1–2, 6–7); mesoscutellum blue-purple with few intergradations of green; legs green to green-blue (except as indicated) with blue-purple and bronze iridescence, inner surfaces of all coxae, femora, tibiae, and basitarsi as well as entire surface of all tarsomeres beyond basitarsi amber-bronze with scarce green hue, pretarsal claws light brown at shaft, darker at tip (Figs. 1–2, 5). First to third metasomal terga blue to blue-purple with some green iridescence, especially on lateral margins, remaining terga progressively becoming green with some blue iridescence which disappears almost totally on seventh tergum (Fig. 9). Metasomal sterna green with bronze iridescence, first sternum with strong amber-bronze hue all over and some bluish hue anteriorly, mid-section of second sternum also with amber-bronze hue; all sterna with narrow posterior margins amber-bronze.

Sculpturing. Head integument strongly areolate except on small localized areas (*vide infra*), areolae on frons around 0.1x mid-ocellar diameter (appearing more like dense punctures) and gradually increasing in size towards lower areas on face, especially large (around 0.25x mid-ocellar diameter) between paramedial ridges of clypeus and upper section of antennal depressions (Fig. 3); paraocular areas also with large areolae, ivory integument of paraocular lines smooth; vertex smooth on anterior area to ocellar triangle, bearing scattered, small punctures as a transition to strongly areolate frons; gena shallowly areolate becoming punctate at margin along compound eye, punctures of dual nature, some large separated by about a puncture diameter while others of minute size and scattered among larger punctures. Mesosoma with round, dense punctures (around 0.10–0.15x mid-ocellar diameter) on mesoscutum, separated by less than one puncture diameter (almost contiguous in denser areas), slightly sparser along posterior section of median line and entire length of parapsidal lines (Fig. 1); mesoscutellum densely punctate, punctures of two different sizes, major punctures twice as big as on mesoscutum, longitudinally elongate, especially dense antero-mesally (contiguous), puncture size increasing posteriorly while density decreases in same direction such that near posterior margin punctures separated by one or two puncture diameters, minor punctures about one-third width of major punctures and intercalated in a ratio of about one minor puncture per five major punctures (Fig. 7); mesepisternum densely punctate (punctures separated by no more than two-thirds a puncture diameter except as noted hereafter), punctures rather elongate, size interme-

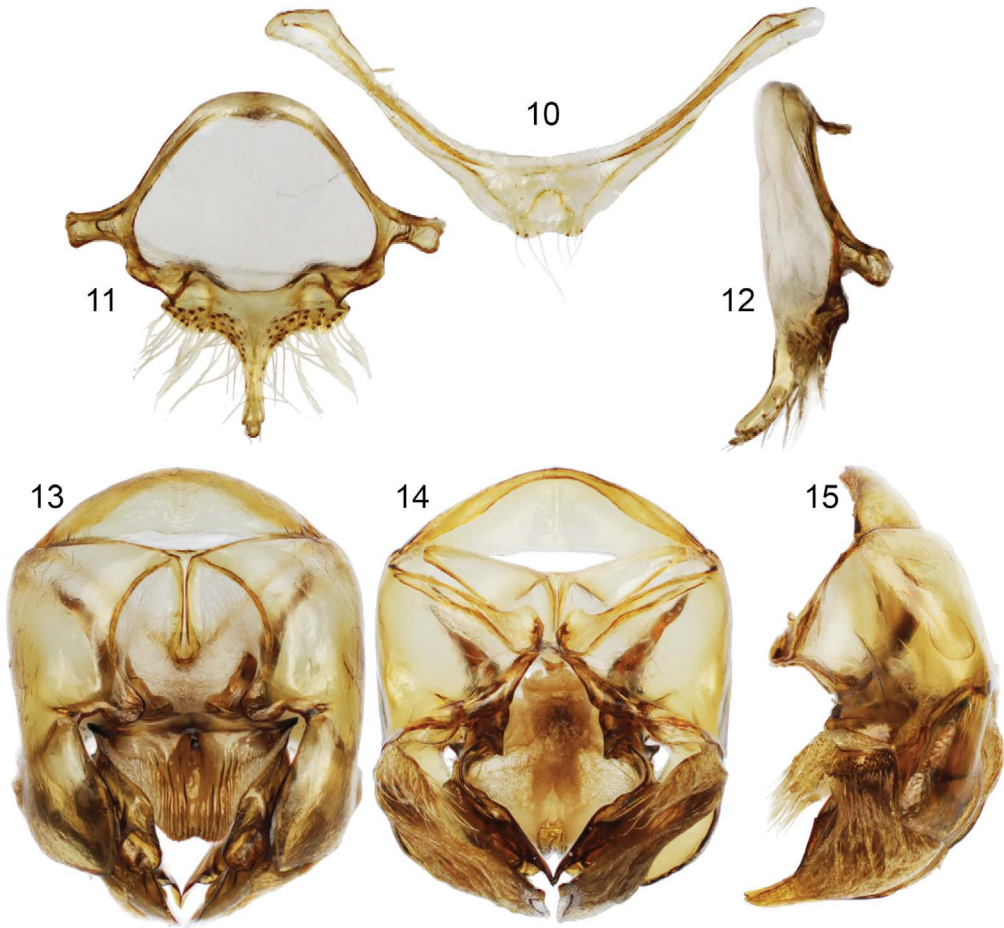


Figures 3–9. *Euglossa (Euglossella) viridis* (Perty), male. 3. Facial aspect. 4. Mesotibial tufts. 5. Outer view of hind leg. 6. Lateral part of mesepisternum. 7. Mesoscutellum. 8. Proximal section of mesobasitarsus. 9. Dorsal view of metasomal terga.

diate to that of punctures on mesoscutum and mesoscutellum, appearing particularly dense and imbricate on upper areas, and becoming less dense (punctures separated by one puncture diameter) on lower areas towards venter (density decreases below upper limit of mesocoxal joint) (Fig. 6); premaular section of mesepisternum with mesal smooth area contiguous to inner margin followed laterally by an oval micro-punctate area (premaular spot) about half size of pronotal lobe; hypoepimeral area moderately punctate, puncture size as on mesoscutum although shallower, separated by one puncture diameter; metatibia moderately dense punctate (separated by less than half a puncture diameter) on proximal area, punctures of two different sizes as on mesoscutellum (major punctures elongated posteriorly, shallow, as big as or bigger than punctures on mesoscutellum), becoming gradually smooth towards ventral border and contiguous area to metatibial organ slit (Fig. 5). All metasomal terga densely

imbricate-punctate with a narrow smooth band along posterior margin (Fig. 9), otherwise as follows: first tergum with antero-mesal half of dorsal surface, as well as ventral sections, smooth, remainder of tergum imbricate-punctate, puncture size on anterior area as on mesoscutum, decreasing halfway to posterior margin, becoming about size of smaller punctures on mesoscutum; second tergum with punctures as big as those on mid-posterior area of first tergum and as dense as on denser areas of first tergum, density of punctures with minor variation along length of tergum, becoming slightly smaller towards posterior area; third to seventh metasomal terga densely punctate, punctures oval-shaped (at least more noticeably elongated than on second tergum), slightly decreasing in size from anterior margin; sterna imbricate-punctate with a narrow smooth band on posterior margin, puncture size and arrangement as on third tergum, puncture density decreasing mesally, especially on first and second metasomal sterna.

Vestiture. Frontal fringe setae moderately dense, composed of two kinds of setae, most dark brown, minutely branched (appearing serrate or simple), intermixed with pale plumose setae, more numerous towards lower section of fringe, setal length about 0.5 mm; vertex with same two kinds of setae although sparser than those on frontal fringe, denser along preoccipital ridge, dark brown setae about twice as long as those on frontal fringe, some of them in interocellar area; antennal depressions with moderately-dense, pale, plumose setae; lower paraocular areas along epistomal sulcus with moderately-dense, pale, minutely-plumose setae, a few dark brown, simple setae on area of convergence of subantennal and epistomal sulci; remainder of face, including labrum, malar area, and outer (anterior) surface of mandible, covered with scattered, pale, minute setae; gena with dense, whitish, plumose setae, short on upper section (close to vertex) and increasing in length towards lower section (also on ventral surfaces of malar area and mandible), intermixed with some scattered, dark brown, short, erect, sturdy setae that run mainly along margin of compound eye; scape and pedicel with scattered, dark brown, short, erect, sturdy setae, pedicel and flagellum covered with dense, pale, very minute, simple setae (Figs. 1–3). Dorsal area of mesosoma (*i.e.*, mesoscutum and mesoscutellum) covered with moderately-dense setae, most whitish, some others dark brown (noticeably bordering posterior margin of mesoscutellum), latter of same nature and size (mostly) of those on facial frontal fringe, while whitish setae variable in size [some of them relatively long (almost as long as brown setae) but most of them short] and structure (plumose on anterior-most section of mesoscutum, simple on most of surface); tegula with moderately-dense, whitish, short, simple setae, except on anterior third where they are mostly dark brown and noticeably branched; remainder of mesosoma (pleural, ventral, anterior, and posterior surfaces) covered with dense, whitish to pale fulvous, plumose setae, generally as long as setae on lower section of gena, except as follows: smooth spots on anterior section of mesepisternum bare, pronotal lobe and contiguous areas of mesoscutum (antero-lateral corner) and mesepisternum (below the tegula) with numerous dark brown, branched (serrate) setae, appearing thicker and sturdier than plumose, whitish setae; proximal podites (mainly coxae, trochanters, and part of femora) with setae as on ventral part of mesosoma (Figs. 1–2); whitish, minutely-plumose (appearing simple) setae on femora (except as previously noted) and tibiae (exceptions noted hereafter), shorter on anterior surfaces, light fulvous towards distal ends of tibiae and outer surface of tarsomeres; chemical-gathering tufts on second through fourth protarsomeres composed of dense, brown, minutely-plumose, long, setae; inner surfaces of probasitarsus, meso- and metatarsomeres with dense, dark brown, sturdy setae; mesotibia with two



Figures 10–11. Male terminalia of *Euglossa (Euglossella) viridis* (Perty). 10. Seventh metasomal sternum, ventral aspect. 11. Eighth metasomal sternum, ventral aspect. 12. Eighth metasomal sternum, lateral aspect. 13. Genitalic capsule, dorsal aspect. 14. Genitalic capsule, ventral aspect. 15. Genitalic capsule, lateral aspect.

proximal tufts, anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid, about 0.30x length of major axis of anterior tuft, both tufts made of fulvous setae directed posteriad that do not overpass concavity of each tuft; both tufts distinguishable as separate units with a noticeable integumental band between them (Figs. 4, 144); mesobasitarsus with three major wavy setae on inner surface right after proximal keel, all brown; metatibia with whitish, simple setae, relatively dense and long on anterior border and even longer on distal half of dorso-posterior border, outer surface with scattered, brown, short, erect setae, bare on contiguous depression to metatibial organ; metatibial organ slit closed with brown setae (Fig. 5). Metasoma covered with whitish, simple setae, moderately dense, long and erect on sterna (except as described hereafter), antero-lateral corners and anterior border of first metasomal tergum, lateral margins of second through sixth terga, and posterior margin of seventh tergum; all terga dorsally covered with moderately dense, whitish, simple, appressed, minute setae, intermixed with scattered, erect, longer setae

of same color, as well as with some brownish, also scattered, erect (sturdier) shorter setae, these last especially located on apical terga; tufts on second sternum (*vide* Structure, *supra*) composed of whitish to fulvous, simple, long setae, directed posteriorly, barely over-passing posterior margin of sternum.

Terminalia. Posterior margin of seventh metasomal sternum invaginated mesially, forming a shallow incision separating discal lobes; setae on discal margin simple, as long as sternal disc, growing in groups of four or five simple setae on each lobe (Fig. 10). Anterior section of eighth metasomal sternum about as wide as long (not considering lateral arms); posterior section of eighth metasomal sternum with basal lobes rhomboid, projected posteriorly (longer axis of rhombus running longitudinally), posterior section after basal lobes very narrow in both lateral and dorsal planes, appearing like an elongate cylinder, apically hooked; moderately dense, long, plumose setae inserted mainly on ventral surface of lobes, some scattered, simple setae also on ventral surface of narrowed posterior section, becoming shorter apically (Figs. 11–12). Dorsal process of gonocoxite about as wide as long (Fig. 13). Gonostylar lateral section with ventral lobe thumb-shaped, slightly acute apically, basal sector adjacent to ventral lobe very well developed with a noticeable “secondary” lobe produced by convexity of its posterior margin, “secondary” lobe almost as long as ventral lobe, forming a right to acute angle between both lobes; ventral lobe with moderately dense, light, simple setae mainly on outer surface (very few on inner surface, principally towards apex), secondary lobe of basal sector with dense, fulvous setae plumose in their apical halves, length of these almost reaching posterior margin of blades of penis valve (Figs. 15, 164). Spatha as long as its basal width with noticeable longitudinal wrinkles (Fig. 13).

♀: Refer to section on females of *E. viridis/azurea* (*vide infra*).

HOLOTYPE: ♂, **Brazil:** “Type [brown label] // 1.; Brasil; C.; *viride* Pty [handwritten] // Brasilien.; Coll. Perty [green label, handwritten] // *Euglossa* sp.; ? {*cordata* [or] *variabilis*; det. Friese 1898 [species names handwritten] // *Euglossa; viridis* Pty.; (= *azurea* Ducke); 1936 det. Hedicke [species name handwritten] // *Euglossa; viridis* perty; hat Priorität; Hedicke’36 [handwritten] // Holotypus; *Cnemidium viride*; Perty S, Diller 1989; Zoologische; Staatssammlg. München [pink label, species name handwritten]” (ZSSM).

ADDITIONAL MATERIAL EXAMINED (35♂♂): **Brazil:** 1♂, “IBUSP, São Paulo, SP 11:47; Brasil 15 2 1984.; Col: F.R.N.K. ; Eugl A5/Juréia [all handwritten except locality] // *Euglossa; (Euglossella); viridis* (Perty) ♂; Det. I. Hinojosa-Díaz 2011” (DZUP). 1♂, “São Sebastião SP BR [São Paulo, Brazil]; Mata-Guaecá; 17/XII/99-Eugenol; Mateus S. Leg // *E. aff. viridis*; A. NEMÉSIO det 2007” (BHMH). 1♂, “Brasil – AM; Titirico; 14-4-1964; J. & B. Bechyne // *Euglossa; viridis* (Perty); Det. R.L. Dressler 1968” (FSCA). 1♂, “BRAZIL: Bahia; Itabuna; 4 XI 1968; R.L. Dressler; 1229 [mixed handwritten]// Eugenol [upside down] // *Euglossa; (Euglossella); viridis* (Perty) ♂; Det I. Hinojosa-Díaz 2012” (FSCA). 1♂, “BRASIL Guapore; Abunã, Nov. ’62; (W. Bokermann) // *Euglossa; viridis* (Perty); Dressler, 1967 [handwritten]” (SEMC). 1♂, “[Brazil] S. Gabriel; Rio Negro; Amaz. [Amazonas] 30. VIII. 1923; J. F. Zikán // *Euglossa; (Euglossella); viridis* (Perty) ♂; Det I. Hinojosa-Díaz 2012” (FSCA). 1♂, “Brazil [round label handwritten] // *E. (Euglossella) viridis* ♂; Perty; Det.J.S. Moure 1972 [mixed handwritten] // *Euglossa; (Euglossella); viridis* (Perty) ♂; Det I. Hinojosa-Díaz 2012” (NHML). **French Guiana:** 1♂, “FRENCH GUIANA; Kourou, Km. 17 SW.; 30 March 1977; D. Roubik, No. 121 [mixed handwritten] // *Euglossa; viridis* (Perty); det. R.L.Dressler, 1978” (SEMC). 1♂, “FRENCH GUIANA; Kourou, Km. 17 SW.; 31 March 1977; D. Roubik, No. 122 [mixed handwritten] // *Euglossa; (Euglossella); viridis* (Perty) ♂; Det. I. Hinojosa-Díaz 2011” (SEMC). 1♂, “*Euglossa* sp. *cyanura*; 07.03.2006; Anth. Rubrinervum [ex.] // Leg./det.; Heiko Hentrich; Nouragues,

F18; French Guiana, // *Euglossa*; (*Euglossella*); *viridis* (Perty) ♂; Det I. Hinojosa-Díaz 2012" (SEMC). **Guyana:** 1♂, "Berbice, Brit. Guiana; October, 1922; e coll. M.D. Haviland; d.d. Collegium Newnhamense // Kartabo,; Brit. Guiana.; B.M.1924-519." [pinned upside down] // *Euglossa*; (*Euglossella*); *viridis* (Perty) ♂; Det. I. Hinojosa-Díaz 2011" (NHML). 1♂, "MAZARUNI.; High Forest.; 20 viii.1937.[day handwritten] // BRITISH GUIANA.; Coll. Richards; & Smart.; B.M.1937-776. // "*Euglossa*; (*Euglossella*); *viridis* (Perty) ♂; Det. I. Hinojosa-Díaz 2011" (NHML). 1♂, "Bartica District; British Guiana; 24. III. 1924 // 1632♂ // Gift of New York; Zoo. Soc.,Dept.; Tropical Research; William Beebe.Dir // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher" (AMNH). 1♂, "Bartica District; British Guiana; Camaria // 30. VI. 1924; Collected by; Jay F.W. Pearson [collector information on underside] // 1640♂ // Gift of New York; Zoo. Soc.,Dept.; Tropical Research; William Beebe.Dir // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher" (AMNH). 4♂♂, as previous except number along gender sign "1636", "1639", "1641", "1643" (AMNH). 1♂, "BRITISH GUIANA; Kartabo, Bartica; Dist. 1920 [last two digits of year handwritten] // Trop. Research Station; New York Zool. Society; No.201290 [number handwritten] // Gift of New York; Zoo.Soc.,Dept.; Tropical Research; William Beebe.Dir // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher" (AMNH). 1♂, as previous except number on second label "201260" (AMNH). 1♂, as previous except year "1921" and number on second label "21221" (AMNH). 1♂, "Kartabo; Bartica District; British Guiana; 17-III-1922 [day and month handwritten] // 1641♂ // Gift of New York; Zoo.Soc.,Dept.; Tropical Research; William Beebe.Dir // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher" (AMNH). 1♂, "guiana [handwritten] // Rothschild; Bequest; B.M. 1939-1. // *E. (Euglossella); viridis*; (Perty); Det.J.S.Moure 1972 [mixed handwritten] // *Euglossa*; (*Euglossella*); *viridis* (Perty) ♂; Det. I. Hinojosa-Díaz 2011" (NHML). **Peru [new record]:** 1♂, "PERU, Madre de Dios: Rio; Madre de Dios & Palma; Real, Huisene guardpost; Clearing floor, 400m; 12°25'S 68°51'W?; T. Larsen, V-14, 1999" (USNM). **Venezuela:** 3♂♂, "VENEZUELA: Amazonas, Cerro; Unturan Camp.; 65°14'W, 01°33'N; 1100m. 11-15.III.89 //Phipps-FUDECI Exped.; by Amer. Mus. Nat. Hist.; D.A. Grimaldi, coll. // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher" (AMNH). 4♂♂, "VENEZUELA, Territorio; Amazonas: Santa Lucia; February 4 1984; Rozen & Stupakoff // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher" (AMNH). 2♂♂, "[Venezuela, Amazonas] Río Cuao,; 12. II. 84; Tree [ex.?][handwritten] // *Euglossa*; *viridis* (Perty); Det. R.L. Dressler 1985" (FSCA). 1♂, "[Venezuela] Gavilan; 24. VI. 84; w/o Rubiaceae // *Euglossa*; *viridis* (Perty); Det. R.L. Dressler 1985" (FSCA). 1♂, "[Venezuela] Gavilan 27. VI. 84 w/o // *Euglossa*; (*Euglossella*); *viridis* (Perty) ♂; Det I. Hinojosa-Díaz 2012" (FSCA).

COMMENTS: Despite the species name (*viridis* being Latin for green), specimens of *E. viridis* exhibit a noticeable amount of blue-green coloration (even more noticeable than green, depending on the angle of view), forming a pattern (as described above) that seems to generally be stable in the majority of the examined specimens regardless of geographic origin. However, caution must be taken when using the pattern of integumental coloration for identification of the species, as two of the studied specimens exhibit noteworthy deviations from the more typical pattern. One specimen, labeled as from Titirico, Amazonas, Brazil, is plainly green all over, with no evident blue portions, a coloration characteristic of other species in this same group (*vide infra*). The second anomalous individual, from Juréia, São Paulo, Brazil, lacks green coloration with the integument rather cyan-violet all over, in this respect resembling *E. cyanea*. Despite the color extremes represented by these two specimens, all other morphological features, particularly the integumental sculpturing of the mesoscutellum and

mesepisternum, shape and dimensions of the mesotibial tufts and mesotibial velvety area, and shape of the angle of the mesobasitarsal keel, clearly correspond to those observed for all other specimens of *E. viridis*.

In *E. viridis* variation in genitalic structures generally is equivalent to that described for species in the *decorata* group (Hinojosa-Díaz & Engel, 2011a), that is to say, the gonostylar secondary lobe, produced by the projection of the dorsal margin adjacent to the ventral lobe (all of this in the lateral section of the gonostylus), is always well developed, although the degree of projection varies among individuals. In some males it is projected beyond the posterior limit of the ventral lobe, while in others it is just slightly shorter than this. The shape of this secondary lobe is not constant, and in some males appears like a strong domelike projection, while in others it may be projected into a trapezoidal shape. Such variation can occur within a single locality and therefore does not seem to be of value in demarcating species, and its function (if it serves any at all) remains entirely unknown.

This species is superficially similar to *E. azurea*, especially in coloration, although in *E. viridis* individuals have the blue to blue-purple coloration more noticeable on the first three metasomal terga (with the exception of the two atypical specimens discussed above). In *E. azurea* the blue coloration tends to cover at least the first four metasomal terga. It is important to note that integumental coloration is rather variable and as such, the cited blue coloration of the metasomal terga alone is insufficient to distinguish these two species. Features that better serve to distinguish these species are described in the comments section for *E. azurea* (*vide infra*). Although a description of females of *E. viridis* was provided by Moure (1960), his material included females from Panama that clearly belong to *E. cyanura*, as the author at that time considered the latter to be a synonym of *E. viridis* (*vide* Comments for *E. cyanura*, *infra*). After years of consideration and adopting a staunchly conservative approach, we have been unable to definitively and unequivocally identify females as *E. viridis*, and the same is true for *E. azurea*. While the males pose little difficulty, positively associating females caught separately for both species remains a challenge. Accordingly, we provide below a separate account for females of both (*vide infra*).

Moure (1967b) cited *E. viridis* as occurring in northern and northeastern Brazil and the Guianas; the species has also been reported from Colombia, Venezuela, and Ecuador (Bonilla-Gómez & Nates-Parra, 1992; Moure *et al.*, 2007; Ramírez *et al.*, 2002), as well as from southeastern Brazil (Nemésio, 2009). The reports from Colombia and Ecuador were not confirmed in this study as no specimens from those countries were available, although such areas likely do host the species, particularly in the western and southwestern areas of Colombia. However, the records cited by Bonilla-Gómez & Nates-Parra (1992) and Ramírez *et al.* (2002) for Colombia could also correspond to *E. celiae*, a species newly described herein (*vide infra*). The Ecuador references in Ramírez *et al.* (2002) are possibly of *E. subandina*, another species newly established in the present work (*vide infra*), as all of the specimens belonging to this newly described species were labeled as *E. viridis* in one of the collections (FSCA) visited by those authors. Records cited for this species from Panama (Ramírez *et al.*, 2002) are based on the early synonymic assumptions of Moure (1960) for the species with *E. cyanura*. We present above the first published record for the species from Peru, and while the reported presence of *E. viridis* in Bolivia (Moure *et al.*, 2007) is consistent with the observed distribution, we have not seen any Bolivian specimens. Some of the records cited previous to this study possibly correspond to (or include specimens of) *E. azurea*. As documented here, records for *E. viridis* are known from Venezuela, the Guianas, southeastern Peru,

and north, northeastern, and southeastern Brazil (Fig. 170), and it is likely present in west-central Brazil as well.

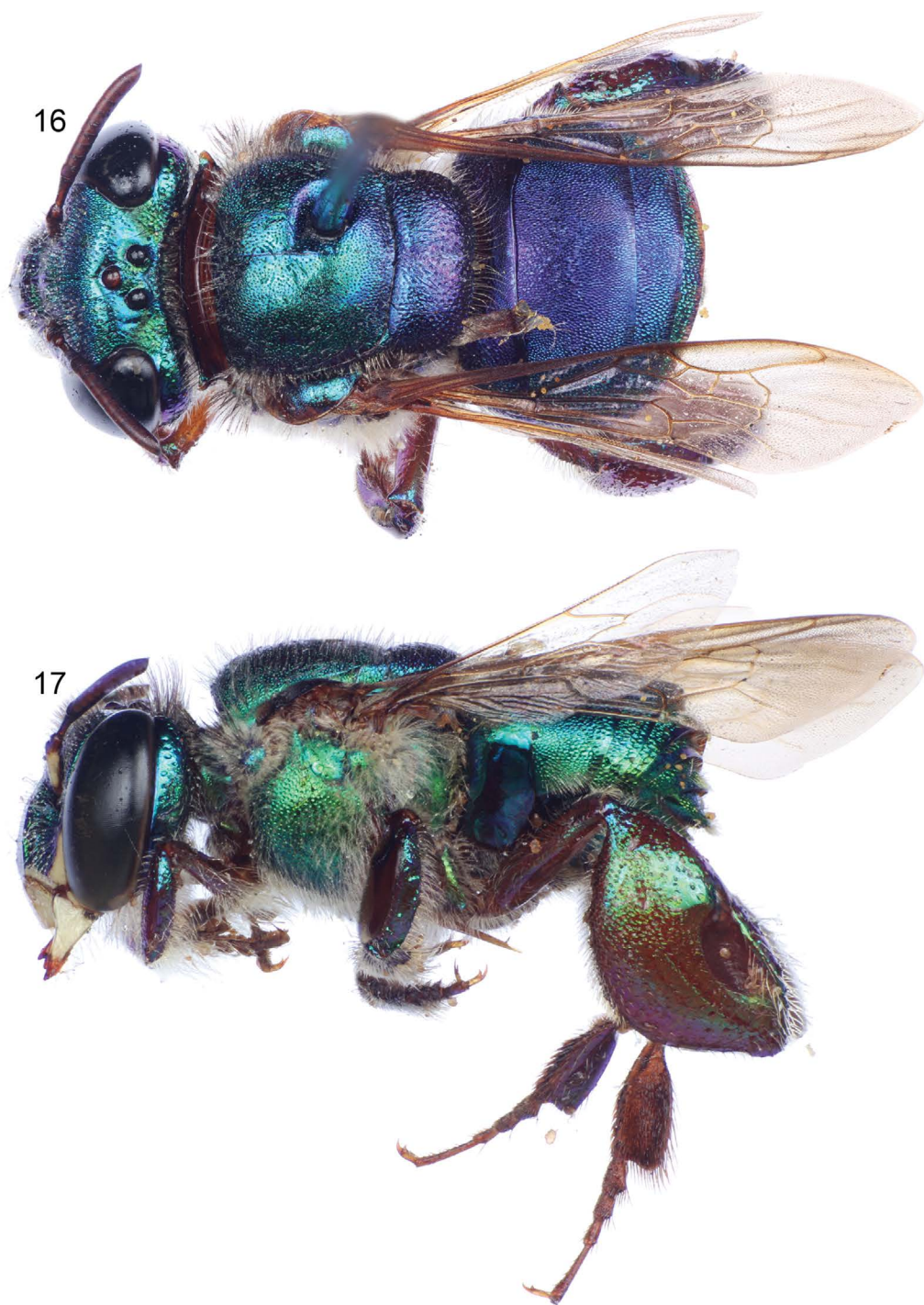
Euglossa (Euglossella) azurea Ducke, **reinstated name**
(Figs. 16–24, 145, 155, 165, 170)

Euglossa azurea Ducke, 1902a: 402 [♂♀]. Lectotype ♂ (MPEG, *visum*).

Euglossa (Euglossella) jacquelynae Nemésio, 2007: 22 [♂]. Holotype ♂ (BHMH, observed published images of holotype; two paratypes examined). **New synonymy.**

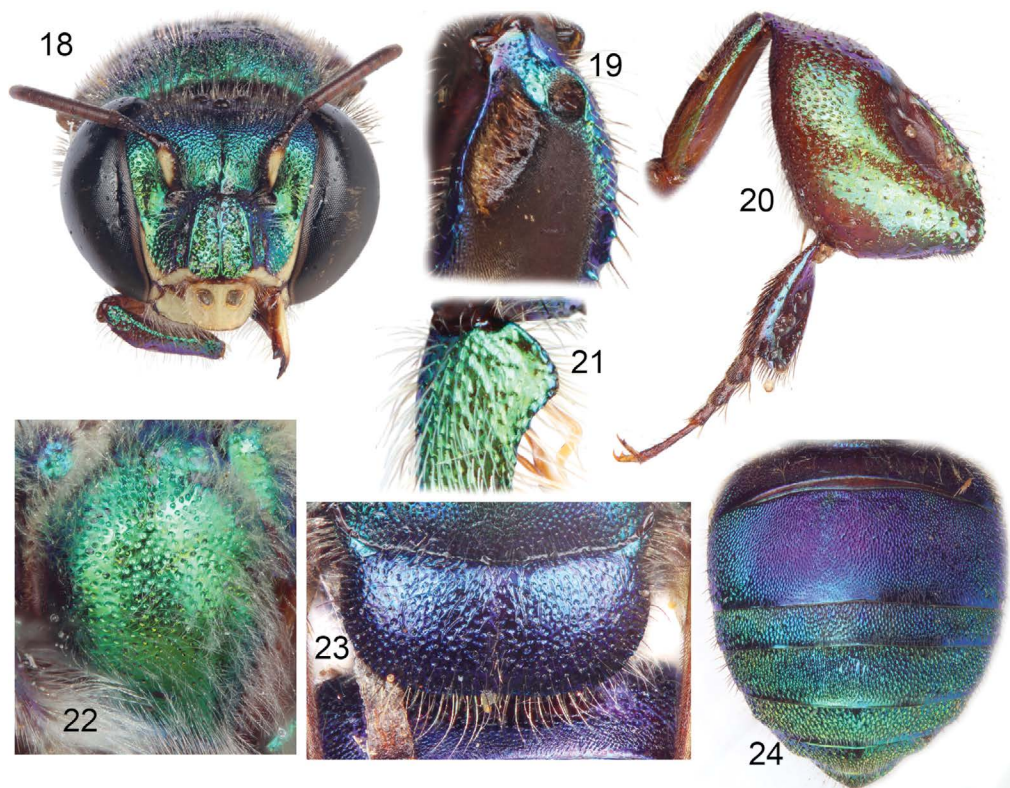
DIAGNOSIS: Labiomaxillary complex in repose reaching second metasomal sternum; upper and lower interorbital distances equal (at most marginally different) (Fig. 18); malar area short (less than 0.25 mm, noticeably shorter than diameter of mid-flagellar articles) (Fig. 18); pronotal dorsolateral angle projected as a lamella; male mesotibial tufts as follows: anterior tuft rhomboid, moderately long (maximum length not exceeding mid-width of velvety area) and narrow (mid-width equivalent to width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 19, 145); mesobasitarsal posterior keel projected in a right to slightly obtuse angle (Fig. 21); second metasomal sternum with two simple meso-lateral tufts; metasoma as wide as head (if different, no more than 1.05 times) (Fig. 16); head mainly green with some blue areas (Fig. 18); paraocular marks trapezoidal, lower width about half length of lower lateral part of clypeus (Figs. 17–18); scape with ivory spot covering almost entire anterior surface (Fig. 18); mesosoma (except mesoscutellum) mainly dark green with blue-purple intergradations and bronzy iridescence (Figs. 16–17), mesoscutellum blue-purple (Fig. 23); first to fourth metasomal terga blue/blue-purple, remaining terga progressively green (Fig. 24); mesoscutellum and central area of mesepisternum moderately punctate (punctures separated by one to two puncture diameters) (Figs. 22–23); metasomal terga densely and evenly imbricate-punctate (Fig. 24); mesosoma vestiture dominated by pale-fuscous setae (Figs. 16–17, 22–23); eighth metasomal sternum posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 155); gonostylar lateral section with posterior margin of basal sector not projected, covered with moderately-dense setae that reach posterior margin of blades of penis valve (Fig. 165).

DESCRIPTION: ♂: **Structure.** Total body length 10.19 mm (9.93–10.52; n=4); labiomaxillary complex in repose reaching anterior half of second metasomal sternum (Fig. 17). Head length 2.63 mm (2.59–2.67; n=4), width 4.42 mm (4.30–4.52; n=4); upper interorbital distance 1.95 mm (1.85–2; n=4); lower interorbital distance 1.93 mm (1.85–1.96; n=4); upper clypeal width 1.08 mm (1.04–1.11; n=4); lower clypeal width 1.80 mm (1.70–1.85; n=4); clypeal protuberance 0.52 mm (0.44–0.59; n=4); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*; labrum wider than long, length 0.88 mm (0.85–0.92; n=4), width 1.01 mm (0.96–1.04; n=4) (Fig. 18); interocellar distance 0.31 mm (0.30–0.31; n=4); ocellocular distance 0.56 mm (0.52–0.59; n=4); first flagellar article longer [0.51 mm (0.46–0.56; n=4)] than second and third flagellar articles combined [0.36 mm (0.33–0.37; n=4)]; length of malar area 0.19 mm (0.17–0.19; n=4). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.22 mm (3.00–3.41; n=4); mesoscutal length 2.61 mm (2.48–2.67; n=4); mesoscutellar length 1.17 mm (1.11–1.19; n=4); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 23); mesotibial length 2.08 mm (1.93–2.22; n=4); mesobasitarsal length 2.06 mm (1.96–2.22; n=4),



Figures 16–17. *Euglossa (Euglossella) azurea* Ducke, male. 16. Dorsal habitus. 17. Lateral habitus.

width 0.66 mm (0.61–0.67; n=4) (measured at proximal posterior keel), posterior keel projected in a right to slightly obtuse angle with proximal margin (between mesotibia-



Figures 18–24. *Euglossa (Euglossella) azurea* Ducke, male. 18. Facial aspect. 19. Mesotibial tufts. 20. Outer view of hind leg. 21. Proximal section of mesobasitarsus. 22. Lateral part of mesepisternum. 23. Mesoscutellum. 24. Dorsal view of metasomal terga.

mesobasitarsus joint and apex of keel) evenly convex (Fig. 21); metatibia triangular (scalene triangular) (Fig. 20), maximum thickness 1.33 mm (1.26–1.48; n=4); metatibial anterior margin length 3.37 mm (3.11–3.48; n=4), ventral margin length 2.28 mm (2.22–2.30; n=4), postero-dorsal margin length 4.19 mm (3.93–4.44; n=4); metatibial organ slit as described for *E. viridis*, dorsal section length 0.59 mm (0.56–0.61; n=4); metabasitarsal length 1.91 mm (1.85–1.93; n=4), mid-width 0.79 mm (0.74–0.81; n=4); metabasitarsal ventral margin truncate. Forewing length 8.69 mm (8.52–8.89; n=4); jugal comb with 12–13 (n=4) blades; hind wing with 18–21 (n=4) hamuli. Maximum metasomal width 4.41 mm (4.22–4.52; n=4); second metasomal sternum as described for *E. viridis*.

Coloration. Head as described for *E. viridis*, except lower width of paraocular ivory marks slightly narrower in most specimens (about one half length of lower lateral part of clypeus, while in most specimens of *E. viridis* this width about two-thirds length of lower lateral part of clypeus) (Figs. 17–18). Mesosoma, including legs, as described for *E. viridis* (Figs. 16–17, 22–23), except preomaular spot matte brown-purple, contrasting with metallic surroundings (in *E. viridis* preomaular spot with faint bronzy coloration). Metasoma as described for *E. viridis* with following remarks: First to fourth metasomal terga blue to blue purple with scarce green iridescence, especially on lateral margins (in most specimens examined for *E. viridis* blue purple coloration goes mainly from first through third metasomal terga, but refer also to Comments for that species, *infra*) (Fig. 24).

Sculpturing. Head as described for *E. viridis* (Fig. 18). Mesoscutum as described for *E. viridis* (Fig. 16); mesoscutellum with moderately dense punctures, also of two different sizes, major punctures slightly bigger than those on mesoscutum (increasing in size towards posterior margin), separated by about one puncture diameter on lateral thirds of mesoscutellar surface, sparser (separated by one to two puncture diameters) along mid-section (by comparison to *E. viridis* in which punctures are dense, *i.e.*, contiguous, antero-medially) and near posterior margin, minor punctures about one-third size of major punctures and in a ratio of about one minor puncture per five major punctures (Fig. 23); mesepisternum similar to that of *E. viridis*, except punctures distinctively sparser (punctures separated by one or two puncture diameters) on middle area above upper limit of mesocoxal joint, remainder of mesosomal sclerites as described for *E. viridis*; metatibia as described for *E. viridis* (Fig. 22); preomalar spot surface noticeably concave (in *E. viridis* preomalar spot rather even with surrounding integument). Metasomal terga as described for *E. viridis* (Fig. 24); sterna as described for *E. viridis*.

Vestiture. Head as described for *E. viridis* (Fig. 18). Mesosoma (including legs) as described for *E. viridis* (Figs. 16–17, 20, 22–23), except length of mesotibial anterior tuft not exceeding mid-width of velvety area, and mid-width of anterior tuft equivalent to width of contiguous velvety area (Figs. 19, 145). Metasoma as described for *E. viridis* (Fig. 24).

Terminalia. Seventh and eighth metasomal sterna as described for *E. viridis*. Gonocoxite as described for *E. viridis* (Fig. 155). Gonostylar lateral section with ventral lobe thumb-shaped, noticeably acute apically, basal sector adjacent to ventral lobe equivalent in width to ventral lobe, posterior margin straight, not projected (by comparison to *E. viridis* in which it is developed as a “secondary” lobe); ventral lobe with moderately-dense, light, simple setae mainly on outer surface (very few on inner surface, principally towards apex), basal sector with dense (not as dense as on “secondary” lobe of *E. viridis*), fulvous, seta plumose in their apical halves, length of these setae reaching mid-section of blades of penis valve, not reaching their margin (Fig. 165). Spatha as described for *E. viridis*.

♀: See section on females of *E. viridis/azurea* (*vide infra*).

LECTOTYPE: ♂, **Brazil:** “LECTOTIPO [red label] // Macapa; 9-11-1900; Ducke [handwritten] // Brazil; Estado do; Pará [upside down] // Lectotype; *Euglossa* ♂; *azurea* Ducke; J.S. Moure 1960 [species name and year handwritten]” (MPEG).

