

The *Zethus* of Venezuela (Hymenoptera: Eumenidae)

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Abstract: Thirty four species of *Zethus* are enumerated from Venezuela, providing known and new locality records. Six new species are described: *Z. rubioi* and *Z. vincenti* in the subgenus *Zethusculus*, *Z. carpenteri* and *Z. milleri* in the subgenus *Zethoides*, and *Z. bolivarensis* and *Z. yepezi* in the nominate subgenus. A key to the species of Venezuela is provided. The distribution patterns of *Zethus* are discussed.

Key Words: Hymenoptera, Eumenidae, *Zethus*, Venezuela

Introduction

Bohart and Stange (1965) recorded fifteen species from Venezuela. Material taken during recent collecting trips by Menke and Vincent (1976), Menke and Carpenter (1985), Stange and Miller (1986) and Stange and Porter (1988), as well as material found in the Maracay collection, have added another 19 species to the faunal list. Six new species are described. Two new species belong to the *Z. arietis* Group (*Zethusculus*), two to the *Z. biglumis* Group (*Zethoides*), and two new species are described in the nominal subgenus.

Venezuela is very diverse in ecological habitats, including cloud forests, lowland rain forests, semi-deserts, lowland savannas, highland savannas, paramos and the Tepuy highlands. Some areas are still poorly collected, or in the case of the Tepuy highlands not collected at all, for *Zethus*. Additional species of *Zethus* will certainly be collected in this country in the future.

Another interesting feature of the Venezuelan *Zethus* fauna is the existence of geographic color forms. In the western state of Zulia there are eight species of which five exhibit a common color pattern of a black head and thorax, crimson abdomen. Also, one species of Central America and Colombia, *Z. matzicatzin*, with this same color pattern also occurs in this part of Venezuela.

Key to species of *Zethus* of Venezuela

1. Lamella of sternite III abbreviated laterally, well-developed otherwise (fig. 2); lamella of tergite III separated into three sections by sharp sub-lateral incisions (Subgenus *Zethoides*) 2
 1'. Lamella of sternite III weakly to well-developed, but not especially abbreviated laterally; lamella of

tergite III not separated into sections by sharp incisions 11

- 2(1). Stem of tergite II longer than that of I (fig. 1); abdominal petiole with complete fusion of sternum and tergum 3
- 2'. Stem of tergite II shorter than that of I; abdominal petiole sternum and tergum separated by suture 4
- 3(2). Petiole and tergite II mostly red; antennal hook of male reaching near middle of flagellomere VIII; male clypeus smooth across distal one-third, somewhat depressed, lateral teeth weak (fig. 3) *matzicatzin* Saussure
- 3'. Petiole and tergite II mostly black; antennal hook reaching to near base of flagellomere VIII; male clypeus completely and coarsely punctate, apex with strong lateral teeth (fig. 4) *binodis* Fabricius
- 4(2'). Pronotal lamella relatively thick and opaque, raised evenly but lower than one mid-ocellus diameter 5
- 4'. Pronotal lamella relatively thin, translucent, higher submedially than mid-ocellus diameter 6
- 5(4). Male foretibia with at most 1 well developed spur; female forebasitarsus without reddish pegs along outer face *miniatus* Saussure
- 5'. Male foretibia with 2 well developed spurs; female forebasitarsus with at least 5 small reddish spines along outer face *toltecus* Saussure
- 6(4'). Abdominal sternite I constricted to a median carina before posterior expanded part; tergite I distinctly bent at anterior one-third (fig. 15) 7
- 6'. Abdominal sternite I not constricted into a median carina before posterior expanded part; tergite I rather evenly expanded in profile 9

- 7(6). Midtibia with 2 spurs; interocellar area with narrow, polished tubercles; dorsal surface of propodeum reticulate *carinatus* Smith
- 7'. Midtibia with 1 spur; interocellar area not tuberculate; dorsal surface of propodeum with large shallow punctures (fig. 13) 8
- 8(7'). Genal carina sharp; male clypeus tridentate (fig. 12); apical flagellomere of male antenna 3 times longer than basal diameter (fig. 16)
..... *bodkini* Bohart & Stange
- 8'. Genal carina rounded; male clypeus bidentate; apical flagellomere of male antenna 2 times longer than basal diameter (fig. 17)
..... *carpenteri* new species
- 9(6'). Interocellar area with broad and somewhat polished tubercles separated by a narrow line of punctures; male antenna with apical flagellomere minute, button-like
..... *haemorrhoidalis* Kriechbaumer
- 9'. Interocellar area without tubercles; male antenna with apical flagellomere not minute 10
- 10(9'). Mid-dorsal area of abdominal tergite I (petiole) with extensive micropunctuation; humerus rounded (fig. 9) *diminutus* Fox
- 10'. Mid-dorsal area of tergite I with macropunctuation but without micropunctuation; humerus sharp (fig. 10) *milleri* new species
- 11(1'). Midtibia with 1 apical spur 12
- 11'. Midtibia with 2 apical spurs 19
- 12(11). Sternite II with a strong, flattened medio-apical bulge; male clypeus very short, mandibles huge (fig. 18); female clypeus polished, sparsely punctate *magretti* Zavattari
- 12'. Sternite II without medio-apical bulge; male clypeus and mandibles not highly modified; female clypeus with regular, longitudinal microstriae (Subgenus *Zethusculus*) 13
- 13(12'). Stem of tergite II shorter than that of I (fig. 22); male with sternite V usually and sternite VI always with a sublateral tooth or process; no whitish or yellow markings on thorax or abdomen (*Z. mexicanus* Group) 14
- 13'. Stem of tergite II longer than that of I; male sternite V and VI without sublateral process or tooth; usually with whitish or yellow markings on thorax or abdomen (*Z. arietis* Group) 15
- 14(13). Tegula nearly convex along outer rim; petiole and propodeum without red color
..... *mexicanus mexicanus* (Linnaeus)
- 14'. Tegula distinctly angled outward opposite posterior margin of scutum; petiole and propodeum with extensive red
..... *brasiliensis fuscatus* Bohart & Stange
- 15(13'). Mesoscutellum and metanotum mostly pale colored 16
- 15'. Mesoscutellum and metanotum black; mesepimeron black 17
- 16(15). Mesoscutellum, metanotum, propodeum, and petiole orange color; tergite I reddish; antennal hook more than 2.0 times longer than greatest width (fig. 25); tergite II with moderate micropubesence *vincenti* n.sp.
- 16'. Mesoscutellum, metanotum, and part of propodeum yellow; tergite I with black ground color; antennal hook less than 2.0 times longer than greatest width (fig. 24); tergite II with dense rust-red micropubesence *westwoodi* Saussure
17. Metasoma reddish in marked contrast to black mesosoma; apical flagellomere of male antenna pale with many short, pale setae on exterior face (fig. 23) *rubioi* new species
- 17'. Metasoma mostly black as is mesosoma; flagellomere of male antenna pale or dark brown, with inconspicuous setae (fig. 21) 18
- 18(17'). Male apical flagellomere all or nearly all pale within (fig. 21) *romandinus* Saussure
- 18'. Male apical flagellomere mostly or all dark brown within (fig. 24) *nigricornis* Saussure
- 19(11'). Stem of tergite II plainly longer than of I 20
- 19'. Stem of tergite II shorter than that of I 22
- 20(19). Maxillary palps with 3-4 palpomeres; mesoscutum with reddish welts .. *hilarianus* Saussure
- 20'. Maxillary palps with 6 palpomeres; mesoscutum without reddish welts 21
- 21(20). Pronotal lamella angularly prolonged backward at least halfway from humerus to tegula
..... *fuscus* (Perty)
- 21'. Pronotal lamella not prolonged toward tegula .
..... *miscogaster* Saussure
- 22(19'). Apical propodeal lamella much abbreviated, not differentiated from rest of submarginal propodeal carina 23
- 22'. Apical propodeal lamella produced as a definite subtriangular rounded lobe on either side of petiole insertion 29
- 23(22). Subhumeral area narrow, critical breadth at most equal to 2 midocellus diameters; distal lamella of tergite II sharply bent upward at middle *trispinosus* Zavattari
- 23'. Subhumeral area broad, critical breadth over 3 midocellus diameters; distal lamella of tergite II not bent upward 24
- 24(23'). Tegula very broadly rounded posteriorly 25

