

**DESCRIPTION OF A NEW SPECIES OF *BLACUS* NEES  
(HYMENOPTERA: BRACONIDAE) FROM MEXICO,  
UTILIZING CHARACTERS OF THE MALE  
EXTERNAL GENITALIA**

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*Abstract.*—A new species of *Blacus* from Mexico is described. A technique for studying the male genitalia in braconids was implemented. The male genitalia of *Blacus parastigmaticus*, new species is described and a terminology for morphological characters is proposed.

*Key Words.*—Insecta, taxonomy, Hymenoptera, Braconidae, *Blacus*, Mexico.

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Members of the subfamily Blacinae (Braconidae) are solitary koinobiont endoparasitoids of Coleoptera, Mecoptera and Hymenoptera larvae (Sharkey 1997, Van Achterberg & Altenhofer 1997). There are about 176 species of Blacinae in the world, included in 12 genera and six tribes (Van Achterberg 1976, 1988, 1995; Van Achterberg & Altenhofer 1997; Belokobyl'skij & Ku 1998). Van Achterberg (1976, 1988) provided the most recent revision of the subfamily Blacinae of the world. During the same period Tobias (1976, 1982) described the genera *Blacometeorus* and *Hellenius*, and Mason (1976) revised *Dyscoletes*. Later Van Achterberg (1995) described the genus *Glyptoblacus* from Honduras. Van Achterberg & Altenhofer (1997) described the genus *Xyeloblacus* from the Palaearctic region.

*Blacus* Nees is the most speciose genus of Blacinae. It is cosmopolitan and common in both temperate and tropical regions. There are nine subgenera (Van Achterberg, 1988). The number of species of *Blacus* reported in the world are 157, forty of which are found in the New World (Van Achterberg 1988, Papp 1993). There are 10 species known from Mexico: *B. albipalpis* Van Achterberg, *B. aulacis* Van Achterberg, *B. chillcotti* Van Achterberg, *B. collaris* (Ashmead), *B. cracentis* Van Achterberg, *B. humilis* (Nees),

Table 1. Uses of male genitalic characters in Braconidae.

Taxa	Taxonomic separation	Reference
Braconidae	Separating genera	Tobias 1967, Marsh 1965, Quicke 1988, Quicke & Van Achterberg 1990
Alysiinae	Separating species	Königsmann 1959, 1960; Lâcâtsu 1965
<i>Aphaereta</i>	Separating species	Wharton 1977
<i>Triaspis</i>	Separating species	Beime 1946
Doryctinac	Separating species	Marsh 1965, 1967
<i>Colastes</i>	Separating species	Beime 1946
Aphidiinae	Separating species	Tremblay 1964, 1976, 1979, 1981, 1983
<i>Ephedrus</i>	Separating species	Gardenfors 1986
<i>Leiophron</i>	Separating species	Loan 1974
<i>Peristenus</i>	Separating species	Loan 1974
<i>Stiropius</i>	Separating species	Whitfield 1988
<i>Viridipyge</i>	Separating species	Whitfield 1988
<i>Epsilogaster</i>	Separating species	Valerio & Whitfield 2000
<i>Digonogastra</i>	Separating species	Wharton et al. 1989
Microgastrinae	Separating genera	Maeto 1996
Cardiochilinae	Separating genera	Maeto 1996
Miracinae	Separating genera	Maeto 1996
<i>Blacus</i>	Separating species	Haesclbarth 1973

*B. ruficornis* (Nees), *B. thoracicus* Van Achterberg, *B. trapezoides* Van Achterberg and *B. crassicus* Van Achterberg. Many Mexican species remain undescribed. They are known from the states of Aguascalientes, Baja California Sur, Coahuila, Colima, Chiapas, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, Mexico State, Michoacan, Morelos, Nuevo Leon, Oaxaca, Puebla, San Luis Potosi, Sinaloa, Tabasco, Tamaulipas, Veracruz, Yucatan and Zacatecas (Marsh 1979; Labougle 1980; Sarazin, 1985; Van Achterberg 1976, 1988; Sánchez et al. 1998; Sánchez & López 2000; Delfin & León 1997; López 1997, 1999; Reyes et al. 1998; Wharton & Mercado 2000). A new species from Mexico is described here emphasizing the utility of the male genitalia for separation of species in this genus. Here male genitalia provide useful characters for the higher level of classification in Braconidae and for separating species in this group (Table 1). This study of *Blacus* contributes to our knowledge of the systematics of Mexican Braconidae.