ADDITIONAL MATERIAL EXAMINED (19♂♂): **Brazil:** 1♂, “Brasil. GO [Goiás]. Caldas; Novas; 18/11/2004; Augusto, S.C. col. // 12324 36326 // *E. jacquelynae*; paratype” (BHMH). 1♂, “Parque Nacional; Serra do Cipó; Salicilato; 12664-36988 // Jaboticatubas MG [Minas Gerais]; BRASIL 28/10/2005; R.A. Souza Salicilato // *E. cfr. jacquelynae*; Nemésio det. 2007” (BHMH). 1♂, “Brasil. MG [Minas Gerais]. Uberlândia; PANGA; 20-IV-2004; Alvarenga, P. col. // 12333 36365 // COLEÇÃO EC; 162 // Salicilato de; metila // *E. jacquelynae*; paratype” (BHMH). 1♂, “BRAZIL: PARÁ; BELÉM, IPEAN [Instituto de Pesquisa Agropecuária do Norte]; 27 X/ 1968; R.L. Dressler; 1205 [day and last number handwritten] // Skatole // *Euglossa; viridis* (Perty); det. R.L. Dressler 196 // *Euglossa; (Euglossella); azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012” (FSCA). 1♂, “M. Salicylate BRAZIL: PARÁ; BELÉM, IPEAN [chemical handwritten] // 30 VI 1971; H Kennedy // *Euglossa; (Euglossella); azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012” (FSCA). 1♂, “Brasilien; Bahia; Gomez S. // *Euglossa; (Euglossella); azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012” (FSCA). 1♂, “RO-8627; BRASIL, Rondônia; Rolim de Moura; Linha 192 // 26 Abr 97; 11°42.293'S 61°42.216'W; Brown, Boina, Vieira // *Euglossa (Euglossella); viridis*

(Perty, 1833); Det. M.L. Oliveira, 1999 // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (AMNH). 1♂, "RO-9893; BRASIL, Rondônia; Porto Velho; Estação Ecológica Cuniã // 23 Maio 1999; 08°17'48.1"S 63°30'30.4"W; Brown, Boina, Vieira // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); Det. M.L. Oliveira, 1999 // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (AMNH). 1♂, "RO-9258; BRASIL, Rondônia; Mirante da Serra; Linha 64 // 16 Maio 1997; 10°58'35.3"S 62°47'08.0"W; Brown, Boina, Vieira // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); Det. M.L. Oliveira, 1999 // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (AMNH). 1♂, "RO-13898; BRASIL, Rondônia; Mirante da Serra; Linha 80 // 29 Agosto 1997; 11°06'46.3"S 62°51'03.6"W; Brown, Boina, Vieira // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (SEMC). 1♂, as previous except first number "RO-13899" (SEMC). 1♂, "BRAZIL, Mato Grosso.; Sinop, October 1976; M. Alvarenga // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (AMNH). 1♂, "2693 // MANAUS. AM; [illegible] 23/8/90; M.L. OLIVEIRA // *viridis* // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (DZUP). 1♂, "Roadside // Cerradão // BRAZIL, Mato Grosso; 12°50'S., 51°47'W.; 10 IV 1968; O.W. Richards [month and day handwritten] // *E.* (*Euglossella*); cfr. *viridis*?; Det. J.S. Moure 1972 [mixed handwritten] // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det. I. Hinojosa-Díaz 2011" (NHML). **French Guiana:** 1♂, "FRENCH GUIANA; Kourou, Km. 17 SW.; 22 March 1977; D. Roubik, No. 115 [mixed handwritten] // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (SEMC). 1♂, "FRENCH GUIANA; Kourou (beach); 2 March 1977; C.D. Michener // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (FSCA). **Venezuela:** 1♂, "Venezuela Amazonas; El Infierno-Atures // *Euglossa viridis*; (Perty); det. R.L. Dressler 1986 // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (AMNH). 1♂, "Carapito [Caripito]; Ven. [Venezuela, Monagas] Apr. 5 1940; B. Denton // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012 (USNM). 1♂, "[Venezuela, Amazonas] Río Cuao; 03 May 86; pdmb [handwritten] // *Euglossa*; (*Euglossella*); *azurea* Ducke ♂; Det I. Hinojosa-Díaz 2012" (FSCA).

COMMENTS: As mentioned in the comments for *E. viridis*, there is strong superficial similarity between *E. azurea* and *E. viridis*, and in most collections specimens of *E. azurea* are understandably identified largely as *E. viridis*. The history of the recognition of *E. azurea* is certainly a reflection of this similarity. The species was first published in German by Ducke (1902a), while the intended initial description appeared later that same year in a Brazilian article (Ducke, 1902b). In both instances the species was described briefly with an emphasis on coloration, although Ducke did mention a few other morphological details. Hedicke (1936) and Moure (1960, 1967b) both viewed *E. azurea* as a junior synonym of *E. viridis*, and this perception remained as the valid view until the present study (e.g., Kimsey & Dressler, 1986; Moure *et al.*, 2007). Moure (1967b) also designated a lectotype for *E. azurea*, which was examined during the course of our work, and is a male, and correctly listed as such in several catalogues (Moure, 1967b; Kimsey & Dressler, 1986; Moure *et al.*, 2007), despite Nemésio & Rasmussen (2011) referring to it as a female.

Nemésio (2007) described *E. jacquelynae* Nemésio from areas in south-central Brazil (states of Goiás and Minas Gerais), specifically mentioning its resemblance to *E. viridis* and *E. cyanura*. Moure *et al.* (2007) considered *E. jacquelynae* as a junior synonym of *E. viridis*, a conclusion with which we disagree. Nemésio (2007) was justified in his conclusion that *E. jacquelynae* was a species distinct from *E. viridis* and *E. cyanura*, and he rightly compared his type series with available material of both of the latter. How-

ever, given that Moure (1960, 1967b) had asserted *E. azurea* to already be synonymous with *E. viridis*, Nemésio (2007) apparently did not examine the lectotype of the former as part of that work. When we compared material of *E. jacquelynae* and *E. azurea*, including its lectotype, it is clear that the two are conspecific and we are confident that had Nemésio (2007) observed the lectotype of *E. azurea* he would have recognized his specimens as such as well as the error of previous authors' synonymy. Although the holotype of *E. jacquelynae* was not available to us, we did have access to paratypes as well as the excellent photographs of the holotype (Nemésio, 2007, 2009) that depict clearly sufficient details to support the synonymy.

The features of coloration used by Ducke (1902a) in his original description of *E. azurea* attest to the fact that this species has for the most part a more extensive blue coloration on the metasoma than *E. viridis*. However, as mentioned before, although useful, the observed variation in color in both taxa makes this character insufficient and, when used alone, is unreliable. Nemésio (2007) also observed the metasomal terga coloration pattern when describing *E. jacquelynae*, and alluded to differences in the configuration of the paraocular marks and of the anterior mesotibial tuft to separate the species from *E. viridis* and *E. cyanura*. The latter species is distinguishable easily from either *E. azurea* or *E. viridis* by the sculpturing of the metasomal terga, aside from its restriction to Central America and southern Mexico. *Euglossa azurea* can be distinguished reliably from *E. viridis* based on various unambiguous characters, such as the paraocular marks, integumental sculpturing, and perhaps most definitively by traits of the midleg. The extension of the lower part of the paraocular marks, covering about two thirds of the length of the lower lateral part of the clypeus in *E. viridis* (Fig. 3), and about half the length of the same in *E. azurea* (Fig. 18). The sculpturing of the mesoscutellum and mesepisternum is distinctive in both species, as punctures are consistently denser in specimens of *E. viridis* (Figs. 6–7) when compared to those of *E. azurea* (Figs. 22–23), and this unambiguously separates these two species. The mesobasitarsal posterior keel is projected as an acute angle in *E. viridis* (Fig. 8), where it is right to slightly obtuse (or rather blunt) in *E. azurea* (Fig. 21). The shape and dimensions of the velvety area and the outer surface of the mesotibia seem to be at the extremes of the morphological variation observed in the *viridis* species group. On the one side *E. viridis* has a comparatively slender velvety area (Fig. 144), while *E. azurea* has the widest velvety area of all species in the group (Fig. 145). The relative size of the anterior mesotibial tuft aids in recognizing these differences when one compares its length to the mid-width of the velvety area and the tuft's mid-width with the width of the contiguous section of the velvety area (refer to key to species, *supra*). The gonostylus of *E. azurea* is also distinctive from *E. viridis*, and although subject to some variation, is rather uniform among specimens, with the basal sector having a straight, non-projecting posterior margin instead of the noticeable "secondary" lobe present in *E. viridis* and all other species in the group. This entire suite of morphological features are important since both taxa are seemingly sympatric and very similar, almost cryptically so, at first glance. Additionally, no individuals of *E. azurea* were found with the extremes in coloration (e.g., either all green or bluish) that we observed for *E. viridis*. As for *E. viridis*, females of *E. azurea* cannot yet be identified unequivocally as belonging to this species and so they are treated in a separate account below (*vide infra*).

As noted, *E. azurea* is largely sympatric with *E. viridis*. Specimens were examined from Venezuela, French Guiana, and the northern, west-central, and southeastern regions of Brazil (Fig. 170).

Euglossa (Euglossella) viridis/azurea ♀♀
(Figs. 25–28, 170)

DESCRIPTION: ♀: **Structure.** Total body length 10.05 mm (9.63–1.52; n=3); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 26). Head length 2.80 mm (2.63–2.89; n=3); head width 4.51 mm (4.45–4.59; n=3); upper interorbital distance 2.16 mm (2.11–2.22; n=3); lower interorbital distance 2.19 mm (2.15–2.22; n=3); upper clypeal width 1.18 mm (1.15–1.19; n=3); lower clypeal width 1.94 mm (1.93–1.96; n=3); clypeal protuberance 0.62 mm (0.59–0.67; n=3); clypeal ridges, labral ridges, and labral windows as in male of *E. viridis*; labrum rectangular, wider than long, length 0.90 mm (0.89–0.93; n=3), width 1.07 mm (1.07–1.08; n=3); anterior margin of labrum arched outwards with subapical carina (Fig. 27); interocellar distance 0.36 mm (0.35–0.37; n=3); ocellocular distance 0.62 mm (0.59–0.63; n=3); first flagellar article longer [0.51 mm (0.49–0.52; n=3)] than second and third flagellar articles combined [0.38 mm (0.37–0.41; n=3)]; length of malar area 0.16 mm (0.13–0.19; n=3). Mandible tridentate. Pronotal dorsolateral angle as in male of *E. viridis*; intertegular distance 3.41 mm (3.41; n=3); mesoscutal length 2.66 mm (2.59–2.72; n=3); mesoscutellar length 1.25 mm (1.19–1.33; n=3); posterior margin of mesoscutellum as in male of *E. viridis* (Fig. 25); mesotibial length 2.12 mm (2.11–2.15; n=3); mesobasitarsal length 2.00 mm (1.93–2.07; n=3), maximum width 0.64 mm (0.59–0.67; n=3); metatibia triangular (right triangle) (Fig. 28); metatibial anterior margin length 3.04 mm (2.96–3.11; n=3); metatibial ventral margin length 1.99 mm (1.93–2.07; n=3); metatibial postero-dorsal margin length 3.50 mm (3.41–3.56; n=3); metabasitarsal length 1.80 mm (1.78–1.85; n=3), proximal margin width 0.85 mm (0.78–0.89; n=3). Forewing length 8.32 mm (8.15–8.52; n=3); hind wing with 20–24 (n=3) hamuli. Maximum metasomal width 4.72 mm (4.67–4.81; n=3).

Coloration. Generally as described for known male specimens of both *E. viridis* and *E. azurea*, with following remarks (*vide* Comments, *infra*): Ivory colored areas of face restricted to lateral area of clypeus, malar area, labrum, and mandibles; anterior margin of labrum brown (Fig. 27).

Sculpturing. Available specimens exhibit integumental sculpturing comparable to that described for male specimens of *E. viridis* (*vide* Comments for extra details, *infra*).

Vestiture. Setal structure, coloration, and arrangement as described for male of *E. viridis* (except, of course, some features of protarsi, meso- and metatibia exclusive to male), with following remarks: Mesoscutellar tuft teardrop shaped, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 25). Metatibial corbicula surrounded by scattered, long, dark, sturdy setae on innermost margin of concavity (Fig. 28).

MATERIAL EXAMINED (6♀♀): **Brazil:** 1♀, “R.S. Base Camp; Serra Roncador; Mato Grosso, Braz.; 8/8/68, dry forest; W.D. Hamilton coll.” [all handwritten] // *Euglossa*; (*Euglossella*); *viridis/azurea* ♀; Det. I. Hinojosa-Díaz 2011” (NHML). 1♀, “R.S. Base Camp; Mato Grosso, Brazil; 8/8/68, dry forest; W.D. Hamilton coll.” [all handwritten] // *Euglossa (Euglossella)*; sp.? ♀♀ // *Euglossa*; (*Euglossella*); *viridis/azurea* ♀; Det. I. Hinojosa-Díaz 2011” (NHML). 1♀, “Faz. Suia Missu; Serra Roncador; Mato Grosso, Braz.; 4/9/68” [all handwritten] // *Euglossa*; (*Euglossella*); *viridis/azurea* ♀; Det. I. Hinojosa-Díaz 2011” (NHML). 1♀, “Campo [some unintelligible handwritten, perhaps “onlassia”] // BRAZIL: Mato Grosso; 12°50’S., 51°47’W.; 28 iii 1968 [month and day handwritten]; O.W. Richards. // R.S. & R.G.S.; Expedition; B.M.1968-260 // *Euglossa*; (*Euglossella*); *viridis/azurea* ♀; Det. I. Hinojosa-Díaz 2011” (NHML). 1♀, “BRAZIL, Mato Grosso; Sinop, October 1976; M. Alvarenga // *Euglossa (Euglossella)*; *viridis* (Perty, 1833); det. J.S.



Figures 25–26. Female belonging to either *Euglossa* (*Euglossella*) *viridis* (Perty) or *E. (E.) azurea* Ducke. 25. Dorsal habitus. 26. Lateral habitus.

Ascher // *Euglossa*; (*Euglossella*); *viridis/azurea* ♀; Det I. Hinojosa-Díaz 2012" (AMNH). 1♀, "BRAZIL, Mato Grosso; Villa Vera, 55°30' long.; 12°46' lat., Oct. 1973; M.Alvarenga



Figure 27–28. Female belonging to either *Euglossa (Euglossella) viridis* (Perty) or *E. (E.) azurea* Ducke. 27. Facial aspect. 28. Outer view of hind leg.

// *Euglossa (Euglossella); viridis* (Perty, 1833); det. J.S. Ascher // *Euglossa; (Euglossella); viridis/azurea* ♀; Det. I. Hinojosa-Díaz 2012" (AMNH).

COMMENTS: Under the morphological framework we have employed, the female specimens used for the preceding description share features with males of both *E. viridis* and *E. azurea*, while at the same time having no definite way to associate them with either one. The pattern of coloration in the available females falls within the range observed for males of both of the aforementioned species, with one specimen (locality data as "R.S. Base Camp; Serra Roncador; Mato Grosso") having predominantly purple-bluish color. The metrics of these specimens are also within the ranges for both species, although having slightly larger measurements (notably in facial distances) than either male averages; however, this is not uncommon in other species in the group for which both sexes are known (*i.e.*, females having larger facial and other measurements relative to the male). It is not surprising to find difficulties in distinguishing females of *Euglossa* from closely related species, as females have a rather conservative morphology. In general, females have an overall denser pattern of sculpturing, and that is the case for the females treated in this section, leaving no recourse to use the observed punctuation differences between males of *E. viridis* and *E. azurea*. Despite their conservative morphology, these females are certainly not associated with any of the other species treated in this work and that are based solely on males, as the coloration and metrics put them distinctly close to either *E. viridis* or *E. azurea*, and outside the range of any other taxa. Moreover, the locality records of the females fall within the range for both *E. viridis* and *E. azurea*, and despite the fact that both have wide ranges no records for other species in the group are known from the specific area where these female records occur (Mato Grosso, Brazil) (Fig. 170). In this respect, records of *E. azurea* are known from two of the same localities where the unassigned females occur (Fig. 170), which could possibly imply that they are in fact females of this species.

However, despite the lack of records in our study for males of *E. viridis* in those specific locations, the area is well within the range of the species, and as such we prefer to treat these females as unplaced to either *E. viridis* or *E. azurea*, but certainly belonging to one of them. Naturally, molecular data would be ideal for resolving such a difficulty and this certainly one of the ways in which DNA barcoding can prove useful despite its broader limitations. Given the rarity of material and that DNA is sometimes degraded in historical specimens, the use of geometric morphometrics may prove to be a more fruitful pursuit as it has the potential to resolve the placement of individual specimens in specific or even higher categories (e.g., Kandemir *et al.*, 2011; Kotthoff *et al.*, 2011, 2013; Wappler *et al.*, 2012; Dewulf *et al.*, 2014; Dehon *et al.*, in press) and is a non-destructive technique. Certainly this remains a topic ripe for future research and it will be exciting to learn eventually how best to associate males and females for these taxa.

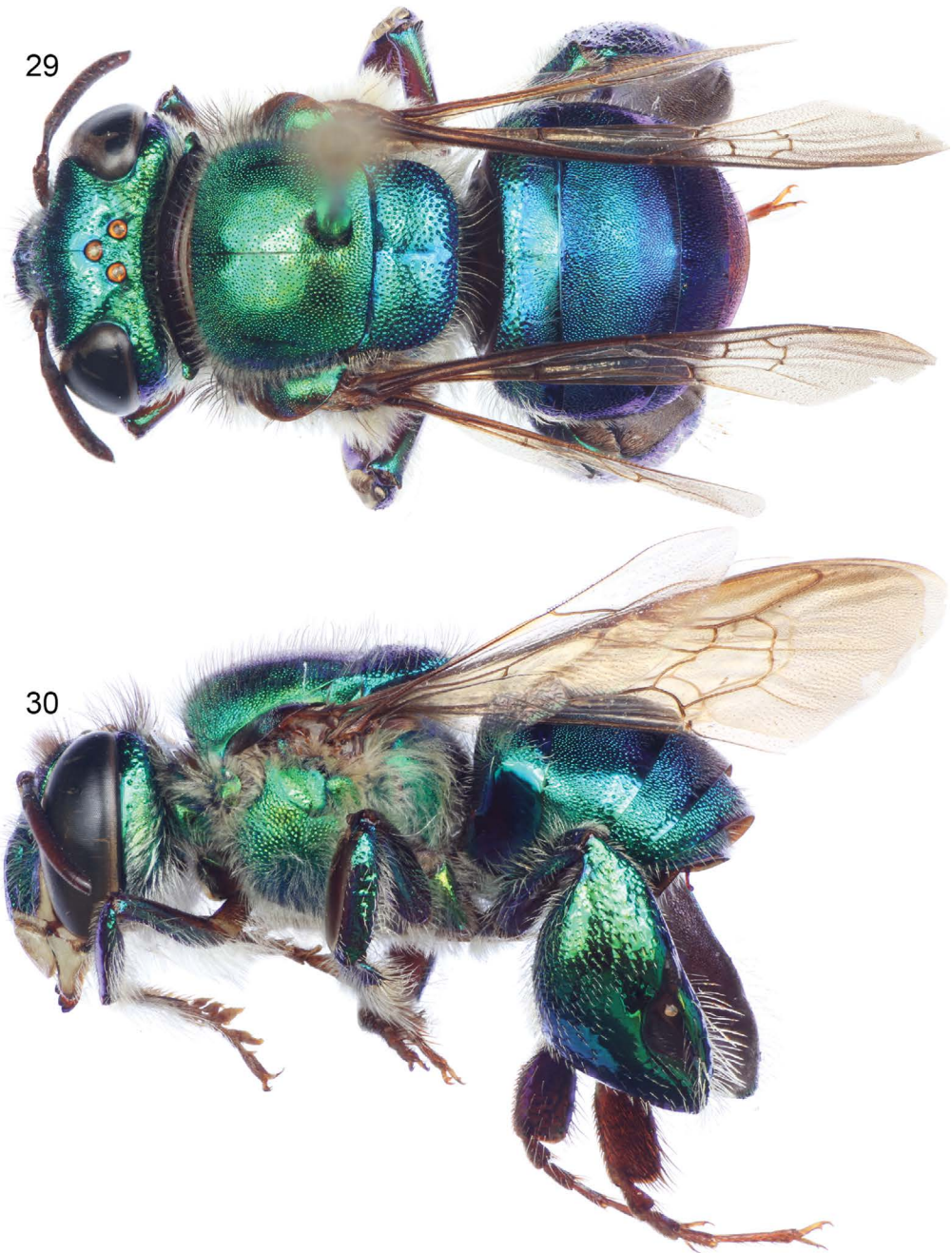
Euglossa (Euglossella) celiae Hinojosa-Díaz & Engel, new species

ZooBank: urn:lsid:zoobank.org:act:1DF48070-92B8-4FD8-84A7-5B80567A205E

(Figs. 29–37, 146, 156, 170)

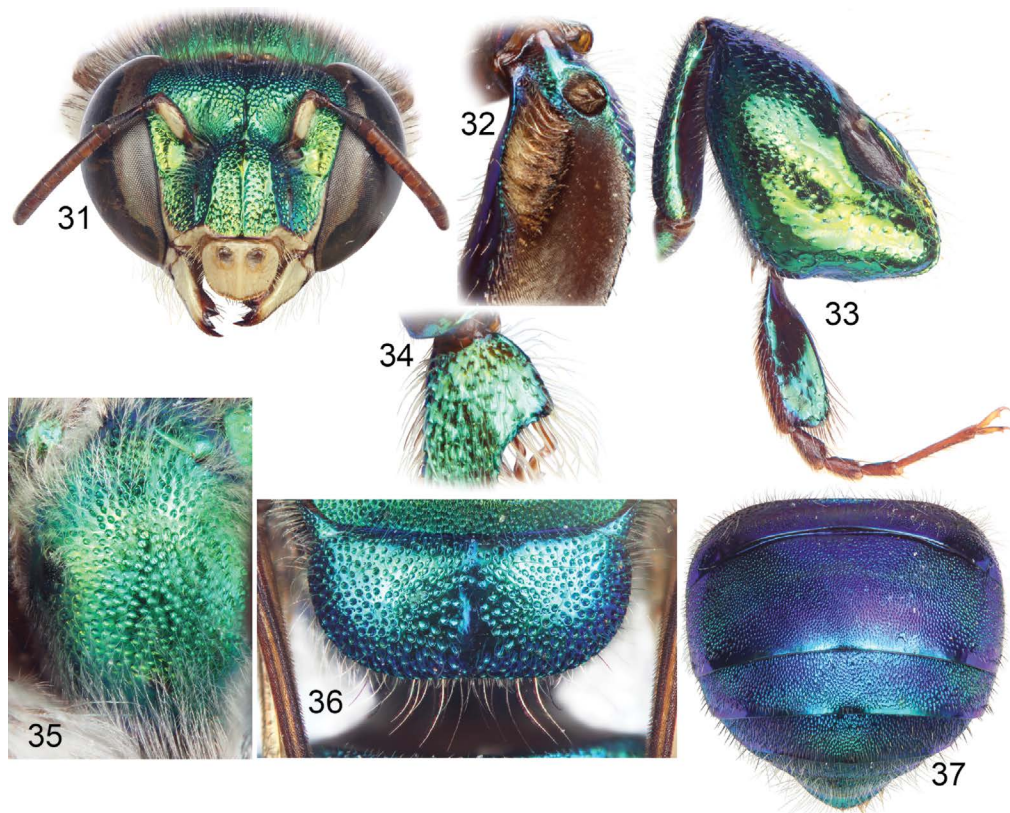
DIAGNOSIS: Labiomaxillary complex in repose reaching posterior half of second metasomal sternum; upper and lower interorbital distances equal (marginally different) (Fig. 31); malar area short (less than 0.25 mm, noticeably shorter than diameter of mid-flagellar articles) (Fig. 31); pronotal dorsolateral angle projected as a lamella; male mesotibial tufts as follows: anterior tuft rhomboid, moderately long (maximum length barely exceeding mid-width of velvety area) and narrow (mid-width equivalent to width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 32, 146); mesobasitarsal posterior keel projected as a right to slightly obtuse angle (Fig. 34); second metasomal sternum with two simple meso-lateral tufts; width of metasoma and head only marginally different (less than 1.05 times) (Fig. 29); head mainly green with some light blue areas (Fig. 31); paraocular marks trapezoidal, lower width not exceeding half length of lower lateral part of clypeus (Figs. 30–31); scape with ivory spot covering almost entire anterior surface (Fig. 31); mesosoma green throughout with noticeable golden-bronzy iridescence (Figs. 29–30), mesoscutellum with faint cyan intergradation (Fig. 36); first to third metasomal terga light cyan, remaining terga green with noticeable golden-bronzy hue (Fig. 37); mesoscutellum moderately punctate (punctures separated by one to two puncture diameters) (Fig. 36); central area of mesepisternum moderately punctate (punctures separated by one and a half puncture diameters) (Fig. 35); metasomal terga densely and evenly imbricate-punctate (Fig. 37); mesosomal vestiture dominated by pale-fuscous setae (Figs. 29–30, 35–36); eighth metasomal sternum posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 156); gonostylar lateral section with well-developed “secondary” lobe, almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

DESCRIPTION: ♂: **Structure.** Total body length 10.12 mm (9.26–11.11; n=6); labiomaxillary complex in repose reaching posterior half of second metasomal sternum (Figs. 29–30). Head length 2.49 mm (2.37–2.59; n=6), width 4.31 mm (4.15–4.50; n=6); upper interorbital distance 1.95 mm (1.85–2.00; n=6); lower interorbital distance 1.90 mm (1.81–1.94; n=6); upper clypeal width 1.07 mm (1.00–1.11; n=6); lower clypeal width 1.76 mm (1.70–1.78; n=6); clypeal protuberance 0.54 mm (0.48–0.59; n=6); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*; labrum wider than long, length 0.86 mm (0.81–0.89; n=6), width 1.02 mm (1.00–1.07; n=6) (Fig. 31); intero-



Figures 29–30. *Euglossa (Euglossella) celiae*, new species, male holotype. 29. Dorsal habitus. 30. Lateral habitus.

cellar distance 0.32 mm (0.30–0.33; n=6); ocellocular distance 0.56 mm (0.52–0.59; n=6); first flagellar article longer [0.55 mm (0.52–0.59; n=6)] than second and third flagellar articles combined (0.37 mm; n=6); length of malar area 0.15 mm (n=6). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella;



Figures 31–37. *Euglossa (Euglossella) celiae*, new species, male holotype. 31. Facial aspect. 32. Mesotibial tufts. 33. Outer view of hind leg. 34. Proximal section of mesobasitarsus. 35. Lateral part of mesepisternum. 36. Mesoscutellum. 37. Dorsal view of metasomal terga.

intertegular distance 3.14 mm (2.96–3.41; n=6); mesoscutal length 2.55 mm (2.44–2.67; n=6); mesoscutellar length 1.16 mm (1.10–1.22; n=6); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 36); mesotibial length 2.09 mm (2.04–2.22; n=6); mesobasitarsal length 2.12 mm (2.04–2.22; n=6), width 0.69 mm (0.65–0.74; n=6) (measured at proximal posterior keel), posterior keel projected in a right to slightly obtuse angle with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing slightly convex (Fig. 34); metatibia triangular (scalene triangular) (Fig. 33), maximum thickness 1.24 mm (1.11–1.30; n=6); metatibial anterior margin length 3.31 mm (3.11–3.41; n=6), ventral margin length 2.23 mm (2.07–2.37; n=6), postero-dorsal margin length 4.29 mm (3.93–4.59; n=6); metatibial organ slit as described for *E. viridis*, dorsal section length 0.53 mm (0.52–0.56; n=6); metabasitarsal length 2.06 mm (2.00–2.15; n=6), mid-width 0.76 mm (0.74–0.78; n=6); metabasitarsal ventral border truncate. Forewing length 8.41 mm (8.15–8.81; n=6); jugal comb with 12–14 (n=6) blades; hind wing with 17–22 (n=6) hamuli. Maximum metasomal width 4.31 mm (4.07–4.59; n=6); second metasomal sternum as described for *E. viridis*.

Coloration. Head as described for *E. viridis*, except as follows: metallic blue areas lighter than in most specimens of *E. viridis*, blue area on vertex restricted to ocellar triangle; lower width of paraocular ivory marks never wider than half length of lower lateral part of clypeus (Figs. 30–31). Mesosoma green throughout, with golden-bronze

noticeably on lateral areas, mesoscutellum with some faint cyan intergradation (Figs. 29–30, 35–36); legs as described for *E. viridis*, except mainly green with no blue-purple iridescence (Figs. 30, 33). First to third metasomal terga light cyan on dorsum, lateral sections green, fourth to seventh terga green with golden-bronzy hue, remainder of metasoma as described for *E. viridis* (Fig. 37).

Sculpturing. Head as described for *E. viridis* (Fig. 31). Mesosoma as described for *E. azurea*, except mesepisternal lateral areas with punctures slightly denser (Fig. 35). Metasoma as described for *E. viridis* (Fig. 37).

Vestiture. Head as described for *E. viridis* (Fig. 31). Mesosoma (including legs) as described for *E. viridis* (Figs. 29–30, 33, 35–36), except mesotibial anterior tuft moderately long (length barely exceeding mid-width of velvety area) and narrow (mid-width as wide as contiguous section of velvety area) (Figs. 32, 146). Metasoma as described for *E. viridis* (Fig. 37).

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 156).

♀: Unknown.

HOLOTYPE: ♂, **Colombia:** “Colombia; Amazonas; Leticia; 6 VI 1974; 1551 // Vanillin; R.L. Dressler” (FSCA).

PARATYPES (6♂♂): **Ecuador:** 3♂♂, “ECUADOR, Napo; September 1987; Dressler, Hills,, Whitten, Williams // anisyl acetate” (two in FSCA, one in SEMC). 2♂♂, “ECUADOR: Napo Prov.; Jatun Sacha Biol.; Sta., 23 km. E. Puerto; Napo, 15-18-X-1988; S. Dunkle // *Euglossa; viridis* (Perty); det. R.L.Dressler, 1989” (FSCA). 1♂, “*Euglossa perviridis*; Rio Tapiche II; Peru; S 5°51'5.10"; W 74°0'3.33"; leg./det.; P.Gettleuber; 8/3/2008 349a” (MUSM).

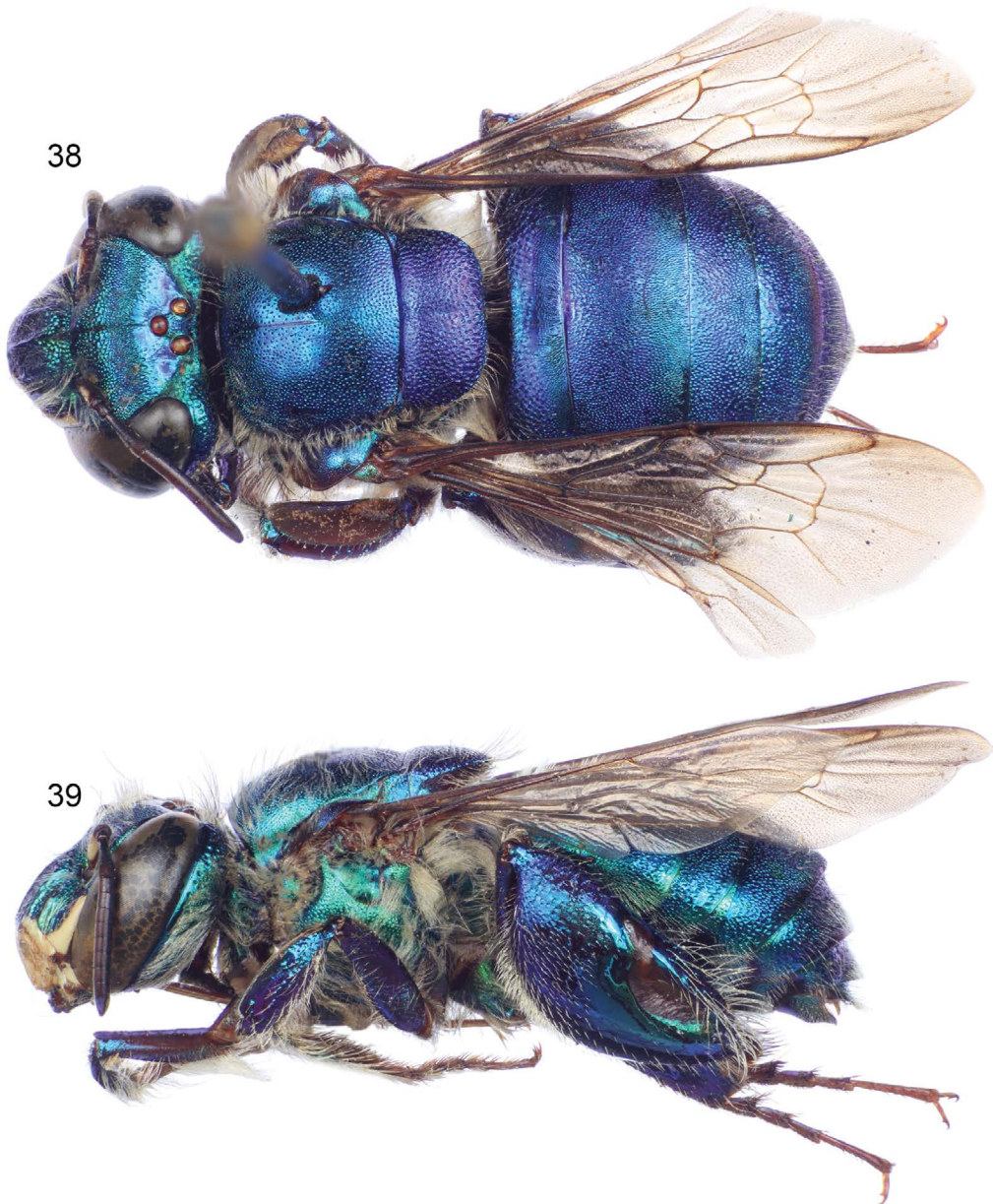
ETYMOLOGY: The specific epithet is a matronym honoring the late Celia Díaz Díaz, mother of the senior author.

COMMENTS: Individuals of this species share features with both *E. viridis* and *E. azurea*, although the combination of characters observed diagnose them clearly as a distinct species. In terms of coloration, males (the only gender known) of *E. celiae* have cyan on areas that would be blue-purple in *E. viridis*, a more noticeable green coloration throughout, and narrower paraocular lines (Figs. 29–31). Puncture density on the mesepisternum is comparable to *E. azurea*. The mesotibial anterior tuft in *E. celiae* is intermediate when compared to *E. viridis* and *E. azurea*, and it is distinguishable by having a mid-width comparable to that of the contiguous velvety area (Fig. 146), while in the other two species the contiguous velvety area is either noticeably narrower (Fig. 144) or wider (Fig. 145). The species is known at present from only a few specimens from the western areas of the Amazon Basin in Colombia, Ecuador, and Peru (Fig. 170), although it must certainly occur in nearby areas of Brazil.

Euglossa (Euglossella) cyanea Friese
(Figs. 38–50, 147, 157, 170)

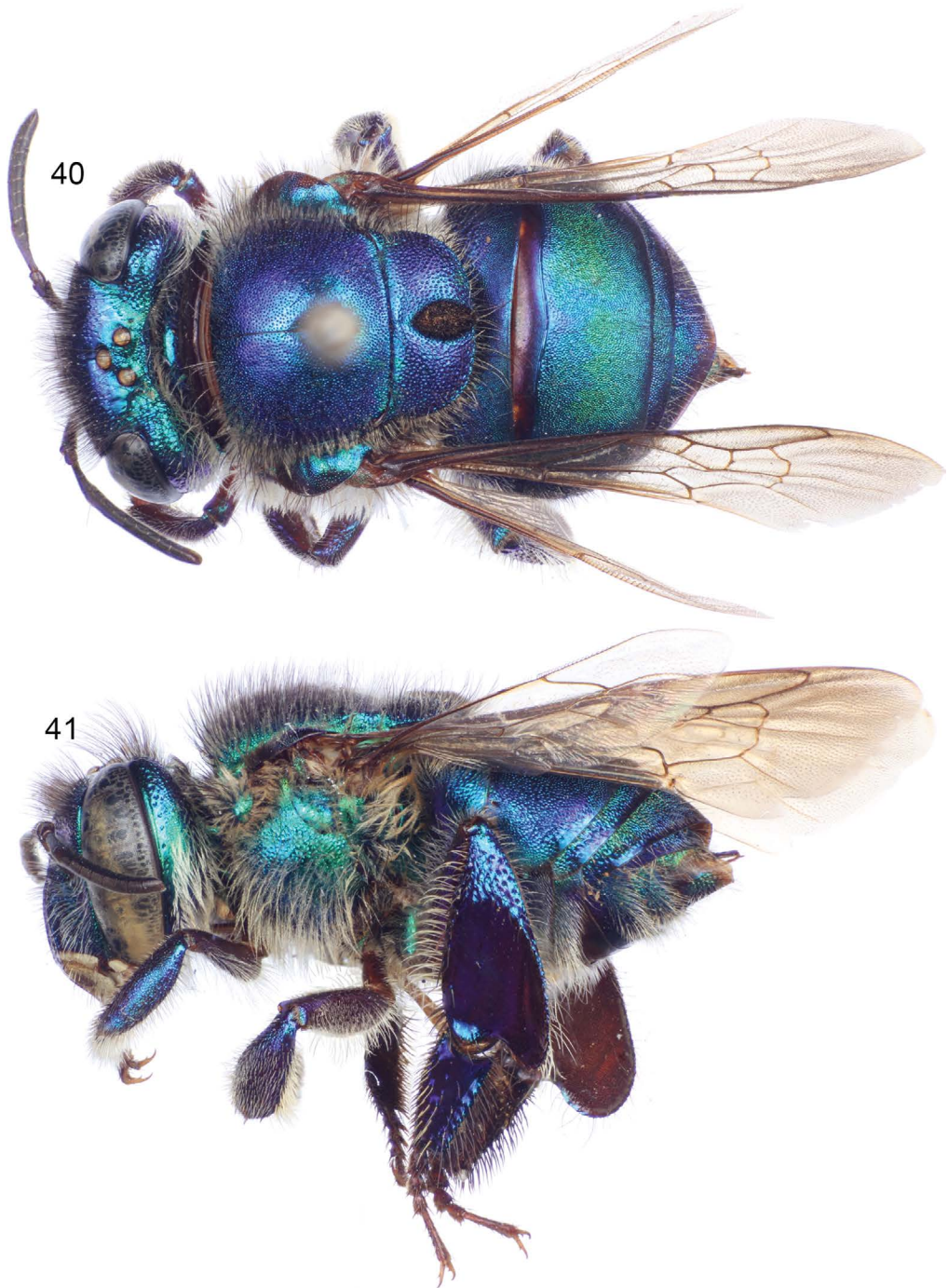
Euglossa variabilis var. *cyanea* Friese, 1899: 135 [♂♀]. Lectotype ♂ (HNHM, *visum*).

DIAGNOSIS: Labiomaxillary complex in repose reaching second metasomal sternum in both sexes (slightly longer in male); upper and lower interorbital distances equal (marginally different) (Figs. 42, 44); malar area short (less than 0.25 mm, noticeably shorter than diameter of mid-flagellar articles) (Figs. 42, 44); pronotal dorsolateral angle projected as a lamella; male mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid



Figures 38–39. *Euglossa (Euglossella) cyanea* Friese, male. 38. Dorsal habitus. 39. Lateral habitus.