- 24'. Tegula considerably narrowed posteriorly 26
- 25(24). Abdomen mostly blue in color; thorax dark colored *chalybeus* Saussure
- 25'. Abdomen mostly orange-yellow, as well as much of head and thorax *bequaerti* Bohart & Stange
- 26(24'). Metanotum with median tubercle or tooth; notaulices undeveloped; male sternite VII with a pale, beveled excavation at base of notch of sternite VII (fig. 20)
..... *nicaraguensis* Zavattari
- 26'. Metanotum without tubercle or tooth; notaulices usually indicated at least posteriorly; male sternite VII not excavated 27
- 27(26'). Expanded part of petiole (tergite I) over 3/4 broader than long in dorsal view; flagellar hook of male minute, button-like *sessilis* Fox
- 27'. Expanded part of petiole much longer than broad in dorsal view; flagellar hook of male evident, at least as long as wide 28
- 28(27'). Mesoscutum polished with sparse punctation medially; tegula definitely bent outward at posterior one-third *laevinodus* Smith
- 28'. Mesoscutum densely micropunctate between sparse macropunctures medially; tegula with outer edge almost evenly rounded as seen from directly above *striatifrons* Fox
- 29(22'). Scutum completely longitudinally striate 30
- 29'. Scutum punctate or striatopunctate 31
- 30(29). Forewing dark brown on basal two-thirds, pale brown or white on distal one-third
..... *apicalipennis* Zavattari
- 30'. Forewing gradually paler toward apex
..... *melanis* Bohart & Stange
- 31(29'). Sternite I constricted to a median carina before expanded posterior section 32
- 31'. Sternite I rounded or flat in constricted area before expanded posterior section 35
- 32(31). Tergite II coarsely punctate anterior to distal lamella 33
- 32'. Tergite II not coarsely punctate anterior to distal lamella 34
- 33(32). Midtibia with 1 well developed spur; pronotum limited laterally by a carina running from humeral angle to below pronotal lobe; postocular carina strong *bolivarensis* new species
- 33'. Midtibia with 2 well developed spurs; pronotum evenly rounded laterally; no postocular carina *cylindricus* Fox
- 34(32'). Pronotum with interhumeral distance somewhat longer than distance between humerus and tegula; postoccipital carina highest at dorsolateral angle; male flagellomere X asymmetrical, hooded *sichelianus* (Saussure)
- 34'. Pronotum with interhumeral distance shorter than distance between humerus and tegula; male flagellomere X symmetrical, not hooded; postoccipital carina not enlarged at dorsolateral angle; male flagellomere x symmetrical, not hooded *yepezi* new species
- 35(31'). Scutum not depressed in front of scutellum, separated from it by a fine cross groove (fig. 19) *prominens* Fox
- 35'. Scutum depressed in front of scutellum separated from it by a pitted cross groove 36
- 36(35'). Tergite I macropunctate but not micropunctate at dorsal middle; tergite II with macropunctures concentrated just before distal lamella .
..... *venezuelanus* Zavattari
- 36'. Tergite I moderately to densely micropunctate at dorsal middle; tergite II with macropunctures not concentrated just before distal lamella
..... *infelix* Zavattari

List of species found in Venezuela

Old Records are taken from Bohart and Stange (1965). Additional Records are cited as "New Records".

Subgenus *Zethus* Fabricius 1804

Zethus coeruleopennis group

1. *Zethus laevinodus* Smith 1857. Cat. hym. Brit. Mus. 5:17. Holotype female, Mexico (BMNH). **Record:** Merida: Merida (ZMUC)
2. *Zethus striatifrons* Fox 1899. Proc. Acad. Nat. Sci. Philadelphia, p. 409. Lectotype male, Chapada de Santa Anna, Mato Grosso, Brasil (ICCM). **Records:** Federal District: Caracas (Giordani Soika collection). Also known from Brazil, Paraguay and Argentina

Zethus magretti group

3. *Zethus magretti* Zavattari 1912. Arch. f. Naturgesch. 78(Abt.A), Heft 4:21. Holotype female, Venezuela (MIZY). **Records:** No further Records from Venezuela. Also known from Costa Rica (Juan Vinas) and Panama (Volcan de Chiriqui). **Observations:** See figure 18 for male face.