(Figs. 43–147); female mesoscutellar tuft ellipsoidal, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 40); male mesobasitarsus with posterior keel projected in a right to slightly acute angle (Fig. 46); female metabasitarsus with anterior margin convex and posterior margin straight (Fig. 47); second metasomal sternum of male with two simple meso-lateral tufts; metasoma wider than head (about 1.07 times or over), best appreciated in dorsal view in both sexes (Figs. 38, 40); head mainly cyan with few blue and green areas (*vide* Description for female variation, *infra*), darker in female (Figs. 42, 44); male with paraocular marks trapezoidal, lower



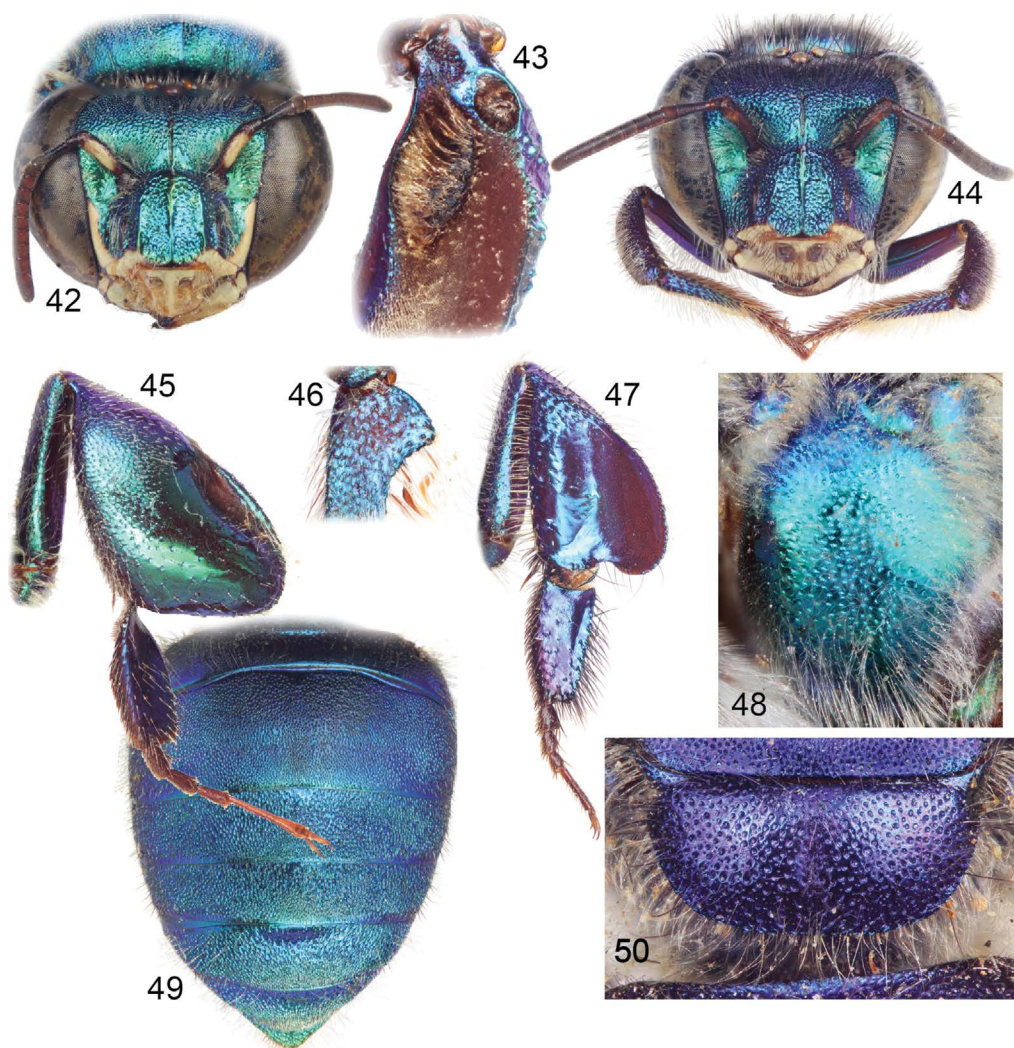
Figures 40–41. *Euglossa (Euglossella) cyanea* Friese, female. 40. Dorsal habitus. 41. Lateral habitus.

width about two thirds of length of lower lateral part of clypeus (Figs. 39, 42); scape of male with ivory spot covering almost entire anterior surface (Fig. 42), absent in female (Fig. 44); mesosoma cyan with green intergradations, female generally darker

(*vide* description for female variation, *infra*) (Figs. 38–41, 47, 50); first to fourth metasomal terga violet-purple with cyan iridescence on lateral margins, fifth to seventh terga cyan, female generally darker (*vide* description for female variation, *infra*) (Figs. 38–41, 49); mesoscutellum moderately punctate (punctures separated by one to two puncture diameters) (Figs 40, 50); punctuation of central area of mesepisternum rather sparse when compared to other species (punctures separated by two to three puncture diameters) (Fig. 48), marginally denser on female; metasomal terga densely and evenly imbricate-punctate (Figs. 40, 49); mesosomal vestiture dominated by fuscous setae, slightly darker than in other species (*vide* description for female variation, *infra*) (Figs. 38–41, 48, 50); eighth metasomal sternum posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 157); gonostylar lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

DESCRIPTION: ♂: **Structure.** Total body length 11.95 mm (10.89–13.33; n=4); labio-maxillary complex in repose reaching posterior half of second metasomal sternum (Figs 38–39). Head length 2.65 mm (2.56–2.74; n=4), width 4.86 mm (4.78–5.04; n=4); upper interorbital distance 2.19 mm (2.15–2.3; n=4); lower interorbital distance 2.22 mm (2.15–2.3; n=4); upper clypeal width 1.23 mm (1.19–1.26; n=4); lower clypeal width 2.03 mm (2–2.07; n=4); clypeal protuberance 0.75 mm (0.59–0.81; n=4); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*, except paramedial ridges quasi-parallel to medial ridge, forming a rectangular clypeal disc (raised section between paramedial ridges); labrum wider than long, length 1.08 mm (1.06–1.11; n=4), width 1.21 mm (1.19–1.26; n=4) (Fig. 42); interocellar distance 0.34 mm (0.33–0.35; n=4); ocellocular distance 0.66 mm (0.64–0.68; n=4); first flagellar article longer [0.65 mm (0.63–0.67; n=4)] than second and third flagellar articles combined [0.44 mm (n=4)]; length of malar area 0.21 mm (0.19–0.24; n=4). Mandible tridentate. Pronotal dorso-lateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.54 mm (3.48–3.63; n=4); mesoscutal length 2.92 mm (2.85–2.96; n=4); mesoscutellar length 1.28 mm (1.26–1.33; n=4); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 50); mesotibial length 2.47 mm (2.44–2.52; n=4); mesobasitarsal length 2.5 mm (2.44–2.59; n=4), width 0.82 mm (0.81–0.85; n=4), posterior keel projected in a right to slightly acute angle with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing slightly convex (Fig. 46); metatibia triangular (scalene triangular) (Fig. 45), maximum thickness 1.39 mm (1.33–1.44; n=4); metatibial anterior margin length 3.83 mm (3.7–4.04; n=4), ventral margin length 2.56 mm (2.44–2.67; n=4), postero-dorsal margin length 4.90 mm (4.76–5.11; n=4); metatibial organ slit as described for *E. viridis*, dorsal section length 0.64 mm (0.61–0.67; n=4); metabasitarsal length 2.45 mm (2.3–2.52; n=4), mid-width 0.91 mm (0.89–0.96; n=4); metabasitarsal ventral margin truncate. Forewing length 9.81 mm (9.63–10.07; n=4); jugal comb with 13–15 (n=4) blades; hind wing with 22–26 (n=4) hamuli. Maximum metasomal width 5.21 mm (5.11–5.33; n=4); second metasomal sternum as described for *E. viridis*.

Coloration. Head mainly cyan (except as described below) (*vide* Comments, *infra*), vertex, and frons blue, some greenish areas above paraocular marks and on depressed antennal area; remainder of head as described for *E. viridis* (Fig. 42). Prothorax, mesoscutum, tegula, mesoscutellum, and posterior surface of propodeum mainly metallic cyan (some specimens purple-like), with metallic green intergradations more noticeable on anterior, posterior, and lateral margins of mesoscutum (Figs. 38–39,



Figures 42–50. *Euglossa (Euglossella) cyanea* Friese. 42. Facial aspect of male. 43. Mesotibial tufts of male. 44. Facial aspect of female. 45. Outer view of male hind leg. 46. Proximal section of male mesobasitarsus. 47. Outer view of female hind leg. 48. Lateral part of mesepisternum of male. 49. Dorsal view of male metasomal terga. 50. Mesoscutellum of male lectotype.

50); mesepisternum cyan with green intergradations (Fig. 48), turning rather green on premaular area, lateral sections of propodeum mainly green with cyan intergradations and some golden hue; legs mainly amber-brown as a base color, shiny with metallic purple-cyan iridescence (except as indicated), especially noticeable on mesobasitarsus, coxae with anterior surfaces metallic green to cyan, inner surfaces of coxae, femora, tibiae, and basitarsi as well as entire surface of all tarsomeres beyond basitarsi amber-bronze with golden hue, pretarsal claws light brown on shaft, darker at tip (Figs. 38–39, 45). First to fourth metasomal terga violet-purple with cyan iridescence on lateral margins, fifth to seventh terga metallic cyan with some green iridescence, especially on posterior part of seventh tergum (Fig. 49). Sterna green or cyan with golden-bronze iridescence.

Sculpturing. Head as described for *E. viridis* (Fig. 42). Mesoscutum and mesoscutellum as described for *E. azurea*; mesepisternum punctate, punctures moderately dense, distinctively sparser than in *E. viridis* and also *E. azurea* (punctures on central surfaces of lateral part of mesepisternum separated by two to three puncture diameters, surfaces close to pronotal lobe and hypoepimeral area with punctures separated by one puncture diameter) (Fig. 48). Second to fourth metasomal terga with dense punctures, sized as those on mesoscutum, not as dense mesally on posterior section (leaving from one to one and half puncture diameters between), otherwise dense (contiguous); fifth to seventh terga with punctures doubled in size compared to previous terga (Fig. 49).

Vestiture. Head as described for *E. viridis* (Fig. 42). Mesosoma as described for *E. viridis*, except mesoscutum and mesoscutellum with slightly denser, darker, and longer setae (Figs. 38–39, 50); legs, including features of mesotibia, as described for *E. viridis* (Figs. 43, 45, 147). Metasoma as described for *E. viridis* (Fig. 49).

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 157).

♀: **Structure.** Total body length 10.95 mm (10.37–11.63; n=4); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 41). Head length 2.92 mm (2.74–3.15; n=4); head width 4.87 mm (4.67–5.04; n=4); upper interorbital distance 2.36 mm (2.22–2.44; n=4); lower interorbital distance 2.42 mm (2.30–2.52; n=4); upper clypeal width 1.31 mm (1.26–1.33; n=4); lower clypeal width 2.09 mm (1.96–2.22; n=4); clypeal protuberance 0.80 mm (0.67–0.89; n=4); clypeal ridges, labral ridges, and labral windows as in *E. viridis*; labrum rectangular, wider than long, length 1.06 mm (1.04–1.08; n=4), width 1.25 mm (1.22–1.30; n=4); anterior margin of labrum arched outwards with subapical carina; interocellar distance 0.34 mm (0.30–0.36; n=4); ocellocular distance 0.72 mm (0.67–0.75; n=4); first flagellar article longer [0.58 mm (0.56–0.59; n=4)] than second and third flagellar articles combined [0.44 mm (0.44–0.45; n=4)]; length of malar area 0.22 mm (0.20–0.24; n=4). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.76 mm (3.63–3.85; n=4); mesoscutal length 2.88 mm (2.74–3.04; n=4); mesoscutellar length 1.36 mm (1.33–1.41; n=4); posterior margin of mesoscutellum as in *E. viridis* (Fig. 9); mesotibial length 2.42 mm (2.30–2.48; n=4); mesobasitarsal length 2.24 mm (2.15–2.37; n=4), maximum width 0.74 mm (0.70–0.78; n=4); metatibia triangular (right triangle) (Fig. 47); metatibial anterior margin length 3.43 mm (3.11–3.56; n=4); metatibial ventral margin length 2.10 mm (1.93–2.30; n=4); metatibial postero-dorsal margin length 3.83 mm (3.48–4.07; n=4); metabasitarsal length 2.02 mm (1.93–2.07; n=4), proximal margin width 0.93 mm (0.85–0.96; n=4). Forewing length 9.36 mm (8.74–9.93; n=4); hind wing with 21–25 (n=4) hamuli. Maximum metasomal width 5.22 mm (4.89–5.41; n=4).

Coloration. Available females with considerable variation in integumental coloration. Peruvian females follow pattern described for males of same species (*vide supra*), with a darker blue coloration in some areas turning purple, and general reduction of green and golden-bronzy iridescence (Figs. 40–41, 44, 47). Bolivian females with a contrasting rather uniform dark green coloration over body, with some cyan iridescence on vertex, mesoscutum, and mesoscutellum, and some golden-bronzy iridescence on frontal facial areas, mesepisternum, legs, and metasoma (especially on fourth to seventh terga).

Sculpturing. As described for male of same species (*vide supra*) except as follows: Mesepisternum denser (albeit marginally); metasomal terga with smaller, denser punctures, but following same pattern (doubled in size on apical terga, fifth and beyond).

Vestiture. Mainly as in males of same species (*vide supra*). Green Bolivian specimens have noticeably darker setae. Mesoscutellar tuft ellipsoidal, otherwise as described for females of *E. viridis/azurea*. Corbicula as described for females of *E. viridis/azurea*.

LECTOTYPE: ♂, **Bolivia**: “Bolivia; S. Antonio // *E. variabilis*; v. *cyanea*; det. Friese 1898 [taxon name handwritten] // Coll.Mus.Hung.; Budapest [red ink] // LECTOTYPUS; *Euglossa* ♂; *cyanea* Friese; Det.J.S. Moure 1966 [red label; taxon name and last two digits of year handwritten]” (HNHM).

ADDITIONAL MATERIAL EXAMINED (33♂♂5♀♀): **Bolivia**: 2♂♂, “COLECÃO; CAMPOS SEABRA // yungas del Palmar; 100 m; 5 Maio 1951; Bolivia R. Zischka [mixed handwritten] // *Euglossa*; n° 3; Det. J.S. Moure 1956 [mixed handwritten]” (SEMC). 1♂, as previous except identification label “*cyanea* [handwritten]” (DZUP). 1♂, as previous except identification label “*Euglossa*; (*Euglossella*); *cyanea* Friese ♂; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♂, “Bolivien, Yungas de; Palmar 1000 m.; 5. 5. 1950; leg. Zischka // Pollinarium // *Euglossa*; *viridis*; Perty 1833; det. B. Bembé 2001 // *Euglossa*; (*Euglossella*); *cyanea* Friese ♂; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♂, as previous except no “pollinarium” label (CRAS). 3♂♂, “Region Chapare; Bolivia 400 M. V-; 5-1949 Zischka // *Euglossa*; *cyanea* Friese; det. R.L. Dressler 1968” (two in FSCA, one in CRAS). 1♂, as previous except identification label “*Euglossa*; *cyanea* Fr.; Dressler, 1967 [handwritten]” (SEMC). 21♂♂, as previous except identification label “*Euglossa*; (*Euglossella*); *cyanea* Friese ♂; Det. I. Hinojosa-Díaz 2012” (SEMC). 2♂♂, as previous except extra identification label “*Euglossa*; n° 3; Det. J.S. Moure 1957 [mixed handwritten]” (SEMC). 1♀, “Cristal Mayu.; Chapare, Cochab-; amba Bol. 200m.; X-20-49 LEPeña [?] // *Euglossa*; n° 7; Det. J.S. Moure 1957 [mixed handwritten] // *Euglossa*; *cyanea* Friese; Det. R.L. Dressler 1987” (SEMC). 2♀♀, “Bolivia: La Paz; Zongo Valley, Cahua; 1,400m. 22–23.vi.1979; M. Cooper; B.M. 1979-397” (NHML). **Peru**: 1♀, “Peru; Marcapata; 1900 [locality handwritten] // *Euglossa*; *cyanea*; ♀ 1900 Friese det. [mixed handwritten] // Am. Mus. Nat. Hist; Dept. Invert. Zool.; No. 28266 [number handwritten]” (AMNH). 1♀, “PERU: Madre de Dios; Pantiacolla Lodge, 5.5 km NW; El Mirador Trail, 500 m; Alto Madre de Dios River; 12°39'10"S, 71°15'28"W; 26 OCT 2000, PERU1800 107; R. Brooks, ex: misc collecting // [bar code]; SM0269249; KUMHM-ENT // *Euglossa*; (*Euglossella*); *cyanea* Friese ♀; Det. I. Hinojosa-Díaz 2012” (SEMC).

COMMENTS: The lectotype of *E. cyanea* was designated by Moure (1967b) in his checklist of the euglossine bees known at that time. However, Moure (1967b) cited the specimen, with the above data, as a female deposited in the Hungarian Natural History Museum in Budapest. Subsequent catalogs reporting type information for euglossines (Kimsey & Dressler, 1986; Roubik & Hanson, 2004; Moure *et al.*, 2007) reproduced the information given by Moure (1967b), and similarly referred to the lectotype as a female. However, the specimen bearing his lectotype label, deposited in Budapest, and bearing all of the correct label information for Friese’s type series is a male. Indeed, the specimen bears a red lectotype label handwritten by Moure (with the year noted as 1966) and also clearly indicating the sex of the specimen as a male (again, in Moure’s handwriting: refer to quotation of lectotype label data, *vide supra*). This confusion regarding the sex of the lectotype for *E. cyanea* had already been noticed by Nemésio (2009) and Nemésio & Rasmussen (2011), and there are several discrepancies as to the sex of types in Moure (1967b). One could argue whether this was, in fact, the specimen Moure had intended (perhaps mislabeling the individual in Budapest), and thereby whether this should be considered the valid lectotype for the species. Moreover, labeling in an institution does not designate a type, only the published account does so.

However, to conclude in this instances that the valid lectotype is actually a Bolivian female in the Budapest collection would be in error, and Moure's designation should remain valid but with the clear correction that an error occurred when transferring information from his notes to the manuscript of his paper. The reason for this becomes apparent when one carefully examines Friese's entire syntype series. Friese (1899) did not indicate the total number of specimens he employed when describing *E. cyanea*, noting only that he had at least one male and one female, and that the part of the series from "Bolivia" was located in the Budapest museum while the other portion from "Cayenne" was deposited in Berlin. A study of the collection in Budapest reveals that there is only a single male present (and it does, indeed, bear Friese's determination label and is from Bolivia), and no females or additional males are part of that series as confirmed by the curators of the HNHM. It would have been, therefore, impossible for Moure to designate a female as lectotype from material in Budapest, and the notation in his paper that it is otherwise (Moure, 1967b) is merely an error without possible alternative interpretation. Had there been females from Bolivia among the Budapest series, then the validity of the lectotype designation could be brought into question as the published designation would technically be for one of the females and would take nomenclatorial precedence, potentially requiring relabeling of the material in Budapest to be in accord with the official designation (again, as we noted above, labeling in a collection does not validate a type designation and only the validly-published account sets the lectotype: refer also to the account of the lectotype for *E. polita* where a seemingly similar but factually different case of mistaken sex also exists and for which the published account must be followed, *infra*). As for the material from "Cayenne" (French Guiana), it is fortunate that no such specimen was selected as the lectotype as they could not possibly belong to *E. cyanea* and the species does not occur within the Guiana Shield region.

From a comparative perspective, *E. cyanea* is larger on average than most other species in the group. The species is rather characteristic in terms of its integumental sculpture and structure. Coloration of the available specimens would for the most part be distinctive, matching well with the specific epithet, if it were not for a series of green females, as described above. As stated when discussing some extremes of male color variation found in *E. viridis*, we emphasize that coloration should be analyzed cautiously, and that structure and integumental sculpture should take precedence as these have proven persistently to be more consistent when circumscribing taxa within *Euglossa*. *Euglossa cyanea* is more similar to *E. subandina* than to any other species in the group. Both species as defined here can be separated by the general size ratio of the head and metasomal width (*vide* Comments for *E. subandina*, *infra*). *Euglossa cyanea* occurs in areas of Yungas forests in Bolivia and Peru, and those from the latter represent the first official records for that country (Fig. 170).

***Euglossa (Euglossella) subandina* Hinojosa-Díaz & Engel, new species**

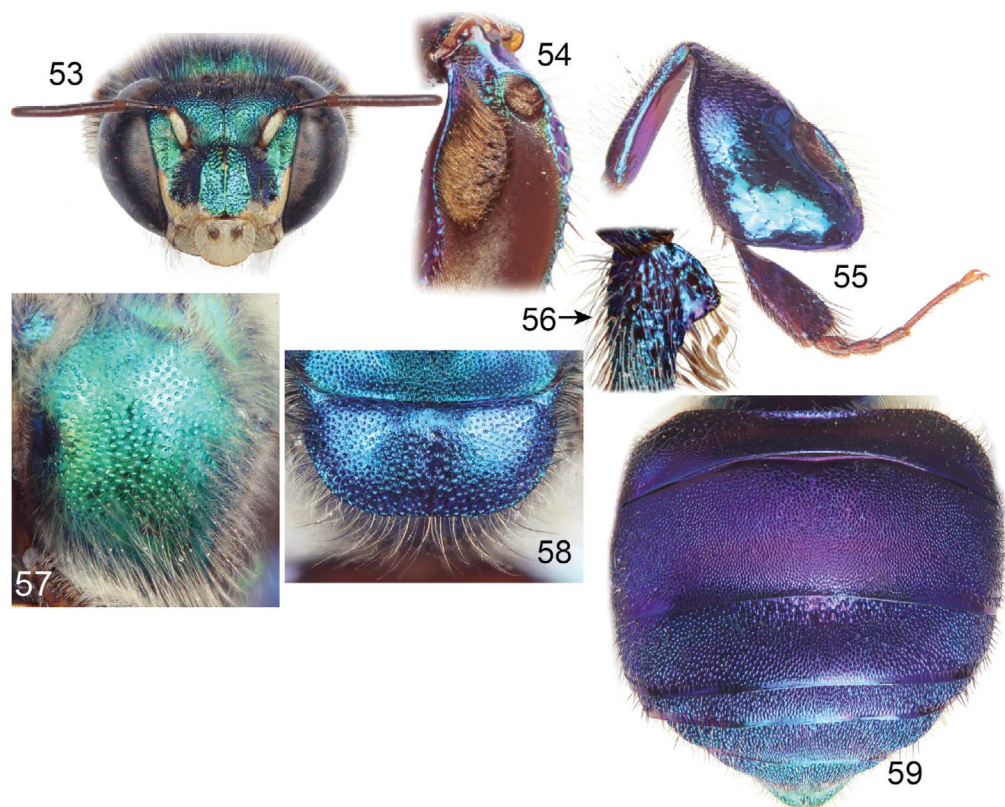
ZooBank: urn:lsid:zoobank.org:act:A3AE7CA8-2E65-47EC-9727-AB06F3D6F2B1

(Figs. 51–59, 148, 158, 170)

DIAGNOSIS: Labiomaxillary complex in repose reaching second metasomal sternum; upper and lower interorbital distances equal (at most marginally different) (Fig. 53); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Fig. 53); pronotal dorsolateral angle projected as a lamella; mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-



Figures 51–52. *Euglossa (Euglossella) subandina*, new species, holotype. 51. Dorsal habitus. 52. Lateral habitus.



Figures 53–59. *Euglossa (Euglossella) subandina*, new species, male holotype. 53. Facial aspect. 54. Mesotibial tufts. 55. Outer view of hind leg. 56. Proximal section of mesobasitarsus. 57. Lateral part of mesepisternum. 58. Mesoscutellum. 59. Dorsal view of metasomal terga.

width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 54, 148); mesobasitarsal posterior keel projected in a right to slightly obtuse angle (Fig. 56); second metasomal sternum of male with two simple meso-lateral tufts; width of metasoma and head only marginally different (less than 1.05 times) (Fig. 51); head mainly cyan with few blue and green areas (Fig. 53); paraocular marks trapezoidal, lower width about two thirds of length of lower lateral part of clypeus (Figs. 52–53); scape with ivory spot covering almost entire anterior surface (Fig. 53); mesosoma cyan with green intergradations (Figs. 51–52, 57–58); first to fourth metasomal terga violet-purple with cyan iridescence on lateral margins, fifth to seventh terga cyan (Fig. 59); mesoscutellum moderately punctate (punctures separated by one to two puncture diameters) (Figs. 58); punctation of central area of mesepisternum rather sparse when compared to other species (punctures separated by two to three puncture diameters) (Fig. 57); metasomal terga densely and evenly imbricate-punctate (Fig. 59); mesosomal vestiture dominated by fuscous setae (Figs. 51–52, 57–58); eighth metasomal sternum posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 158); gonostylar lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

DESCRIPTION: ♂: **Structure.** Total body length 10.81 mm (10.37–11.33; n=5); labio-

maxillary complex in repose reaching posterior half of second metasomal sternum (Fig. 52). Head length 2.39 mm (2.15–2.52; n=5), width 4.51 mm (4.44–4.59; n=5); upper interorbital distance 2.06 mm (2.00–2.11; n=5); lower interorbital distance 2.06 mm (2.00–2.11; n=5); upper clypeal width 1.13 mm (1.11–1.19; n=5); lower clypeal width 1.90 mm (1.85–1.93; n=5); clypeal protuberance 0.71 mm (0.59–0.81; n=5); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*, paramedial ridges orientation intermediate between conditions observed in *E. viridis* and males of *E. cyanea*; labrum wider than long, length 0.98 mm (0.96–1.04; n=5), width 1.14 mm (1.11–1.19; n=5) (Fig. 53); interocellar distance 0.29 mm (0.26–0.30; n=5); ocellocular distance 0.63 mm (0.59–0.65; n=5); first flagellar article longer [0.61 mm (0.59–0.63; n=5)] than second and third flagellar articles combined [0.43 mm (0.41–0.44; n=5)]; length of malar area 0.21 mm (0.19–0.22; n=5). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.41 mm (3.33–3.48; n=5); mesoscutal length 2.60 mm (2.52–2.74; n=5); mesoscutellar length 1.18 mm (1.11–1.22; n=5); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 58); mesotibial length 2.22 mm (n=5); mesobasitarsal length 2.23 mm (2.22–2.26; n=5), width 0.70 mm (0.67–0.74; n=5) (measured at proximal posterior keel), posterior keel projected in a right to slightly obtuse angle with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing slightly convex (intermediate situation between *E. viridis* and *E. azurea*) (Fig. 56); metatibia triangular (scalene triangular) (Fig. 55), maximum thickness 1.25 mm (1.22–1.26; n=5); metatibial anterior margin length 3.50 mm (3.26–3.63; n=5), ventral margin length 2.28 mm (2.22–2.37; n=5), postero-dorsal margin length 4.53 mm (4.44–4.59; n=5); metatibial organ slit as described for *E. viridis*, dorsal section length 0.54 mm (0.44–0.59; n=5); metabasitarsal length 2.18 mm (2.07–2.26; n=5), mid-width 0.79 mm (0.74–0.81; n=5); metabasitarsal ventral margin truncate. Forewing length 9.04 mm (8.67–9.33; n=5); jugal comb with 14–15 (n=5) blades; hind wing with 20–23 (n=5) hamuli. Maximum metasomal width 4.62 mm (4.52–4.74; n=5); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. As described for males of *E. cyanea* (Figs. 51–59).

Sculpturing. As described for males of *E. cyanea* (Figs. 51–53, 57–59).

Vestiture. As described for males of *E. cyanea* (Figs. 51–53, 57–59), including features of metatibia (Figs. 54, 148).

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 158).

♀: Unknown.

ETYMOLOGY: The specific epithet refers to the known occurrence of the species from several localities at mid-elevations on the eastern slope of the Ecuadorian Andes.

HOLOTYPE: ♂, **Ecuador:** “Ecuador: Zamora-; Chinchipe, Zamora; 27 IV 1989; Dressler,; Whitten & Williams // Ips dienol [label turned upside down]” (FSCA).

PARATYPES (144♂♂): **Ecuador:** 105♂♂, same label data as holotype (FSCA, two in SEMC). 22♂♂, varying only date of collection, “26 IV 1989” (FSCA, one in SEMC). 5♂♂, “ECUADOR: Napo:; Hollin-Loreto Rd km 14; 1200 m 20 May 1993; Mark Whitten // p-cresol [label turned upside down]” (FSCA, one in SEMC). 4♂♂, “ECUADOR: Zamora-; Chinchipe, 8 km. E; Los Encuentros; 28; IV 1989; Dressler,; Whitten & Williams // Ips dienol [label turned upside down]” (FSCA, one in SEMC). 3♂♂, “ECUADOR: Zamora Chinchipe; Zamora: Rio Jamboe km. 12.; 1500 m. 29 Nov. 1988; M. Whitten, N. Williams // *Stanhopea anfracta*; fragrance sample [label turned upside down]” (FSCA, one in SEMC). 1♂, “ECUADOR: Zamora-; Chinchipe; El Zarza; 30 IV 1989; Dressler,; Whitten & Williams // Ips dienol [label turned upside down]” (FSCA). 1♂, “ECUADOR: Zamora

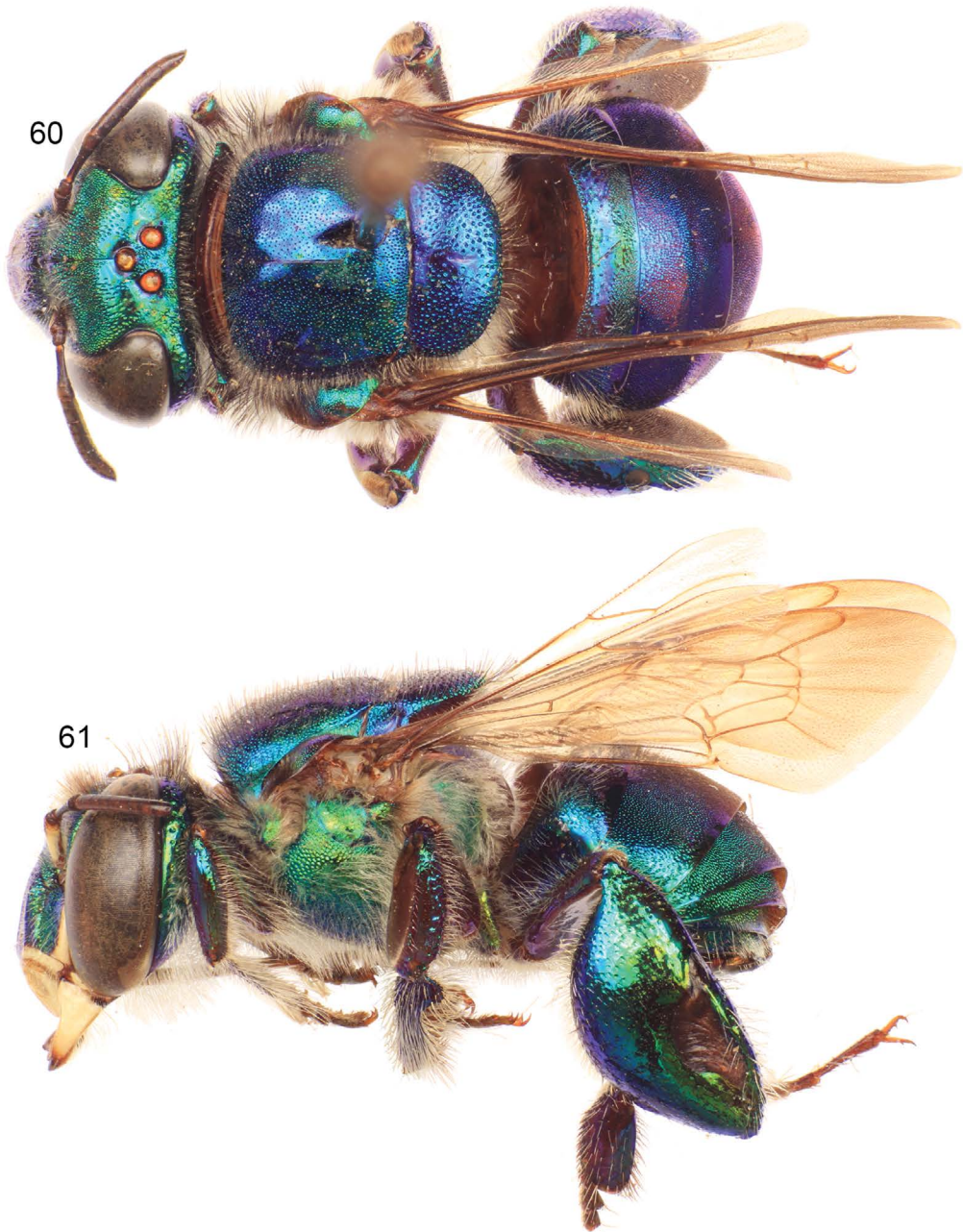
Chinchipe; Zamora: Jimenez garden; 1000 m. 2 Dec. 1988; M. Whitten, N. Williams // *G. aromatica* [handwritten]" (FSCA). 1♂, "ECUADOR: Zamora Chinchipe; Zamora: Rio Yacuambe; 3 Dec. 1988. 1500 m.; M. Whitten, N. Williams // *Peristeria* sp. [label turned upside down]" (FSCA). 1♂, "ECUADOR: Mor.-Stgo. [Morona-Santiago]; E. Patuca; 27–31 Aug.; 1987; Dressler, Hills;; Whitten, Williams // p-cresol [label turned upside down]" (FSCA). 1♂, "ECUADOR: Zamora-Ch. [Zamora-Chinchipe];; Ecuagenera, Pangüü; Williams & Whitten // at *Peristeria; lindenii*; 3 oct. 2003 [label turned upside down]" (FSCA).

COMMENTS: The repeated allusions to *E. cyanea* in the description above attests to the morphological similarity between that species and *E. subandina*. Coloration, integumental sculpture, and vestiture are basically the same in both species. There is however a noticeable difference in the general habitus of both that can be appreciated in a dorsal view (cf. Figs. 38 vs. 51). The metasoma of *E. cyanea* is noticeably wider when compared to the width of the head, while the metasoma is only marginally wider than the head in *E. subandina*. When measuring these, *E. cyanea* has a metasomal maximum width on average 7% larger than the head width, this percentage being only about 2.5% for *E. subandina*. We describe *E. subandina* as a new species based on this very distinctive feature that is seen in all specimens of this species compared with all observed individuals of *E. cyanea*, regardless of the locality of origin. Additionally, the allopatric distribution of the known specimens for both taxa reinforces our view that they are distinct and the status of *E. subandina* as a valid species within the group. *Euglossa subandina* is known presently from a number of localities at mid elevations on the eastern slope of the Andes of Ecuador (Fig. 170).

Euglossa (Euglossella) polita Ducke
(Figs. 60–66, 149, 159, 170)

Euglossa polita Ducke, 1902a: 402 [♂♀]. Lectotype ♂ (MPEG, *visum*).

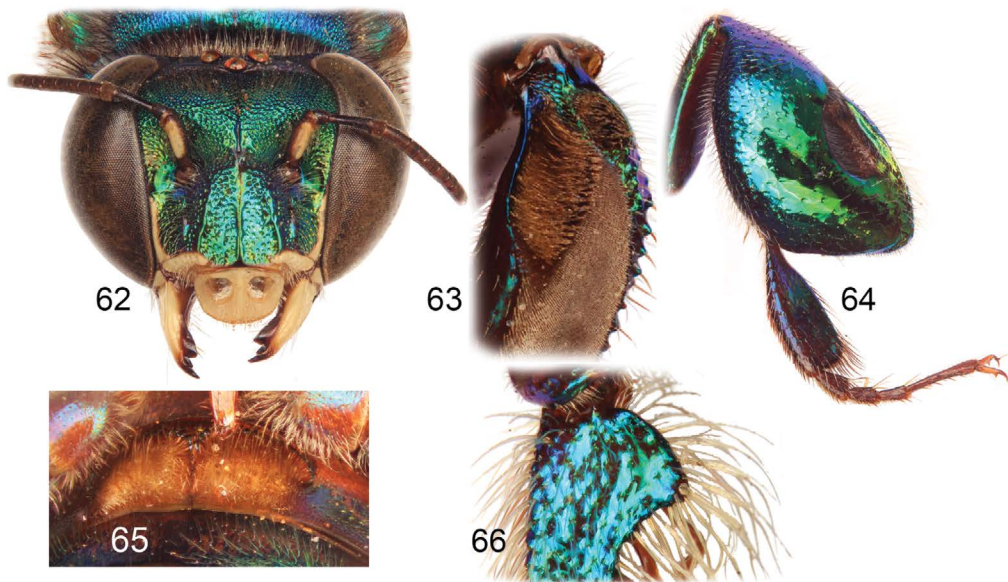
DIAGNOSIS: Labiomaxillary complex in repose reaching anterior half of second metasomal sternum; upper and lower interorbital distances subequal (lower distance at most 8% wider than upper) (Fig. 62); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Fig. 62); pronotal dorsolateral angle projected as a lamella; mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and noticeably wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft oblong oriented diagonally (Figs. 63, 149); mesobasitarsal posterior keel acutely projected (Fig. 66); second metasomal sternum with two conspicuous cowled slits covering setose tufts (Fig. 65); width of metasoma and head only marginally different (less than 1.05 times) (Fig. 60); head mainly green with some blue areas (Fig. 62); paraocular marks trapezoidal, lower width about two thirds of length of lower lateral part of clypeus (Figs. 61–62); scape with ivory spot covering almost entire anterior surface (Fig. 62); mesosoma (except mesoscutellum) mainly dark green with blue-purple intergradations and bronzy iridescence (Figs. 60–61), mesoscutellum blue-purple (Fig. 60); first to third metasomal terga mainly cyan-blue, remaining terga progressively green (Figs. 60–61); mesoscutellum with large sparse (as compared to other species) punctures (separated by one to one and a half puncture diameters) (Fig. 60); central area of mesepisternum with punctures separated by at least one puncture diameter (Fig. 61); metasomal terga densely and evenly imbricate-punctate (Figs. 60–61); mesosomal vestiture dominated by pale-fuscous setae (Figs. 60–61); eighth metasomal sternum



Figures 60–61. *Euglossa (Euglossella) polita* Ducke, male. 60. Dorsal habitus. 61. Lateral habitus.

posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 159); gonostylar lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

DESCRIPTION: ♂: **Structure.** Total body length 11.59 mm (11.11–12.07; n=2); labio-maxillary complex in repose reaching anterior half of second metasomal sternum (Fig.



Figures 62–66. *Euglossa (Euglossella) polita* Ducke, male. **62.** Facial aspect. **63.** Mesotibial tufts. **64.** Outer view of hind leg. **65.** Posterior view of second metasomal sternum showing cowled slits. **66.** Proximal section of mesobasitarsus.

61). Head length 2.76 mm (2.74–2.78; n=2), width 4.79 mm (4.76–4.81; n=2); upper interorbital distance 2.03 mm (1.94–2.11; n=2); lower interorbital distance 2.19 mm (2.11–2.26; n=2); upper clypeal width 1.26 mm (1.19–1.33; n=2); lower clypeal width 2.09 mm (2.07–2.11; n=2); clypeal protuberance 0.52 mm (n=2); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*; labrum wider than long, length 1.04 mm (n=2), width 1.26 mm (n=2) (Fig. 62); interocellar distance 0.30 mm (0.27–0.33; n=2); ocellocular distance 0.55 mm (0.54–0.56; n=2); first flagellar article longer [0.61 mm (0.59–0.63; n=2)] than second and third flagellar articles combined [0.39 mm (0.38–0.39; n=2)]; length of malar area 0.15 mm (n=2). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.63 mm (3.56–3.70; n=2); mesoscutal length 2.80 mm (2.78–2.81; n=2); mesoscutellar length 1.33 mm (n=2); posterior margin of mesoscutellum evenly convex (Fig. 60); mesotibial length 2.22 mm (n=2); mesobasitarsal length 2.19 mm (2.15–2.22; n=2), width 0.74 mm (n=2) (measured at proximal posterior keel), posterior keel projected in an acute angle, with proximal margin appearing straight (slightly convex) (Fig. 66); metatibia triangular (scalene triangular) (Fig. 64), maximum thickness 1.30 mm (1.26–1.33; n=2), length 3.56 mm (3.48–3.63; n=2), ventral margin length 2.28 mm (2.26–2.30; n=2), postero-dorsal margin length 4.48 mm (4.44–4.52; n=2); metatibial organ slit as described for *E. viridis*, dorsal section length 0.52 mm (n=2); metabasitarsal length 2.07 mm (n=2), mid-width 0.78 mm (n=2); metabasitarsal ventral margin truncate. Forewing length 8.78 mm (8.67–8.89; n=2); jugal comb with 14–15 (n=2) blades; hind wing with 22–26 (n=2) hamuli. Maximum metasomal width 4.63 mm (4.59–4.67; n=2); second metasomal sternum with two conspicuous cowled slits (*sensu* Roubik, 2004) converging mesially (no separation between them), together occupying about one third of sternum width, each cowl covering proximal section of setose tufts which in turn are also contiguous mesially (Fig. 65).

Coloration. Head green (specimen deposited in London with blue coloration on vertex, frons, and clypeus), with golden-bronze highlights; lower width of paraocular ivory marks never wider than half length of lower lateral part of clypeus, remainder of head structures colored as described for *E. viridis* (Figs. 61–62). Mesosoma as described for *E. viridis* although mesoscutellum not as dark (Figs. 60–61); legs as described for *E. viridis*, except they are mainly green with no blue-purple iridescence (Figs. 61, 63–64, 66). Metasomal terga as described for *E. viridis*, although seemingly metallic blue coloration on first to third terga rather cyan (specimen in London rather darker, with blue coloration extending to fourth and fifth terga) (Figs. 60); sterna as described for *E. viridis*.

Sculpturing. Head as described for *E. viridis* (Fig. 62). Central area of mesoscutum double punctate, regular-size punctures separated by two to three puncture diameters, minute punctures (easily differentiated from regular-sized punctures) interspaced and scarce, slightly increasing in density towards margins (Fig. 60); mesoscutellum also double punctate, larger punctures double size of those on mesoscutum, separated from each other by one to one and a half puncture diameters, denser towards margins and leaving noticeably smooth area mesially (Fig. 60); mesepisternum with punctures as large as those on mesoscutellum, central area with punctures separated by one puncture diameter, sparser (two puncture diameters between) on ventral areas, and denser (almost contiguous) towards upper sections (Fig. 61). All metasomal terga (except central disc of first tergum and narrow posterior margin of first to fifth terga) with dense punctation, punctures about as large as those on mesoscutum (Fig. 60); sterna as in *E. viridis*.

Vestiture. Head as described for *E. viridis* (Fig. 62). Mesosoma as described for *E. viridis*, except posterior mesotibial tuft oblong and oriented diagonally (Figs. 63, 149). Metasoma as described for *E. viridis* (Figs. 60–61), except as follows: contiguous tufts on second metasomal sternum coming off entire area covered by each integumental cowl (*vide* Structure, *supra*), and composed of a velvety carpet of fulvous, plumose, short, appressed setae under noticeably fulvous, simple, long setae, directed posteriorly (Fig. 65).