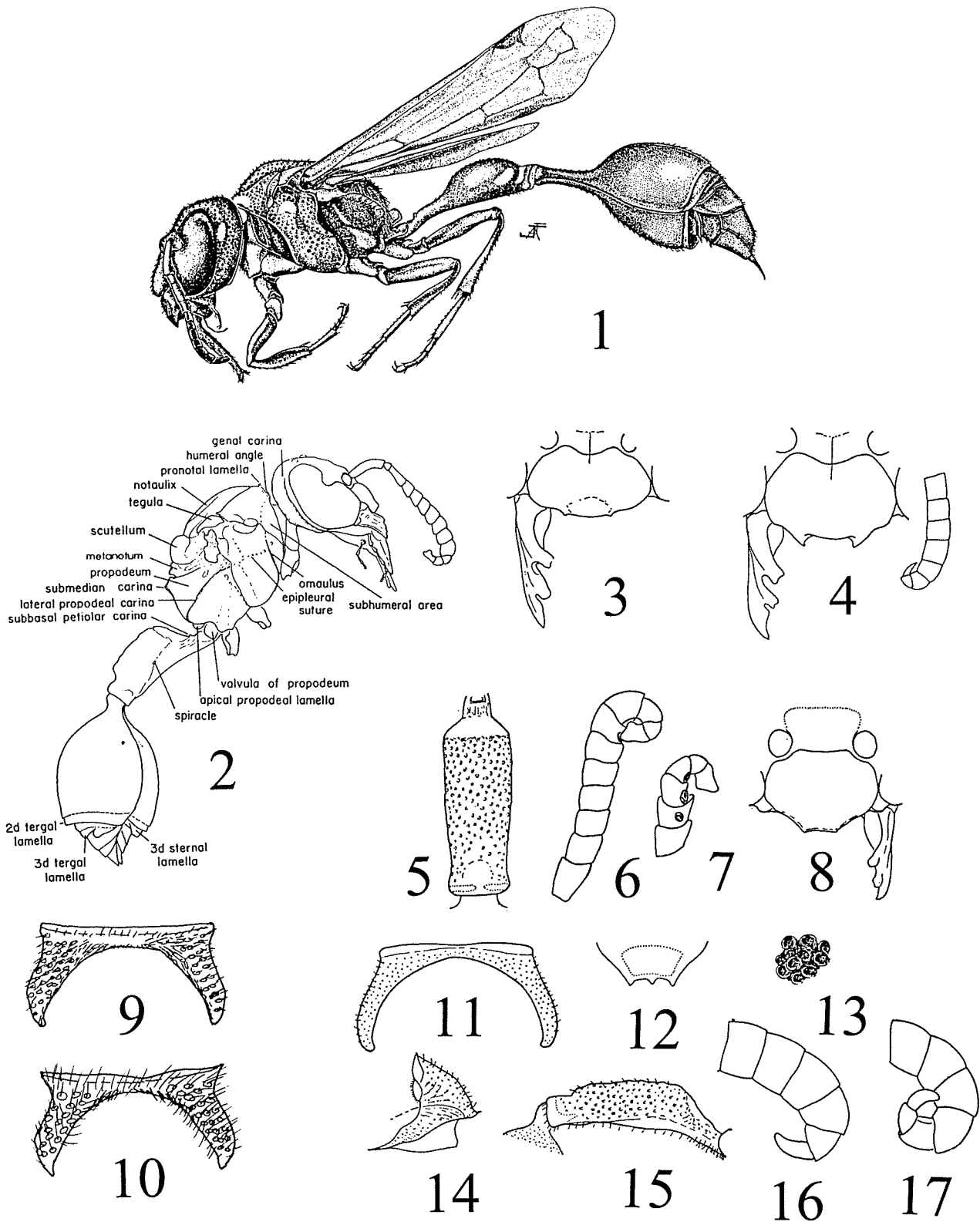


Plate 1 (Figs. 1-17). 1. *Z. matzicatzin*. 2. *Z. olmecus*. Male clypeal apex of *Z. matzicatzin* (fig. 3) & *Z. binodis* (fig. 4). *Z. miniatus*, petiole (fig. 5), male antenna (figs. 6, 7) and male clypeus (fig. 8). Outline of pronotum of *Z. diminutus* (fig. 9), *Z. milleri* (fig. 10), and *Z. bodkini* (fig. 11). *Z. bodkini*, pronotum (fig. 11), male clypeal apex (fig. 12), sculpture on upper lateral surface of male propodeum (fig. 13), profile of female pronotum (fig. 14), petiole (fig. 15), male antenna (fig. 16). 17. Male antenna of *Z. carinatus*.

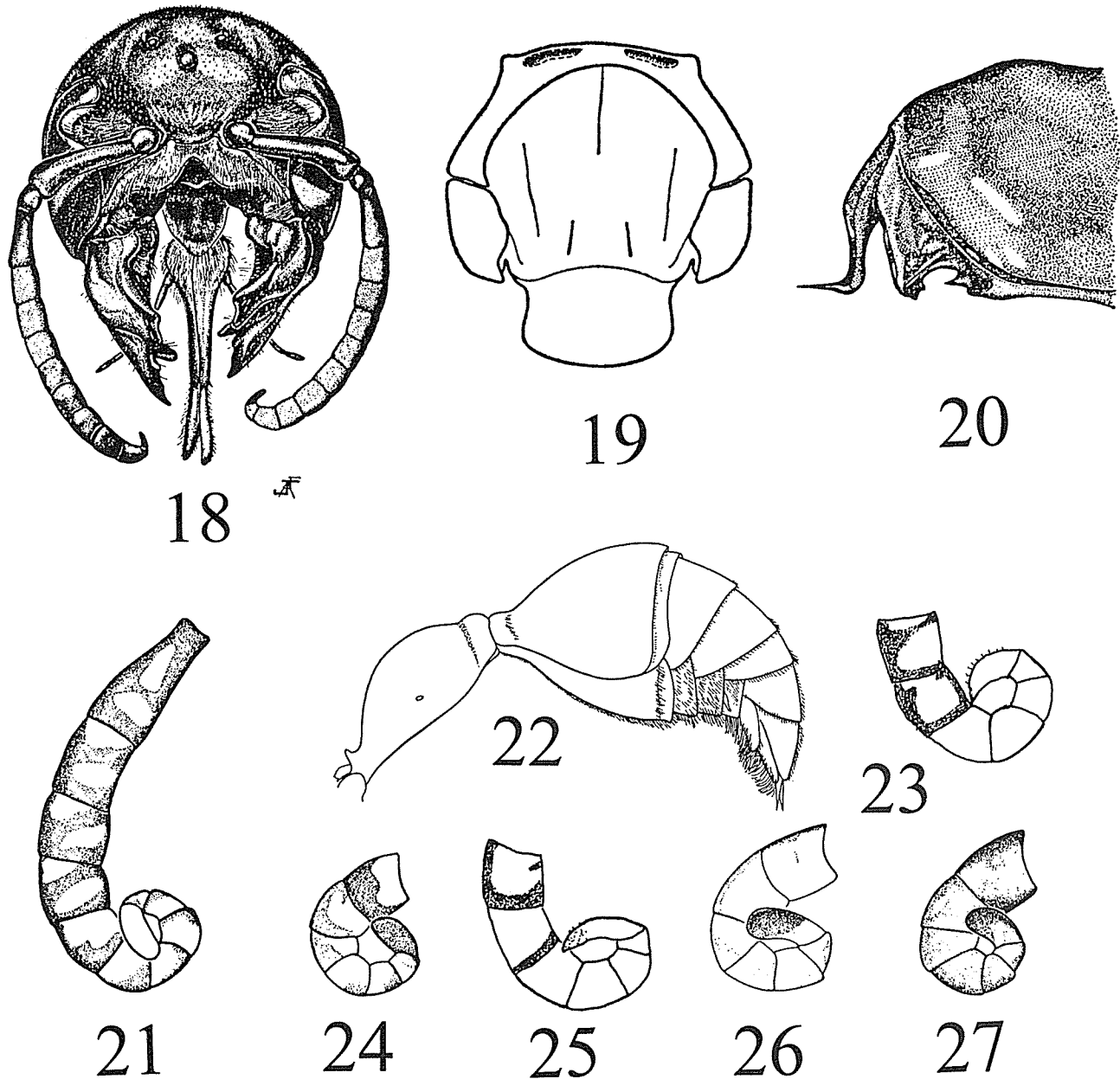


Plate 2 (Fig. 18-27). 18. Male head of *Z. magretti*; 19, dorsal view of male pronotum and mesonotum of *Z. prominens*; 20, abdominal apex of male *Z. nicaraguensis*. 21, 23 - 27, male antennal hook of *Z. romandinus* (fig. 21), *Z. rubioi* (fig. 23), *Z. nigricornis* (fig. 24), *Z. vincenti* (fig. 25), *Z. brasiliensis* (fig. 26), *Z. mexicanus* (fig. 27). 22, lateral view of male abdomen of *Z. mexicanus*.

Zethus prominens group

4. *Zethus prominens* Fox 1899. Proc. Acad. Nat. Sci. Philadelphia, p. 408. Lectotype female, Chapada da Santa Anna, Matto Grosso, Brasil (ICCM). **Records:** Monagas: 42 kms. southeast of Maturin (LACM). Also known from Brazil and Bolivia. **New Record:** Amazonas: Piedra de Cocuy, Dpto. Rio Negro, 11.XI.79, Martinez (FSCA). **Observations:** See figure 19.

Zethus chalybeus group

5. *Zethus bequaerti* Bohart & Stange 1970. U. Cal. Publ. Ent. 40:40. Holotype female, Restrepo, Meta, Colombia, 1913, Bequaert (MCZC). **New Record:** Bolivar: Las Nieves, 25.V.1969 (FSCA). Also known from Brazil, Colombia and Surinam.
6. *Zethus chalybeus* Saussure 1852. Et. fam. Vesp. 1:10. Holotype female, Cayenne ("Cay"), French Guiana

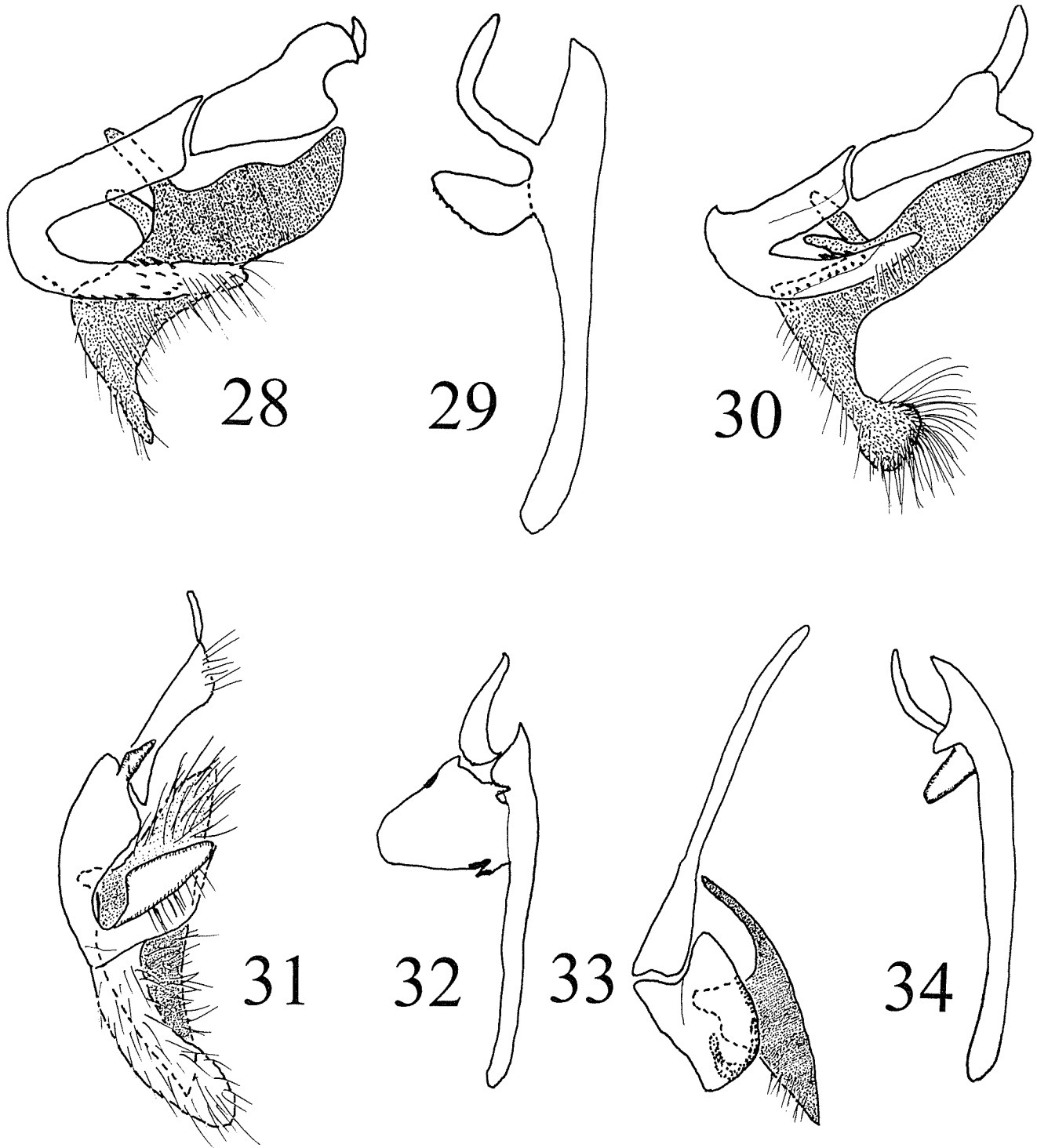


Plate 3 (Fig. 28-34). Male digitus & cuspis of *Z. vincenti* (fig. 28), *Z. rubioi* (fig. 30), *Z. yepezi* (fig. 31), *Z. carpenteri* (fig. 33). Aedeagus of *Z. vincenti* (fig. 29), *Z. yepezi* (fig. 32), and *Z. carpenteri* (fig. 34).

(MHNG). New Record: Barinas: Reserva Forestal Ticoporo 230 m., 10.IV.1966 (1 female, FSCA)

Zethus discoeliodes group

7. *Zethus sessilis* Fox 1899. Proc. Acad. Nat. Sci. Philadelphia, p. 410. Lectotype male, Chapada

da Santa Anna, Mato Grosso, Brasil (ICCM). **Records:** Las Adjuntas (BMNH). Also known from Brazil, Bolivia, Paraguay, and Argentina.

Zethus hilarianus group

8. *Zethus hilarianus* Saussure 1855. Et. fam. Vesp. 3:120. Lectotype female, Goyaz State, Brazil (MNHN). **Records:** Distrito Federal: Caracas (MNHN). Trujillo: Valera (MCZC); Yaracuy (USNM). Monagas: 42 kms. southeast of Maturin (LACM). **New Records:** Aragua: El Limon, 450 m., 15.II.85, R. Miller & L. Stange (1 female, FSCA). Lara: 18 km. southwest of Carora, 11.VII.1988, C. Porter & L. Stange (6 males, 7 females, FSCA); 20 Km east of Carora, 19-24.VI.1976, Menke & Vincent (18 males, 36 females, USNM, FSCA). Zulia: 6 km. west of La Concepcion, 18.VI.1976, Menke & Vincent (28 males, 3 females, (USNM, FSCA). Also known from Nicaragua, Brazil, Paraguay, and Argentina.

Zethus smithii group

9. *Zethus miscogaster* Saussure 1852. Et. fam. Vesp. 1:18 Holotype female, without data (MHNG). **Records:** Monagas: 42 km. southeast of Maturin (LACM). **New Records:** Zulia: Carrasquero, 18.VI.1976, Menke and Vincent (1 female, USNM); Carrasquero, 13.VII.1988, Porter and Stange (2 females, FSCA). This species is known from Arizona and Texas in the U.S.A. to Argentina. **Observations:** The two females collected by Porter and Stange have the gaster crimson, which is found in several other species in this area. The female collected by Menke and Vincent has a black gaster which is the typical color pattern of this species. The discovery of the male may lead to the recognition of the crimson gaster phenotype as a distinct species. It should also be noted that the closely related species, *Z. smithii* Saussure, probably occurs in Venezuela, since this species is known from Mexico to Argentina.

Zethus fuscus group

10. *Zethus fuscus* (Perty) 1833. Delect. anim. artic. Brasil 3:145. Holotype female, Brazil (ZSMC). **New Record:** Tachira: Rio Frio, 600 m., 10.XI.1981, Fernandez (IZAV).

Zethus heydeni group

11. *Zethus infelix* Zavattari 1912. Arch. f. Naturgesch. 78(Abt.A), Heft 4:62. Lectotype female, Bogota, Cundinamarca, Colombia (ZMHB). **New Records:** Merida: La Culata, Valle Grande 2800 m., 23.VI.1991, C. Porter and L. Stange (2 females, FSCA); Mucuruba, 2400 m., 23.VII.1988, Porter and Stange (2 males, 1 female, FSCA). Tachira: Betania, 2050 m., 5.VIII.1972 (1 female, FSCA).

12. *Zethus venezuelanus* Zavattari 1912. Arch. f. Naturgesch. 78 (Abt. A), Heft 4:61. Lectotype female, Merida, Venezuela (MCSN). **New Record:** Merida: 8 km. northeast of Merida, Valle Grande, 1.VII.1981. Stange and Porter (1 male, FSCA). **Observations:** The original notes on the holotype failed to place this species in the proper species group. The collecting of a second specimen shows the species belongs to the *Z. heydeni* group.

Zethus sichelianus group

13. *Zethus bolivarensis* Stange, new species. Holotype female, El Bochinche Res, Forestal Imataca, Bolivar, Venezuela, 6-13. XII.1974 (FSCA).