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 159).

♀: Females of this species were included in the type series by Ducke (1902a); however, despite our efforts to borrow such material none were available for personal review, and so we do not offer a full description of the female at this time (*vide* Comments, *infra*). Females should share with males their coloration and, most importantly, the distinctive evenly convex posterior margin to the mesoscutellum.

LECTOTYPE: 1♂, **Brazil**: “Brasil Pará 15.5.1902 Ducke [month, day, and last digit of year handwritten] // *Euglossa polita* LECTOALLOTYPUS Moure & Michener 1955 [handwritten with red ink] // Hymenoptera: Apocrita Aculeata: Apoidea: Apidae: Euglossinae: Euglossini: *Euglossa polita* Reorganizado 5.XII.1998” (MPEG) (*vide* Comments on status as lectotype, *infra*).

ADDITIONAL MATERIAL EXAMINED (2♂♂): **Brazil**: 1♂, “TYPE [round label with red margin] // B.M. TYPE; HYM.; 17B. 944. [last line handwritten] // *Euglossa; polita* Ducke; ♂ type [label handwritten] // Brazil.; Mus.Goeldi.; 1910-90 [some digits illegible] // Brasil.; Pará; 22.4. 19002 [1902]; Ducke” (NHML). 1♂, “BRAZIL: PARÁ; BELÉM, I.P.E.A.N.; 26 X/1968; R.L. Dressler; 1200 // Vanillin // *Euglossa; polita* Ducke; det. R.L. Dressler 1968” (FSCA).

COMMENTS: As was the case with *E. azurea*, this species was first published in German (Ducke, 1902a), with the intended initial description appearing subsequently in the same year and in a Brazilian journal (Ducke, 1902b). In the latter paper, Ducke

(1902b) noted that the description was based on a series of no more than 17 specimens (5 females, 12 males), that we presume constitute the type series. In the German description that appeared prior (Ducke, 1902a), Ducke gives an abbreviated description of coloration and some sculpturing, but most notably he specifically refers to the distinctive cowled slits on the second metasomal sternum of the male and which are perhaps the most unique feature of this species among all other *Euglossella*. Moure (1967b) designated a lectotype, literally as “Lectotype ♂: Coll. Ducke, Mus. Paraense, Belém”. Among the specimens here examined, one male belonging to the lectotype repository collection (Museu Paraense Emílio Goeldi, Belém, Pará, Brazil), bears a label “*Euglossa polita* LECTOALLOTYPUS Moure & Michener 1955 [handwritten with red ink]”, while a female specimen deposited in the same collection, and unfortunately not available for personal examination, is labeled as the lectotype. Clearly this is another example of a discrepancy between the published lectotype designation (a male) and the labeling of specimens in the collection, as was the case for *E. cyanea* (*vide* Comments for that species, *supra*), and for others as well (Nemésio & Rasmussen, 2011). As noted elsewhere, what takes nomenclatorial precedence is the published lectotype designation and not labeling within an institution, although it is always required that the lectotype be appropriately labeled and hoped that such a label is placed on the specimen that actually was alluded to in the official publication (which is not the case here). The ICZN (1999, Art: 74.5) dictates that in a validly *published* lectotype designation prior to 2000, “either the term ‘lectotype’, or an exact translation or equivalent expression (e.g. ‘the type’), must have been used or the author must have unambiguously selected a particular syntype to act as the unique name-bearing type of the taxon.” It is the *published* usage of this information that designates the lectotype, not merely adding labels to specimens in a collection (otherwise there would be no need to publish lectotype designations; but fortunately such actions are not permitted by the ICZN for the subsequent fixation of types). Unlike the case described for *E. cyanea* (*vide supra*) whereby the published notation regarding the sex of the type is demonstrably an error and could not be anything other (the Bolivian portion of the syntype series consisted of only a single male, with no such female specimen existing; nothing can be ambiguous about that!), here the collection holds both a male and female from Ducke’s syntype series meaning that there is a legitimate ambiguity. There are two possible courses of action that could be followed given the incertitude involved.

First, one could follow what is stated on the labels added by Moure and Michener during their examination of Ducke’s material in 1955 (whereby the lectotype would be a female, the allolectotype a male), implicitly granting the labeling ‘precedence’ owing that it was done in 1955 and more than a decade prior to the appearance of a published lectotype designation. This decision would be less ideal given that females exhibit fewer diagnostic features relative to males and particularly since the most important feature supporting the validity of the species is the presence of cowled slits on the male, a trait emphasized by Ducke (1902a, 1902b) himself. Nonetheless, one could make such an argument to consider the female as the ‘type’. In this scenario, one would have to argue that it is the labels that resolve the ambiguity and that the labels, independent of the publication by Moure (1967b), have some kind of precedence in fixing the type (after all, the ICZN says, “unambiguously selected a particular syntype”), momentarily ignoring the fact that subsequent type designations must be validly published (which was not done by Moure and Michener in 1955 nor was done together by these authors at any time). However, within the context of Moure’s published designation there is no ambiguity as he unambiguously indicates the lectotype to be a male. The ambigu-

ity is only introduced by the labeling found in Belém, a recourse that is not mentioned anywhere in the ICZN (1999) as taking precedence over the validly-published account. Thus, in order to truly follow this scenario to its extreme conclusion whereby the male is dismissed as the lectotype, one ultimately must declare Moure's (1967b) published action as erroneous and invalid, presumably given his failure to unambiguously select a particular syntype (although, as already noted, it seems rather clear to us within the confines of his publication and not taking extraneous information into consideration), and elevate the female as lectotype (contra the published account and despite the fact that the available sexes of the syntypes mentioned does not conclusively exclude the possibility that the male was truly intended; the latter point of which was certainly not the situation for *E. cyanea* and why that case differs so significantly from the present one). We believe that this line of reasoning is the least defensible, particularly in that it means contradicting the ICZN (1999) and even perhaps dictating that unpublished accounts of labeling somehow are available to fix types. Moreover, if this scenario is taken to its most extreme conclusion, then the published designation would be deemed invalid (otherwise we see no legitimate, ICZN-backed reason to naturally follow the labeling to the exclusion of the publication and recognize the female), and whatever labels are on the specimens would become moot as there is then no published fixation of types, all specimens reverting to syntypes. A new lectotype designation would then be needed and the new author could select whichever sex he or she felt best (to which we would again argue that the male is to be preferred given that it is the cowled slits of this gender that are the most compelling argument for recognition of the biological entity).

The second option is to strictly follow the statement in the ICZN (1999: Art. 74.5, quoted above), and from the first, validly-published account consider the lectotype to be the specimen "unambiguously" referred to by the author. In this case, there is no mistaking what is printed and thereby intended in Moure (1967b) as in addition to mentioning the repository and his intention to designate a lectotype, he clearly states, "♂", to which there is indeed in the repository noted such a male clearly from Ducke's original series. Relying on the published information the identity of the lectotype does not appear to be all that ambiguous, and this is in accordance with the ICZN (1999). Under this scenario, the male must be considered the lectotype and the 'Moure & Michener' labels considered nothing more than a historical curiosity. Although lengthy and belabored, we believe that the explanations provided here are necessary to clarify and justify the conclusions we have reached regarding the status of the male designated by Moure (1967b), why we believe that it must be considered the lectotype under the ICZN (1999), and all of this despite the ambiguity generated by the erroneous labeling of specimens. Lastly, we believe our discussion here and our action to follow the designation of the male as the lectotype should serve as the final arbitrament of any dispute regarding its status as based on the principle of the 'First Reviser' (ICZN, 1999: Art. 24.2.1).

Although there was only a meager series available for study, there is observable variation in color among them, and the specimen deposited in London is noticeably darker than the others. The male mesotibial tufts in *E. polita* are more similar to those of *E. viridis*, whereby the anterior tuft is long and the contiguous velvety area is narrow; however, the posterior tuft in *E. polita* is distinctively oblong (Figs. 63, 149). Furthermore, males of *E. polita* are quite distinctive when compared to males of other species in the group, not only for the presence of the cowled-slits on the second metasomal sternum, but also for the particular shape of the posterior margin of the mesoscutel-

lum, which is noticeably convex along its entire length (Fig. 60) and lacks the medial flattening that is present in others (*e.g.*, Fig. 58). Despite the rather conservative nature of female morphology across *Euglossa*, features such as the shape of the mesoscutellum are shared between sexes and it is presumed that in addition to sharing more superficial similarities such as coloration and vestiture, the female of the species should also have the distinctive mesoscutellar border in which the posterior margin is evenly convex rather than medially truncate. However, this must await confirmation when females of this rare species may be examined first hand.

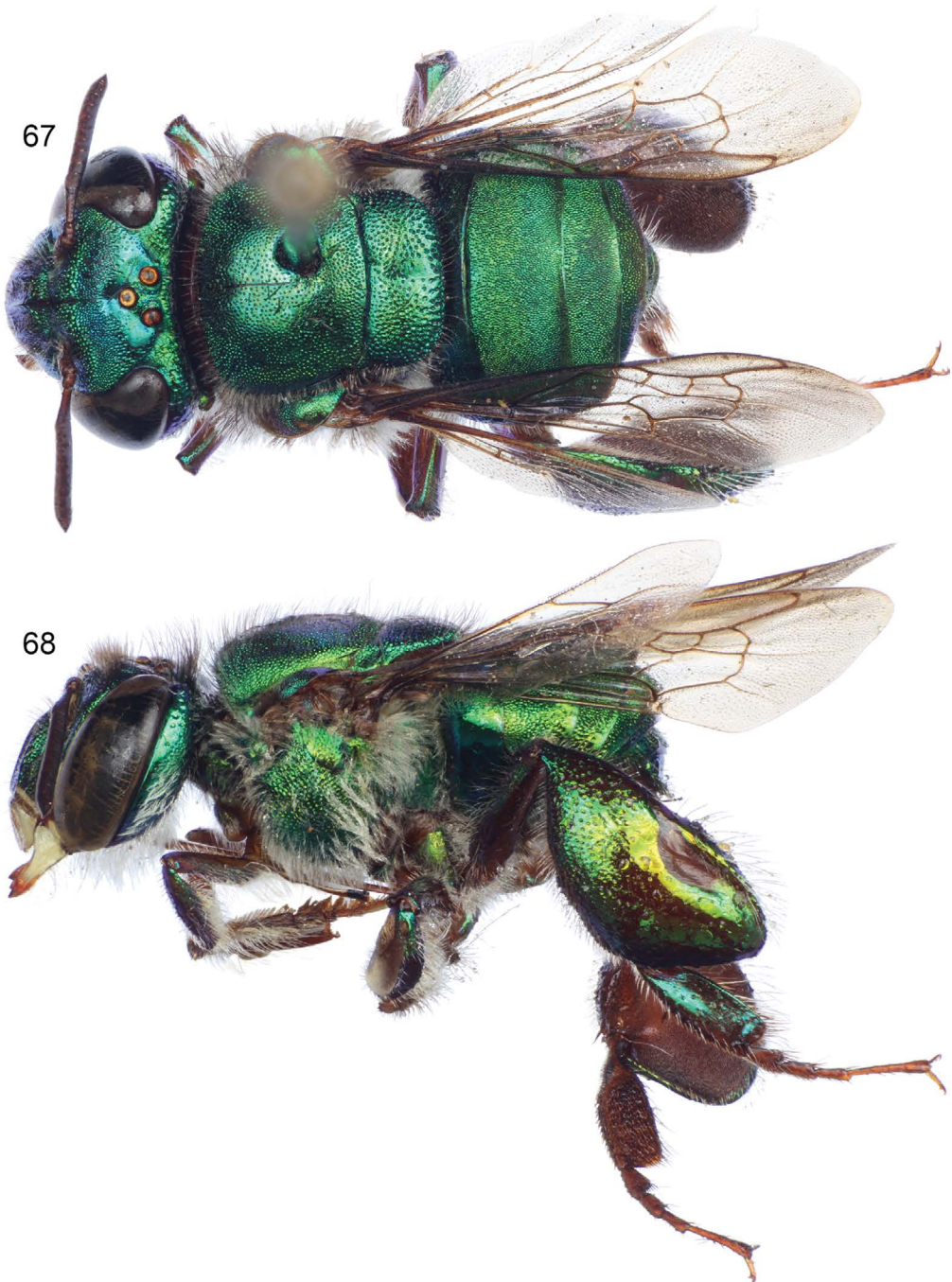
Presently *E. polita* is known only from a few, less-than-specific localities in north-western Brazil. The species has been collected in the state of Pará in northwestern Brazil (Fig. 170), and has been reported by Moure *et al.* (2007) from the Brazilian state of Amazonas, although we never found specimens from that area.

Euglossa (Euglossella) perviridis Dressler
(Figs. 67–79, 150, 160, 170)

Euglossa (Euglossella) perviridis Dressler, 1985: 79 [♂]. Holotype ♂ (USNM, *visum*).

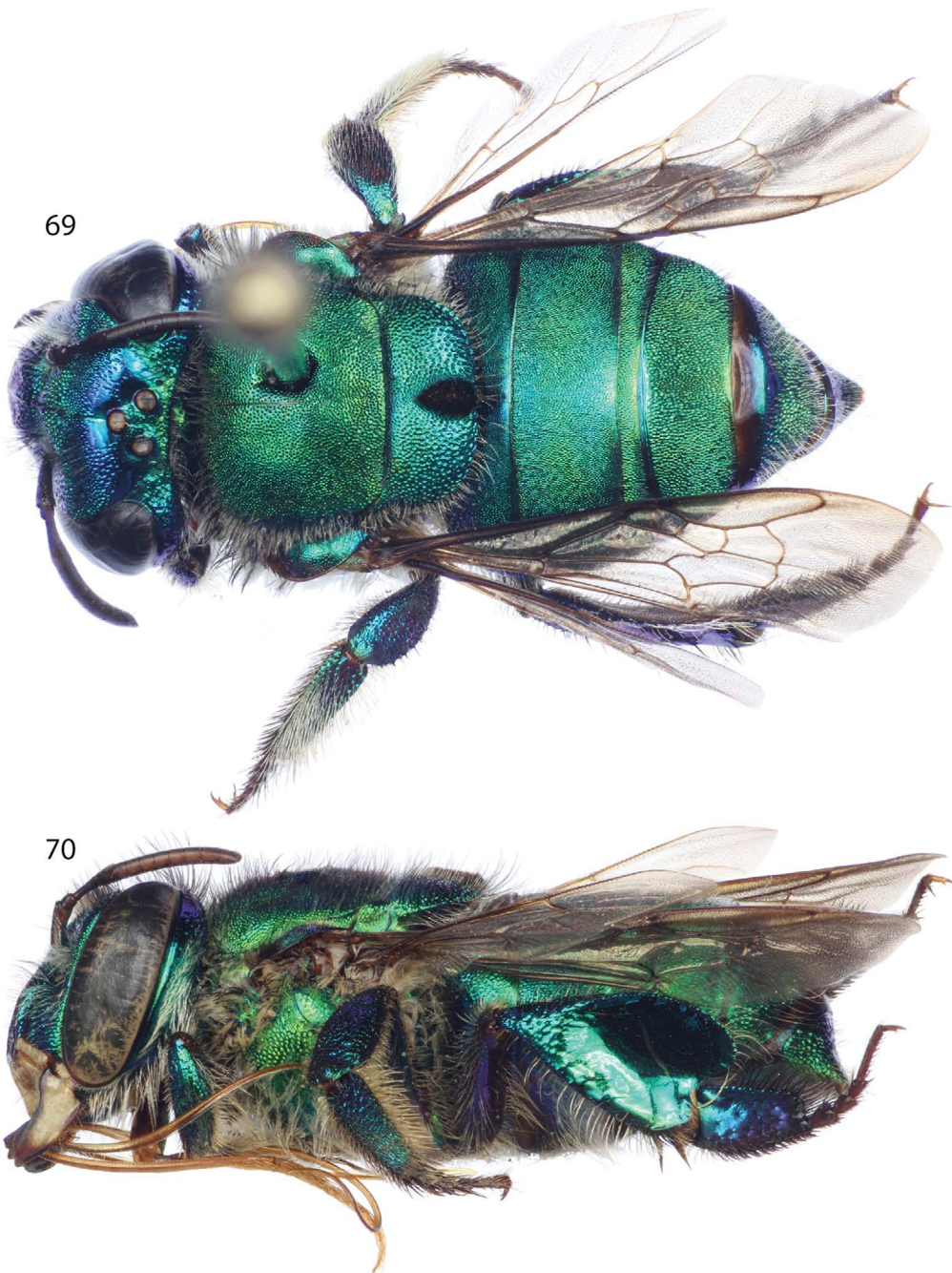
DIAGNOSIS: Labiomaxillary complex in repose reaching second metasomal sternum in both sexes (slightly longer in male); upper and lower interorbital distances equal (or only marginally different) (Figs. 71–72); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles (Figs. 71–72)); pronotal dorsolateral angle projected as a lamella; male mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 73, 150); female mesoscutellar tuft teardrop shaped, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 69); male mesobasitarsus with posterior keel projected in an acute angle (Fig. 75); female metabasitarsus with anterior margin convex and posterior margin straight (Fig. 76); second metasomal sternum of male with two, simple meso-lateral tufts; width of metasoma and head only marginally different (much less than 1.05 times) in male (Fig. 67), metasoma wider than head (about 1.07 times) in female (Figs. 69); head green (Figs. 71–72); male with paraocular marks trapezoidal, lower width about half length of lower lateral part of clypeus (Fig. 71); scape of male with ivory spot covering almost entire anterior surface (Fig. 71), absent in female (Fig. 72); mesosoma and metasomal terga green (Figs. 67–70, 77–79); male mesoscutellum moderately punctate (punctures separated by one to two puncture diameters) (Fig. 77); mesepisternum densely punctate (punctures contiguous in central areas) (for males this is the most densely punctured mesepisternum of all species in the group) (Fig. 78); metasomal terga densely imbricate-punctate (Fig. 79); mesosomal vestiture dominated by fuscous setae, slightly darker than in other species (Figs. 67–70, 77–78); eighth metasomal sternum posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 160); gonostylar lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

DESCRIPTION: ♂: **Structure.** Total body length 9.74 mm (9.33–10.00; n=4); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 68). Head length 2.53 mm (2.41–2.67; n=4), width 4.46 mm (4.26–4.59; n=4); upper interorbital distance 2.01 mm (1.93–2.04; n=4); lower interorbital distance 2.01 mm (1.93–2.04; n=4); upper



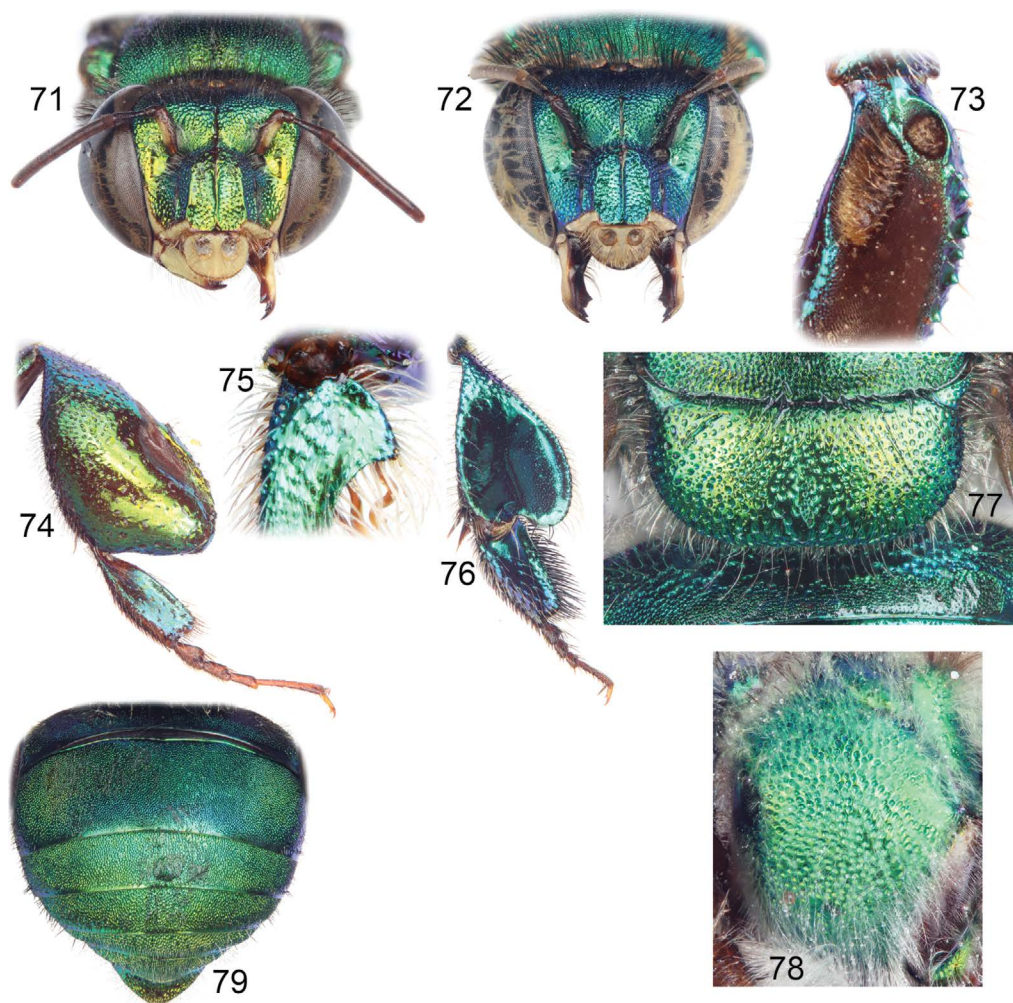
Figures 67–68. *Euglossa (Euglossella) perviridis* Dressler, male. 67. Dorsal habitus. 68. Lateral habitus.

clypeal width 1.16 mm (1.11–1.19; n=4); lower clypeal width 1.87 mm (1.81–1.93; n=4); clypeal protuberance 0.59 mm (0.52–0.67; n=4); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*, paramedial ridges orientation intermediate between condition observed in *E. viridis* and males of *E. cyanea*; labrum wider than long,



Figures 69–70. *Euglossa (Euglossella) perviridis* Dressler, female. 69. Dorsal habitus. 70. Lateral habitus.

length 0.87 mm (0.79–0.89; n=4), width 1.07 mm (1.01–1.11; n=4) (Fig. 71); interocellar distance 0.32 mm (0.30–0.33; n=4); ocellocular distance 0.59 mm (n=4); first flagellar article longer [0.60 mm (0.52–0.67; n=4)] than second and third flagellar articles combined [0.39 mm (0.33–0.44; n=4)]; length of malar area 0.19 mm (0.15–0.22; n=4). Man-



Figures 71–79. *Euglossa (Euglossella) perviridis* Dressler. 71. Facial aspect of male. 72. Facial aspect of female. 73. Mesotibial tufts of male. 74. Outer view of male hind leg. 75. Proximal section of male mesobasitarsus. 76. Outer view of female hind leg. 77. Mesoscutellum of male holotype. 78. Lateral part of mesepisternum of male. 79. Dorsal view of male metasomal terga.

dible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.35 mm (3.11–3.56; n=4); mesoscutal length 2.52 mm (2.44–2.67; n=4); mesoscutellar length 1.13 mm (1.08–1.19; n=4); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 77); mesotibial length 2.19 mm (2.07–2.30; n=4); mesobasitarsal length 2.18 mm (2.07–2.22; n=4), width 0.69 mm (0.64–0.73; n=4) (measured at proximal posterior keel), posterior keel projected in an acute angle, with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing straight (slightly convex) (Fig. 75); metatibia triangular (scalene triangular) (Fig. 74), maximum thickness 1.27 mm (1.19–1.41; n=4); metatibial anterior margin length 3.48 mm (3.41–3.56; n=4), ventral margin length 2.24 mm (2.07–2.37; n=4), postero-dorsal margin length 4.35 mm (4.22–4.44; n=4); metatibial organ slit as described for *E. viridis*, dorsal section length 0.52 mm (n=4); metabasitarsal

length 2.11 mm (1.93–2.22; n=4), mid-width 0.80 mm (0.74–0.89; n=4); metabasitarsal ventral margin truncate. Forewing length 8.41 mm (8.00–8.74; n=4); jugal comb with 12–15 (n=4) blades; hind wing with 18–20 (n=4) hamuli. Maximum metasomal width 4.49 mm (4.22–4.74; n=4); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. Head green throughout with golden hue (except as described below), and light cyan on vertex, especially on ocellar triangle as well as on frons along frontal fringe area, also with some cyan highlights along subantennal sulcus and upper section of epistomal sulcus (between subantennal sulci); paraocular ivory marks well developed, trapezoidal, lower width about half of length of lower lateral part of clypeus; remainder of head as described for *E. viridis* (Figs. 67–68, 71). Mesosoma metallic green with bronzy-golden hue (more noticeable on mesepisternum) (Figs. 67–68, 77–78); legs with noticeable brown-amber basal coloration, highly combined with green coloration and golden hue, metabasitarsus with some cyan-blue iridescence, otherwise as described for *E. viridis* (Figs. 68, 74). Metasomal terga green with golden hue, first and second terga with faint cyan iridescence on posterior half (Fig. 79); sterna metallic green with golden hue, first metasomal sternum and mid-section of second metasomal sternum with strong amber hue.

Sculpturing. Head as described for *E. viridis* (Fig. 71). Mesoscutum and mesoscutellum as described for *E. azurea* (Figs. 67, 77); mesepisternum with strong dense punctation on lateral-facing areas (densest of all species in the group), punctures contiguous with no smooth areas between them (Fig. 78). Metasomal terga densely punctate, first to fourth terga with minute contiguous punctures, fifth to sixth similar but punctures slightly larger, seventh tergum with punctures about double or triple size of punctures on sixth tergum (Fig. 79); metasomal sterna as in *E. viridis*.

Vestiture. Head as described for *E. viridis* (Fig. 71). Mesosoma as described for *E. viridis* (Figs. 67–68, 77–78); legs, including features of mesotibia, as described for *E. viridis* (Figs. 73–74, 150). Metasoma as described for *E. viridis* (Fig. 79).

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 160).

♀ (previously unknown): **Structure.** Total body length 11.26 mm (11.04–11.48; n=2); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 70). Head length 2.45 mm (2.41–2.48; n=2); head width 4.29 mm (4.22–4.35; n=2); upper interorbital distance 2.09 mm (2.07–2.11; n=2); lower interorbital distance 2.06 mm (2.04–2.07; n=2); upper clypeal width 1.15 mm (1.11–1.19; n=2); lower clypeal width 1.80 mm (1.76–1.83; n=2); clypeal protuberance 0.54 mm (0.52–0.56; n=2); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*, paramedial ridges orientation closer to condition in males of *E. cyanea*; labrum rectangular, wider than long, length 0.89 mm (n=2), width 1.04 mm (n=2); anterior margin of labrum arched outwards with subapical carina; interocellar distance 0.32 mm (0.31–0.33; n=2) (Fig. 72); ocellocular distance 0.62 mm (0.61–0.63; n=2); first flagellar article longer [0.52 mm (n=2)] than second and third flagellar articles combined [0.39 mm (0.37–0.41; n=2)]; length of malar area 0.11 mm (n=2). Mandible tridentate. Pronotal dorsolateral angle as in *E. viridis*; intertegular distance 3.30 mm (3.26–3.33; n=2); mesoscutal length 2.52 mm (n=2); mesoscutellar length 1.18 mm (1.17–1.18; n=2); posterior margin of mesoscutellum as in *E. viridis* (Fig. 69); mesotibial length 1.93 mm (n=2); mesobasitarsal length 1.91 mm (1.85–1.96; n=2), maximum width 0.59 mm (n=2); metatibia triangular (right triangle) (Fig. 76); metatibial anterior margin length 2.91 mm (2.78–3.04; n=2); metatibial ventral margin length 1.74 mm (1.70–1.78; n=2); metatibial postero-dorsal margin length 3.13 mm (3.07–3.19; n=2); metabasitarsal length 1.62 mm (1.56–1.67; n=2), proximal margin

width 0.81 mm (n=2). Forewing length 7.56 mm (7.48–7.63; n=2); hind wing with 18–21 (n=2) hamuli. Maximum metasomal width 4.58 mm (4.52–4.63; n=2).

Coloration. As described for males of same species (*vide supra*), except frons and vertex with more noticeable cyan-blue coloration, legs with more noticeable blue-green hue, and some purple highlights on metabasitarsus (Figs. 69–70, 72, 76).

Sculpturing. Overall sculpturing as in males of same species (Figs. 69–70, 72).

Vestiture. Head, mesosoma, and metasoma as in *E. viridis*. Mesoscutellar tuft and corbicula as in females of *E. viridis/azurea* (Figs. 69–70, 72, 76).

HOLOTYPE: ♂, **Peru:** “PERU: Madre de Dios; 30km sw P.Maldonado; 28 Feb. 1983; D.L. Pearson [date, except fist two digits of year, handwritten] // terre firma // P-Cymene [handwritten] // HOLOTYPE; *Euglossa perviridis* Dressler; det.R.L.Dressler, 1984 [red label]” (USNM).

ADDITIONAL MATERIAL EXAMINED (9♂♂, 2♀♀): **Brazil:** 1♂, “Ouro Preto; d’Oeste, RO. [Brazil, Rondônia]; 20.VIII 1987; C. Elias, Leg [day and month handwritten]” (DZUP). **Bolivia [new record]:** 3♂♂, “On Fls. [Flowers] of small palm + pungent scent [handwritten] // BOLIVIA: Pando; Porvenir 30km. S.; Cobjija. 250m.; 5–10.VII.1979. M. Cooper; B.M. 1979-397 // *Euglossa*; (*Euglossella*); *perviridis* Dressler ♂; Det. I. Hinojosa-Díaz 2011” (NHML). **Peru:** 3♂♂, as for holotype except label indicating chemical used to collect “Anisyl Acetate”, and type label reading “PARATYPE” (two in FSCA, one in SEMC). 1♂, labeled as holotype except date “22 Feb 1983”, chemical “Eugenol”, and type label reading “PARATYPE” (MUSM). 1♂, “PERU: Huánuco, Lulla-; pichis, Río Pachitea; 26 I 1975; R.L. Dressler 1590 [date day and last number handwritten] // PARATYPE; *Euglossa*; *perviridis* Dressler; det.R.L.Dressler, 1984 [label with red margins]” (FSCA). 1♀, “PERU: Madre de Dios; Pantiacolla Lodge, 5.5 km NW; El Mirador Trail, Alto Madre de Dios River, 500 m; 12°39’10”S, 71°15’28”W; 23–26 OCT 2000; R.Brooks; PERU1800 100; ex: flight intercept trap // [barcode]; SM0263639; KUNHM-ENT // *Euglossa*; (*Euglossella*) ♀; *perviridis* Dressler; Det. I.Hinojosa-Díaz 2012” (SEMC). 1♀, as previous except barcode number “SM0263645” (SEMC).

COMMENTS: Dressler (1985) recognized this species based on the distinctive “plain” green coloration and the denser sculpturing on the mesoscutum in males (females were unknown at the time of the original description). The coloration of males is certainly distinctive, as is the sculpturing, although this is more clearly appreciated on the mesepisternum. Males of *E. perviridis* have the densest mesepisternal punctation of all species in the *viridis* group (Fig. 78). The metasoma is distinctive in that the punctures across terga are more homogeneous in shape, particularly on the fourth metasomal tergum where they are similar to those on the more anterior terga (round), while in males of other species the punctures of the fourth tergum are elongate. Because the mesotibial tufts are comparable to those of *E. viridis*, and given that entirely green males are present in *E. viridis*, the features of sculpturing are the most reliable traits for the recognition of males of *E. perviridis*. The females, described here for the first time, have a denser punctation when compared to females of other species (but refer to the descriptions of the next three species, *infra*), and are also recognizable for their largely green coloration despite patches of cyan-blue on the head and some bluish coloration on the legs. There is a noticeable difference in the ratio of the widths of the metasoma and head when comparing the two females known to males. Nonetheless, we feel confident in ascribing these females to *E. perviridis* given that both sexes share the distinctive features of sculpturing and their distribution accords with records of the males.

Euglossa perviridis is known from the southwestern Amazon Basin in Peru, Brazil, and Bolivia, the latter newly recorded here (Fig. 170). References to the species as be-

ing present in Colombia (Bonilla-Gómez & Nates-Parra, 1992; Ramírez *et al.*, 2002), are based on unconfirmed records and most likely misidentifications. Unfortunately, we have not had the opportunity to examine the material upon which they based their conclusions.

Euglossa (Euglossella) cetera Hinojosa-Díaz & Engel, new species

ZooBank: urn:lsid:zoobank.org:act:4678B186-8F4F-4454-9CC3-3A8E0A5D3958

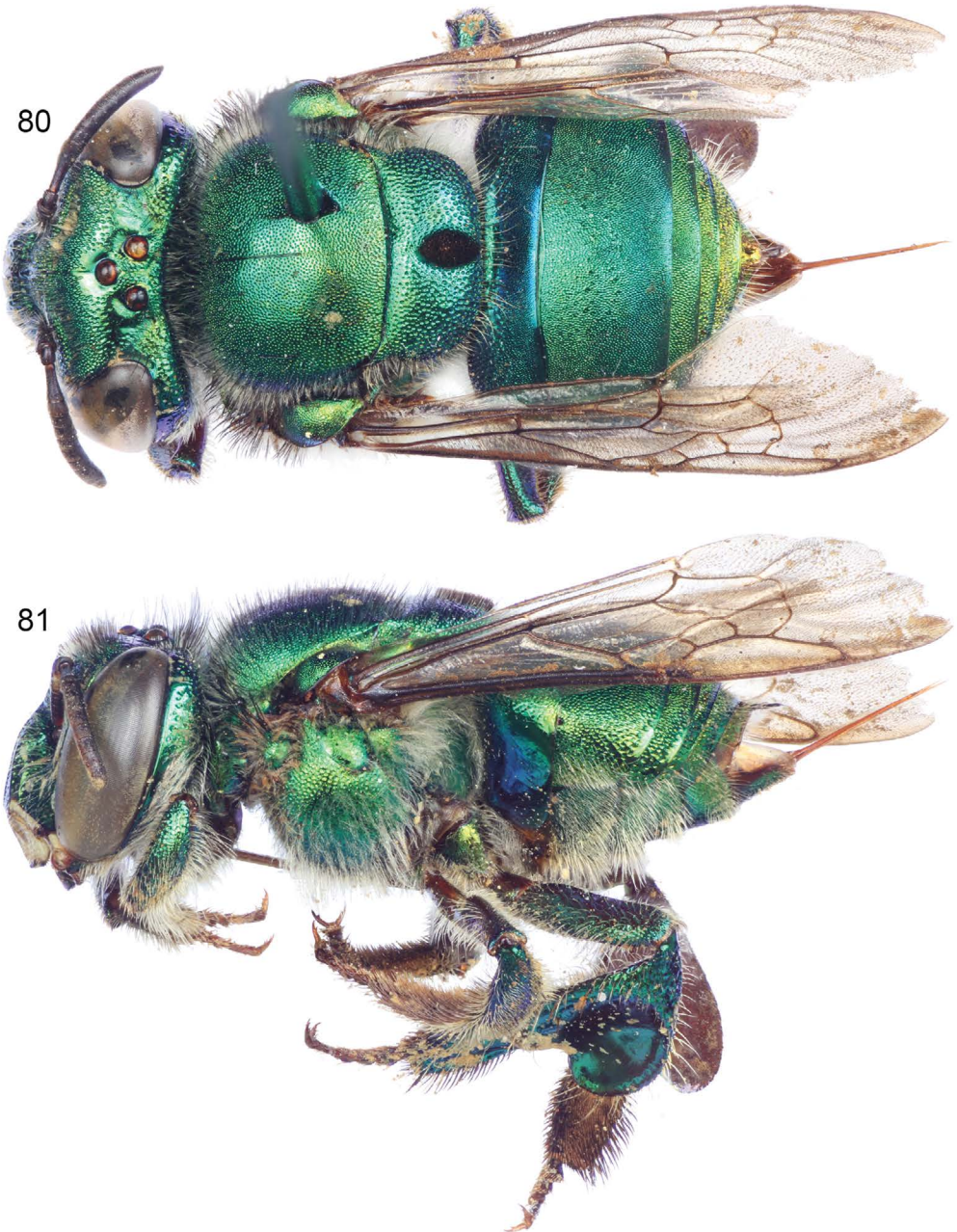
(Figs. 80–83, 170)

DIAGNOSIS: Labiomaxillary complex in repose reaching first metasomal sternum; upper and lower interorbital distances equal (at most marginally different) (Fig. 82); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Fig. 82); pronotal dorsolateral angle projected as a lamella; mesoscutellar tuft ovoid, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 80); metabasitarsus with anterior margin appearing straight (subtle convexity), posterior margin straight (Fig. 83); width of metasoma and head only marginally different (much less than 1.05 times) (Fig. 80); head green (Fig. 82); scape with upper third of outer surface with yellowish spot (Fig. 82); mesosoma and metasomal terga green (Figs. 80–81); mesoscutellum moderately punctate (punctures separated by one puncture diameter) (Fig. 80); mesepisternum densely punctate (punctures contiguous in central areas) (Fig. 81); metasomal terga densely and evenly imbricate-punctate (Fig. 80); mesosomal vestiture dominated by fuscous setae, slightly darker than in other species (Figs. 80–81).

DESCRIPTION: ♀: **Structure.** Total body length 9.93 mm (9.85–10.07; n=4); labiomaxillary complex in repose reaching first metasomal sternum (Fig. 81). Head length 2.84 mm (2.78–2.89; n=4); head width 4.46 mm (4.36–4.53; n=4); upper interorbital distance 2.15 mm (n=4); lower interorbital distance 2.07 mm (2.00–2.11; n=4); upper clypeal width 1.12 mm (1.11–1.15; n=4); lower clypeal width 1.83 mm (1.78–1.85; n=4); clypeal protuberance 0.70 mm (0.59–0.74; n=4); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*; labrum rectangular, wider than long, length 0.86 mm (0.81–0.89; n=4), width 1.04 mm (1.01–1.07; n=4); anterior margin of labrum arched outwards with subapical carina (Fig. 82); interocellar distance 0.35 mm (0.33–0.37; n=4); ocellocular distance 0.60 mm (0.59–0.61; n=4); first flagellar article longer [0.51 mm (0.48–0.52; n=4)] than second and third flagellar articles combined [0.34 mm (0.33–0.37; n=4)]; length of malar area 0.15 mm (n=4). Mandible tridentate. Pronotal dorsolateral angle as in *E. viridis*; intertegular distance 3.40 mm (3.33–3.48; n=4); mesoscutal length 2.62 mm (2.52–2.70; n=4); mesoscutellar length 1.19 mm (1.18–1.19; n=4); posterior margin of mesoscutellum as in *E. viridis* (Fig. 80); mesotibial length 2.06 mm (2.00–2.11; n=4); mesobasitarsal length 1.87 mm (1.85–1.93; n=4), maximum width 0.62 mm (0.59–0.67; n=4); metatibia triangular (right triangle) (Fig. 83); metatibial anterior margin length 2.97 mm (2.89–3.07; n=4); metatibial ventral margin length 1.94 mm (1.78–2.04; n=4); metatibial postero-dorsal margin length 3.38 mm (3.26–3.48; n=4); metabasitarsal length 1.54 mm (1.48–1.56; n=4), proximal margin width 0.89 mm (0.81–0.96; n=4). Forewing length 8.17 mm (8.00–8.37; n=4); hind wing with 18–20 (n=4) hamuli. Maximum metasomal width 4.49 mm (4.41–4.52; n=4).

Coloration. Generally as described for females of *E. perviridis*, only with stronger golden-bronzy iridescence throughout and scape with yellow spot on upper third laterally (Figs. 80–83).

Sculpturing. As described for male (and for female) of *E. perviridis* (Figs. 80–82).