Length to apex of tergite II about 10 mm; Black with yellow as follows: mandible, dorsolateral spot on clypeus, scrobal spot, ocular spot, most of scape, prominent postocular spot; pronotum anteriorly and weakly posteriorly; mesopleural spot; tegula mostly, parategula weakly, mesoscutellum with faint sublateral spot at middle, metanotum nearly entirely; anterior face of meso- and metacoxa; femora with broad yellow band on apical half of closing face, hindfemur less extensive; foretibia mostly with black stripe on much of posterior surface, midtibia mostly on outer face, hindtibia with yellow not extending to apex; tergite I with apical band, tergites II-III with narrow subapical band. Mesopleuron with moderate, appressed white pubescence; propodeum with abundant appressed white pubescence; clypeus striate, interantennal carina moderately developed, extending strongly onto clypeus; subhumeral area regularly striate, mesopleuron at middle moderately punctate; pronotum with an oblique carina extending nearly to pronotal lobe; scutum with mostly close, large punctures; punctures more separated on mesoscutellum; propodeum with submedian carina fading below, area between carinae mostly striate except dorsally, area between submedian and sublateral carinae strongly punctate; petiole (tergite I) shiny, without micropunctuation, large punctures on dorsal surface mostly contiguous; tergite II mostly micropunctate with macropunctures concentrated posteriorly. Head broader than long in front view, genal carina strongly developed; pronotum with interhumeral distance about twice as long as distance between humerus and tegula; critical breadth of subhumeral area at least three midocellus diameters; scutum about as long as greatest breadth, notaulices undeveloped; midtibia with well developed spur; petiole with expanded area broadest

near base, becoming narrower apically, about 2.5 times longer than greatest breadth.

Observations. This species keys out to *Z. clypeolaris* Bohart & Stange in Bohart and Stange (1965). These are the only two species in the Group with one midtibial spur. *Z. bolivarensis* can be separated from *Z. clypeolaris* by the concentrated macropunctures at the apex of abdominal tergite II, the oblique carina on the pronotum extending nearly to the pronotal lobe, and lack of micropunctures on the mesoscutum.

14. *Zethus cylindricus* Fox 1899. Proc. Acad. Nat. Sci. Philadelphia, p. 414. Lectotype male, Chapada da Santa Anna, Mato Grosso, Brazil (ICCM). **New Record:** Aragua: Rancho Grande, Portachuelo, 1100 m., 21.V. 1981 (FSCA). This species ranges from Veracruz, Mexico to Misiones, Argentina.
15. *Zethus yepezi* Stange, new species. Holotype male, Curimagua, Falcon, Venezuela, 1640 m., 22.III.1987, R. Miller & L. Stange, cloud forest (FSCA).

Length from head to tergite II 10 mm, black with yellow as follows: clypeus laterally and apically, scrobal spot, scape below, mandible with stripe above; pronotum anteriorly; small upper mesopleural spot; tegula and parategula; mesoscutellum and metanotum with small dot sublaterally at middle; propodeum with elongate sumedial stripe; tergite I with broad apical band, extending short distance anteriorly on lateral margin; tergites II-IV with subapical band; sternites II-IV with subapical band, VI with weak area medially; forefemur and midfemur with band on apical half of posterior surface; foretibia and midtibia externally. Mesopleuron with moderately dense pubescence; vertex and mesonotum with abundant, erect brownish pubescence; propodeum and especially tergite I below with moderate erect whitish pubescence. Clypeus with weak striatopunctation, interantennal carina not developed; subhumeral area with moderately spaced macropunctures; mesopleuron and scutum with fairly close and coarse macropunctation; propodeum strongly striate between strong medial carina and fully developed submedial carinae; irregularly striate between submedial carina and sublateral carina; petiole with weak micropunctation dorsally between macropunctation; tergite II strongly micropunctate, without macropunctures. Head almost as broad as long in front view, postoccipital carina not produced at dorsolateral angle, no genal carina; male flagellomere X symmetrical, not hood-

ed; flagellomere XI evenly rounded, about twice as long as greatest diameter; subhumeral area about equal to four midocellus diameters; pronotum with interhumeral distance slightly longer than distance between humerus and tegula, without oblique carina, humerus square at anterior corner; scutum about equal in length to greatest breadth, notaulices not indicated; midtibia with two well-developed tibial spurs; tergite I with expanded area with greatest width anteriorly, narrowing posteriorly where it is nearly square in cross section; genitalia with cuspis and digitus as in fig. 30, aedeagus as in fig. 31.

Female. About as described for male. Head longer than wide in front view. Clypeus striatopunctate, apical margin truncate.

Paratypes. 2 males, Rancho Grande, Aragua, Venezuela, 4.VII.1988, L. Stange and C. Porter (FSCA). 1 Allotype female, Portachuelo, Rancho Grande, Aragua, Venezuela, 1100 m., 21.V.1981, F. Fernandez Yepez (IZAV)

Observations. This species keys out to *Z. sichelianus* (Saussure) in Bohart and Stange (1970). It differs from that species by the unflared postoccipital carina, the symmetrical male flagellomere X, and the petiole is relatively shorter. This species is named in honor of Fernando Fernandez Yepez, in appreciation for his help in providing specimens and field assistance.

Zethus sulcatus group

16. *Zethus apicalipennis* Zavattari 1912. Arch. f. Naturgesch. 78 (Abt. A), Heft 4:60. Lectotype female, Merida, Venezuela (MCSN). **New Record:** Tachira: La Grita, 1.700 m., 22.I.1969 (FSCA)
17. *Zethus melanis* Bohart and Stange 1965. U. Calif. Publ. Ent. 40:111. Holotype female, Rancho Grande, Aragua, Venezuela, 1100 m., 6.IX.1952, Fernandez-Yepez (IZAV). **New Record:** Aragua: Rancho Grande, 11.V.1980, Clavijo (2 males, 3 females, FSCA, IZAV).

Zethus spinosus group

18. *Zethus nicaraguensis* Zavattari 1912. Arch. f. Naturgesch. 78 (Abt.A), Heft 4:54. Holotype male, Sierra de Managua, Nicaragua (MCSN). **New Record:** Guarico: Hato Masaquaral, 44 km. south of Calabozo, 20-28.V.1985, Menke and Carpenter (3 females, FSCA, USNM). This species is recorded from Mexico, Nicaragua, Costa Rica, and Panama. **Observations:** See figure 20.

Subgenus *Zethusculus* Saussure 1855*Zethus mexicanus* group

19. *Zethus brasiliensis fuscatus* Bohart and Stange 1965. U. Calif. Publ. Ent. 40:130. Holotype male, Benevides, Para, Brazil. X. 1918, Klages (ICCM). **Records:** Aure: Ciudad de Nutrias (MNHN). Bolivar: Saupure (CUIC); Uruyen (IZAV)
20. *Zethus mexicanus mexicanus* (Linnaeus) 1758. Syst. Nat. (Ed. 10) 1:576 (n.6). Syntypes, Surinam (Stockholm?). **Records:** Bohart and Stange (1965) have recorded this species from various parts of Venezuela in a distribution map. **Observations:** See figure 22.

Zethus arietis group

21. *Zethus nigricornis* Saussure 1875. Smithsonian Misc. Coll. 254:22. Lectotype male, Cordoba, Veracruz, Mexico (MHNG). **New Records:** Aragua: Cata, 7.VII.1988, Porter & Stange (1 male, FSCA). Zulia: Carrasquero, 15.VI.1976, Menke & Vincent (10 males, 2 females, FSCA, USNM); near Rio Pueblo Viejo, Ruta 17, 15.VII.1988, Porter & Stange (1 male, 1 female, FSCA). This species is widespread in Mexico and Central America. **Observations:** See figure 24.
22. *Zethus romandinus* Saussure 1852. Et. fam. Vesp. 1:20. Holotype male, Cayenne, French Guiana (MHNG). **Record:** Monagas: 42 km. southeast of Maturin (LACM). **Observations:** See figure 21.
23. *Zethus rubioi* Stange, new species. Holotype male, Carrasquero, Zulia, Venezuela, 13.VII.1988, Porter and Stange (FSCA).