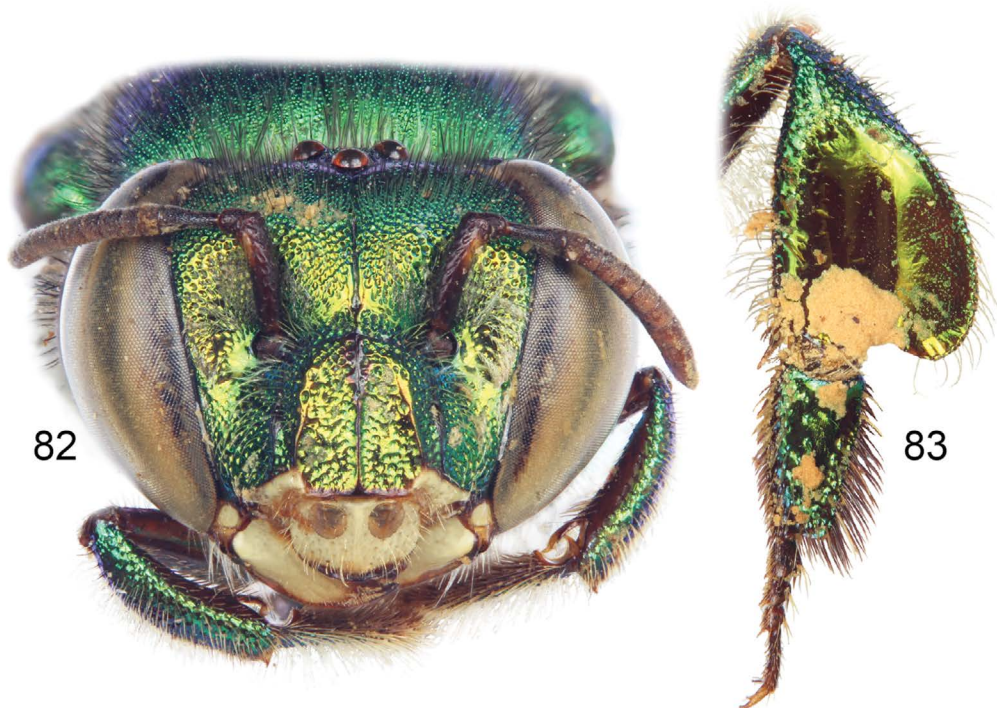


Figures 80–81. *Euglossa (Euglossella) cetera*, new species, female holotype. 80. Dorsal habitus. 81. Lateral habitus.

Vestiture. Head, mesosoma, and metasoma as in *E. viridis* (Figs. 80–82). Mesoscutellar tuft ovoid, otherwise as in females of *E. viridis/azurea* (Fig. 80); corbicula as in females of *E. viridis/azurea* (Fig. 83).

♂: Unknown

ETYMOLOGY: The specific epithet is taken from the Latin word *cetera*, meaning “the rest”, as a reference to the presence of more than one superficially-similar species.



Figures 82–83. *Euglossa (Euglossella) cetera*, new species, female holotype. **82.** Facial aspect. **83.** Outer view of hind leg.

HOLOTYPE: ♀, **Venezuela:** “VENEZUELA: Amaz. [Amazonas]; Pto. Ayacucho; 27 IV1967; R.L. Dressler 652 [mixed handwritten]” (FSCA).

PARATYPES (3♀): **Venezuela:** 3♀, all with label data as holotype (two in FSCA, one in SEMC).

COMMENTS: When Dressler (1985) described *E. perviridis*, then known solely from males, he mentioned the occurrence of green-colored females of *Euglossella* in the Guiana Shield region and alluded to the possibility that they might belong to his species but refrained from assigning them to any known species. Some of the females mentioned there (Dressler, 1985) are likely part of the series here included as *E. cetera* and *E. cupella* (see next description, *infra*), as all the specimens for these two species were collected by Dressler in 1967.

Despite the challenge posed by associating males and females for many species of *Euglossa s.l.* given the conserved morphology of the latter, we feel confident in describing three new species — *E. cetera* and the two species that follow. There is sufficient morphological evidence to make us confident that these may be separated from the others while simultaneously believing they do not belong with any of those species known solely from males. In the case of *E. cetera*, the females are recognizable from other species by the shape of the metabasitarsus, which has both anterior and posterior margins noticeably straight (the anterior one only faintly and weakly convex at most and in certain views), giving it the appearance of a truncate cone (Fig. 83). This feature is easily noticeable when comparing specimens of this species to other females in the group, especially with the other green-bodied species, including *E. perviridis*, and particularly with *E. cupella* and *E. ashei* (refer to diagnoses for those species, *infra*). This character has proven to be important taxonomically for most groups of *Euglossa s.l.*, and

is stable within species while its differences are consistent among species. Another feature present in all *E. cetera* is the presence of a yellowish spot on the uppermost part of the outer surface of the scape (Fig. 82), which is not known in other females in the group.

We consider the possibility that these females, or those of either of the following two species, are associated with males of other *viridis* group species occurring in the same regions (*i.e.*, *E. viridis* and *E. azurea*) to be exceedingly unlikely. We have addressed previously those females which belong to *E. viridis* and *E. azurea*, and those individuals we are placing in *E. cetera*, *E. cupella*, and *E. ashei* cannot be ascribed to the aforementioned two taxa without rendering their circumscriptions meaningless, even with the conservative taxonomic position we have tried to adopt. Given the scarcity of female records, it is hoped that the establishment of these new species and bringing their presence known to melittologists interested in orchid bees will encourage further surveys from these regions. From such work we will hopefully discover further material upon which to test our hypotheses as to species diversity, refine our concepts of their circumscription and variation, and reveal the hitherto unknown males. The four known specimens of *E. cetera* are from Puerto Ayacucho, State of Amazonas, Venezuela (Fig. 170).

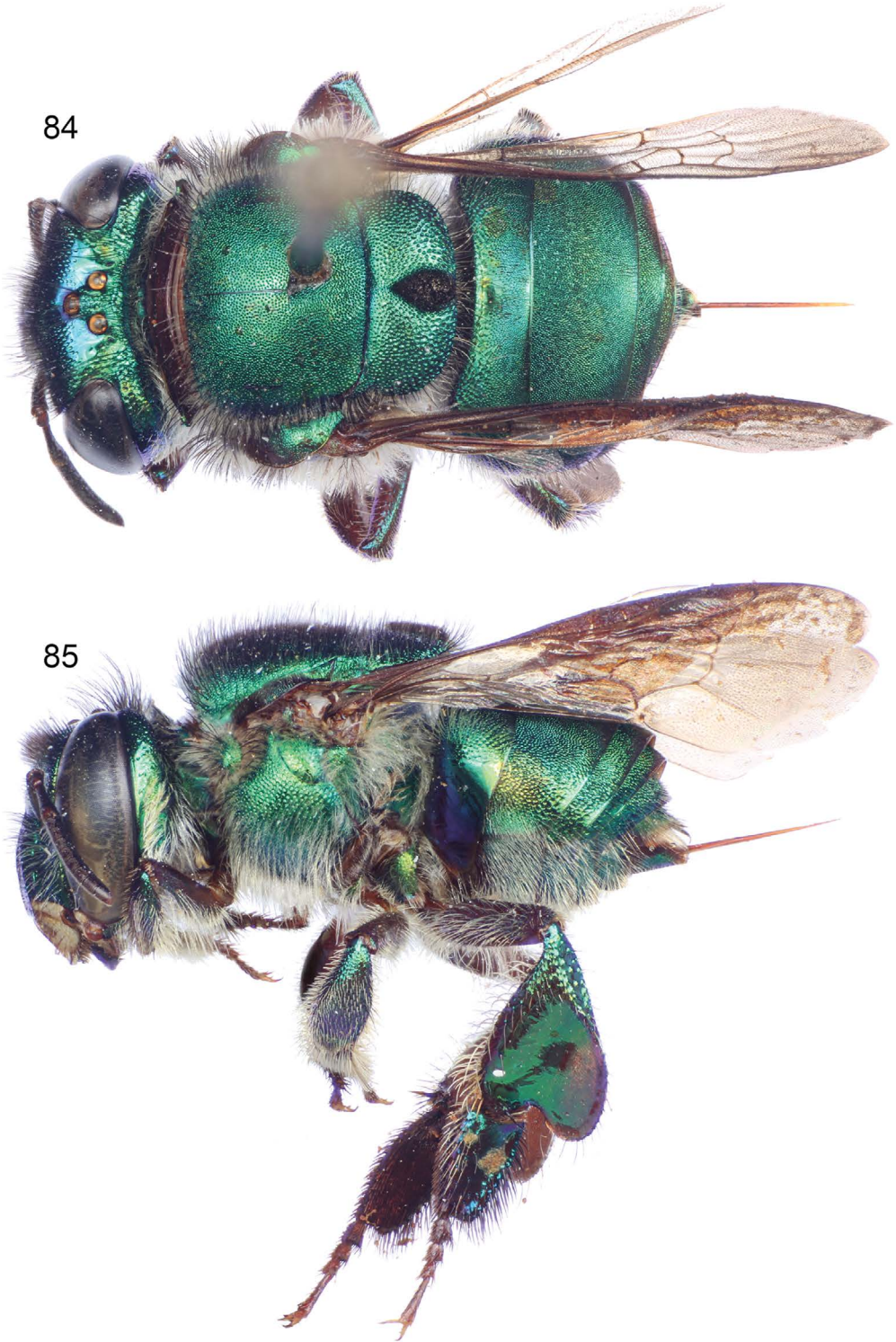
Euglossa (Euglossella) cupella Hinojosa-Díaz & Engel, new species

ZooBank: urn:lsid:zoobank.org:act:BFDA80E3-EB7A-4E33-8997-475EE84C587A

(Figs. 84–87, 170)

DIAGNOSIS: Labiomaxillary complex in repose reaching first metasomal sternum; upper and lower interorbital distances equal (at most marginally different) (Fig. 86); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Fig. 86); pronotal dorsolateral angle projected as a lamella; mesoscutellar tuft teardrop shaped, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 84); metabasitarsus with anterior and posterior margins noticeably convex (Fig. 87); metasoma noticeably wider than head (about 1.07 times or over) (Fig. 84); head green (Fig. 86); scape brown with no ivory or yellowish coloration (Fig. 86); mesosoma and metasomal terga green (Figs. 84–85); mesoscutellum densely punctate (punctures contiguous in most areas) (Fig. 84); mesepisternum densely punctate (punctures contiguous in central areas) (Fig. 85); metasomal terga densely and evenly imbricate-punctate (Fig. 84); mesosomal vestiture dominated by fuscous setae, slightly darker than in other species (Figs. 84–85).

DESCRIPTION: ♀: **Structure.** Total body length 10.30 mm (9.63–10.81; n=5); labiomaxillary complex in repose reaching first metasomal sternum (Fig. 85). Head length 2.62 mm (2.56–2.78; n=5); head width 4.58 mm (4.52–4.67; n=5); upper interorbital distance 2.24 mm (2.15–2.33; n=5); lower interorbital distance 2.16 mm (2.11–2.22; n=5); upper clypeal width 1.20 mm (1.11–1.26; n=5); lower clypeal width 1.98 mm (1.93–2.04; n=5); clypeal protuberance 0.62 mm (0.59–0.67; n=5); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*, orientation of paramedial ridges intermediate between condition present in *E. viridis* and males of *E. cyanea*; labrum rectangular, wider than long, length 0.94 mm (0.89–1.00; n=5), width 1.13 mm (1.11–1.19; n=5); anterior margin of labrum arched outwards with subapical carina (Fig. 86); interocellar distance 0.35 mm (0.33–0.36; n=5); ocellocular distance 0.64 mm (0.61–0.67; n=5); first flagellar article longer [0.55 mm (0.52–0.59; n=5)] than second and third flagellar articles combined [0.37 mm (n=5)]; length of malar area 0.15 mm (0.13–0.16; n=5). Mandible tridentate. Pronotal dorsolateral angle as in *E. viridis*; intertegular distance 3.58



Figures 84–85. *Euglossa (Euglossella) cupella*, new species, female holotype. **84.** Dorsal habitus. **85.** Lateral habitus.



Figures 86–87. *Euglossa (Euglossella) cupella*, new species, female holotype. 86. Facial aspect. 87. Outer view of hind leg.

mm (3.48–3.78; n=5); mesoscutal length 2.72 mm (2.63–2.78; n=5); mesoscutellar length 1.27 mm (1.22–1.30; n=5); posterior margin of mesoscutellum as in *E. viridis* (Fig. 84); mesotibial length 2.20 mm (2.15–2.30; n=5); mesobasitarsal length 1.97 mm (1.85–2.22; n=5), maximum width 0.67 mm (0.59–0.74; n=5); metatibia triangular (right triangle) (Fig. 87); metatibial anterior margin length 3.16 mm (3.00–3.41; n=5); metatibial ventral margin length 1.97 mm (1.90–2.07; n=5); metatibial postero-dorsal margin length 3.54 mm (3.41–3.78; n=5); metabasitarsal length 1.79 mm (1.67–1.85; n=5), proximal margin width 1.00 mm (0.96–1.11; n=5). Forewing length 8.28 mm (8.07–8.52; n=5); hind wing with 19–23 (n=5) hamuli. Maximum metasomal width 4.91 mm (4.78–5.11; n=5).

Coloration. Generally as described for females of *E. perviridis*, only with stronger golden-bronzy iridescence throughout (Figs. 84–87).

Sculpturing. As described for male (and by extension for female) of *E. perviridis* (Figs. 84–86).

Vestiture. Head, mesosoma, and metasoma as in *E. viridis* (Figs. 84–86). Mesoscutellar tuft and corbicula as in females of *E. viridis/azurea* (Figs. 84, 87).

♂: Unknown.

ETYMOLOGY: The specific epithet is taken from the Latin word *cupa*, meaning “barrel”, and the diminutive suffix *-ella* (together meaning, “small barrel”), as a reference to the characteristic shape of the metabasitarsus in the species.

HOLOTYPE: ♀, **Venezuela:** “VENEZUELA: BO. [Bolivar]; Sta. Elena; 21 II 1967; R.L. Dressler 618 [mixed handwritten]” (FSCA).

PARATYPES (4♀♀): **Venezuela:** 4♀♀, all with same data as holotype except date “20 II 1967” (three in FSCA, one in SEMC).

COMMENTS: As mentioned in the comments for the previous species (*vide supra*), those females upon which *E. cupella* is based are likely part of the series from the Gui-

ana Shield region mentioned by Dressler (1985) during his proposal of *E. perviridis*. Although superficially similar to *E. cetera*, the shape of the metabasitarsus is also characteristic in this species, having noticeably convex anterior and posterior margins, (giving it a barrel-shaped appearance, as alluded to by the name of the species). The five females examined for this species also have a characteristically wide metasoma in relation to the head width (metasoma about 7% wider than the head on average), which also can be used to separate them from *E. cetera* and *E. ashei* as the latter two have a metasomal width almost equivalent to the head width (less than 2% wider on average). *Euglossa cupella* can be separated from females of *E. perviridis* (which have a metasoma to head ratio similar to *E. cupella*) by the already mentioned shape of the metabasitarsus. The five known specimens of the species are from Santa Elena, State of Bolívar, Venezuela (Fig. 170).

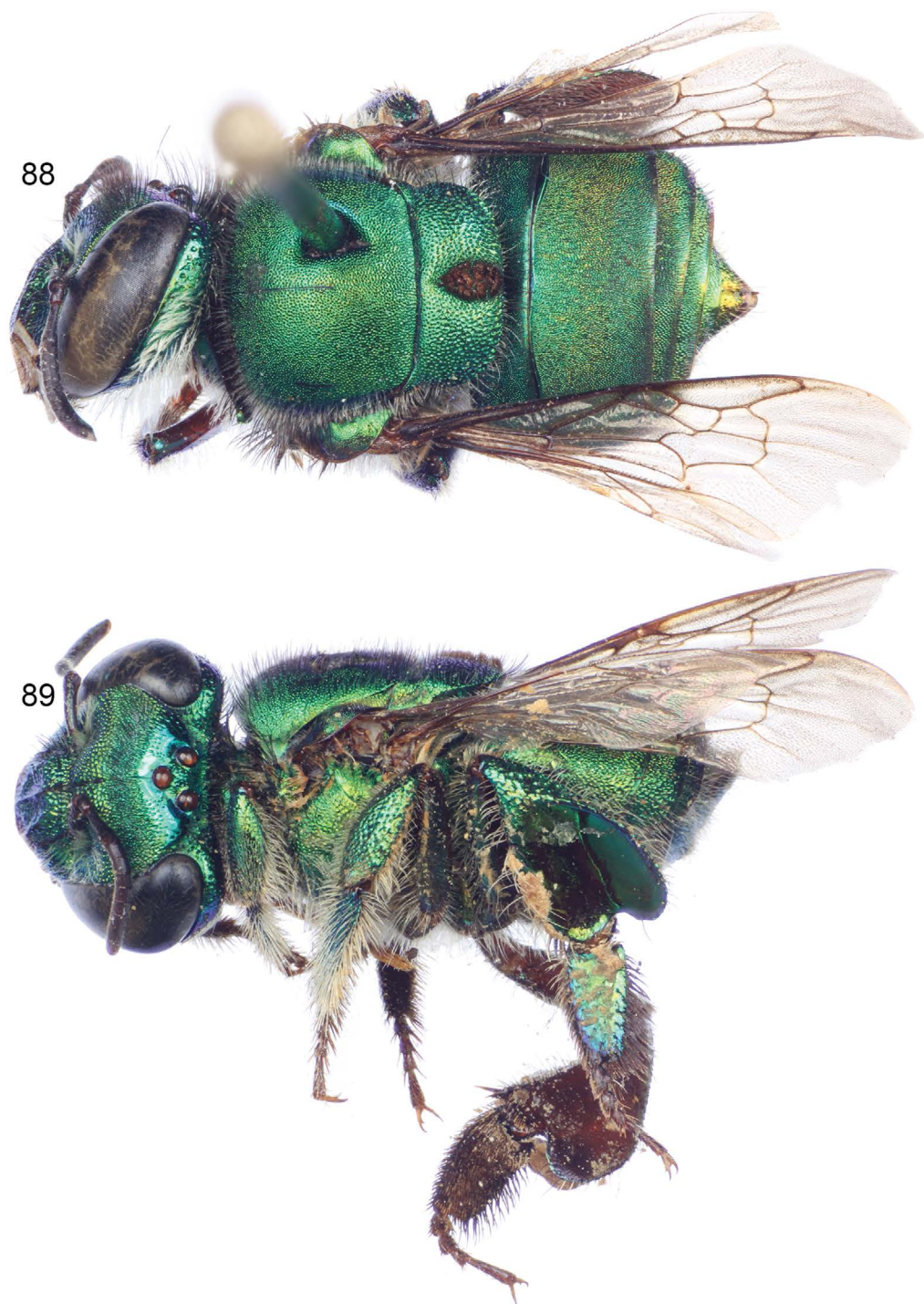
Euglossa (Euglossella) ashei Hinojosa-Díaz & Engel, new species

ZooBank: urn:lsid:zoobank.org:act:9BE41018-B4BE-40EC-94FA-F3D9554E213A

(Figs. 88–91, 170)

DIAGNOSIS: Labiomaxillary complex in repose reaching first metasomal sternum; upper and lower interorbital distances equal (at most marginally different) (Fig. 90); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Fig. 90); pronotal dorsolateral angle projected as a lamella; mesoscutellar tuft teardrop shaped, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 88); metabasitarsus with anterior margin convex, posterior margin very slightly convex (Fig. 91); width of metasoma and head only marginally different (much less than 1.05 times) (Fig. 88); head green (Fig. 90); scape brown with no ivory or yellowish coloration (Fig. 90); mesosoma and metasomal terga green (Figs. 88–89); mesoscutellum densely punctate (punctures contiguous in most areas) (Fig. 88); mesepisternum densely punctate (punctures contiguous in central areas) (Fig. 89); metasomal terga densely and evenly imbricate-punctate (Fig. 88); mesosomal vestiture dominated by fuscous setae (Figs. 88–89).

DESCRIPTION: ♀: **Structure.** Total body length 9.69 mm (9.11–10.22; n=4); labiomaxillary complex in repose reaching first metasomal sternum (Fig. 89). Head length 2.59 mm (2.48–2.67; n=4); head width 4.31 mm (4.19–4.44; n=4); upper interorbital distance 2.05 mm (2.02–2.07; n=4); lower interorbital distance 2.00 mm (1.93–2.04; n=4); upper clypeal width 1.09 mm (0.96–1.15; n=4); lower clypeal width 1.83 mm (1.78–1.85; n=4); clypeal protuberance 0.56 mm (0.52–0.67; n=4); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*; labrum rectangular, wider than long, length 0.86 mm (0.84–0.89; n=4), width 1.03 mm (1.01–1.04; n=4); anterior margin of labrum arched outwards with subapical carina (Fig. 90); interocellar distance 0.33 mm (0.30–0.34; n=4); ocellocular distance 0.58 mm (0.56–0.59; n=4); first flagellar article longer [0.51 mm (0.49–0.52; n=4)] than second and third flagellar articles combined [0.38 mm (0.35–0.41; n=4)]; length of malar area 0.13 mm (0.07–0.15; n=4). Mandible tridentate. Pronotal dorsolateral angle as in *E. viridis*; intertegular distance 3.29 mm (3.11–3.41; n=4); mesoscutal length 2.56 mm (2.41–2.63; n=4); mesoscutellar length 1.16 mm (1.07–1.22; n=4); posterior margin of mesoscutellum as in *E. viridis* (Fig. 88); mesotibial length 2.00 mm (1.93–2.11; n=4); mesobasitarsal length 1.85 mm (1.78–1.93; n=4), maximum width 0.58 mm (0.56–0.59; n=4); metatibia triangular (right triangle) (Fig. 91); metatibial anterior margin length 2.91 mm (2.81–3.04; n=4); metatibial ventral margin length 1.81 mm (1.74–1.93; n=4); metatibial postero-dorsal margin length 3.23 mm (3.15–3.33;



Figures 88–89. *Euglossa (Euglossella) ashei*, new species, female holotype. 88. Dorsal habitus. 89. Lateral habitus.

n=4); metabasitarsal length 1.68 mm (1.56–1.81; n=4), proximal margin width 0.78 mm (0.74–0.81; n=4). Forewing length 7.60 mm (7.26–8.00; n=4); hind wing with 18–21 (n=4)



Figures 90–91. *Euglossa (Euglossella) ashei*, new species, female holotype. 90. Facial aspect. 91. Outer view of hind leg.

hamuli. Maximum metasomal width 4.39 mm (4.22–4.52; n=4).

Coloration. Generally as described for females of *E. perviridis*, only with somewhat stronger golden-bronzy iridescence throughout (not as strong though as in *E. cetera* and *E. cupella*) (Figs. 88–91).

Sculpturing. As described for male (and by extension for female) of *E. perviridis* (Figs. 88–90).

Vestiture. Head, mesosoma, and metasoma as in *E. viridis* (Figs. 88–90). Mesoscutellar tuft and corbicula as in females of *E. viridis/azurea* (Figs. 88, 91).

♂: Unknown.

ETYMOLOGY: The specific epithet is a patronym honoring the late James S. Ashe (1947–2005), renowned specialist of Aleocharinae (Staphylinidae), consummate collector of rove beetles and bees, and remembered colleague.

HOLOTYPE: ♀, **French Guiana:** “FRENCH GUIANA; Kourou, Km. 12 SW.; 29 June 1977; D. Roubik, No. 185 [Date and all numerals handwritten]” (SEMC).

PARATYPES (3♀): **French Guiana:** 1♀, “FRENCH GUIANA; Kourou, Km. 17 SW.; 27 March 1977; D. Roubik, No. 117 [Date and all numerals handwritten]” (SEMC). **Brazil:** 2♀, “Serra do Navio-AP; Brasil 7-II-62; F.M. Oliveira” (FSCA, SEMC).

COMMENTS: This is the third largely green species based solely on females and occurring in the Guiana Shield region, and as noted in the previous two species, it is possible that some of these specimens were part of those mentioned by Dressler (1985), although the individuals of *E. ashei* correspond to different collecting events. Females of this species can be distinguished from the similarly green females of other species owing to the combination of the shape of the metabasitarsus and metasomal width comparable to the head width (less than 2% wider on average). *Euglossa cetera*, although having a similar metasoma to head width ratio, has a metabasitarsus with straight margins, while *E. cupella* has the characteristic barrel-shaped metabasitarsus and a noticeably wide metasoma with respect to the head. Females of *E. perviridis* have metabasitarsal margins not so convex and a wide metasoma with respect to the head.

Based on the four known specimens of *E. ashei*, the species occurs in the eastern section of the Guiana Shield, collected from near Kourou, French Guiana, and Serra do Navio, State of Amapá, Brazil (Fig. 170).

Euglossa (Euglossella) cyanura Cockerell
(Figs. 92–104, 151, 161, 170)

Euglossa cyanura Cockerell, 1917: 146 [♀]. Holotype ♀ (USNM, *visum*).

DIAGNOSIS: Labiomaxillary complex in repose reaching second metasomal sternum in both sexes; upper and lower interorbital distances equal (Figs. 96–97); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Figs. 96–97); pronotal dorsolateral angle projected as a lamella; male mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 98, 151); female mesoscutellar tuft ellipsoidal, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 94); male mesobasitarsus with posterior keel projected in a right to slightly acute angle (Fig. 100); female metabasitarsus with anterior and posterior margins convex (Fig. 101); second metasomal sternum of male with two, simple meso-lateral tufts; metasoma slightly (but consistently) wider than head (about 1.05 times) (Figs. 92, 94); head mainly green in most specimens (cyan in males at northernmost areas of range) (Figs. 96–97); male with paraocular marks trapezoidal, lower width about two thirds of length of lower lateral part of clypeus (Figs. 93, 96); scape of male with ivory spot covering almost entire anterior surface (Fig. 96), absent in female (Fig. 97); mesosoma (except mesoscutellum) green (northernmost specimens mainly cyan) with blue-purple intergradations and bronzy iridescence (Figs. 92–95), mesoscutellum blue-green (darker in northernmost specimens) (Figs. 92, 94, 103), some females rather green throughout mesosoma; first to fourth metasomal terga blue-green with cyan iridescence on lateral margins, fifth to seventh terga cyan (all terga with strong cyan tinge in northernmost specimens) (Figs. 92–95, 104); mesoscutellum and central area of mesepisternum moderately punctate (punctures separated by about one puncture diameter in central areas), slightly denser in female (Figs. 102–103); metasomal terga in male with moderately-dense punctures, noticeably larger on second tergum and progressively towards posterior segments (Fig. 104), densely and evenly imbricate-punctate in female (Fig. 94); mesosomal vestiture dominated by fuscous setae (Figs. 92–95, 102–103); eighth metasomal sternum posterior section very narrow as a slender cylinder (Figs. 92–95, 102–103); gonocoxite dorsal process about as wide as long (Fig. 161); gonostylar lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

DESCRIPTION: ♂: **Structure.** Total body length 11.16 mm (9.78–12.74; n=5); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 93). Head length 2.65 mm (2.44–2.89; n=5), width 4.64 mm (4.48–4.81; n=5); upper interorbital distance 2.09 mm (2.01–2.22; n=5); lower interorbital distance 2.09 mm (2.00–2.22; n=5); upper clypeal width 1.13 mm (1.04–1.19; n=5); lower clypeal width 1.90 mm (1.81–2.00; n=5); clypeal protuberance 0.69 mm (0.63–0.86; n=5); clypeal ridges, labral ridges, and labral windows as described for *E. viridis*, except paramedial ridges quasi-parallel to medial ridge, forming a rectangular clypeal disc; labrum wider than long, length 0.96

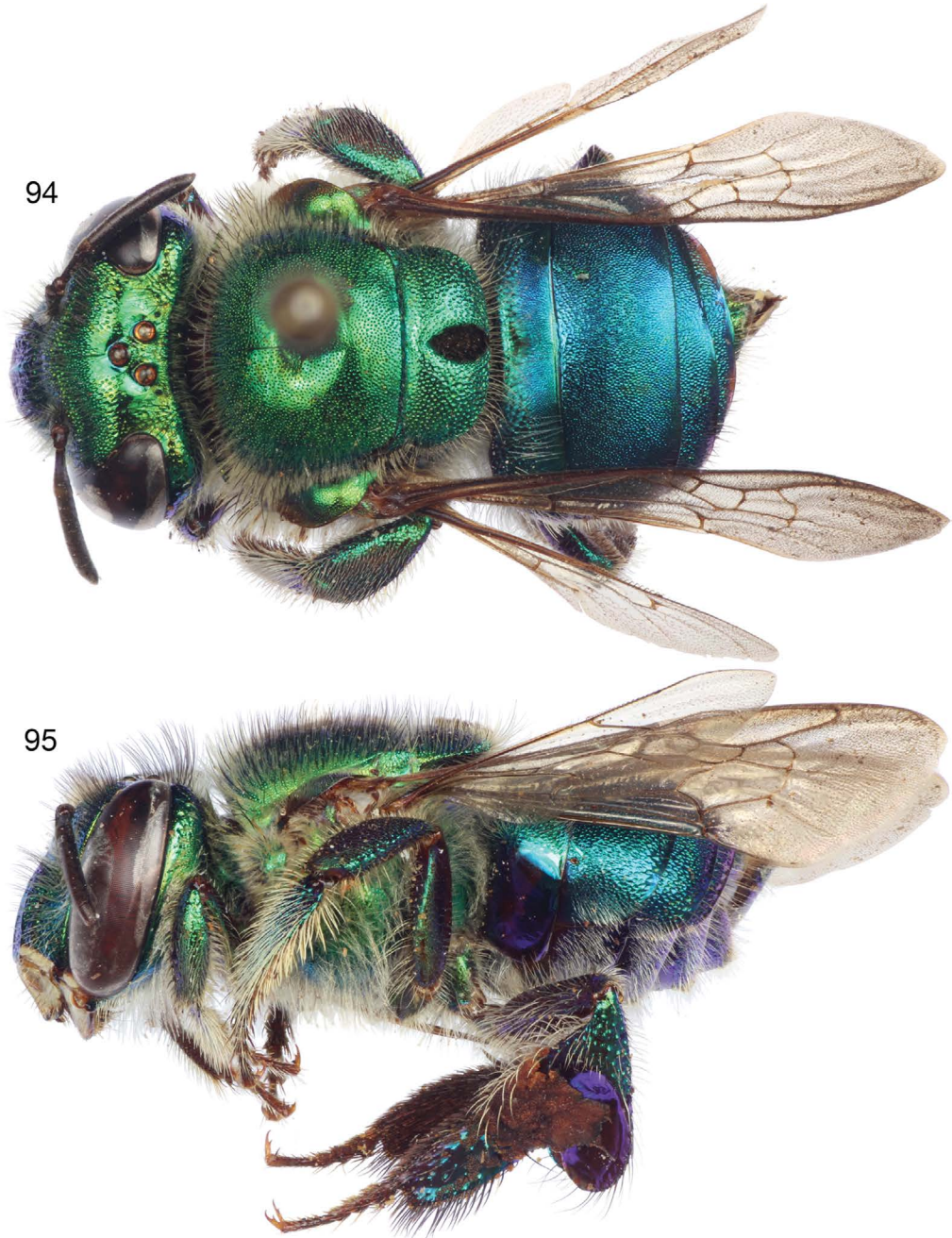
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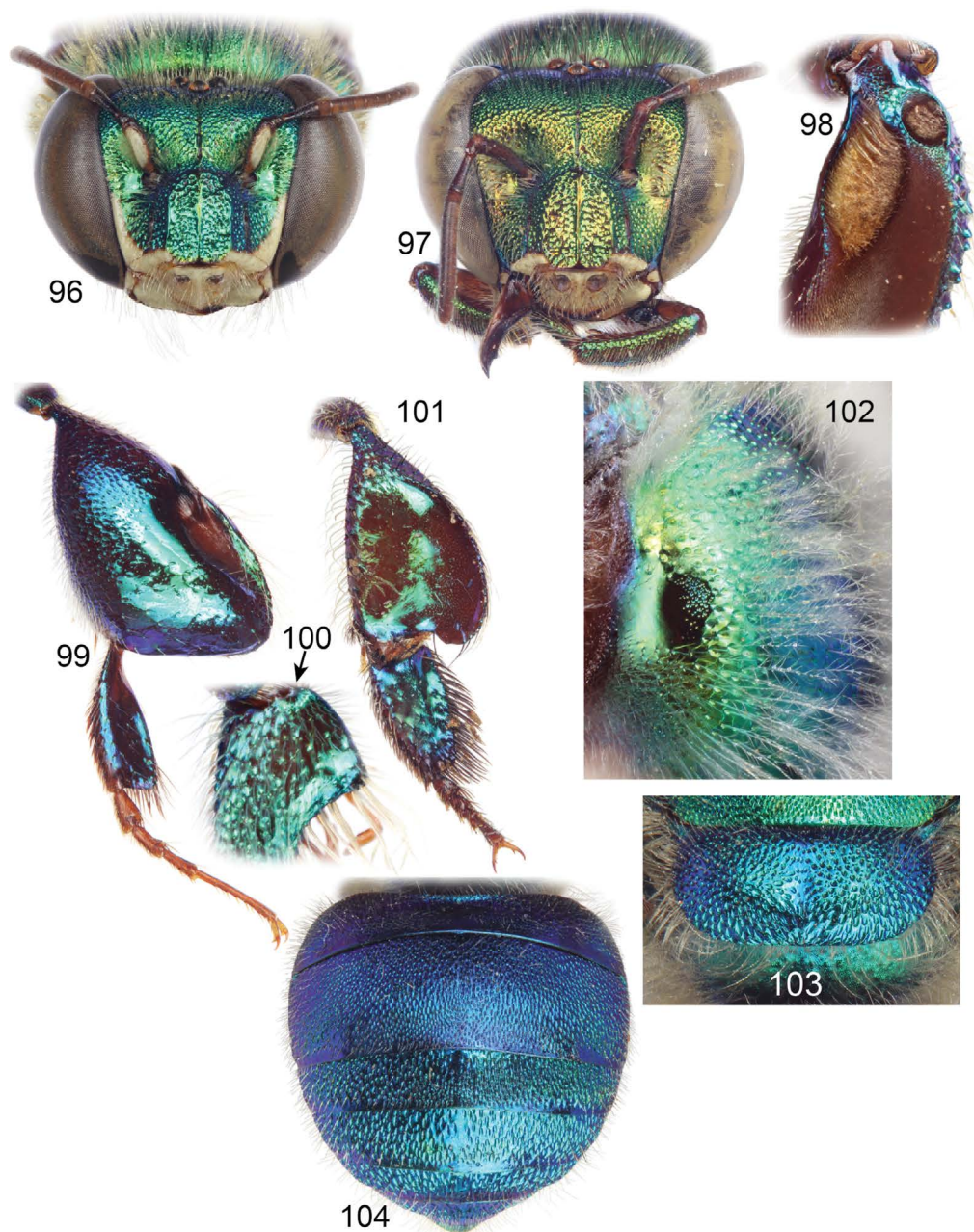


Figures 92–93. *Euglossa (Euglossella) cyanura* Cockerell, male. 92. Dorsal habitus. 93. Lateral habitus.



Figures 94–95. *Euglossa (Euglossella) cyanura* Cockerell, female. 94. Dorsal habitus. 95. Lateral habitus.

mm (0.90–1.07; n=5), width 1.10 mm (1.04–1.19; n=5) (Fig. 96); interocellar distance 0.30 mm (0.29–0.30; n=5); ocellocular distance 0.61 mm (0.59–0.64; n=5); first flagellar article longer [0.58 mm (0.56–0.62; n=5)] than second and third flagellar articles combined [0.38 mm (0.36–0.41; n=5)]; length of malar area 0.15 mm (0.10–0.18; n=5). Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella;



Figures 96–104. *Euglossa (Euglossella) cyanura* Cockerell. **96.** Facial aspect of male. **97.** Facial aspect of female. **98.** Mesotibial tufts of male. **99.** Outer view of male hind leg. **100.** Proximal section of male mesobasitarsus. **101.** Outer view of female hind leg. **102.** Anterolateral view of mesepisternum of male. **103.** Mesoscutellum of male. **104.** Dorsal view of male metasomal terga.

intertegular distance 3.44 mm (3.37–3.59; n=5); mesoscutal length 2.70 mm (2.59–2.82; n=5); mesoscutellar length 1.25 mm (1.19–1.33; n=5); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 103); mesotibial length

2.26 mm (2.19–2.37; n=5); mesobasitarsal length 2.25 mm (2.15–2.37; n=5), width 0.71 mm (0.67–0.78; n=5), posterior keel projected in a right to slightly acute angle with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing slightly convex (Fig. 100); metatibia triangular (scalene triangular) (Fig. 99), maximum thickness 1.40 mm (1.33–1.44; n=5); metatibial anterior margin length 3.59 mm (3.33–3.78; n=5), ventral margin length 2.53 mm (2.37–2.81; n=5), postero-dorsal margin length 4.15 mm (4.15–4.89; n=5); metatibial organ slit as described for *E. viridis*, dorsal section length 0.61 mm (0.52–0.67; n=5); metabasitarsal length 2.16 mm (1.93–2.37; n=5), mid-width 0.81 mm (0.74–0.89; n=5); metabasitarsal ventral margin truncate. Forewing length 8.93 mm (8.15–9.78; n=5); jugal comb with 13–15 (n=5) blades; hind wing with 19–24 (n=5) hamuli. Maximum metasomal width 4.88 mm (4.67–5.15; n=5); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. Two color variants of males of *E. cyanura* exist among known specimens, specimens from Panama to Chiapas, Mexico, with integumental coloration very similar to that of *E. celiae*, albeit green areas showing an olive green tone throughout (Figs. 92–93, 96, 99, 102–104), lower width of paraocular ivory marks about two thirds of length of lower lateral part of clypeus (Figs. 93, 96), and first to fourth metasomal terga mainly blue-green (fourth tergum sometimes greener) (Fig. 104). Males from state of Veracruz, Mexico, with a noticeable cyan coloration throughout, due mainly to a strong blue iridescence in those areas with golden-bronzy iridescence in more southerly specimens; bluish coloration in these specimens is also dominant on metasoma, where first to sixth terga are predominantly blue-green.

Sculpturing. Head as in *E. viridis* (Fig. 96). Mesosoma as in *E. azurea* (Figs. 92, 102–103). Metasomal terga as follows: All terga (except anterior discal section of first tergum) moderately dense punctate, large punctures (punctures on second tergum as large as 0.40x mid-ocellus diameter), noticeably elongate longitudinally, progressively larger on apical terga (Fig. 104); sterna with similar sculpturing as in *E. viridis*, but punctures slightly larger.

Vestiture. Mainly as described for *E. viridis*, except as follows: specimens from Panama to Chiapas, Mexico, with light fulvous setae throughout; frontal fringe in these specimens with brown setae (Fig. 96), sturdier setae on other areas of body concolorous with softer setae (Figs. 92–93, 102–103); features of mesotibia as described for *E. viridis* (Figs. 98, 151). Metasomal terga not as densely setose as in *E. viridis* (Fig. 104). Specimens from state of Veracruz, Mexico, with pilosity more similar to *E. viridis*.

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 161).

♀: **Structure.** Total body length 10.78 mm (10.07–11.48; n=5); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 95). Head length 2.80 mm (2.59–3.11; n=5); head width 4.66 mm (4.48–4.89; n=5); upper interorbital distance 2.23 mm (2.14–2.34; n=5); lower interorbital distance 2.25 mm (2.15–2.39; n=5); upper clypeal width 1.22 mm (1.19–1.33; n=5); lower clypeal width 1.96 mm (1.85–2.11; n=5); clypeal protuberance 0.70 mm (0.63–0.81; n=5); medial clypeal ridge sharp, paramedial clypeal ridges sharp in lower half, otherwise rather blunt, labral ridges and labral windows as in *E. viridis*; labrum rectangular, wider than long, length 0.96 mm (0.89–1.04; n=5), width 1.17 mm (1.10–1.23; n=5); anterior margin of labrum arched outwards with subapical carina (Fig. 97); interocellar distance 0.31 mm (0.30–0.34; n=5); ocellocular distance 0.66 mm (0.63–0.68; n=5); first flagellar article longer [0.56 mm (0.52–0.59; n=5)] than second and third flagellar articles combined [0.38 mm (0.36–0.41; n=5)]; length of malar area 0.17 mm (0.13–0.21; n=5). Mandible tridentate. Pronotal dorsolateral angle

as in *E. viridis*; intertegular distance 3.60 mm (3.41–3.78; n=5); mesoscutal length 1.27 mm (1.19–1.36; n=5); mesoscutellar length 2.71 mm (2.59–2.79; n=5); posterior margin of mesoscutellum as in male of *E. viridis* (Fig. 94); mesotibial length 2.16 mm (2.07–2.30; n=5); mesobasitarsal length 2.07 mm (2.00–2.15; n=5), maximum width 0.63 mm (0.59–0.67; n=5); metatibia triangular (right triangle) (Fig. 101); metatibial anterior margin length 3.16 mm (2.96–3.33; n=5); metatibial ventral margin length 2.02 mm (1.81–2.19; n=5); metatibial postero-dorsal margin length 3.57 mm (3.37–3.78; n=5); metabasitarsal length 1.91 mm (1.85–2.00; n=5), proximal margin width 0.94 mm (0.89–1.04; n=5). Forewing length 8.08 mm (7.56–8.59; n=5); hind wing with 19–24 (n=5) hamuli. Maximum metasomal width 4.86 mm (4.67–5.11; n=5).

Coloration. Females exhibit integumental coloration as that described for males known from Panama to Chiapas, Mexico, although some females have predominantly green coloration (noticeably the holotype), with very faint bluish areas (Figs. 94–95, 97, 101). No females known from Veracruz, Mexico, for comparison with those males.

Sculpturing. Overall sculpturing as observed for males of *E. viridis* (and by extension for those females described as *E. viridis/azurea*) (Figs. 94–95, 97).

Vestiture. Head, mesosoma, and metasoma as in *E. viridis* (Figs. 94–95, 97). Mesoscutellar tuft and corbicula as in females of *E. viridis/azurea* (Fig. 94).

HOLOTYPE: ♀, **Panama:** “Porto Bello; Pan [Panama] Feb 24. ’11 // Aug. BusckI; Collector // Type No.; 23144; U.S.N.M. [red label, number handwritten] // *Euglossa*; *cyanura*; CKLL TYPE.” (USNM).

ADDITIONAL MATERIAL EXAMINED (113♂♂22♀♀): Costa Rica: 4♂♂, 3♀♀, “COSTA RICA, San Jose; Prov., 4 Km. E. San; Ignacio de Acosta; 8 July 1963 4000 ft.; (C.D. Michener *et al.*) // *Euglossa*; (*Euglossella*); *cyanura* Cockerell; Det. I. Hinojosa-Díaz 2012” (SEMC, 1♂ in FSCA). 1♂, as previous except identification label, “*Euglossa cyanura*; Ckll. Det. By; R.L. Dressler” (CRAS). 1♂, “COSTA RICA: Pun-; tarenas: San Vito; de Java 19 III 1966; R.L. Dressler 472 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♂, “COSTA RICA, (S.) Puntarenas; Prov. Gromaco, 34km. SE. of; Potrero Grande, on Rio Coto; Brus. 21 July 1963, 1000ft.; (C.D. Michener & W. Kerfoot) // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♂, “COSTA RICA: Las Cruces, S. San Vito, Puntarenas Prov.; 15 III 1966 [mixed handwritten] // *Anthurium*; C.H. Dodson 204 [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♀, “COSTA RICA: Pun-; tarenas: Golfito; 16 III 1966; R.L. Dressler 479 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♀, “COSTA RICA: Guan. [Guanacaste]; Tilaran; 24 III 1966; R.L. Dressler 489 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♂, “Specimen’04 # 1888; morphospp: 153 // Costa Rica, Coto Brus, near San Vito; Tucanes; 8°49’01.88” N, 82°59’31.02” W; elev. 1200m; Aug. 2004; aerial netting; B. Brosi, T. Shih, B. Graham INT 818 // *Euglossa*; *cyanura* det; T. Shih // *Euglossa* ♂; *cyanura*; Cockerell; Det. I. Hinojosa-Díaz 2005” (BBROSI). 1♂, as previous except first number on top label “1887” (BBROSI). 1♀, “Specimen’04 # 784; morphospp: 105 // Costa Rica, Coto Brus, near San Vito; Lom. Lind.; 8°44’25.33” N, 82°55’17.19” W; elev. 1150m; July. 2004; Van Someren trap; B. Brosi, T. Shih, B. Graham 7-13 // *Euglossa* ♂; *cyanura*; Cockerell; Det. I. Hinojosa-Díaz 2005” (BBROSI). 1♀, “Specimen’04 # 1481; morphospp: 140 // Costa Rica, Coto Brus, near San Vito; LA; 8°47’06.37” N, 82°56’05.62” W; elev. 1150m; July. 2004; Van Someren trap; B. Brosi, T. Shih, B. Graham 7-31 // *Euglossa* ♂; *cyanura*; Cockerell; Det. I. Hinojosa-Díaz 2005” (BBROSI). 1♀, “Specimen’04 # 2336; morphospp: 105 // Costa Rica, Coto Brus, near San Vito; Sn Ramon; 8°50’26.33” N,

82°55'0.49" W Jesus; elev. 950m; July. 2004; aerial netting trap; B. Brosi, T. Shih, B. Graham I 8/26 // *Euglossa* ♂; *cyanura*; Cockerell; Det. I. Hinojosa-Díaz 2005" (BBROSI). 1♂, 3♀♀, "COSTA RICA, (S.) Puntarenas; Prov., Gromaco 34km. SE. of Potrero Grande, on Rio Coto; Brus. 21 July 1963, 1000 ft.; (C.D. Michener & W. Kerfoot) // *Euglossa*; (*Euglossella*); *cyanura* Cockerell; Det. I. Hinojosa-Díaz 2012" (SEMC). 1♀, "COSTA RICA, Limon Prov.; Puerto Cahuita; March 16, 1966; C.D. Michener coll. // *Euglossa*; *cyanura* Cockerell; Det. R.L. Dressler, 1987" (SEMC). **Mexico:** 1♂, "MEXICO: Chiapas; 9 km SW Palenque; ruins, 200m; 24-IV-1993 R. Ayala // ex. Orchidaceae // *Euglossa* ♂; *viridissima*; det. D. Yanega 1993 [handwritten] // *Euglossa* ♂; *cyanura*; Cockerell; Det. I. Hinojosa-Díaz 2005" (SEMC). 1♂, "MEX: Cordoba; Veracruz; Oct. 14, 1965; Alfred B. Lau // *E.* (*Euglossa*); *charapensis*; Ckll; Det. J.S. Moure 1952 [mixed handwritten] // *Euglossa*; *cyanura*; Ckll.; det. D. Roubik 2003" (USNM). 30♂♂, "MEXICO, Las [Los] Tuxtlas; W.M. Whitten; 4 July 1986; ipsdienol // *Euglossa*; *cyanura* Cockerell // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (27 in FSCA, three in SEMC). 1♂, "MEX: Ver.; Jardín Moctezuma.; Fortin.; 950msnm: 13-VIII-86; Rodriguez G. // MUSEO DE ZOOLOGIA; HYMENOPTERA; 10440 // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2013" (MZFC). **Nicaragua:** 1♂, "NICARAGUA: Rio San Juan Dept.; 60 km SE San Carlos, Refugio; Bartola, 100 m 10°58.409N, 84°20.309W; 30-V-2002, R. Brooks, Z. Falin; S. Chatzimanolis ex. methyl salicylate/; eucaliptus oil baits, NIC1BFC02 128 // [barcode] SM0534058; KUNHM-ENT // *Euglossa*; *cyanura*; Cockerell; Det. I. Hinojosa-Díaz 2004 [species epithet and author handwritten]" (SEMC). **Panama:** 1♂, "84-991 [pencil] // Panama: Colon; Río Iguanita; March 1984; Mark Whitten // P-CRESOL [upside down] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, as previous except number "84-341", chemical "TERPINEN-4-OL" (FSCA). 1♂, as previous except number "84-813", chemical "IPSDIENOL" (FSCA). 2♂♂, as previous except number "84-814", "84-815" (FSCA). 1♂, as previous except number "84-449", plant instead of chemical "*Spathiphyllum*; sp." (FSCA). 1♂, "84-53 [pencil] // Panama: Cocle; El Valle de Antón; March 1984; Mark Whitten // IPSDIENOL [upside down] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 4♂♂, as previous except numbers "84-54", "84-55", "84-206", "84-207" (FSCA). 2♂♂, as previous except numbers "84-209", "84-210", chemical "P-CRESOL" (FSCA). 4♂♂, as previous except numbers "84-48", "84-49", "84-50", "84-51", "84-52", plant instead of chemical "*Anthurium*; *ochranthum*" (FSCA). 2♂♂, "PANAMA: Coclé: N.; El Valle de Antón; 23-24 IX 1964; R.L.Dressler 108 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 2♀♀, "PANAMA: N. El Valle; de Anton, Cocle Prov.; 23-24 IX 1964; R.L.Dressler 108 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012" (one in SEMC, one in AMNH). 2♂♂, "Cerro; Campana; Panama [handwritten] // 7/27/65; CH Dodson [handwritten] // *Cynoches*; *egertonianum*; El Valle [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, "PANAMA: Pma.; Cerro Campana; 23 XI 1976; R.L. Dressler; 1661 [mixed handwritten] // *Euglossa*; *cyanura* [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, "PANAMA: Panama;; Cerro Campana; β-ionone 11 VIII 1979; J.D. Ackerman 569 [mixed handwritten] // *Euglossa cyanura* ♂; det. JDA 1979 [handwritten]" (FSCA). 1♀, "PANAMA: Pma.; Cerro Campana; 8 V 1965; R.L. Dressler 261 [mixed handwritten] // *Euglossa*; *cyanura* [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♀, "PANAMA: Pma.; Cerro Campana; 13 X 1967 [mixed handwritten] // NH Williams // *Euglossa*; *cyanura* // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hino-

josa-Díaz 2012" (FSCA). 1♀, "El Valle; Panama [handwritten] // 7/25/65; CH Dodson [handwritten] // buzzing [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, "PANAMA: Summit; Gardens, C.Z.; 28 VI 1965; R.L. Dressler 277 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 3♂♂, "PANAMA: C.Z.: Navy; Reserv. N. Gamboa; 19 IV 1964; R.L. Dressler 1 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (two in FSCA, one in SEMC). 2♂♂, "PANAMA: C.Z.: Barro Colorado I.; 26 III 1964; R.L. Dressler 9 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, "PANAMA: Barro; Colorado Island; 26 III 1964; R.L. Dressler 9 [mixed handwritten] // *Euglossa* (*Euglossella*); *viridis* (Perty, 1833); det. J.S. Ascher // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (AMNH). 2♂♂, "PANAMA: Barro; Colorado Island; 12–13 IV 1965; R.L. Dressler 247 [mixed handwritten] // *Euglossa*; *cyanura* Cockerell; det. R.L. Dressler" (FSCA). 3♂♂, as previous except identification label "*Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (one each in USNM, SEMC, AMNH). 2♂♂, "PANAMA, C.Z.; Barro Colorado Is.; 26 March 1964; (C.H. Dodson) [handwritten] // On *Gongora*; *tricolor* // *Euglossa*; *viridis* (Perty); Det. C.D. Michener [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (SEMC). 1♀, "Barro Colo Isld.; Canal Zone; I-7-1929 // Collector; C.H. Curran // *Euglossa*; *cyanura* Ckll.; Det. H.F. Schwarz [handwritten] // *Euglossa*; *cyanura*; Ckll.; Det. C.D. Michener '92" (AMNH). 3♂♂, "Panama, Canal Zone; Summer Gardens; 12 December 1970; Michener, Wille [handwritten] // *Euglossa*; *cyanura* Cockerell; Det. R.L. Dressler, 1987" (SEMC). 1♂, "Panama, C.Z.; Fort Sherman; 28 March 1964 // On *Gongora*; *maculata*; var *latibasis* // *Euglossa*; *viridis* (Perty); Det. C.D. Michener [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (SEMC). 1♀, "PANAMA: C.Z.: Piña area; 18 VII 1965; R.L. Dressler 313 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♀, "PANAMA: C.Z.; Piña area; 22 May 1959; W.J. Hanson [date handwritten] // *Euglossa* ♀ *viridis* (Perty); J.S. Moure 1963 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2012" (SEMC). 2♂♂, "PANAMA: Pma.; Las Cumbres; 17 III 1968; R.L. Dressler 903 [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 3♂♂, "PANAMA: Pma.; Cerro Jefe; 12 VII 1967; R.L. Dressler 697 [mixed handwritten] // *Euglossa*; *cyanura* [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 3♂♂, as previous except date "14 VII 1967" (two in FSCA, one in USNM). 6♂♂, "PANAMA C.Z.; Cerro Galera; 3 Mar. 1959; W.J. Hanson [mixed handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (five in SEMC, one in DZUP). 3♂♂, as previous except date "12 Mar 1959" (SEMC). 1♂, as previous except date "14 Mar 1959", and extra identification label "*Euglossa*; *viridis* ♂; (Perty); J.S. Moure 1963" (SEMC). 5♂♂, "Barro Colo. I.; C.Z.; III-12-37; S.W. Frost // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (USNM). 1♂, as previous except identification label "*Euglossa*; *cyanura*; Ckll.; Det. J.S. Moure 1957 [mixed handwritten]" (USNM). 1♂, "PANAMA Colon Prov.; Pipeline Rd., 10 km.; NW. Gamboa (C.Z.); 4 January 1981; C.D. Michener // *Euglossa*; *cyanura* Cockerell; Det. R.L. Dressler, 1987" (SEMC). 1♂, "Panama; Canal Zone; Pipeline Road; 14 April 1964; Coll. C.H. Dodson [handwritten] // On; *Gongora tricolor* // *Euglossa*; *viridis* (Perty); (= *E. cyanura* Ckll.); Det. C.D. Michener '69 [handwritten] // *Euglossa*; *cyanura* Ckll.; Dressler, 1967 [handwritten] // *Euglossa*; *viridis* (Perty); = *cyanura* Ckll.; Moure 1963 [handwritten] // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♂; Det. I. Hinojosa-Díaz 2012" (SEMC).

1♂, as previous except missing Moure's identification label (SEMC). 1♀, "PANAMA Panama Prov.; 13 km. W. El Llano; (Carti Rd Km 7); 22Apr1981 on *Psy-*; *chotria* R.W. Brooks // RW Brooks; Collection; KUNHM #; 2005-En-053 // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2011" (SEMC). 1♀, "PANAMA Panama Prov.; 15 km. N. El Llano; (Carti Rd Km 7); 10May1981; at Cineole; Robert W. Brooks // RW Brooks; Collection; KUNHM #; 2005-En-053 // *Euglossa*; (*Euglossella*); *cyanura* Cockerell ♀; Det. I. Hinojosa-Díaz 2011" (SEMC).

COMMENTS: Cockerell (1917) described *E. cyanura* apparently based on a single female, and at the time of his work euglossine males were collected only scarcely. As we have recurrently mentioned, females are often not readily distinguishable from other species (although exceptions do exist). This reality certainly influenced earlier authors' perceptions as to the validity of Cockerell's species. Moure (1960) initially took the position that *E. cyanura* was a synonym of *E. viridis* (synonymizing *E. azurea* as well), apparently relying solely on females to base his judgement. Subsequently, and most likely after having seen males conspecific with Cockerell's holotype and noting that they were quite distinct from other taxa including *E. viridis*, Moure (1967b) reinstated *E. cyanura* as a valid species in his annotated checklist, and followed up in support of this decision a few years later (Moure, 1970). This is one of those species for which it is truly critical to understand the male if one wishes to appreciate its discreteness from other taxa in *Euglossella*. Males of this species are distinguished easily from others in the *viridis* group by the combination of two features: large punctures on the metasomal terga (Fig. 140) and pale-fuscous setae on the body, especially the mesosoma. The latter feature can be used to distinguish *E. cyanura* from *E. granti*, the males of which also have large punctures on the metasomal terga but a dramatically different vestiture (refer to the following account on *E. granti*, *vide infra*).

Historically *E. cyanura* has been known from Panama and Costa Rica, as noted by Moure (1970) in his reassessment validating the species. In addition, there is one record from southern Nicaragua (close to the Costa Rican border), recently documented by Hinojosa-Díaz & Engel (2012a). The species also was recently reported by Schorkopf *et al.* (2011) from two localities in the state of Veracruz, southeastern Mexico, and here we were able to examine specimens from four localities in two states in southeastern Mexico (Veracruz and Chiapas), one of them (Los Tuxtlas) being the same as that cited in their study (Fig. 170). Although Bonilla-Gómez & Nates-Parra (1992), Ramírez *et al.* (2002), and Roubik & Hanson (2004) reported the species from Colombia, in none of those studies were specimens actually examined [*e.g.*, Ramírez *et al.* (2002) based their report solely on Bonilla-Gómez & Nates-Parra (1992)]. The species could likely be found in areas of northwestern Colombia, towards the Pacific side of the Andes, but this needs to be confirmed. Cockerell (1922) reported a female of *E. cyanura* from Ecuador, but the few morphological details given in his account are ambiguous and the uncertainty of the identification is only exacerbated by the fact that females of the species are not easily differentiated from congeners. It is quite likely that Cockerell misidentified his material.

Those specimens from Veracruz have a distinctive cyan coloration and darker vestiture in contrast to all other individuals we have examined, but otherwise exhibit no structural (including genitalic structures), sculpturing, or other differences that we can discern. The male from Chiapas has the integumental and vestiture coloration typical to individuals from more southerly localities. There is a paucity of material from northern Central America and broad gaps between sampling localities (likely owing to a lack of collecting effort), but in the absence of more clearly defining features we

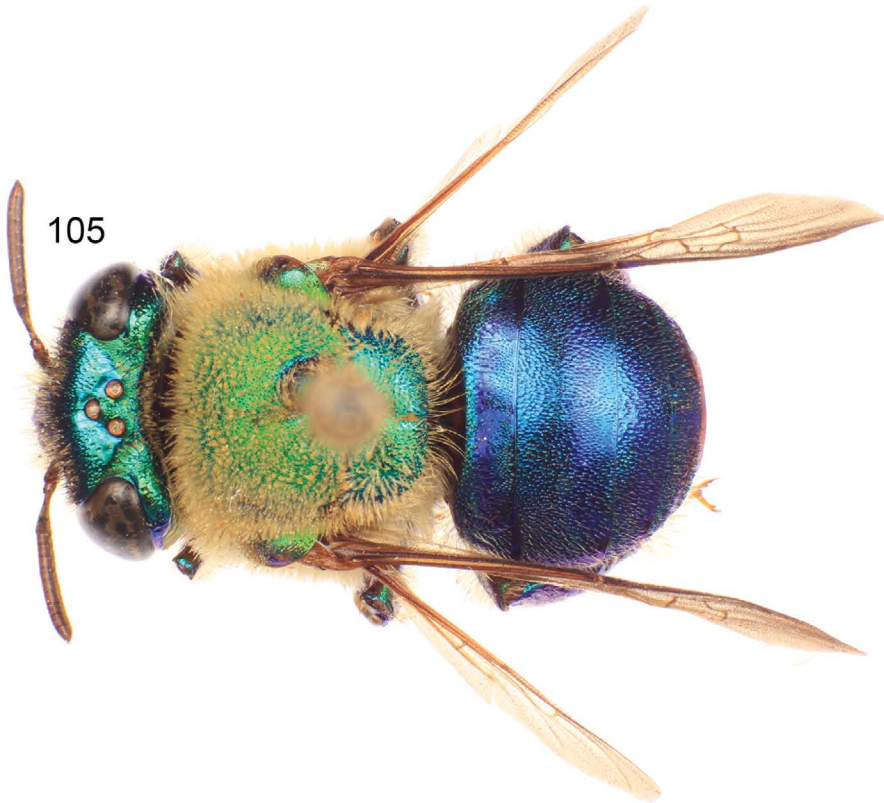
consider this at present to be nothing more than color variation. There is a need for more extensive sampling across this part of the distribution so as to more fully define the northern limits of its range, more complete document and understand the transition in coloration, and test whether or not the darker populations represent a separate lineage. This is another area in which the combined application of morphological and molecular data would be beneficial toward refining our hypothesis of species limits for *E. cyanura*.

Euglossa (Euglossella) granti Cheesman
(Figs. 105–116, 152, 162, 170)

Euglossa granti Cheesman, 1929: 147 [♀]. Holotype ♀ (NHML, *visum*).

DIAGNOSIS: Labiomaxillary complex in repose reaching second metasomal sternum in both sexes; upper and lower interorbital distances equal (at most marginally different) (Figs. 109–110); malar area short (less than 0.25 mm, or noticeably shorter than diameter of mid-flagellar articles) (Figs. 109–110); pronotal dorsolateral angle projected as a lamella; male mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and wide (mid-width exceeding width of contiguous section of velvety area), posterior tuft circular-ovoid (Figs. 111, 152); female mesoscutellar tuft ellipsoidal, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 107); male mesobasitarsus with posterior keel projected in a right to slightly acute angle (Fig. 112); female metabasitarsus with anterior margin slightly convex and posterior margin appearing straight (Fig. 114); second metasomal sternum of male with two, simple meso-lateral tufts; width of metasoma and head only marginally different (less than 1.05 times) in males (Fig. 105) (female not available for measurement); head mainly green (Figs. 109–110); male with paracocular marks trapezoidal, lower width about two thirds of length of lower lateral part of clypeus (Figs. 106, 109); scape of male with ivory spot covering almost entire anterior surface (Fig. 109), absent in female (Fig. 110); mesosoma (except mesoscutellum) green with blue-purple intergradations and bronzy iridescence (Figs. 105–108), mesoscutellum blue-green (Figs. 105, 107, 115); first to fourth metasomal terga blue-green with cyan iridescence on lateral margins, fifth to seventh terga cyan (Figs. 92–95, 104); mesoscutellum and central area of mesepisternum moderately punctate (punctures separated by about one puncture diameter in central areas), slightly denser in female (Figs. 106–108, 115); male metasomal terga with moderately dense punctures, noticeably larger on second tergum and progressively towards posterior segments (Fig. 116), densely and evenly imbricate-punctate in female (Fig. 107); mesosomal vestiture dominated by dense, yellow-fulvous setae (Figs. 105–108, 115); eighth metasomal sternum posterior section very narrow as a slender cylinder; gonocoxite dorsal process about as wide as long (Fig. 162); gonostylar lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector) almost as long as adjacent ventral lobe, covered with dense setae reaching posterior margin of blades of penis valve.

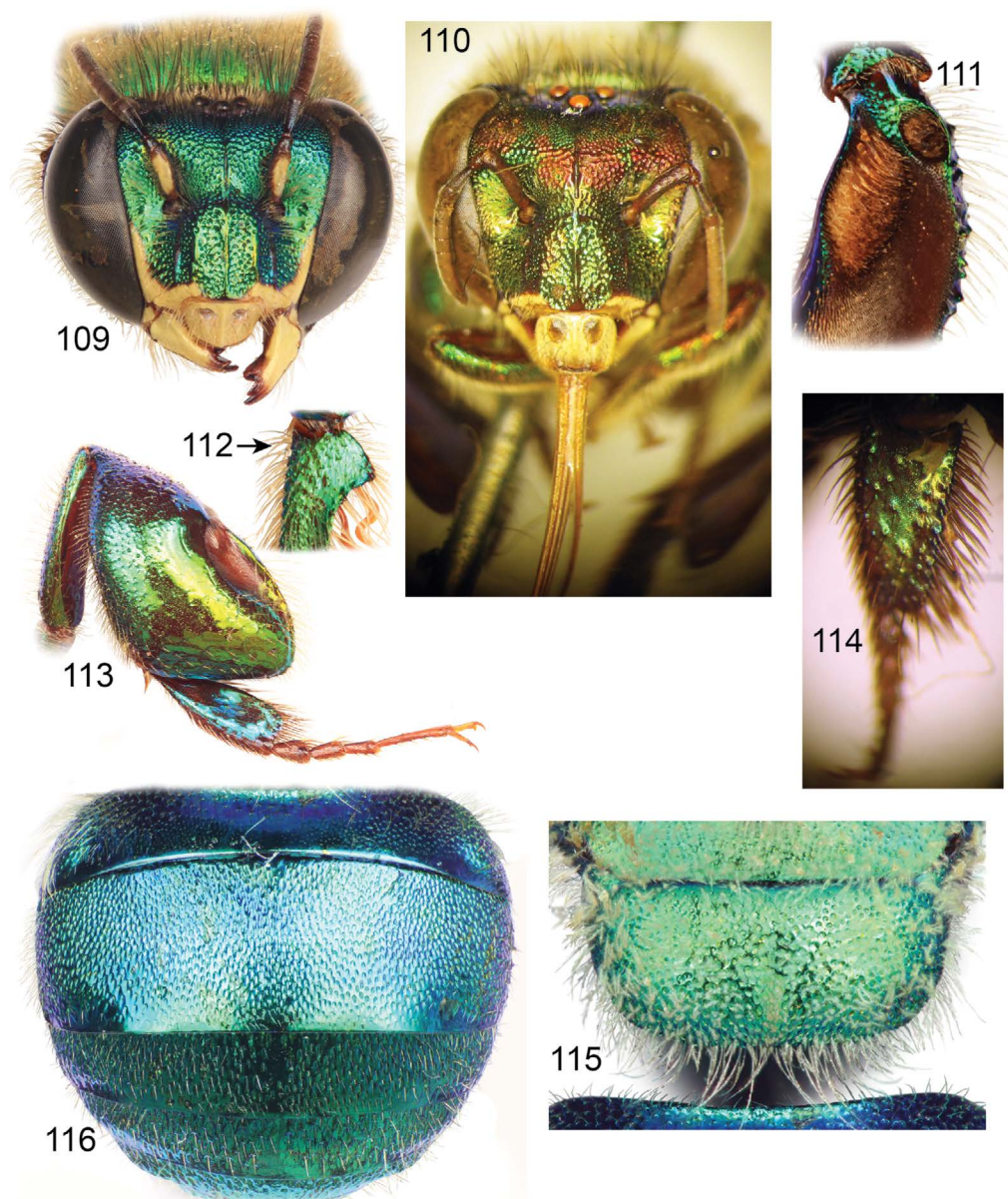
DESCRIPTION: ♂: **Structure.** Total body length 10.39 mm (10.00–10.89; n=5); labiomaxillary complex in repose reaching second metasomal sternum (Fig. 106). Head length 2.44 mm (2.37–2.52; n=5), width 4.49 mm (4.37–4.65; n=5); upper interorbital distance 2.06 mm (2.00–2.15; n=5); lower interorbital distance 2.00 mm (1.93–2.07; n=5); upper clypeal width 1.10 mm (1.00–1.19; n=5); lower clypeal width 1.81 mm (1.74–1.87; n=5); clypeal protuberance 0.54 mm (0.44–0.63; n=5); clypeal ridges, labral ridges, and



Figures 105–106. *Euglossa (Euglossella) granti* Cheesman, male. 105. Dorsal habitus. 106. Lateral habitus.



Figures 107–108. *Euglossa (Euglossella) granti* Cheesman, female holotype. 107. Dorsal habitus. 108. Lateral habitus.



Figures 109–116. *Euglossa (Euglossella) granti* Cheesman. 109. Facial aspect of male. 110. Facial aspect of female holotype. 111. Mesotibial tufts of male. 112. Proximal section of male mesobasitarsus. 113. Outer view of male hind leg. 114. Outer view of metabasitarsus of female holotype. 115. Mesoscutellum of male. 116. Dorsal view of male metasomal terga.

labral windows as described for *E. viridis*, except paramedial ridges quasi-parallel to medial ridge, forming a rectangular clypeal disc; labrum wider than long, length 0.89 mm (0.81–0.96; n=5), width 1.04 mm (1.00–1.11; n=5) (Fig. 109); intercellular distance 0.30 mm (0.30–0.31; n=5); ocellocular distance 0.62 mm (0.59–0.67; n=5); first flagellar article longer [0.54 mm (0.50–0.59; n=5)] than second and third flagellar articles combined [0.39 mm (0.37–0.41; n=5)]; length of malar area 0.13 mm (0.11–0.15; n=5).

Mandible tridentate. Pronotal dorsolateral angle projected posterolaterally as a truncate lamella; intertegular distance 3.47 mm (3.33–3.59; n=5); mesoscutal length 2.66 mm (2.52–2.81; n=5); mesoscutellar length 1.20 mm (1.17–1.24; n=5); posterior margin of mesoscutellum truncate along most of its length (laterally rounded) (Fig. 115); mesotibial length 2.22 mm (2.15–2.30; n=5); mesobasitarsal length 2.22 mm (2.15–2.30; n=5), width 0.69 mm (0.66–0.74; n=5), posterior keel projected in a right to slightly acute angle with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing slightly convex (Fig. 112); metatibia triangular (scalene triangular), maximum thickness 1.29 mm (1.25–1.44; n=5); metatibial anterior margin length 3.46 mm (3.26–3.59; n=5), ventral margin length 2.44 mm (2.22–2.59; n=5), postero-dorsal margin length 4.36 mm (4.22–4.52; n=5); metatibial organ slit as described for *E. viridis*, dorsal section length 0.51 mm (0.48–0.52; n=5); metabasitarsal length 2.08 mm (2.00–2.19; n=5), mid-width 0.76 mm (0.74–0.81; n=5); metabasitarsal ventral margin truncate. Forewing length 8.61 mm (8.30–9.04; n=5); jugal comb with 13–14 (n=5) blades; hind wing with 20–24 (n=5) hamuli. Maximum metasomal width 4.55 mm (4.42–4.78; n=5); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. As described for males of *E. cyanura* from Panama to Chiapas, Mexico (Figs. 105–106, 109, 113, 115–116).

Sculpturing. As described for males of *E. cyanura* (Figs. 105–106, 109, 115–116).

Vestiture. Head as described for *E. viridis*, except setae rather yellow-fulvous (Fig. 109). Metasoma densely covered with yellow-fulvous setae over mesepisternum, mesoscutum, and mesoscutellum, those on mesoscutum and mesoscutellum longer than in other species (Figs. 105–106, 115); features of mesotibia as described for *E. viridis* (Figs. 111, 152). Metasoma as described for *E. viridis*, except setae color yellow-fulvous (Fig. 116).

Terminalia. Hidden sterna and genital capsule as described for *E. viridis* (Fig. 162).

♀: **Structure.** The female holotype was examined but no measurements were taken as it could only be studied on location and no means of taking metrics was available.

Coloration. As described for females of *E. cyanura* (Figs. 107–108, 110, 114).

Sculpturing. Overall sculpturing as for males of *E. viridis* (and by extension for those females described as *E. viridis/azurea*).

Vestiture. Head, mesosoma, and metasoma as described for males of same species (Figs. 107–108, 110). Mesoscutellar tuft and corbicula as in females of *E. viridis/azurea* (Figs. 107–108).

HOLOTYPE: ♀, **Colombia:** “TYPE [round label with red margin] // B.M. TYPE; HYM.; 17B. 945. [last line handwritten] // *Euglossa; granti*; Cheesman; Det. L.E. Cheesman. [name and author handwritten] // Gorgona I.; 2.59.N. 78.20.W; July 1924.; L.E. Cheesman. // St. George Exp.; B.M. 1925. 573 [turned upside down]” (NHML).

ADDITIONAL MATERIAL EXAMINED (12♂♂): Ecuador: 6♂♂, “CH Dodson 10-18-72; Rio Palenque Station; Los Rios, Ecuador; on *Catasetum* sp [mixed handwritten] // *Euglossa; (Euglossella); granti* Cheesman ♂; Det. I. Hinojosa-Díaz 2012” (FSCA, one in SEMC). 1♂, “RIO PALENQUE, ECUADOR; LOS RIOS PROV. C. DODSON; 197[?] // *Euglossa; (Euglossella); granti* Cheesman ♂; Det. I. Hinojosa-Díaz 2012” (FSCA). 2♂♂, “ECUADOR: Los Rios; Rio Palenque; Station // 18 X 1972; C.H. Dodson; *Catasetum* sp. // *Euglossa; (Euglossella); granti* Cheesman ♂; Det. I. Hinojosa-Díaz 2012” (FSCA, one in SEMC). 1♂, “ECUADOR: Pichincha.; Santo Domingo; 28 VII 1967; R.L. Dressler 735 // *Euglossa; granti* Cheesman; det. R.L. Dressler, 1969” (FSCA). 1♂, “ECUADOR: Pichincha.; Santo Domingo // C.H. Dodson 258; VIII 1967 // *Euglossa; (Euglossella); granti*

Cheesman ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1 ♂, "ECUADOR: El Oro; near Piñas, 930 m; III-6 1980; N.H. Williams // 2-phenylethyl; acetate // *Euglossa*; (*Euglossella*); *granti* Cheesman ♂; Det. I. Hinojosa-Díaz 2012" (FSCA).

COMMENTS: This species is morphologically closer to *E. cyanura* than to any other species in the *viridis* group. As mentioned above, both species share the larger punctures on the metasomal terga in males; however, the chief feature that characterizes *E. granti* is the mesosomal vestiture in both males and females, whereby the mesoscutum and mesoscutellum have a dense, furry-like cover of distinctively-plumose setae not found in any other species in the group (Figs. 105–108). This vestiture involves a clear difference in setal structure when compared with other species and particularly with *E. cyanura*; as such, despite few other structural distinctions, the species is here considered discrete and valid. Enigmatically, the species was listed as endemic to the Amazon Basin by Nemésio & Silveira (2007), but in fact it is known only from the Pacific lowlands of Colombia and Ecuador (Fig. 170).

mandibularis species group

DIAGNOSIS: Species in the *mandibularis* group can be recognized from other species of *Euglossella* (i.e., the *viridis* and *decorata* groups) by the combination of the following features: Pronotal dorsolateral angle orthogonal to acute, slightly projected; body coloration strongly metallic with bright, blue, bronzy-red, and mixture and variations of these; integumental sculpturing varying among species, metasomal terga with either strong or shallow punctation; lower interorbital distance noticeably wider (at least 1.10 times) than upper interorbital distance; malar area noticeably longer than diameter of mid-flagellar articles; mesoscutellum with a large central concavity, creating two mid-lateral cusps, especially noticeable in males, but also in females where it is evident by depressed contour of mesoscutellar tuft. Species in the group can be found in the western section of the Amazon Basin in Peru and Brazil, as well as in the Parana and Atlantic Forests in southern Paraguay, northeastern Argentina, and southeastern Brazil.

INCLUDED SPECIES: *Euglossa* (*Euglossella*) *mandibularis* Friese, *E. (E.) bigibba* Dressler, and *E. (E.) perfulgens* Moure (Table 1).

Key to species of the *mandibularis* species group

NOTE: Males remain unknown for *E. perfulgens*, while females are as of yet undiscovered for *E. bigibba*.

- 1. Male: antenna with 11 flagellar articles; metasoma with seven exposed terga; metatibia inflated bearing organ slit (setose-lined opening) 2
- Female: antenna with 10 flagellar articles; metasoma with six exposed terga; metatibia with well-developed and expanded corbicula 3
- 2(1). Malar area twice as long as diameter of mid-flagellar articles (Fig. 135); punctures on second metasomal tergum large (maximum length nearly 0.50x mid-ocellus diameter), longitudinally elongate, similar to punctures on third to seventh terga; malar area and mandibles predominantly ivory colored (Figs. 134–135); large green bees with some blue highlights and moderate golden-bronzy iridescence [western areas of Amazon Basin (Peru and Brazil)] *E. (E.) bigibba* Dressler

- Malar area roughly 1.25 times as long as diameter of mid-flagellar articles (Fig. 121); punctures on second metasomal tergum small (puncture diameter about 0.20x mid-ocellus diameter), round, similar to punctures on third and anterior half of fourth terga (although these progressively larger), longitudinally elongate punctures appearing on posterolateral areas of third tergum and remaining terga (Figs. 117–118); malar area with variable amounts of ivory coloration but with noticeable brown coloration, mandible predominantly brown; large blue-purple bees with some green coloration on face (Figs. 117–118) [southeastern Brazil, northeastern Argentina, and southern Paraguay] *E. (E.) mandibularis* Friese
- 3(1). Malar area twice as long as diameter of mid-flagellar articles (Fig. 141); mesoscutellar tuft large, slightly wider than long, composed of yellow-fulvous setae; malar area and mandibles predominantly ivory colored (Figs. 140–141); large bees with underlying integumental coloration green, strongly introgressed by red-coppery color in most parts of body and becoming dominant on metasoma (darker specimens, such as the holotype, have a rather red-bluish metasoma) (Figs. 139–140) [western areas of Amazon Basin] *E. (E.) perfulgens* Moure
- Malar area roughly 1.25 times as long as diameter of mid-flagellar articles (Fig. 122); mesoscutellar tuft noticeably longer than wide, composed of black setae (Fig. 119); malar area with brown basal coloration and metallic highlights concolorous with other areas of face (Fig. 122); mandible predominantly brown; large blue-purple bees with some green coloration on face (Figs. 119–120, 122) [southwestern Brazil, northwestern Argentina, and southern Paraguay] *E. (E.) mandibularis* Friese

Euglossa (Euglossella) mandibularis Friese
(Figs. 117–132, 153, 166, 170)

Euglossa mandibularis Friese, 1899: 137 [♂♀]. Lectotype ♀ (ZMB, *visum*).

Euglossa mandibularis var. *bernardina* Cockerell, 1917: 144 [♂]. Holotype ♂ (USNM, *visum*). Synonymy by Moure (1967b).

Euglossa aenescens Friese, 1925: 28 [♂♀]. Lectotype ♂ (ZMB, *visum*). Synonymy by Moure (1967b).

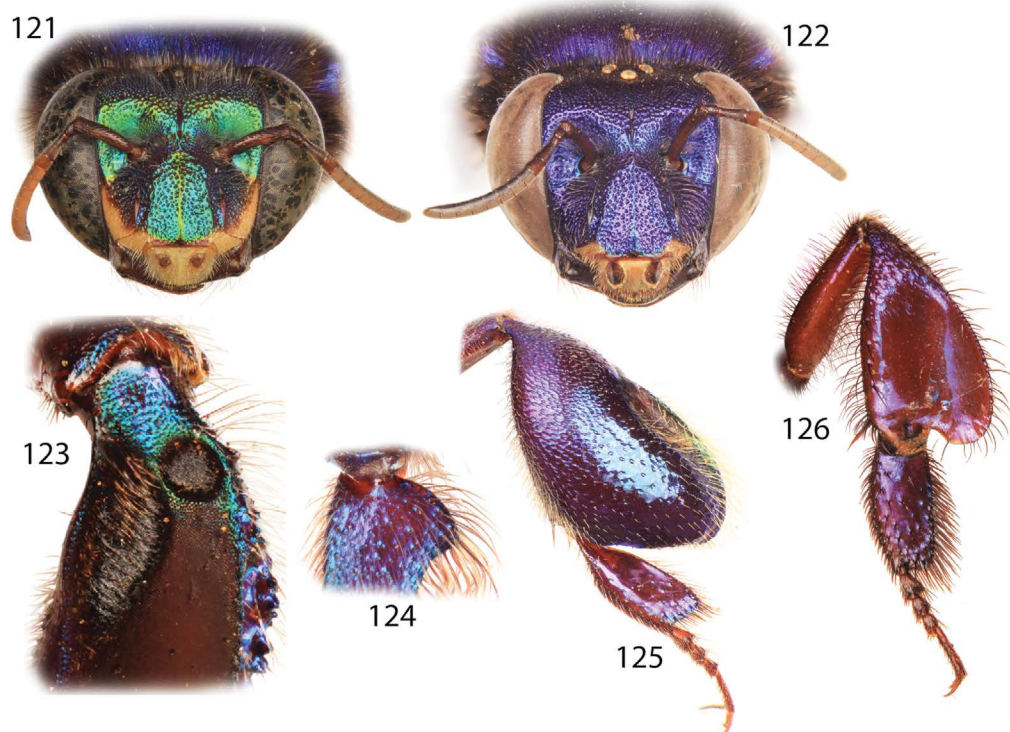
DIAGNOSIS: Labiomaxillary complex in repose reaching fifth to sixth metasomal sternum in male (Fig. 118), third metasomal sternum in female (Fig. 120); lower inter-orbital distance noticeably wider than upper, by about 1.10 times in male (Fig. 121), and 1.20 times in female (Fig. 122); malar area long (over 0.30 mm in either sex, 1.25 times as long as diameter of mid-flagellar articles) (Figs. 121–122); pronotal dorso-lateral angle orthogonal to acute, slightly projected; male mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and moderately wide (mid-width slightly exceeding width of contiguous section of velvety area), posterior tuft circular (Figs. 123, 153); female mesoscutellar tuft oblong, composed of dense, dark setae, occupying two thirds of mesoscutellum length (Fig. 119); male mesobasitarsus with posterior keel projected in an obtuse angle (Fig. 124); female metabasitarsus with anterior margin noticeably convex and posterior margin appearing straight (Fig. 126); second metasomal sternum of male with two simple meso-lateral tufts; metasoma slightly (but consistently) wider than head (about 1.06 times or more) (Figs. 117, 119); head evenly purple-bluish in female (Fig. 122), frontal areas below frontal fringe in male green (remainder of male head purple-bluish) (*vide* Com-



Figures 117–118. *Euglossa (Euglossella) mandibularis* Friese, male. **117.** Dorsal habitus. **118.** Lateral habitus.