Length from head to apex of tergite II 11 mm. Black head and thorax, crimson red petiole and gaster. Clypeus mostly yellow except dorsally, flagellomeres I - VI with pale areas below, VI-XI mostly pale; midtibia with yellow stripe on closing face; hindtibia with small yellow spot on apex of exterior surface; petiole with small lateral yellow area subapically; tergite II with weak yellow subapical band. Pubescence mostly inconspicuous except moderately dense white, appressed micropubescence on clypeus, metapleuron, and propodeum; some erect hairs laterally of scutellum and metanotum, propodeum above. Clypeus sparsely punctate; frons closely punctate, somewhat with a "braised" effect; vertex, pronotum, mesoscutum, scutellum with moderate punctation; metanotum almost impunctate, with a weak transverse ridge near middle; posterior propodeal face with micro-

punctation obscured by micropubescence, few punctures toward lateral margin; petiole polished, with scattered small punctures; tergite II polished with few macropunctures on posterior half; clypeal apex moderately emarginate, bidentate; flagellum with hook less than twice as long as greatest width, with conspicuous setae (fig. 23); pronotum rounded; mesoscutum without notaulices; tegula strongly bent out at posterior third; petiole about as high as broad, not especially flattened above; stem of tergite II longer than that of I; apical lamella of tergite II flat, about 1.5 midocellus diameters; tergite V without tooth; genitalia with gonostyle about 3/4's as long as gonocoxite; digitus and cuspis as in fig. 30; aedeagus about as in fig. 29.

Female. About as described for male; clypeus weakly tridentate.

Types. 1 paratype female, same data as holotype (FSCA). 1 paratype male, 15 km. north of Carrasquero, Zulia, Venezuela, 29. V.1978, A. Menke and D. Vincent (USNM); 1 paratype female, Carrasquero, Zulia, Venezuela, 15.VI.1978, A. Menke and D. Vincent (USNM); 1 male, 1 female paratype, 12 km. east of Santa Marta, Magdalena, Colombia, 27.XI.1974, M. Cooper, dry tropical forest (BMNH 1975-33).

Observations. This species has distinctive coloration and can be separated from other species of the *Z. arietis* group by the contrast between the black head and thorax and orange petiole and gaster. The coloration is most similar to *Z. slossonae* Fox from Florida which usually has tergite I black. The gonostyle is very long in this species. This species is named for the celebrated Venezuelan Hymenopterist, Edmundo Rubio-Espina.

24. *Zethus vincenti* Stange, new species. Holotype male, Carrasquero, Zulia, Venezuela, 13.VI.1988, Porter & Stange (FSCA).

Length from head to apex of tergite II 13 mm. Black with extensive orange as follows: mandibles, scape, pedicel and flagellomere I; scrobe; pronotum; most of upper mesopleuron; tegula; legs; scutellum, metanotum, propodeum, petiole and stem of tergite II. Clypeus mostly yellow, flagellomeres I-VI with yellow below, VII-X mostly yellow, hook mostly pale; some yellow on scape blending with orange coloration. Pubescence inconspicuous; dense mostly appressed white micropubescence on propodeum, base of petiole, and expanded part of sternite I. Clypeus with shallow, sparse macropunctures, surface finely microstriate; vertex and pronotum

with moderately space macropunctures; scutum with moderately space macropunctures except sparser medially, especially posteriorly; scutellum with moderate punctation; metanotum nearly impunctate, without transverse ridge; posterior face of propodeum granulate with fine transverse striae; petiole polished with sparse macropunctures, nearly impunctate in narrow lateral strip basad of spiracle; tergite II dulled by shagreening and micropubesence with moderately spaced macropunctures on posterior half; clypeal apex moderately emarginate, bidentate; antennal hook more than twice as long as greatest width (fig. 25); pronotum rounded; mesoscutum without notaulices; tegula weakly angled out at posterior two-fifths along outer rim; petiole broader (at widest point) than high, somewhat flattened above; stem of tergite II longer than that of I; apical lamella of tergite II flat, about 1.5 midocellus diameters; sternite V without tooth; gonostyle less than 1/2 as long as gonocoxite; digitus and cuspis as in fig. 28; aedeagus as in fig. 29.

Female. About as described for male; clypeal apex beveled.

Types. Holotype male, 1 male paratype, 1 female paratype from Carrasquero, Zulia, Venezuela, 13.VII.1988, C. Porter and L. Stange (FSCA). 2 male, 1 female paratypes, Rosario, Zulia, Venezuela, 14.VI.1978, A. Menke and D. Vincent (USNM).

Observations. The orange coloration of the pronotum, propodeum, and petiole is distinctive in the subgenus *Zethusculus*. Structurally the male genitalia provides a good diagnostic character. This species is named for David Vincent, one of the collectors of this species.

25. *Zethus westwoodi* Saussure 1852. Et. fam. Vep. 1:16. Holotype female, "Penol de los Banos", Mexico (OXUM).

Record. Monagas: 43 km. southeast of Maturin (LACM).

Subgenus *Zethoides* Fox 1899

Zethus binodis group

26. *Zethus binodis* (Fabricius) 1793. Ent. Syst. Suppl., p. 264. Holotype female, Cayenne, French Guiana (MNHN).

Although no records of this species are known to date for Venezuela, it is known from Trinidad which suggests strongly that this species is found in

Venezuela. The male clypeus and antennal hook are illustrated in fig. 4.

27. *Zethus matzicatzin* Saussure 1857. Rev. Mag. Zool. (Ser. 2) 9:271. Holotype male, Tampico, Tamaulipas, Mexico (MCSN).

New Records. Zulia: La Sierra, near Machiques, 22.II.1986, R. Miller & L. Stange (2 females, FSCA); Los Angeles del Tucuco, 15.IV.1981, E. Grissell (1 male, USNM).

Observations. This is an especially interesting range distribution for this species, which was previously known from Mexico to the Panama Canal. This record indicates that there is a corridor of species penetration to the east side of the Andes at the northwestern corner of Venezuela. This species is closely related to *binodis* but differs structurally by the less dentate clypeal apex (fig. 3) and shorter antennal hook.

Zethus olmecus group

28. *Zethus miniatus* Saussure 1858. Rev. Mag. Zool. (Ser. 2) 10:64. Lectotype male, Para, Brazil (MHNG).

New Records. Aragua: Rancho Grande, Portachuelo, 1100 m., 21.V.1981, Fernandez (1 male, IZAV); 2 km. north of Ocumare de La Costa, 22.VI.1976, A. Menke & D. Vincent (2 males, FSCA, USNM). Trujillo: Sabana Grande, 2 VI.1976, Menke & Vincent (1 male, USNM).

Observations. See figures 5 to 8.

29. *Zethus toltecus* Saussure 1875. Smithsonian Misc. Coll. 254:27. Holotype female, Orizaba, Mexico (MHNG).

New Records. Falcon: Boca de Aroa, 1.X.1978, J. Clavijo (1 female, IZAV). Zulia: Carasquero, 13.VII.1988, C. Porter & L. Stange (1 female, FSCA).

Zethus parvulus group

30. *Zethus haemorrhoidalis* Kriechbaumer 1900. Berl. Ent. Ztschr. 45: 104. Holotype male, Barranquilla, Dept. Atlantico, Colombia (MLUH).

New Records. Aragua: 29 km. north of Ocumane de la Costa, 21.VI.1976, A. Menke & D. Vincent (1 male, 1 female, USNM); Puerto de Cata, 10.VI.1976, A. Menke & D. Vincent (39 males, 6 females, FSCA, USNM); Cata, 7.VII.1988, C. Porter & L. Stange (6 males, 1 female, FSCA). Lara: 20

km. east of Carora, 24.VI.1976, A. Menke & D. Vincent (3 males, 4 females, USNM); 18 km. southwest of Carora, 11.VII.1988, C. Porter & L. Stange (1 female, FSCA). Trujillo: Sabana Grande, 23.VI.1976, A. Menke & D. Vincent (1 male, USNM). Zulia: Rosario, 4.VI.1976, A. Menke & D. Vincent (1 female, USNM); 6 km. west of La Concepcion, 18.VI.1976, A. Menke & D. Vincent (1 female, USNM); 15 Km. north of Carrasquero, 29.V.1976, A. Menke & D. Vincent (1 female, USNM); Carrasquero, 13.VII.1988, C. Porter & L. Stange (6 males, 20 females, FSCA); 31 Km. southwest of Machiques, 14.IV.1981, A. Menke & L. Hollenberg (1 male, USNM).