Figures 119–120. *Euglossa (Euglossella) mandibularis* Friese, female. **119.** Dorsal habitus. **120.** Lateral habitus.



Figures 121–126. *Euglossa (Euglossella) mandibularis* Friese. **121.** Facial aspect of male. **122.** Facial aspect of female. **123.** Mesotibial tufts of male. **124.** Proximal section of male mesobasitarsus. **125.** Outer view of male metatibia and metatarsus. **126.** Outer view of female hind leg.

ments, *infra*) (Fig. 121); male with paraocular marks triangular, lower width occupying entire length of lower lateral part of clypeus (Figs. 118, 121); scape of male with ivory spot limited to distal half (or less) on lateral surface (Fig. 121), absent in female (Fig. 122); mesosoma and metasomal terga purple-bluish (Figs. 117–120); mesoscutellum and central area of mesepisternum rather sparsely punctate (punctures separated by two puncture diameters) (Figs. 117, 119); metasomal terga with round deep punctures separated by about one third of a puncture diameter (slightly denser in female), doubling in size towards last tergum (Figs. 117–120); mesosomal vestiture dominated by a mix of soft, fuscous and brown, sturdy setae, the former dominant in male (Figs. 117–118), the latter more so in female (Figs. 119–120); eighth metasomal sternum posterior section conical in dorsal or ventral views, lateral width noticeably narrower than anterior section of sternum (as in all previous species) (Figs. 128–129); gonocoxite dorsal process longer than wide (slender) (Fig. 130); gonostylar lateral section with well developed secondary lobe (convexity of posterior margin of basal sector), whole basal sector larger than in all previous species and with denser setae (Figs. 132–166).

DESCRIPTION: ♂: **Structure.** Total body length 13.96 mm (12.52–15.19; n=5); labio-maxillary complex in repose reaching fifth sternum (in some specimens reaching anterior section of sixth metasomal sternum) (Fig. 118). Head length 2.99 mm (2.81–3.22; n=5), width 5.49 mm (5.22–5.70; n=5); upper interorbital distance 2.44 mm (2.33–2.59; n=5); lower interorbital distance 2.69 mm (2.59–2.81; n=5); upper clypeal width 1.32 mm (1.19–1.37; n=5); lower clypeal width 2.40 mm (2.30–2.52; n=5); clypeal protuber-

ance 0.86 mm (0.78–0.89; n=5); medial clypeal ridge sharp, paramedial clypeal ridges rather blunt (compared to *E. viridis*), orientation of paramedial ridges as in *E. viridis*; labrum wider than long, length 1.11 mm (1.04–1.19; n=5), width 1.35 mm (1.26–1.44; n=5) (Fig. 121); medial labral ridge sharp; paramedial labral ridges slightly weaker than medial ridge, oblique, present in proximal two-thirds of labrum; labral windows ovoid, occupying proximal half of labrum; interocellar distance 0.37 mm (0.35–0.39; n=5); ocellocular distance 0.70 mm (0.66–0.74; n=5); first flagellar article as long [0.59 mm (0.56–0.63; n=5)] as second and third flagellar articles combined [0.60 mm (0.58–0.63; n=5)]; length of malar area 0.32 mm (0.30–0.37; n=5). Mandible tridentate. Pronotal dorsolateral angle orthogonal to acute, slightly projected; intertegular distance 4.27 mm (4.07–4.59; n=5); mesoscutal length 3.48 mm (3.26–3.63; n=5); mesoscutellar length 1.50 mm (1.44–1.56; n=5); posterior margin of mesoscutellum rather convex, convexity less pronounced mesially, mesoscutellar disc with a central concavity, creating two mid-lateral cusps (Fig. 117); mesotibial length 3.02 mm (2.74–3.19; n=5); mesobasitarsal length 2.81 mm (2.59–3.04; n=5), width 1.00 mm (0.93–1.04; n=5), posterior keel projected in an obtuse angle with proximal margin (between mesotibia-mesobasitarsus joint and apex of keel) appearing noticeably convex (Fig. 124); metatibia triangular (scalene triangular) (Fig. 125), maximum thickness 1.88 mm (1.70–2.00; n=5); metatibial anterior margin length 4.77 mm (4.44–5.11; n=5), ventral margin length 3.49 mm (3.26–3.67; n=5), postero-dorsal margin length 6.05 mm (5.81–6.37; n=5); metatibial organ slit as described for *E. viridis*, dorsal section length 0.73 mm (0.70–0.74; n=5); metabasitarsal length 2.84 mm (2.67–3.11; n=5), mid-width 1.14 mm (1.11–1.19; n=5); metabasitarsal ventral margin truncate. Forewing length 11.95 mm (11.48–12.52; n=5); jugal comb with 12–18 (n=5) blades; hind wing with 21–26 (n=5) hamuli. Maximum metasomal width 5.80 mm (5.33–6.22; n=5); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. Purple bluish coloration throughout (Figs. 117–118). Head with distinctive green facial areas below frontal fringe, otherwise blue with golden-bronzy hue throughout; paraocular ivory marks triangular, lower width occupying entire length of lower lateral part of clypeus, and noticeably brown on margins (Figs. 118, 121); malar area with yellow/ivory coloration of different degrees, mostly occupying anterior half (some specimens with no yellow coloration); mandible with yellow spot basally, otherwise completely brown; scape with yellow spot limited to distal half of lateral surface, smaller in some specimens (Fig. 121). Mesosoma dark blue, glossy, with purple highlights more noticeable on mesoscutellum (Figs. 117–118); legs concolorous with remainder of mesosoma. Metasomal terga dark blue with strong purple iridescence, more noticeable on posterior half of terga, all with glossy shine, some specimens with faint green iridescence on margins of terga (Figs. 117–118); metasomal sterna dark blue with purple iridescence.

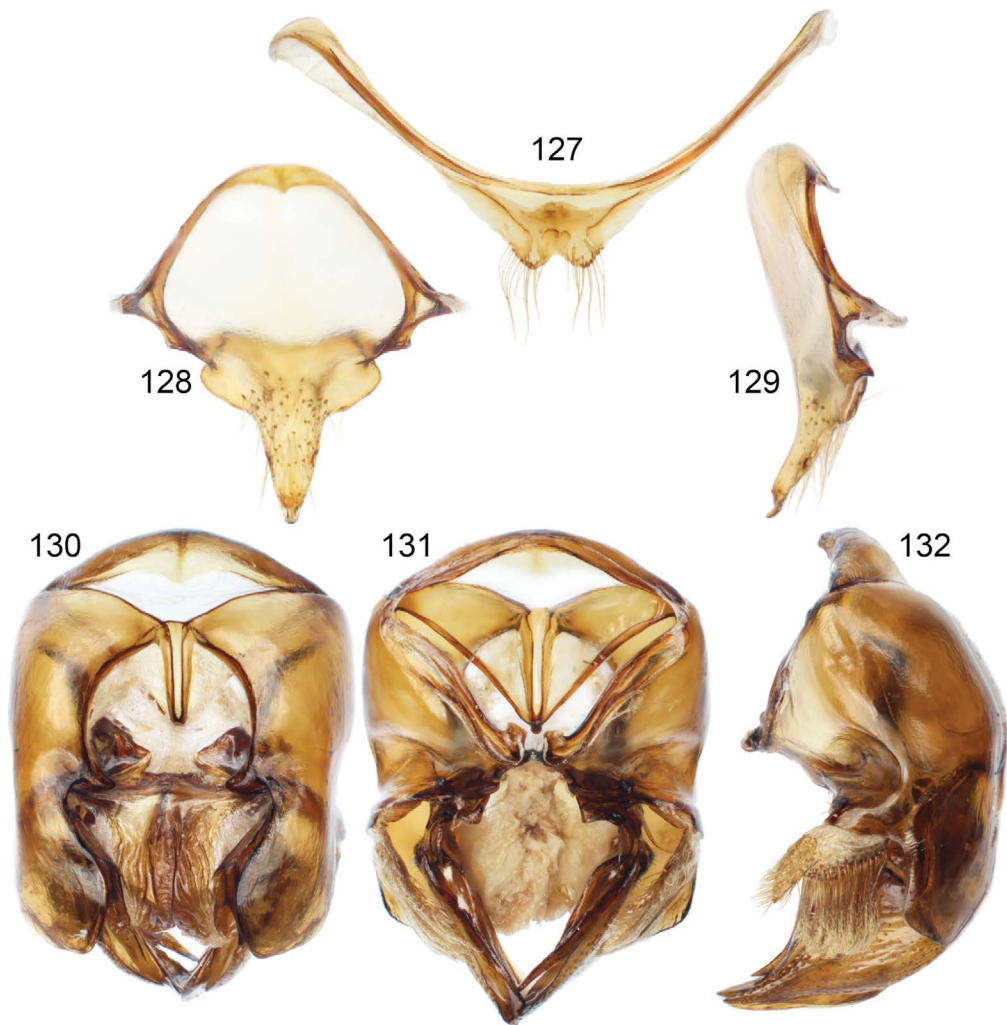
Sculpturing. Head as described for *E. viridis*, except punctures on margin of antennal depressions slightly larger and sparser (Fig. 121). Mesoscutum sparsely punctate (punctures separated by one to two puncture diameters), punctures of two sizes, smaller punctures about one-third diameter of larger and more common punctures (Fig. 117); mesoscutellum with a similar mixture of punctures as mesoscutum, but punctures larger and denser, separated by about one puncture diameter (Fig. 117); mesepisternal lateral areas centrally with punctures separated by two puncture diameters. Metasomal terga as follows: first to second terga with punctures as larger punctures on mesoscutum, separated by about one-third puncture diameter, remaining terga with similar pattern but punctures increasing in size towards posterior terga

so that they double in size on fourth to seventh terga (Fig. 117). Sterna with punctures as those on fourth tergum, sterna with wide smooth mesial areas (narrower towards posterior segments).

Vestiture. Head with fuscous setae throughout (arranged as in *E. viridis* although slightly longer), frontal fringe and vertex with a mix of fuscous setae and brown, long, erect and simple setae; some of erect simple setae intermixed on lower facial area, especially on mandibles (Fig. 121). Mesoscutum and mesoscutellum with a similar composition as frontal fringe and vertex (moderately dense and brown, erect setae slightly dominant), setal length as on vertex, anteriorly on mesoscutum and progressively becoming shorter posteriorly, getting longer and more curved on mesoscutellum margin (variation in mesoscutum and mesoscutellum setal coloration exists and is correlated to variation in integumental coloration, *i.e.*, darker integument correlates with darker setae). Ponotal lobe with brown, sturdier, long setae; mesepisternum with dense, fuscous, plumose, long setae, those on upper section (as well as hypoepimeral area) turning darker (almost same color as sturdier setae on mesoscutum) (Figs. 117–118). Legs as follows: Coxae and trochanters with fuscous, plumose, long setae; profemur and protibia with brown, simple, erect setae, long on proximal posterior margin of profemur, probasitarsus with fulvous-golden chemical-collecting tufts; mesotibia with brown setae on velvety area and mesotibial tufts; anterior mesotibial tuft rhomboid, posterior mesotibial tuft round, anterior one with longer setae on antero-proximal section, some of these setae continuing on a fringe outside of tuft cavity; dimensions of anterior tuft and contiguous velvety area as described for *E. viridis*, although not as wide (Figs. 123, 153); mesobasitarsus with fuscous setae outside, fulvous-amber, sturdy setae inside; metatibial slit with brown setae, inner surface with brown, simple, short setae, outer surface with fulvous setae sparse on central areas, dense on anterior margin where setae also longer, postero-dorsal margin of metatibia with fulvous, long setae forming a fringe on posterior half; metabasitarsus with very sparse, brown, simple, short setae on outer surface, inner surface as on mesobasitarsus (Fig. 125). Metasoma as follows: first tergum dorsally with fuscous, simple, semi-erect, long setae; second to third tergum dorsally with dense, sturdy, simple, erect setae oriented posteriorly, fourth to seventh terga with setae turning again fuscous and increasing in length posteriorly (Figs. 117–118); sterna with setae structurally as those on first tergum, but rather fulvous and longer mesially along both sides of smooth areas, especially long and curved inwards on second sternum (sternal tufts).

Terminalia. Seventh metasomal sternum as described for *E. viridis* (including variation, but incision much more distinct) (Fig. 127). Eighth metasomal sternum distinctive from all previously described species as follows: posterior section after basal lobes noticeably conical in dorsal or ventral views (opposite to elongate and cylindrical structure in previous species), otherwise lateral width as in *E. viridis*; setae on lobes only restricted to areas contiguous to conical apical projection, and not as dense as in previous species (Figs. 128–129). Dorsal process of gonocoxite longer than wide (by comparison to previous species in which it is as wide as long) (Fig. 130). Gonostylar lateral section similar to that of *E. viridis*, but basal sector enlarged and with noticeably denser setae (Figs. 132, 166). Spatha as described for *E. viridis* (130).

♀: **Structure.** Total body length 14.43 mm (13.56–16.30; n=5); labiomaxillary complex in repose reaching third metasomal sternum (Fig. 120). Head length 3.46 mm (3.37–3.59; n=5); head width 5.68 mm (5.56–5.87; n=5); upper interorbital distance 2.55 mm (2.50–2.61; n=5); lower interorbital distance 3.01 mm (2.96–3.11; n=5); upper clypeal width 1.39 mm (1.33–1.48; n=5); lower clypeal width 2.47 mm (2.41–2.59; n=5);



Figures 127–132. Male terminalia of *Euglossa* (*Euglossella*) *mandibularis* Friese. **127.** Seventh metasomal sternum, ventral aspect. **128.** Eighth metasomal sternum, ventral aspect. **129.** Eighth metasomal sternum, lateral aspect. **130.** Genitalic capsule, dorsal aspect. **131.** Genitalic capsule, ventral aspect. **132.** Genitalic capsule, lateral aspect.

clypeal protuberance 0.81 mm (0.74–0.89; n=5); clypeal ridges as described for male, labral ridges and labral windows as described for male (*vide supra*); labrum rectangular, wider than long, length 1.20 mm (1.15–1.24; n=5), width 1.46 mm (1.44–1.51; n=5); anterior margin of labrum arched outwards with subapical carina (Fig. 122); interocellar distance 0.41 mm (0.39–0.41; n=5); ocellocular distance 0.75 mm (0.70–0.78; n=5); first flagellar article as long [0.59 mm (0.56–0.63; n=5)] as second and third flagellar articles combined [0.60 mm (0.56–0.67; n=5)]; length of malar area 0.37 mm (0.32–0.41; n=5). Mandible tridentate. Pronotal dorsolateral angle as described for male; intertegular distance 4.39 mm (4.30–4.52; n=5); mesoscutal length 3.57 mm (3.41–3.67; n=5); mesoscutellar length 1.58 mm (1.56–1.63; n=5); posterior margin of mesoscutellum as described for male (Fig. 119); mesotibial length 2.80 mm (2.59–2.96; n=5); mesobasitarsal length 2.61 mm (2.44–2.74; n=5), maximum width 0.87 mm (0.81–0.89; n=5); metati-

bia triangular (right triangle) (Fig. 126); metatibial anterior margin length 4.01 mm (3.70–4.37; n=5); metatibial ventral margin length 2.47 mm (2.37–2.59; n=5); metatibial postero-dorsal margin length 4.69 mm (4.44–4.96; n=5); metabasitarsal length 2.58 mm (2.37–2.74; n=5), proximal margin width 1.21 mm (1.19–1.26; n=5). Forewing length 11.05 mm (10.59–11.48; n=5); hind wing with 21–28 (n=5) hamuli. Maximum metasomal width 6.01 mm (5.85–6.22; n=5).

Coloration. As described for male of same species (Figs. 119–120), except as follows: face mainly blue with green coloration in very narrow areas along antennal sockets, sulci, lower frons, medial clypeus ridge, and anterior margin of clypeus; apical margin of labrum dark brown, malar area purple (Fig. 122). Margins of mesoscutum, mesepisternum, propodeum, and angled areas of podites also with faint blue-green hue (especially on coxae). Metasoma with coppery hue throughout (Figs. 119–120).

Sculpturing. Largely matching male of same species, only punctures appearing denser on metasomal terga (Fig. 119).

Vestiture. For most part as described for male of same species, although setae darker, with brown, sturdy setae dominating areas where both kinds of setae are found, plumose setae darker than in most males (Figs. 119–120). Mesoscutellar tuft oblong, occupying two thirds of mesoscutellar length, and composed of black setae (Fig. 119); metatibial corbicula with a larger number of sturdy, hook-like setae as compared with previously described species, light setae on margins of metatibia absent (Fig. 126). Metasomal sterna with a similar arrangement of setae as just described; long setae on bordering central smooth areas of sterna (some of these setae noticeably erect and dark) (Figs. 119–120).

HOLOTYPE: ♀, **Brazil:** “S. Cruz; Brasil; coll. Speyer // *Euglossa* ♀; *mandibularis*; det. Friese 1898 [species name handwritten] // Type [brown colored label] // Coll.; Friese // Zool. Mus.; Berlin” (ZMB).

ADDITIONAL MATERIAL EXAMINED (18♂♂, 4♀♀): **Argentina [new records]:** 1♂, “ARG.- MISIONES; DOS DE MAYO; FOERSTER- 2.90 [handwritten] // *Euglossa*; *mandibularis*; Friese; Fritz 93 [handwritten]” (AMNH). 1♀, as previous except date “1.90” (AMNH). 1♀, “ARG.- CORRIENTES; ITUZAINGO; FRITZ- XII.81 // *Euglossa mandibularis*; Friese; det. R.L.Dressler, 1986” (AMNH). **Brazil:** 1♂, “Brasil; Passa Quatro; 1923; Zikán [all but country name handwritten on a previously printed label] // *Solanum* [handwritten] // *Euglossa*; *aenescens*; ♂ F. [Friese] [handwritten] // Type [brown colored label] // = *Euglossa*; *mandibularis* Friese; det. R.L. Dressler 1975 [last two digits of year handwritten] // Zool. Mus.; Berlin” (holotype of *E. aenescens* Friese) (ZMB). 1♂, “Brasil; Passa Quatro; 1923; Zikán [all but country name handwritten on a previously printed label] // *Solanum* [handwritten] // *Euglossa*; *aenescens*; ♂ F. [Friese] [handwritten] // *Euglossa*; *mandibularis* Friese; det. R.L. Dressler 1975 [last two digits of year handwritten] // Zool. Mus.; Berlin” (ZMB). 1♂, “Brasil; Passa Quatro; 1923; Zikán [all but country name handwritten on a previously printed label] // *Solanum* [handwritten] // *Euglossa*; *aenescens*; ♂ F. [Friese] [handwritten] // Am. Mus. Nat. Hist; Dept. Invert. Zool.; No. 28260 [number handwritten] // *Euglossa*; (*Euglossella*); *mandibularis* Friese ♂; Det. I. Hinojosa-Díaz 2012” (AMNH). 1♂, “Espirito-Santo; Brasil. // *Euglossa*; *mandibularis*; ♂ F. [Friese] [handwritten] // Am. Mus. Nat. Hist; Dept. Invert. Zool.; No. 26010 [number handwritten] // *Euglossa*; (*Euglossella*); *mandibularis* Friese ♂; Det. I. Hinojosa-Díaz 2012” (AMNH). 1♂, “Corupa; (Hansa Humbolt) S. Cath. Brazil; Feb. 1942 [date handwritten] // A.Maller.Coll.; Frank Johnson; Donor // *Euglossa*; (*Euglossella*); *mandibularis* Friese ♂; Det. I. Hinojosa-Díaz 2012” (AMNH). 1♂, “♂ // J.F. Zikán [vertical writing]; Itatiaia; Est. do. Rio; 21.-1.-1925; 1100 m. Km8 [date and kilometer handwritten] // *Eu-*

glossa; mandibularis Friese; J.F. Zikán determ. [species name handwritten] // *Euglossella; aenescens*; (Fr.) [handwritten on wrapped label]" (MZUSP). 1♂, "Est. Biol. Boracéia; Salesópolis, SP; W. Wilms. Col.; 3.3.1993 [date handwritten] // *Euglossa; mandibularis*; Friese, 1899; det. W. Wilms, 1994" (MZUSP). 1♀, as previous except date "15.2.1992" (MZUSP). 1♂, "R. Vermelho; SC-BR . [Brazil] III.57; A.Maller Leg // *E. (Euglossella); mandibularis* ♂ det. GAR Melo 2006 [species name and last digit of year handwritten]" (FSCA). 1♂, "BRAZIL: GB. Flor-; esta de Tijuca; 8 I 1966; R.L. Dressler 446 [month, day, last digit of year, and number handwritten] // 8 [round label] // *mandibularis* [handwritten] // *Euglossa; (Euglossella); mandibularis* Friese ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, "COLEÇÃO CAMPOS SEABRA // RIO VERMELHO; S. Catarina BRASIL; Fevereiro 1957; A. Maller [date handwritten] // R. Vermelho; 257 [handwritten on folded label] // *Euglossa; (Euglossella); mandibularis* Friese ♂; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♂, as previous except date "Janeiro 1957" and number in folded label "157" (FSCA). 1♂, as previous except missing folded label (FSCA). 1♂, as previous except two extra labels "8 [round label] // *Euglossa; mandibularis* Friese; det. R.L.Dressler 1968 [last digit of year handwritten]" (FSCA). 1♀, "Alto da Boa Vista; Tijuca(D.F.); II-3 51 [handwritten, illegible]; C.A.C. Seabra col. // *Eu.; mandibularis*; Det.J.S.Moure 19 [species name handwritten, last two digits of year missing]" (FSCA). 1♀, "Brasil-Minas Gerais; Poços de Caldas; Morro do Ferro; January 28, '64; J. Becker & O. Roppo cols // *Euglossa; (Euglossella); mandibularis* Friese ♀; Det. I. Hinojosa-Díaz 2012" (FSCA). 1♀, "Nova Teutonia; Santa Catarina; Brasil 18-II-1954; Fritz Plauman [month and day handwritten] // *Euglossa; mandibularis*; Friese; Det.J.S. Moure 1956 [species name and two last digits of year handwritten]" (SEMC). 1♂, "Mafrá; S.Cath.Brazil; March 1940 [date handwritten] // A.Maller.Coll.; Frank Johnson; Donor // *aenescens* [handwritten] // *Euglossa; mandibu; laris* Friese; Det.J.S. Moure 1956 [species name and two last digits of year handwritten]" (SEMC). 1♂, "BRASIL-Sao Paulo, Sales-; opolis, Boracea, 850 mts. 13 Nov. 1950 (Rabello) // *Euglossa* ♂; *mandibularis*; Fr.; J.S.Moure 1963 [species name and two last digits of year handwritten]" (SEMC). **Paraguay:** 1♂, "S Bernardino; Paraguay // K Fiebrig; Collector // 4 obt; Gei Ruhlein; Vetten, moeyw; sinter Beatt [interpretation of handwritten folded label] // Type No.; 23143; U.S.N.M. [red label] // *Euglossa; mandibularis*; var. *bernardina*; Ckll. TYPE. [handwritten]" (holotype of *E. mandibularis* var. *bernardina* Cockerell) (USNM). 1♂, "PARAGUAY Itapua; Cantera ? [Puerto Cantera?]; November 1956 // *Euglossa; (Euglossella); mandibularis* Friese ♂; Det. I. Hinojosa-Díaz 2012" (SEMC).

COMMENTS: Besides those features mentioned above to recognize species in the *mandibularis* group, the three species included have an average body length in both sexes that is at least two millimeters above the longest bee in the *viridis* group, and the labiomaxillary complex in these reaches or surpasses the third metasomal sternum, versus only reaching to the second sternum in the *viridis* group.

Coloration in *E. mandibularis*, as currently understood, is quite consistent within the bright purple bluish variety, the only noteworthy exception being the male from, "Paraguay, Itapua, Cantera" which atypically has a light green face, light purple mesosoma, and rather light brown metasoma with a faint purple hue. In addition, the same specimen has light brown setae in those areas where other specimens have dark brown vestiture, but is otherwise identical in all structural traits to the remaining males of *E. mandibularis*. In a manner, the coloration of this specimen is similar to what is often seen in species of the *decorata* group (Hinojosa-Díaz & Engel, 2011a). It is unclear whether this atypical coloration is merely due to preservation. Aside from this one anomaly, variations in color are subtle.

Morphology of the genital capsule and hidden sterna is distinctive when comparing *E. mandibularis* (and *E. bigibba*, the only other species in the group with males known) to those species of the *viridis* group. In both ventral and dorsal views, the conical shape of the posterior section of the eighth metasomal sternum in *E. mandibularis* (Fig. 128) is distinguishable from the rather elongate, cylindrical shape in both the *viridis* (Fig. 11) and *decorata* groups (Hinojosa-Díaz & Engel, 2011a). The distribution of setae on this same structure and the adjacent lobes also differ. The dorsal process of the gonocoxite is narrower (Fig. 130), and the gonostylus has a rather elongate basal sector with noticeably denser setae (Fig. 166), by comparison to the state observed in the *viridis* (Figs. 13, 155–162, 164–165) and *decorata* groups (Hinojosa-Díaz & Engel, 2011a). Males of *E. mandibularis* have been shown to be dimorphic regarding the presence or absence of a setose mesoscutellar tuft, and when present is similar to tuft of females (Peruquetti, 2002; Nemésio, 2009).

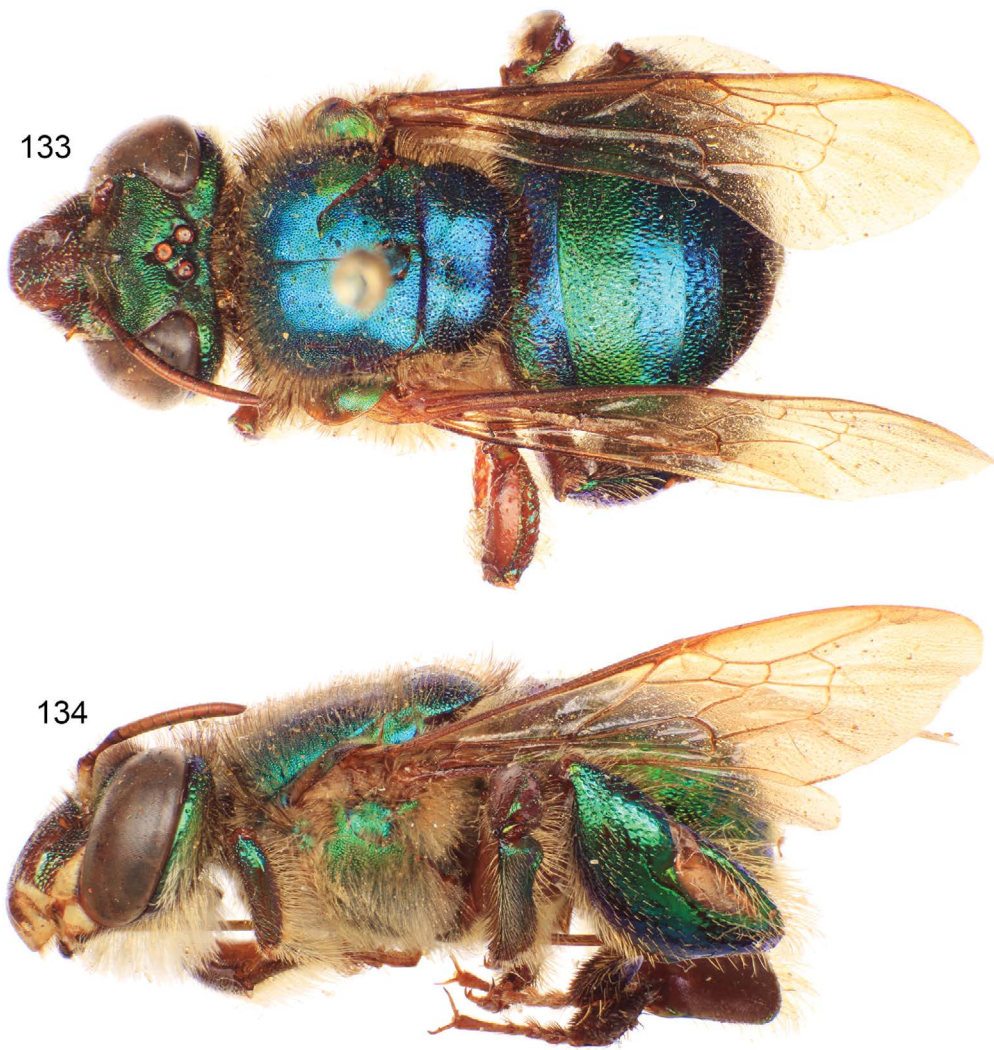
Interestingly, superficial similarities in color and distribution led Nemésio (2009) to suspect the possibility of *E. mandibularis* being conspecific with *E. (Glossura) iopoecila* Dressler. This is assuredly not the case as the latter species belongs clearly to a different subgenus and shares little in structural traits with *E. mandibularis*.

Euglossa mandibularis has previously been recorded from southern Paraguay and the southern and southeastern regions of Brazil (Moure, 1967b; Moure *et al.*, 2007; Nemésio, 2009). Here we expand the distribution to include areas in northern Argentina (Corrientes and Misiones Provinces) (Fig. 170).

Euglossa (Euglossella) bigibba Dressler
(Figs. 133–138, 154, 163, 167–169, 170)

Euglossa (Euglossella) bigibba Dressler 1982b: 129 [♂]. Holotype ♂ (HNHM, *visum*).

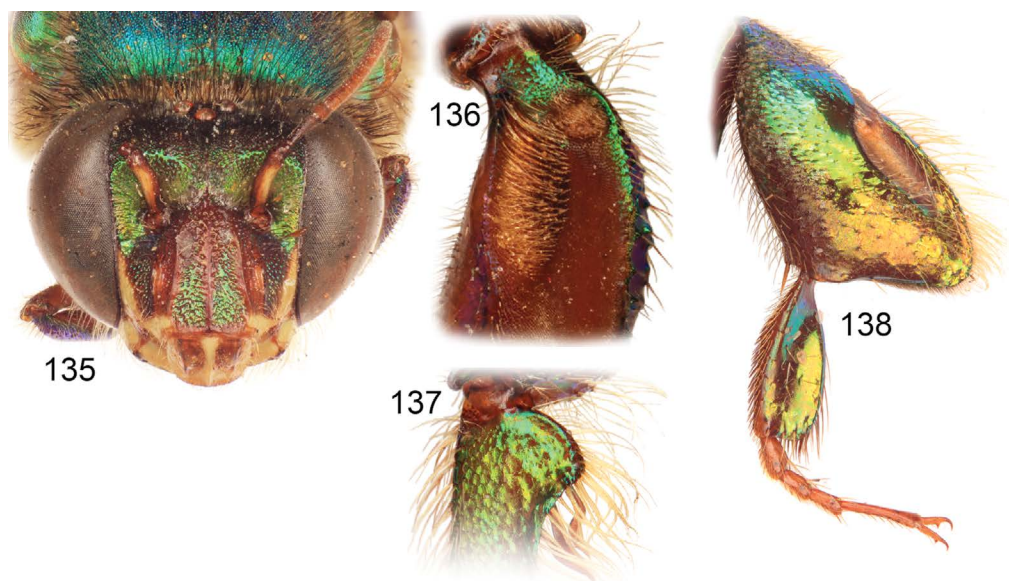
DIAGNOSIS: Labiomaxillary complex in repose reaching tip of metasoma; lower interorbital distance about 1.20 times as wide as upper interorbital distance (Fig. 135); malar area long (over 0.45 mm, twice as long as diameter of mid-flagellar articles) (Figs. 135); pronotal dorsolateral angle acute; mesotibial tufts as follows: anterior tuft rhomboid, long (maximum length exceeding mid-width of velvety area) and moderately wide (mid-width slightly exceeding width of contiguous section of velvety area), posterior tuft oval (Figs. 136, 154); mesobasitarsus with posterior keel projected in an obtuse angle (Fig. 137); second metasomal sternum with two, simple meso-lateral tufts; metasoma noticeably wider than head (by about 1.15 times) (Fig. 133); head mainly green (Fig. 135); paraocular marks trapezoidal, lower width about two thirds of length of lower lateral part of clypeus (Figs. 134–135); scape with yellow-ivory spot covering almost entire outer-lateral surface (Fig. 135); mesosoma green with noticeable blue-green iridescence dorsally (Figs. 133–134); metasomal terga green with noticeable blue-green iridescence (Fig. 133); mesoscutellum rather sparse (punctures separated by two puncture diameters) (Fig. 133); central area of mesepisternum moderately-densely punctate (punctures separated by one to one and a half puncture diameters); metasomal terga with dense to moderately-dense, big punctures (about half size of mid-ocellus) (Figs. 133–134); mesosomal vestiture dominated by a mix of soft, fulvous and reddish-brown, sturdy setae (Figs. 133–134); eighth metasomal sternum posterior section conical in dorsal or ventral views, lateral width equivalent to width of lateral section of sternum (this is the only species in *Euglossella* with this condition) (Figs. 168–169); gonocoxite dorsal process longer than wide (slender) (Fig. 163); gonostylar



Figures 133–134. *Euglossa (Euglossella) bigibba* Dressler, male holotype. 133. Dorsal habitus. 134. Lateral habitus.

lateral section with well-developed “secondary” lobe (convexity of posterior margin of basal sector), large, and with tightly dense and long setae (Fig. 167).

DESCRIPTION: ♂: **Structure.** Total body length 13.96 mm (13.70–14.22; n=2); labio-maxillary complex in repose reaching metasomal apex (Fig. 134). Head length 2.96 mm (2.81–3.11; n=2), width 5.19 mm (5.12–5.26; n=2); upper interorbital distance 2.23 mm (2.22–2.24; n=2); lower interorbital distance 2.59 mm (n=2); upper clypeal width 1.39 mm (1.37–1.41; n=2); lower clypeal width 2.19 mm (2.15–2.22; n=2); clypeal protuberance 1.11 mm (n=2); medial clypeal ridge sharp, paramedial clypeal ridges as sharp or slightly sharper than medial, paramedial ridges oblique (clypeal disk trapezoidal); labrum wider than long, length 1.19 mm (n=2), width 1.33 mm (n=2) (Fig. 135); labral ridges sharp, paramedial ones oblique, present along entire labral length; labral windows ovoid, occupying proximal half of labrum (Fig. 135); interocellar distance 0.34



Figures 135–138. *Euglossa (Euglossella) bigibba* Dressler, male. **135.** Facial aspect of holotype. **136.** Mesotibial tufts. **137.** Proximal section of mesobasitarsus. **138.** Outer view of metatibia and metatarsus.

mm (0.30–0.37; n=2); ocellocular distance 0.58 mm (0.57–0.59; n=2); first flagellar article longer [0.62 mm (0.60–0.64; n=2)] than second and third flagellar articles combined [0.54 mm (0.52–0.56; n=4)]; length of malar area 0.48 mm (0.47–0.48; n=2). Mandible tridentate. Pronotal dorsolateral angle acute; intertegular distance 4.09 mm (3.96–4.22; n=2); mesoscutal length 3.37 mm (3.33–3.41; n=2); mesoscutellar length 1.55 mm (1.52–1.57; n=2); posterior margin of mesoscutellum convex, mesially rather truncate or very slightly concave, mesoscutellar disc with a central concavity, creating two mid-lateral cusps (Fig. 133); mesotibial length 2.74 mm (n=2); mesobasitarsal length 2.52 mm (n=2), width 0.89 mm (n=2), posterior keel projected in an obtuse angle with proximal margin (between tibia-basitarsus joint and apex of keel) noticeably convex (Fig. 137); metatibia triangular (scalene triangular) (Fig. 138), maximum thickness 1.21 mm (1.19–1.22; n=2); metatibial anterior margin length 4.37 mm (n=2), ventral margin length 2.81 mm (n=2), postero-dorsal margin length 5.26 mm (n=2); metatibial organ slit as described for *E. viridis*, dorsal section length 0.56 mm (0.53–0.59; n=2); metabasitarsal length 2.52 mm (2.44–2.59; n=2), mid-width 1.07 mm (n=2); metabasitarsal ventral margin truncate. Forewing length 10.78 mm (10.67–10.89; n=2); jugal comb with 13–15 (n=2) blades; hind wing with 20–23 (n=2) hamuli. Maximum metasomal width 5.96 mm (5.85–6.07; n=2); second metasomal sternum with two meso-lateral tufts separated by twice width of an individual tuft.

Coloration. Head uniformly green with noticeable golden-bronzy iridescence throughout; noticeable amber brown matte coloration on clypeal ridges (Fig. 135); paraocular mark yellowish, triangular, lower width half of length of lateral part of clypeus (Figs. 134–135); scape lateral surface covered with yellow spot; malar area and mandible (except margins and teeth) yellow (Fig. 135). Mesosoma (including legs) green with noticeable golden-bronzy iridescence throughout, and blue-green iridescence, especially strong on mesoscutum and mesoscutellum; preaular area largely

amber (Figs. 133–134). Metasoma uniformly green; first tergum with noticeable blue-green iridescence, remaining terga with noticeable golden-bronzy iridescence, becoming strong on fourth to seventh terga as well as all sterna (Figs. 133–134).

Sculpturing. Head as described for males of *E. mandibularis* (Fig. 135). Mesoscutum and mesoscutellum comparable to *E. mandibularis*, slightly sparser (Fig. 133); mesepisternum punctures denser than those on *E. mandibularis* (punctures on central areas separated only by one to one and a half puncture diameters). Metasomal terga densely to moderately-densely punctate, all terga with large, elongate punctures, length of those on second metasomal tergum (and mainly on all following terga) about 0.50x mid-ocellar diameters (Fig. 133).

Vestiture. As described for male of *E. mandibularis* except as follows: setae in general lighter, those brown, sturdy setae as described in *E. mandibularis* instead light brown-amber on dorsal areas of body, while fuscous setae as described in *E. mandibularis* instead rather fulvous throughout (Figs. 133–135); mesotibial tufts with fulvous-amber setae, posterior tuft longitudinally oval, almost touching anterior tuft, dimensions of anterior tuft and contiguous velvety area as described for *E. mandibularis* (Figs. 136, 154).

Terminalia. Seventh metasomal sternum as described for *E. viridis* and *E. mandibularis*. Eighth metasomal sternum as described for *E. mandibularis* except noticeably wider (as wide as anterior section of sternum) in lateral view, and with sparser and very short simple setae present only on shaft of posterior projection (Figs. 168–169). Gonocoxite as described for *E. mandibularis* (Fig. 163). Gonostylus as described for *E. mandibularis* but with denser setae (Fig. 167). Spatha as described for *E. viridis* (Fig. 163).

♀: Unknown.

HOLOTYPE: ♀, **Peru:** “*Euglossa; bigibba*; Dressler; HT [handwritten in red ink] // 685; 80. [handwritten] // PERU; Pebas [handwritten] // Holotypus; *Euglossa; bigibba*; R.L. Dressler [label with red margin, first row in red ink, species name and author handwritten] // HOLOTYPE; *Euglossa; bigibba* Dressler; R.L. Dressler, 1982 [red colored label]” (HNHM).

ADDITIONAL MATERIAL EXAMINED (2♂♂): **Brazil:** 1♂, “TABATINGA; Amazonas BRASIL; Novembro 1958; F.M. Oliveira // *Euglossella* [handwritten] // *E. (Euglossella); bigibba* (DZUP). **Peru:** 1♂, “Peru // 685; 80 [handwritten] // *Euglossa; bigibba* // PARATYPE; *Euglossa; bigibba* Dressler; R.L. Dressler, 1982 [label with red margin]” (FSCA).