Zethus carinatus group

31. *Zethus bodkini* Bohart & Stange 1965. Univ. Calif. Publ. Ent. 40:180. Holotype male, Surinam (UCDC).

New Records. Merida: Puente Real, 7 km. west of Lagunillas, 16.VII.1991, C. Porter & L. Stange (1 male, FSCA). Zulia: Highway 6 at Rio Lora, 79 km. south of Machiques, 12.IV.1982, A. Menke & L. Hollenberg (1 female, USNM).

Observations. Coloration of the gaster is variable. The specimen from Merida Province has the gaster all black whereas the Zulia specimen has most of the gaster reddish. This species is known from British Guiana and Surinam. Re-examination of the holotype revealed the presence of only one midtibial spur rather than two spurs as implied in the Group description. See figures 11 to 16 for structural details.

32. *Zethus carinatus* Smith 1857. Cat. Hym. Brit. Mus. 5:13. Holotype male Villa Nova, Para(?), Brazil (BMNH).

New Records. Aragua: Rancho Grande, 1100 m., 11.V.1980, Fernandez (1 female, IZAV). Guarico: 44 Km. south of Calabozo, Hato Masguaral, 60 m., 8° 34'N., 7° 35' W., 11.II.1986, R. Miller & L. Stange (1 female, FSCA).

Observations. See figure 17 for antennal hook.

33. *Zethus carpenteri* Stange, New Species. Holotype male, Carrasquero, Zulia, Venezuela, 13.VII.1988, C. Porter & L. Stange (FSCA).

Length from head to tergite II 12 mm.; Head and thorax mostly black with mandibles and flagel-

lum reddish, yellow stripe on scape below, orbital spot, small postorbital spot; yellow to reddish yellow are pronotum laterally and posteriorly, upper mesopleural spot, tegula, parategula apically; small area sublaterally on metanotum, and tiny spot on propodeum below; legs mostly crimson except mostly black coxae and trochanters; abdomen crimson with small yellow area sublaterally at apex of petiole. Micropubescent silvery, relatively sparse except pronotum laterally, pleura and propodeum where it is densest medially between submedial carinae. Punctuation moderate, fairly close on vertex, pronotum, and scutum, sparse on middle of scutellum and metanotum; dorsal face of propodeum with large shallow punctures, posteriorly with irregular oblique carinulae; petiole and tergite II with well space macropunctures, interspaces polished. Clypeus weakly bidentate; genal carina rounded; apical flagellomere two times longer than basal diameter; occipital carina weakly angled opposite orbit; humerus obtuse, a carina ending in front of pronotal lobe; critical breadth of subhumeral area about two midocellus diameters; metanotum relatively flat, without median carina; apical lamella of propodeum weakly developed; petiole without dorsobasal carina; membrane of tergite II pitted basally; genitalia as in figs. 33 and 34; aedeagus with lateral "wings" united as median process; basivosella elongate.

Female. About as described for male except clypeus striatopunctate, apex tridentate.

Types. 1 female paratype, same data as type (FSCA); 1 female paratype, Pueblo Nuevo, Falcon, Venezuela, 21.III.1987, R. Miller & L. Stange (FSCA).

Observations. The presence of only one well developed midtibial spur distinguishes this species from all others in the Group except for *Z. bodkini*. The rounder genal carina of *Z. carpenteri* appears to be a consistent although minor difference from *Z. bodkini*. In the male the relative lengths of the apical flagellomere and the clypeal apex are specific differences. This species is named for Jim Carpenter who has collected *Zethus* specimens in Venezuela.

Zethus biglumis group

34. *Zethus diminutus santaremae* Bohart & Stange 1965. Univ. Calif. Publ. Ent. 40:187. Holotype male, Santarem, Para, Brazil (BMNH).

New Records. Guarico: Hato Masaguaral, Venezuela, 2-29.V.1985, J. Carpenter & A. Menke (2 females, AMNH, FSCA); Estacion Biologica las Llanos, 8° 36' N, 67°, 25' W. (1 female, FSCA).

Observations. This species appears closely related to the following new species. Both have been captured at the same locality (Hato Masaguaral) at the same time. Only females are known so that precise comparison with *Z. diminutus* from other localities in Brazil, Paraguay and Argentina is difficult. These Venezuelan females seem to agree with other South American specimens of *Z. diminutus* in sculpture and structure and the coloration is most similar to the "subspecies" *santaremae*. The humerus of the pronotum is more rounded (fig. 9) than in the following species.

35. *Zethus milleri* Stange, new species. Holotype male, Peninsula Paraguana Moruy, Falcon, Venezuela, 21.II.1986, R. Miller & L. Stange (FSCA).

Length from head to apex of tergite II 9 mm.; Head, thorax, and petiole black with yellow as follows: mandibular spot, scrobe, scape mesally, flagellar hook, humeral spot, tegula, apex of parategula, a pair of small spots on metanotum, petiole posteriorly; gaster crimson red with black on basal one-half of tergite II. Silvery-grey micropubescence sparse except on clypeus, metapleura and propodeum; macropunctures each with moderately long setae resulting in fairly dense pubescence especially on vertex, pronotum, and mesoscutum. Punctuation fine and close on clypeus, coarse but shallow on vertex, pronotum, mesoscutum and mesoscutellum, latter two areas with macropunctures more widely spaced medially; propodeum with sculpture obscured by pubescence, sparsely punctate; tergite with well spaced punctures, without micropunctuation dorsally; tergite II with moderately spaced punctures, close micropunctuation. Antennal flagellomeres without calli; clypeal apex beveled, rimmed, nearly straight between short teeth; interantennal longitudinal carina very weak; stipes with relatively low, rounded bulge sublaterally; flagellar hook about as long as preceding flagellomere; pronotum square below sharp humerus (fig. 10); critical breadth of subhumeral area about 2.0 midocellus diameters; notaulices absent; tegula with outer rim a little bowed at posterior one-third; postscutellum sloping forward to a thin edge behind scutellum, lateral carina curved in posteriorly, a low median anterior ridge; submedian propodeal ridges converging and strong halfway to

petiole insertion; upper lamella of propodeum weakly projecting; sternite II slightly angled.

Types. 1 female, 18 km. southwest of Carora, 11.VII.1988, C. Porter & L. Stange (FSCA). 2 females, 6 km. west of La Concepcion, 18.VI.1976, A. Menke & D. Vincent (USNM); 11 females, Hato Masaguaral, Guarico, Venezuela, 8° 34' N, 67° 35' W, 60 m. 20-28.V.1985, A. Menke & J. Carpenter (AMNH, FSCA, USNM); 1 female, Maracaibo, Botanical Garden, Zulia, Venezuela, 23.IV.1981, A. Menke & L. Hollenberg (USNM).

Observations. The series of females from Hato Masaguaral have the petiole and first gastral segment black with broad yellow stripes posteriorly. The rest of the gaster is yellowish. This may represent a different species but no males are known which are needed to compare genitalia and antennal characters. This species is named for Robert Bruce Miller, one of the collectors of Venezuelan *Zethus*. The male genitalia are missing in the holotype.