COMMENTS: The particular morphology of *E. bigibba* was noted by Dressler (1982b) when describing the species. The species has a pronouncedly biconvex mesoscutellum (hence the specific epithet), as well as a markedly protuberant clypeus (Figs. 133–134). Features of the eighth metasomal sternum (Figs. 168–169) and the gonostylus (Fig. 167), although comparable to those observed in *E. mandibularis*, are a bit more deviant compared to other species of *Euglossella* species. Specifically, the lateral width of the posterior section of the eighth sternum is noticeably wide (Fig. 169), whereas in all other taxa with males known, including *E. mandibularis*, this section is comparatively narrow (Figs. 12, 129). Females are not yet known for *E. bigibba* nor could we confidently associate such specimens as definitively conspecific with the males. However, the numerous characters shared with *E. perfulgens*, for which only females are known and from the same region (*vide* Comments for *E. perfulgens*, *infra*), does raise the suspicion that these taxa might be synonymous. Despite this strong possibility, we could not confidently assert this with conclusive evidence and they are retained here as distinct, pending future work (refer to more extensive discussion of the matter under Comments for *E. perfulgens*, *infra*). This is another area where the application of DNA barcoding techniques might aid a final determination of the validity of *E. bigibba*

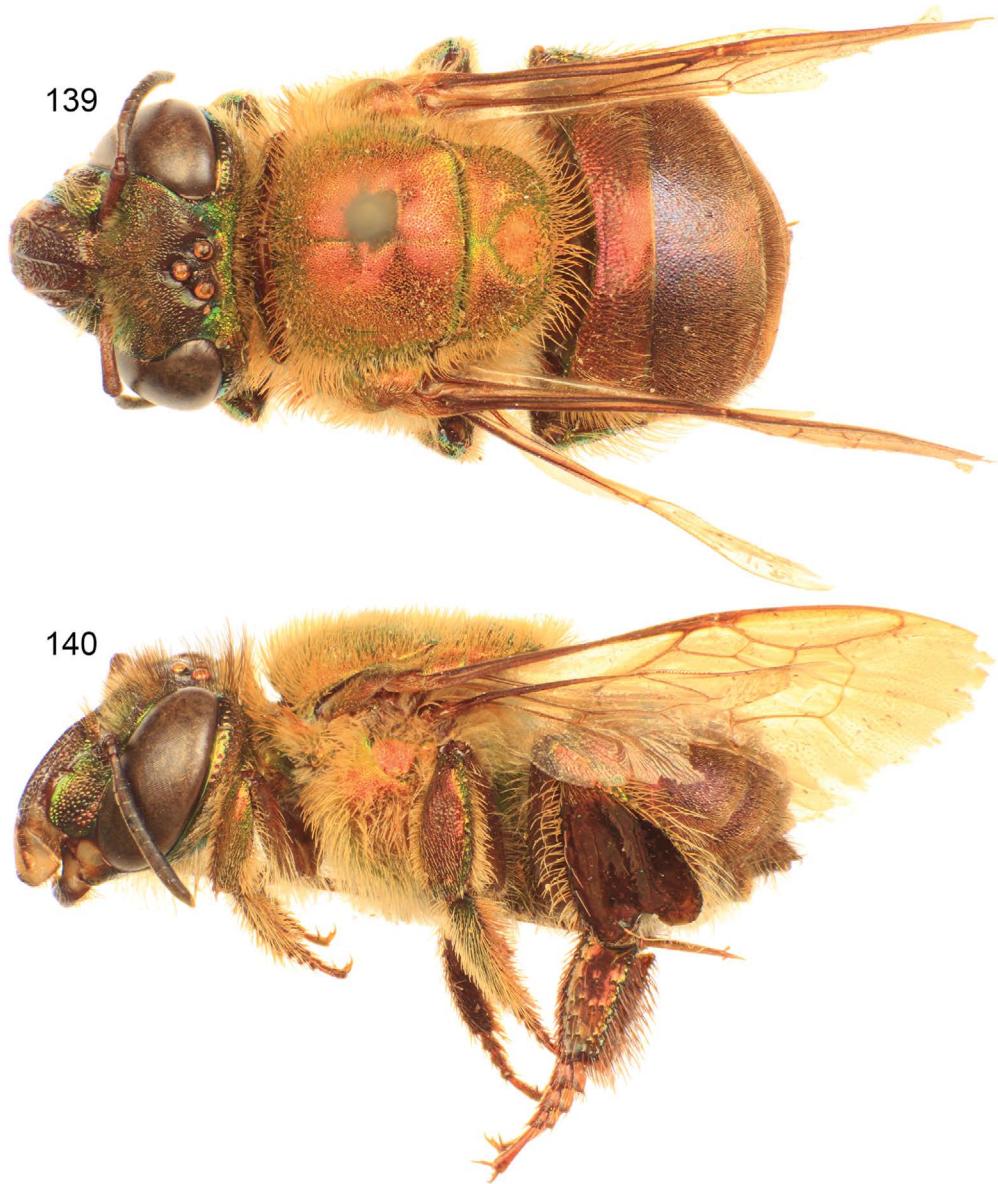
relative to *E. perfulgens*. The species is known from a small sample of specimens, all of which come from the western section of the Amazon Basin in Peru and Brazil (Fig. 170).

Euglossa (Euglossella) perfulgens Moure
(Figs. 139–143, 170)

Euglossa (Euglossa) perfulgens Moure, 1967a: 388 [♀]. Holotype ♀ (DZUP, *visum*).

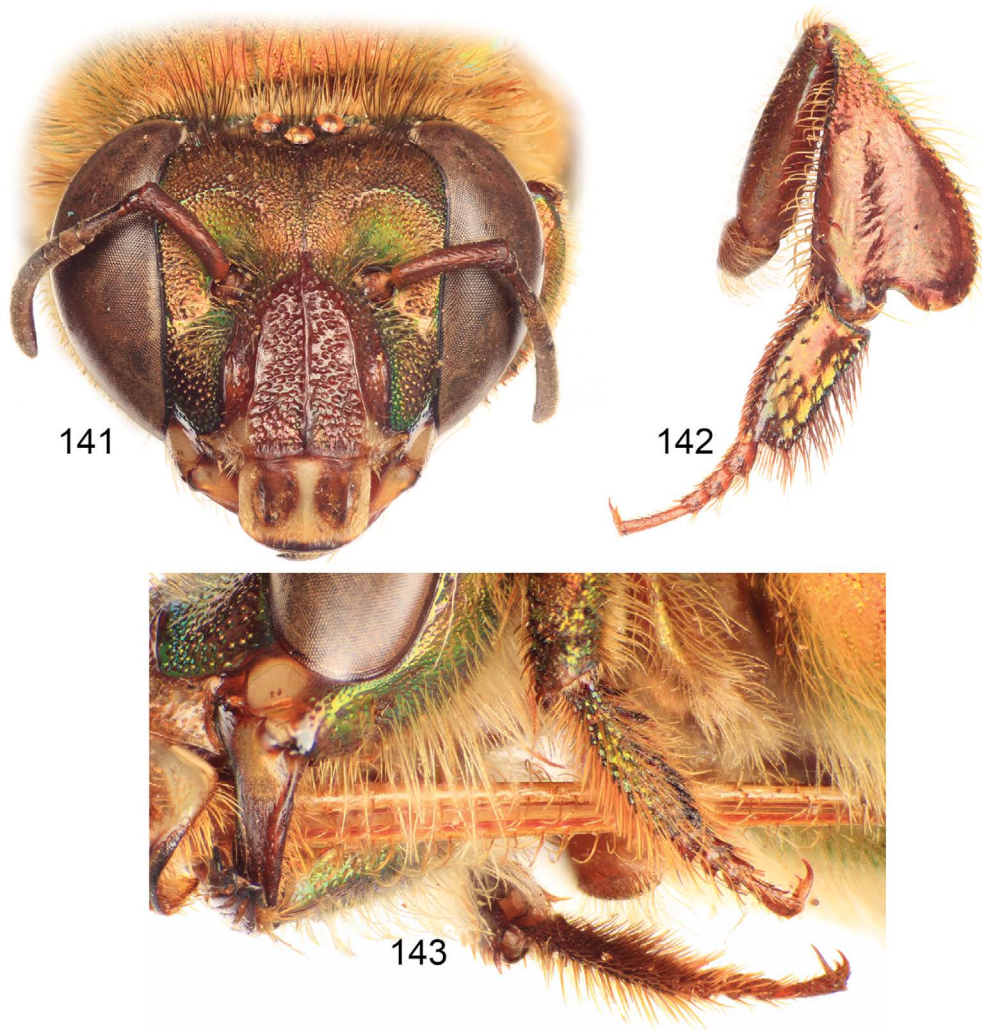
DIAGNOSIS: Labiomaxillary complex in repose reaching fourth metasomal sternum; lower interorbital distance about 1.20 times as wide as upper interorbital distance (Fig. 141); malar area long (over 0.40 mm, twice as long as diameter of mid-flagellar articles) (Figs. 141, 143); pronotal dorsolateral angle acute; mesoscutellar tuft, large, cordate slightly wider than long, occupying about one third of width and about three fourths of length of mesoscutellum, composed of dense, fulvous setae (Fig. 139); metabasitarsus with anterior margin slightly convex and posterior margin straight (Fig. 142); metasoma wider than head (about 1.07 times or over) (Fig. 139); head amber-brown with strong golden-bronzy iridescence and green areas on margins and sulci (Fig. 141); scape brown with no ivory coloration (Fig. 141); mesosoma golden-bronzy with green coloration along margins and sulci/sutures (*vide* Description for variation, *infra*) (Figs. 139–140); metasomal terga with strong bronzy-reddish coloration (*vide* Description for variation, *infra*) (Fig. 139); mesoscutellum densely punctate (punctures separated by about half a puncture diameter) (Fig. 139); central area of mesepisternum moderately densely punctate (punctures separated by one to one and a half puncture diameters); metasomal terga densely punctate with small, shallow punctures (Fig. 139); mesosomal vestiture dominated by a mix of soft, fulvous and reddish-brown, sturdy setae (Figs. 139–140).

DESCRIPTION: ♀: **Structure.** Total body length 13.61 mm (12.96–13.93; n=5); labiomaxillary complex in repose reaching fourth metasomal sternum (Fig. 140). Head length 3.44 mm (3.30–3.70; n=5); head width 5.46 mm (5.39–5.56; n=5); upper interorbital distance 2.46 mm (2.37–2.52; n=5); lower interorbital distance 2.94 mm (2.85–3.01; n=5); upper clypeal width 1.45 mm (1.41–1.48; n=5); lower clypeal width 2.38 mm (2.33–2.41; n=5); clypeal protuberance 1.13 mm (1.04–1.26; n=5); clypeal ridges, labral ridges, and labral windows as in male of *E. bigibba*; labrum rectangular, wider than long, length 1.25 mm (1.19–1.30; n=5), width 1.46 mm (1.41–1.52; n=5); anterior margin of labrum arched outwards with subapical carina (Fig. 141); interocellar distance 0.37 mm (0.36–0.37; n=5); ocellocular distance 0.70 mm (0.67–0.74; n=5); first flagellar article longer [0.65 mm (0.63–0.67; n=5)] than second and third flagellar articles combined [0.53 mm (0.52–0.59; n=5)]; length of malar area 0.52 mm (0.44–0.59; n=5). Mandible tridentate. Pronotal dorsolateral angle acute; intertegular distance 4.30 mm (4.07–4.37; n=5); mesoscutal length 3.41 mm (3.33–3.56; n=5); mesoscutellar length 1.53 mm (1.48–1.56; n=5); posterior margin of mesoscutellum as described for male of *E. bigibba* (Fig. 139); mesotibial length 2.85 mm (2.81–2.96; n=5); mesobasitarsal length 2.38 mm (2.22–2.52; n=5), maximum width 0.73 mm (0.67–0.74; n=5); metatibia triangular (right triangle) (Fig. 142); metatibial anterior margin length 3.99 mm (3.93–4.04; n=5); metatibial ventral margin length 2.27 mm (2.15–2.37; n=5); metatibial postero-dorsal margin length 4.30 mm (4.22–4.44; n=5); metabasitarsal length 2.33 mm (2.22–2.37; n=5), proximal margin width 1.00 mm (0.96–1.04; n=5). Forewing length 10.48 mm (9.93–11.04; n=5); hind wing with 21–25 (n=5) hamuli. Maximum metasomal width 5.81 mm (5.70–5.93; n=5).



Figures 139–140. *Euglossa (Euglossella) perfulgens* Moure, female. 139. Dorsal habitus. 140. Lateral habitus.

Coloration. Head with basal amber brown coloration and dominant golden-bronzy metallic color, especially on frons and paraocular areas; green metallic color accentuated on posterior area of vertex, around epistomal sulcus, on subgena, and contact area of compound eye and gena; malar area with large central yellow spot occupying more than two thirds of malar area length; mandible yellow on proximal half, margins and distal half brown (Fig. 141). Mesosoma with dominant golden-bronzy coloration throughout, noticeable green coloration along margins and sulci/sutures, a few specimens with dominant green coloration and noticeable golden-bronzy iridescence (a contrasting condition when compared to most individuals) (Figs. 139–140);



Figures 141–143. *Euglossa (Euglossella) perfulgens* Moure, female. **141.** Facial aspect. **142.** Outer view of hind leg. **143.** Anterior section of galea showing prominent hook-like setae.

legs mainly golden-bronzy to red with strong green iridescence, especially on distal podites of foreleg and outer surface of mesobasitarsus (Figs. 140, 142). Metasomal terga and sterna with strong bronzy-reddish coloration (a variable degree of green or dark-green intermixed), margins of all terga and sterna exhibiting golden and green iridescence (Figs. 139–140).

Sculpturing. Head and mesosoma as described for *E. bigibba*, except mesoscutellum and mesoscutum with denser punctation (Figs. 139–141). Metasomal terga and sterna (except smooth areas of first tergum and first sternum) densely punctate with small, shallow punctures [similar to sculpture found on species in *decorata* group, refer to Hinojosa-Díaz & Engel (2011a)] (Figs. 139–140).

Vestiture. Head as described for *E. bigibba* (*i.e.*, similar to *E. mandibularis* but lighter and with darker, sturdy setae on lower facial areas absent) (Fig. 141). Mesosoma as described for *E. bigibba*, but light setae noticeably fulvous, becoming darker on dor-

sal areas (mesoscutum and mesoscutellum), and pale on ventral metasomal areas (Figs. 139–140); specimens with darker integument have sturdier setae appearing light brown, in specimens with lighter integument such setae are concolorous with softer setae; mesoscutellar tuft, large, cordate (heart shaped, pointing anteriorly), slightly wider than long, occupying about one third of width and about three fourths of length of mesoscutellum, composed of dense, fulvous setae (Fig. 139). Metasomal terga covered with moderately-dense, fulvous to light brown, simple, setae, those on anterior and lateral areas of first tergum as long as those on mesoscutellar margin, those on second to third terga slightly shorter than those on mesoscutum, those on fourth to seventh terga rather scattered and becoming light brown and long, second to sixth terga with noticeable, narrow, apical bands of pale, appressed setae (Figs. 139–140); sterna with fulvous setae becoming pale and long alongside smooth, mid-sternal areas.

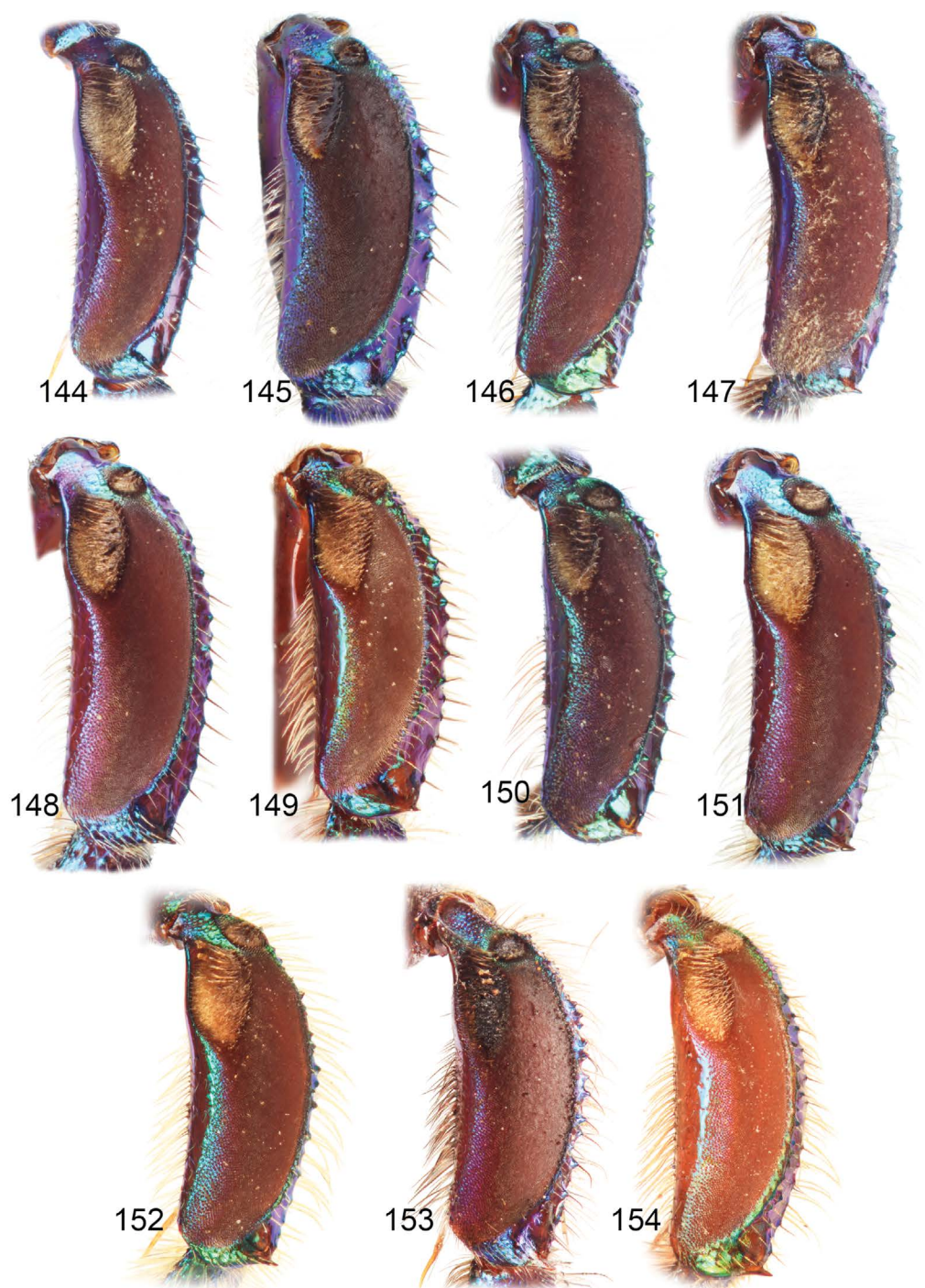
♂: Unknown.

HOLOTYPE: ♀, **Brazil:** “HOLOTYPE; *Euglossa* ♀; *perfulgens*; J.S. Moure 1964; Atas Simp. Biota; Amazonica; 5:388–391 [red label; name and year handwritten; publication data on underside] // Tefé; Amazonas BRASIL; Novembro 1959; R. Carvalho” (DZUP).

ADDITIONAL MATERIAL EXAMINED (6♀♀): **Peru:** 1♀ (paratype), “La Florida, Peru; III-13-1931 // Paratype; *Euglossa; perfulgens* ♀; J. S. Moure 1964 [type label, red]” (AMNH). 1♀, “PERU: Loreto; Iquitos; X 1964; R.L. Dressler 133 [mixed handwritten] // *Euglossa; perfulgens* Moure; det. R.L. Dressler 1968” (FSCA). 1♀, as previous except identification label: “*Euglossa; (Euglossella); perfulgens* Moure; Det. I. Hinojosa-Díaz 2012” (SEMC). 1♀, “Iquitos; Peru // 15Oct64; CH Dodson // on *Ananas; cosmos* // *Euglossa; (Euglossella); perfulgens* Moure; Det. I. Hinojosa-Díaz 2012” (FSCA). 1♀, “Iquitos; Peru // 17Sep64; CH Dodson // *Euglossa; perfulgens* Moure; det. R.L. Dressler 1968” (FSCA). 1♀, “Iquitos; Peru // 17Sep64; CH Dodson // *Euglossa; perfulgens* Moure; det. R.L. Dressler 1968” (FSCA). 1♀, “Iquitos; Peru // 19-X-64; C.H. Dodson // *Ananas; comsos* // *E. (Euglossella); perfulgens* ♀; Det. J. S. Moure 1993” (DZUP).

COMMENTS: When establishing the species, Moure (1967a) placed it within *Euglossa s.str.*, and under the subgeneric concepts of the time (e.g., Moure, 1967b, 1970) predicted that the unknown male would have a bidentate mandible in accordance with his circumscription of *Euglossa* proper. As already discussed, Dressler (1978) redefined the subgenera, to which *E. perfulgens* clearly belonged within *Euglossella* as it was newly cast, and the unknown male would be accordingly be predicted to be tridentate. A feature of *E. perfulgens* that deserves mention is the presence of strong, hook-like setae on the anterior section of the galea (Fig. 143). Similar setae are present in all females of *Euglossa s.l.*, but never as long as those observed in *E. perfulgens*. It would be interesting to elucidate the use of such setae in *E. perfulgens* should biological observations at flowers ever become available.

Moure (1967a), in his original description of *E. perfulgens*, noted the differences in color between the two females he examined. The amount of intergrading golden-bronzy and green to dark-green coloration varies among individuals, such that some specimens have a rather greenish head and mesosoma, while others are more predominantly bronzy-red. The metasomal terga, because of the intergradation of those same colors, may be bronzy-red (i.e., more towards the red side of the spectrum) to dark purple, the latter seemingly resulting from greater intensity among the dark-green colors (very noticeable in the holotype). It is possible that the methods used to kill or preserve different specimens had some influence on these variations, but similarly dramatic (or even more so) color differences are known in *E. decorata*, which has a similar distribution (Hinojosa-Díaz & Engel, 2011a). It must be stressed that despite



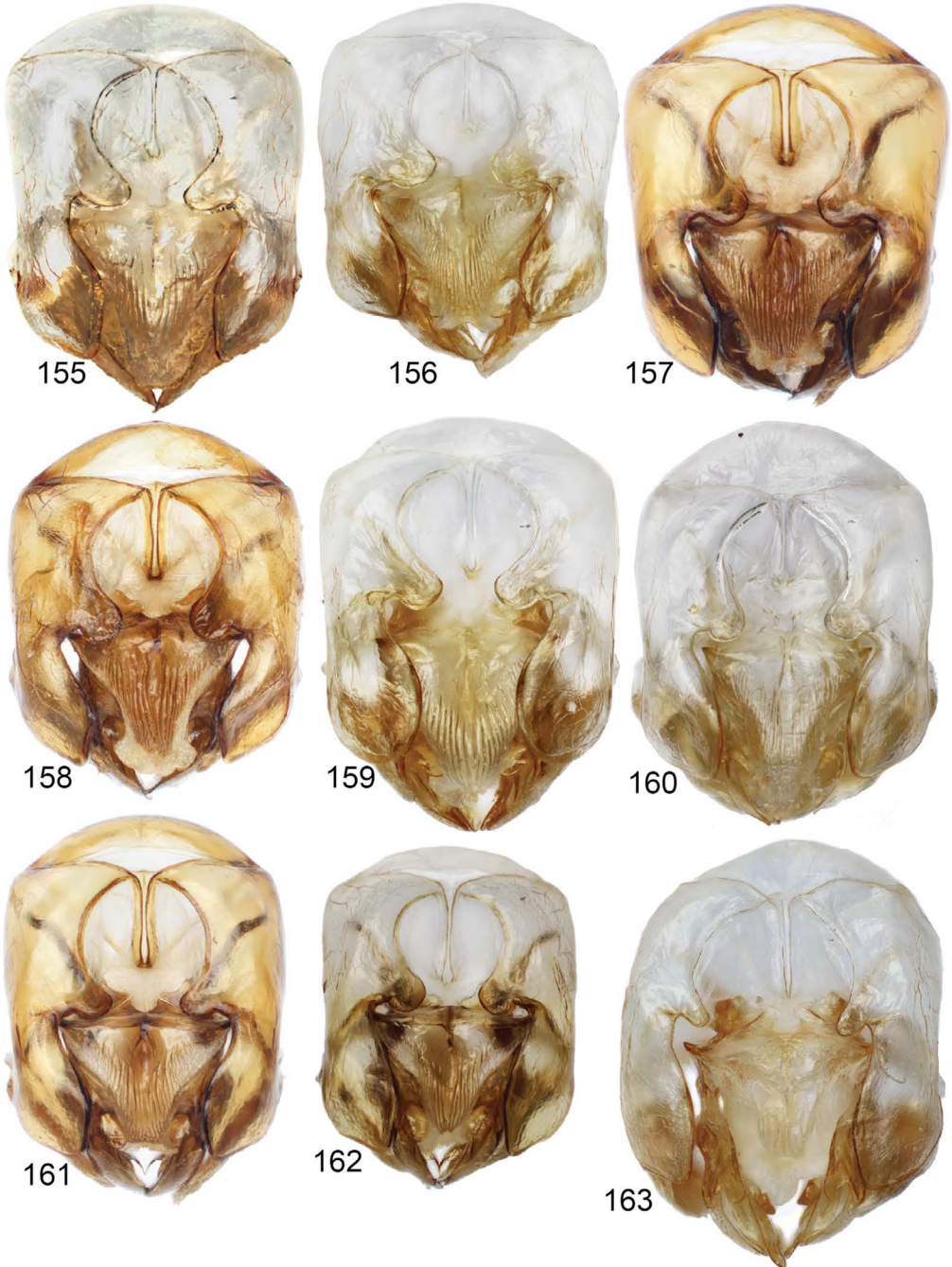
Figures 144–154. Outer view of mesotibiae of males of species of *Euglossella* Moure, *viridis* and *mandibularis* species groups. 144. *Euglossa* (*Euglossella*) *viridis* (Perty). 145. *E. (E.) azurea* Ducke. 146. *E. (E.) celiae*, new species. 147. *E. (E.) cyanea* Friese. 148. *E. (E.) subandina*, new species. 149. *E. (E.) polita* Ducke. 150. *E. (E.) perviridis* Dressler. 151. *E. (E.) cyanura* Cockerell. 152. *E. (E.) granti* Cheesman. 153. *E. (E.) mandibularis* Friese. 154. *E. (E.) bigibba* Dressler.

the color variation observed, no structural differences exist among the specimens we examined and so they are otherwise a cohesive group.

The long malar area, rather protuberant clypeus, and long labiomaxillary complex (Figs. 139–141, 143), make this species very close morphologically to *E. bigibba*. The large, characteristic “cordate” mesoscutellar tuft sits in a concavity very much like the one observed in *E. bigibba* as a result of the latter’s strongly biconvex mesoscutellum. The sizes of these two species are also comparable, as are the shape of the pronotal dorsolateral angle, the structure of the clypeus and labrum (Figs. 135, 141), and for the most part the vestiture. As mentioned previously in a different context, females almost invariably have a denser sculpturing than males, especially when looking at the metasomal terga, and this pattern tends to hold when comparing the male of *E. bigibba* to the female of *E. perfulgens*. Lastly, both taxa occupy similar ranges (Fig. 170), albeit the locality data, like the available individuals themselves, are limited. When taken in their totality, these observations, combined with the reality that each species is known only from an opposing sex, makes a compelling case that they are instead conspecific (*E. bigibba* thereby merely being the male of *E. perfulgens*). While we have repeatedly avoided coloration as a primary trait separating species, it has always been done so in the context of colors that, for the very large part, are similar (e.g., varying degrees of green, or green versus blue, or mere differences in the intensity of particular highlights, &c.). Here, the colors are dramatically different (cf. Figs. 133–134 vs. 139–140) and not so easily reconciled as merely sexual dimorphism, particularly when males and females have not been captured together. We are aware that red individuals do occur within otherwise largely green species. For example, *E. (Alloglossura) gorgonensis* Cheesman is a noteworthy case of such color variation (e.g., Hinojosa-Díaz & Engel, 2012b; Hinojosa-Díaz & Brosi, 2013). In this species males and females are largely green in the southern portion of their range, while they become increasingly reddish to the north, seemingly forming a cline in color variation (even distinctive enough in range and color that the reddish form was described as a separate subspecies). The reddish color is more slight in the known females, but can be dramatic in males (e.g., Hinojosa-Díaz & Engel, 2012b). Even here, however, the more extensively red males still have strong green coloration intermixed throughout, particularly laterally whereby the ‘red’ stands out merely as intense golden-bronze among a lighter green and thereby retaining some of the intergradation between the two extremes. From the extremely limited material available, this is not the pattern observed between the color extremes represented by *E. bigibba* and *E. perfulgens*, nor do the colors cluster themselves in a distinctive cline of variation (Fig. 170), as is observable in taxa such as *E. gorgonensis*. If the two were conspecific, then the pattern of color dimorphism, sexual or otherwise, would be unique within *Euglossa*. Thus, despite all of our great misgivings regarding the discreteness of *E. bigibba* and *E. perfulgens*, we momentarily retain them as separate species believing that this more conservative stance is the only one justifiable with so little material. We encourage the investment of collecting effort in those areas where both species are found (western Amazon Basin), and the application of molecular techniques to either better delimit these taxa or validate their conspecificity. Like *E. bigibba*, *E. perfulgens* is known from the central and western Amazon Basin in Brazil and Peru (Fig. 170).

DISCUSSION

Compared to other species of *Euglossa*, most *Euglossella* are poorly represented in museum collections and scarcely collected in local surveys (Dressler, 1985; Nemésio,



Figures 155–163. Dorsal view of genital capsule of males of *Euglossella* Moure, *viridis* and *mandibularis* species groups. 155. *Euglossa* (*Euglossella*) *azurea* Ducke. 156. *E. (E.) celiae*, new species. 157. *E. (E.) cyanea* Friese. 158. *E. (E.) subandina*, new species. 159. *E. (E.) polita* Ducke. 160. *E. (E.) perviridis* Dressler. 161. *E. (E.) cyanura* Cockerell. 162. *E. (E.) granti* Cheesman. 163. *E. (E.) bigibba* Dressler.



Figures 164–169. Additional male genitalic features of some species of *Euglossella* Moure, *viridis* and *mandibularis* species groups. **164.** Lateral section of gonostylus of *Euglossa* (*Euglossella*) *viridis* (Perty). **165.** Lateral section of gonostylus of *E. (E.) azurea* Ducke. **166.** Lateral section of gonostylus of *E. (E.) mandibularis* Friese. **167.** Lateral section of gonostylus of *E. (E.) bigibba* Dressler. **168.** Eighth metasomal sternum of *E. bigibba*, ventral aspect. **169.** Eighth metasomal sternum of *E. bigibba*, lateral aspect.

2009); notwithstanding, enough material is available to set the basis for a better systematic understanding of the group, although we admit that there were several issues we could not resolve given the sometimes small series and other limitations imposed. The two species groups presented in this study complete the initial picture for the subgenus started in a previous paper for the *decorata* group (Hinojosa-Díaz & Engel, 2011a). Dressler's (1978) reinterpretation of *Euglossella* remains the basis for the group's boundaries, which was originally presented as a single species group and then expanded to two (Hinojosa-Díaz & Engel, 2011a). As we have done here, the subgenus is better understood as composed of three species groups — *decorata*, *viridis*, and *mandibularis* — which is consistent with the available phylogenetic evidence (Hinojosa-Díaz, 2010; Ramírez *et al.*, 2010). Based solely on external morphology, species in the *viridis* and *mandibularis* groups bear features that make their group association unequivocal, and appear phylogenetically valid as monophyletic based on both morphological (Hinojosa-Díaz, 2010) and molecular (Ramírez *et al.*, 2010) evidence. The *viridis* group encompasses the largest species assemblage in the subgenus, and based on the aforementioned phylogenetic hypotheses, is sister to the *decorata* group with whom it shares, among the most readably noticeable features, the lamellate dorsolateral angle

of the pronotum, the short malar area, and the configuration of virtually all terminalic structures (hidden sterna and genitalia). The two groups are set apart easily by integumental coloration, but metrics of the upper and lower interorbital distances are also different and consistent within each group. The three species known for the *mandibularis* group are quite distinctive within *Euglossella*, with protruding clypeal areas, long malar areas, and a non-lamellate but acute dorsolateral angle to the pronotum, in addition to distinctive genitalic features. The *mandibularis* group is apparently basal to all other species of *Euglossella* (i.e., the clade pairing the *decorata* and *viridis* groups) (Hinojosa-Díaz, 2010; Ramírez *et al.*, 2010). All species of *Euglossella* have males with relatively unmodified mesotarsomeres beyond the mesobasitarsus, while all other *Euglossa* s.l. show some emargination or compression of these (especially the second mesotarsomere). If these tarsomere modifications are evolutionary novelties within the genus, then *Euglossella* are rather conservative, matching its basal position within the genus. The morphology of the mesotibial tufts in *Euglossella* is also characteristic, and although there are noticeable differences among the three species groups, for the most part these distinctions are not as dramatic as in other clades in the genus (e.g., Roubik, 2004; Bembé, 2007; Faria & Melo, 2007, 2012; Hinojosa-Díaz & Engel, 2012b).

Ideally, one may find a unique and correlated suite of traits that are objectively different among individual species. This ideal is often not met, particularly within *Euglossa*. We have found that patterns of integumental sculpture tend to be a consistent means of differentiating species in the *viridis* group, and these often correlate nicely with other features. Historically, the study of euglossines has relied heavily on patterns of coloration. Reliance on colors that are not immediately correlated with other traits is challenging and can be misleading. Color can be informative and there do seem to be recognizable patterns for each species as we have treated them herein (albeit several of them overlapping), but in nearly every case there are significant deviations and these stress the need for a critical examination of color variants before using this alone to separate taxa. Accordingly, we have attempted to avoid overly stressing coloration when delimiting the boundaries of taxa. Conversely, the use of color characters cannot outright be ignored entirely and there are cases where we have stated what we believe to be extenuating circumstances for the use of color differentiation (e.g., *E. bigibba* vs. *E. perfulgens*). Some of the color variants may be population and geographic differences, as would appear to be the case for those *E. cyanura* from Veracruz, but in most instances there simply are too few specimens of *Euglossella* to conclusively document clines or other such patterns. Alternatively, there remains also the possibility that some of the color deviations we have mentioned are simply the result of sampling techniques or methods of conservation (e.g., more or less exposure to light).

We have hypothesized three new species based solely on females (*E. cetera*, *E. cupella*, and *E. ashei*), despite the aforementioned difficulties of working with females in *Euglossa*. However, for each there are sufficiently distinctive and unambiguous combinations of structural traits, and moreover traits that elsewhere in combination with different features consistently prove useful in delimiting species in the *viridis* group. Accordingly, there is no a priori reason to assume they are not indicative of individual taxa and we believe sampling for males in those same localities will corroborate our conclusions.

The *viridis* group is the only one of the three groups of *Euglossella* with species found to the west of the Andes in northwestern South America (e.g., *E. cyanura* from southeastern Mexico to Panama, *E. granti* in the Choco corridor in Colombia and Ecuador) (Fig. 170). Two species, *E. viridis* and *E. azurea* have a somewhat widespread

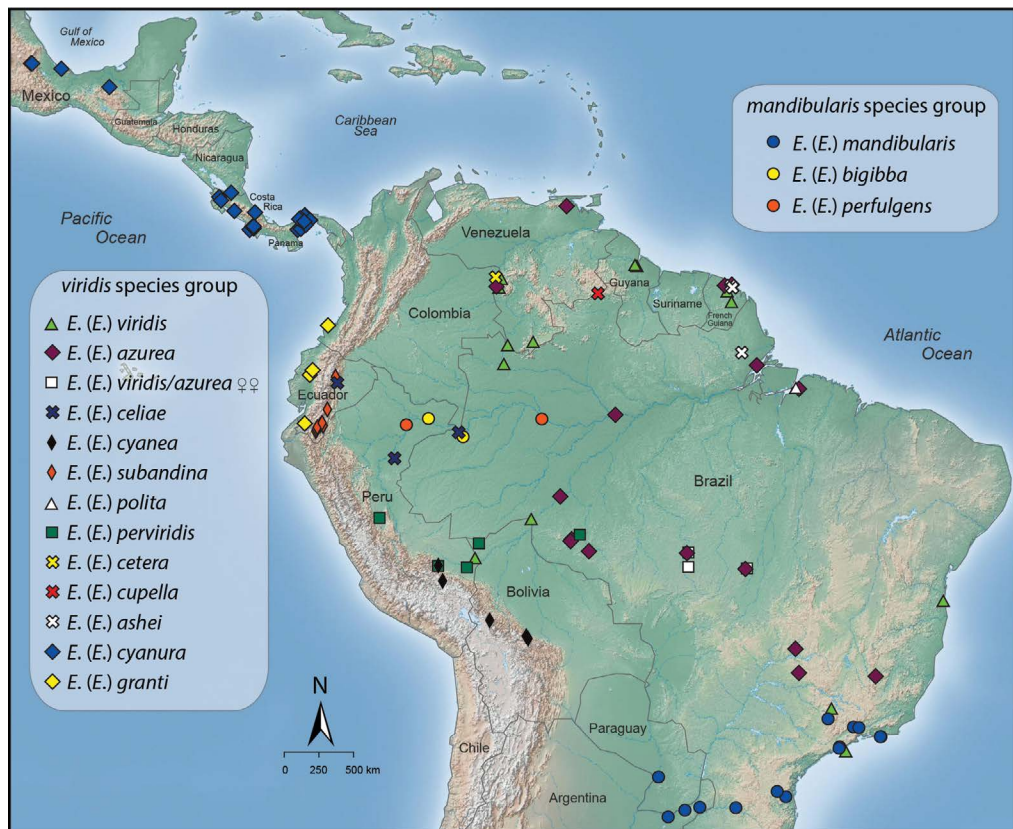


Figure 170. Collection localities for species of *Euglossella* Moure, *viridis* and *mandibularis* species groups [also showing localities for females attributable only to *Euglossa* (*Euglossella*) *viridis* (Perty)/*azurea* DUCKE]. Locality points are based on examined specimens.

range east to the Andes, while all of the other species in the *viridis* group have more localized distributions — some in the Guianas area (*E. cetera*, *E. cupella*, and *E. ashei*); two in the western portions of the Amazon Basin, either to the north (*E. celiae*) or to the south (*E. perviridis*); one in the eastern extreme of the Amazon Basin (*E. polita*); and two at mid-elevations east of the Andes, one in the south (*E. cyanea*) and another in central-north (*E. subandina*) (Fig. 170). The *mandibularis* group has the southernmost species within *Euglossella*, with *E. mandibularis* reaching areas in southern Paraguay, southern and southeastern Brazil, and northeastern Argentina. The other two species in this group (*E. bigibba* and *E. perfulgens*) seem to be restricted to the western half of the Amazon Basin (Fig. 170). Interestingly, distributions of the three species groups now recognized in *Euglossella* [refer to Hinojosa-Díaz & Engel (2011a) for a distributional overview of the *decorata* group] resemble in several ways those patterns described by Pedro & Camargo (2003) for species groups of *Partamona* Schwarz (Meliponini).

The number of described species for the subgenus as presented here, considering synonymies and including those in the *decorata* group (Hinojosa-Díaz & Engel, 2011a), has more than doubled, with a total of 21 species as compared to the nine listed by Dressler (1978), although he mentioned the existence of several undescribed species at that time. For some species there has been confusion regarding the identity or sex of the primary types as presented in several checklists with type data (*i.e.*, Moure, 1967b;

Kimsey & Dressler, 1986; Roubik & Hanson, 2004; Moure *et al.*, 2007; Nemésio, 2009; Nemésio & Rasmussen, 2011). We believe we have resolved satisfactorily these difficulties, particularly in establishing that the lectotype of *E. cyanea* is a male (and that it could not possibly have been a female), and that the lectotype of *E. polita* is similarly a male. Minor confusion has occurred also in one or more of the cited checklists for *E. azurea*, for which the lectotype is a male, and for *E. cyanura*, for which the holotype is a female.

As we have noted repeatedly, no revision is ever complete and there are obvious issues that remain unresolved for species of *Euglossella* and considerable collecting is needed to further advance our understanding. The success of this work will be measured in the number of forthcoming discoveries stimulated by questions left open here. Euglossines hold a special place among corbiculate bees as they are the only group that is not eusocial and are putatively the earliest-diverging branch (*e.g.*, Schultz *et al.*, 1999, 2001; Engel, 2001b; Noll, 2002; Cardinal & Packer, 2007) within a clade that extends at least to the latest Cretaceous (*e.g.*, Engel, 2000, 2001a, 2004; Ohl & Engel, 2007), albeit available fossils of orchid bees are much younger (*e.g.*, Engel, 1999, 2014; Hinojosa-Díaz & Engel, 2007b; Michez *et al.*, 2012; Dehon *et al.*, in press). These realities coupled with their unique morphology, behavior, and intimate relationship with orchids makes them of paramount interest, particularly the diverse genus *Euglossa* which encapsulates 55% of the known species. Within *Euglossa*, the subgenus *Euglossella* holds a hallowed position as one of the most, if not the most, basal lineage (Hinojosa-Díaz, 2010; Ramírez *et al.*, 2010). As such, these bees are critical for understanding the early origin and evolution of *Euglossa*, as well as for resolving larger patterns of floral associations and biogeography. It is hoped that with a firmer grasp on the known species of *Euglossella* and a means to more readily identify them, that their biologies shall be elucidated and a group once hidden in the 'dark' may become illuminated.

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