Zoogeography

According to Cabrera & Willink (1973), there are eight zoogeographical provinces within Venezuela. These can be roughly divided into the lowland provinces and the highland provinces as follows:

Lowland Provinces

1. Amazon
2. Savanna
3. Venezuelan
4. Guajira

Highland Provinces

5. Paramo
6. Cloud forest
7. Tepuys (Guayana)
8. High Andes

There are no records of *Zethus* from the Paramo, Tepuys or High Andes. The most endemic fauna is found in the Guajira Province where four endemic species are found. There is no data to support the recognition of the Venezuelan and Savanna Provinces from the Amazon Province and for the sake of discussion these are combined. Based on the information gathered to date, three main zoogeographic provinces can be defined based on the *Zethus* fauna.

Guajira Province. This is an arid tropical zone in the states of Zulia and Falcon on the Caribbean coast and evidently in the Northeast area of Colombia although few records of *Zethus* are known from that part of Colombia. This zone lies between two spurs of the Andes mountains. This area has semi-desert areas but most of the species were collected in the more humid western part of the area at Carrasquero. This area is of considerable zoogeographical interest because it appears to be a corridor of faunal exchange from the western side of the Andes to the eastern side of the Andes. For example, *Z. matzicatzin* was previously known only from Mexico to Panama whereas its adelphotaxon, *Z. binodis*, ranges from Trinidad south to Brazil. Now its occurrence in western Zulia indicates its successful passage to the far side of the Andes although still contained by the Andes. This also appears to be the case with *Z. nigricornis* which was previously known from Mexico to Colombia.

There is a distinct geographic facies in this area. One notable color combination is head and thorax black and abdomen crimson. This occurs in five species in the subgenus *Zethoides* (*Z. carpenteri*, *Z. bodkini*, *Z. milleri*, *Z. matzicatzin* and *Z. haemorrhoidalis*), one species of *Zethusculus* (*Z. rubioi*) and one species in the nominal subgenus (*Z. miscogaster*). These species (or color forms in the case of *Z. miscogaster* and *Z. bodkini*) are not known from the other areas of Venezuela. Another color type is represented by *Z. vincenti* and *Z. miniatus*, which have a lot of orange. Two additional *Zethusculus* are found in this zoogeographical province (*Z. nigricornis* and *Z. westwoodi*) which are mostly black. The comparative representation of the subgenera in this area is remarkable since 90% of the species belong to *Zethoides* and *Zethusculus*. The percentage of *Zethoides* is the highest known. This subgenus is often well represented in arid tropical zones such as Mexico which has about 45% *Zethoides*. The representation of *Zethusculus* is also high with 36% of the species and 22% of all the species known in the *Zethusculus arietus* Group.

Cloud Forests. All the species known from the cloud forests of Venezuela belong to the nominate subgenus. Cloud forests are tropical cool areas which have considerable humidity owing in part to regular fogs. A well developed cloud forest is usually characterized by the presence of tree ferns. The best represented Group in the Venezuelan cloud forests is the *Z. sulcatus* Group with two species. One species, *Z. melanis*, appears to be endemic

whereas the other species is found also in Costa Rica.

Zethus magretti is the only member of its group and is known from only three specimens from Costa Rica, Panama, and Venezuela. This species appears to be a cloud forest species. Three additional species are known from the cloud forests belonging to the *Z. heydeni* Group (*Z. infelix* & *Z. venezuelanus*) and the *Z. sichelianus* Group (*Z. cylindricus*). This latter species is the only one that is also found in the lowland Amazon Biotic Province.

Amazon Province. This is the largest biotic province in South America with more than 4 million square kilometers extending from Venezuela to Bolivia and Paraguay. This area has high precipitation and is often flooded and in its best development has three tree layers. More than 50% of the described species of *Zethus* live in this area. In Venezuela about 65% of the known species live in the Amazon Province.

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AMNH - American Museum of Natural History, New York, New York. Jim Carpenter.

BMNH - Department of Entomology, British Museum, Natural History, London, England. Colin Vardy.

CUIC - Department of Entomology, Cornell University, Ithaca, New York.

FSCA - Florida State State Collection of Arthropods. Gainesville, Florida. Jim Wiley.

ICCM - Carnegie Museum, Pittsburgh, Pennsylvania.

IMLA - Instituto y Fundacion Miguel Lillo, San Miguel de Tucuman, Argentina. Abraham Willink.

- IZAV - Institut de Biologia Agricola, Universidad Central de Venezuela, Maracay, Venezuela. F. Fernandez Yopez.
- MCSN - Museo Civico di Storia Naturale, Genoa, Italy. D. Guiglia.
- MCZC - Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. Jim Carpenter.
- MIZT - Instituto di Zoologia Sistemica, Universita di Torino, Torino, Italy.
- MHNG - Musee d'Histoire Naturelle, Geneva, Switzerland. C. Besuchet.
- MLUH - Wissenschaftsbereich Zoologie, Sektion Biowissenschaften Martin-Luther-Universitat Halle, WB Zoologie, Halle (Saale), Germany.
- OXUM - Hope Entomological Collections, University Museum, Oxford, England.
- USNM - United States National Museum, Washington, D. C. Arnold Menke.
- UCDC - Department of Entomology, University of California, Davis, California. Robert M. Bohart
- ZMHB - Zoologisches Museum der Humboldt-Universitat, Berlin, Germany.
- ZMUC - Department of Entomology, Zoological Museum, University of Copenhagen, Kobenhavn, Denmark.
- ZSMC - Zoologische Sammlung des Bayerischen Staates, Munchen, Germany.
- Fox, W. J.** 1899. Contributions to a knowledge of the Hymenoptera of Brazil. No. 7, Eumenidae. Proceedings of the Academy of Natural Sciences of Philadelphia, pp. 407-464.
- Fabricius, J. C.** 1793. Entomologia systematica emendata et aucta....etc. Hafniae, C. Proft, vol.2, 519 pp.
- Kriechbaumer, J.** 1900. Von ihrer Konigl. Hoheit der Prinzessin Therese von Bayern auf einer Reise in Sudamerika. 1. Hymenoptera. Berliner Entomologische Zeitschrift 45: 97-107.
- Linnaeus, C. von** 1758. Systema naturae...etc., 10th ed. Tomus 1, Laurentii Salvii, Holmiae, 823 pp.
- Perty, M.** 1833. Delectus animalium articulorum quae in itinere per Brasiliam annis 1817-1820....etc. Munchen, fasc. 3, pp. 125-224.
- Saussure, Henri de.** 1852-1853. Etudes sur la famille des Vespides. Paris & Geneve, vol. 1, pp. 1-64 (1852), 65-286 (1853).
- Saussure, Henri de.** 1855. Etudes sur la famille des Vespides. Paris & Geneve, vol. 3:193-288.
- Saussure, Henri de.** 1857. Nouveaux vespides du Mexique et de l'Amerique septentrionale. Revue de Zoologie (ser. 2) 9:269-282.
- Saussure, Henri de.** 1858. Note sur la famille des Vespides. Revue de Zoologie (ser. 2) 10:63-81.
- Saussure, Henri de.** 1875. Synopsis of American wasps. Smithsonian Miscellaneous collections 254, 393 pp.
- Smith, F.** 1857. Catalogue of hymenopterous insects in the collection of the British Museum. Part V - Vespidae. London, 147 pages.
- Zavattari, E.** 1912. Materialien fur ein Monographie der Neotropischen Eumeniden. Archiv fur Naturgeschichte 78 (Abt.A), Heft 4:1-272.

References

- Bohart, Robert M., and Lionel A. Stange.** 1965. A revision of the genus *Zethus* Fabricius in the Western Hemisphere. University of California Publications in Entomology 40:1-208.
- Cabrera, Angel L., and Abraham Willink.** 1973. Biogeografia de America Latina. Organizacion de los Estados Americanos, Serie de Biologia, Monografia no. 13, pp. 1-120.