#### TERMINOLOGY

Terminology for male genitalia was taken from Snodgrass (1941), Michener (1956), Tremblay (1964, 1976, 1979, 1981, 1983), Marsh (1965), Wharton (1977) and Maeto (1996). The genitalia consists of the modified tergum and sternum of the ninth segment, the gonobase and the phallus. The IX tergum is essentially a capsule that encloses the basal two-thirds of the phallus. The X tergum is much more reduced and it is represented only by two small flaps and a pair of small pygostyles located at the posterior end of the IX tergum. The IX sternum, or subgenital plate, lies beneath the gonobase, with a projection extending dorsally on each side. The gonobase (basal ring) is an annular sclerite surrounding the basal foramen of the phallus and its anteroventral margin bears a knoblike process called the "conocondyle." The phallus consists of five parts: a pair of gonoforceps, a pair of volsellae (which lie in a horizontal plane between the gonoforceps and beneath

the aedeagus) and the aedeagus. The volsella of the Braconidae consists of the lamina volsellaris and two distal lobes; the digitus and the cuspis. At the apex of a median longitudinal ridge, the lamina volsellaris is distally articulated with the digitus. While the cuspids are usually reduced to small lateral lobes, the digiti are strongly developed, freely articulated lobes, usually toothed at their apical edge, which turn laterally and dorsally at the end of each volsella. The volsellar apodemes extend internally from the digiti and serve as attachments for muscles that move the digiti. The aedeagus is a simple structure, usually broad, notched at the apex and grooved below. The apodemes of the aedeagus extend internally from its base.

#### MATERIALS AND METHODS

*Preparation of Male Genitalia.*—The following technique was used to prepare the male genitalia of Braconidae. Specimens were relaxed for about 5 min in precipitate glasses by boiling them in 70% ethanol. Under a dissecting microscope the relaxed braconids were dissected with the aid of fine forceps or two pins, with the apex of the metasoma being gently lifted to expose the genitalia. After separating several membranes with forceps, the genitalia were removed. The apex of the metasoma was then carefully restored to its normal, closed position. In order to clean genitalia from muscular fibers and fat, they were placed in 10% KOH solution and heated for 6 to 10 min, at 65.8°C until they were clear. Later, they were washed in water to remove KOH and dissolved tissues. The genitalia were placed in glycerin on a slide and were digitized under a light microscope fitted with a video camera using Ati Video Player 3.5 and the resulting images were adjusted for contrast and printed using Adobe Photo Shop 5.0. Male genitalia were stored in small plastic genitalia vials containing glycerin.

All the specimens were remounted, putting them through a sequence of alcohols: 80, 96 and 100%. After this they were placed in amyl acetate for 2 hours, dried, then, mounted on points. The small genitalia vials were placed on the same pin below the specimens.

*Measurements of Other Characters.*—For measuring characters of specimens, a technique was used that consisted of digitalizing images of specimens with the following programs: Video Blaster FS200 and Image Tool Version 1.28 for Windows. The characters measured were: length of body, length of fore wings, length and width of 3th, 4th and penultimate antennal segments, dorsal length of eye, length of temple, maximum and minimum width of head, length of malar space, basal width of mandible, length and height of mesosoma, length of 1CUa and 1CUB veins of fore wings, length and width of hind femur, tibia and basitarsus, length and basal width of first tergum and length of the ovipositor.

Terminology used in the descriptions generally follows Sharkey & Wharton 1997. Data labels were transcribed to a database of the Program Paradox Version 4.

*Collections Examined.*—The specimens of *Blacus parastigmaticus*, new species were borrowed from the following collections: Colección Entomológica del Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas, México (ECOSC); Colección del Instituto de Fitosanidad del Colegio de Postgraduados, Montecillo, Edo, México, México (CEIFIT), Colección “Leopoldo Tinoco Corona”, Instituto de Ciencias Agrícolas, Universidad Autónoma de Guanajuato, ex Hacienda El Copal, Irapuato, Guanajuato, México (LTC), Colección de Insectos Benéficos de la Universidad Autónoma de Nuevo León, México (UANL) and Texas A&M University, College Station, Texas, USA (TAMU).

## RESULTS

*Blacus (Blacus) parastigmaticus* Sánchez & Wharton, NEW SPECIES

(Figs. 1–9)

*Male*.—Length of body: 1.89–2.50 mm. Color: dark brown; palpi white; mandible, labrum, antenna basally, tegula and legs yellow-brown; parastigma and pterostigma brown. Head (Figs. 2–3): ovoid; 18 antennal segments; antenna moderately slender; length of 3rd segment 1.11–1.33 times longer than 4th segment, length of 3rd and 4th segments 2.25–3.0 and 1.75–2.25 times their width respectively, penultimate segments longer than wide; dorsal length of eye 0.87 times the length of temple; maximum width of head 1.61–1.95 its minimum width; frontal and malar sutures absent; area in front of occipital carina crenulate; frons, vertex and clypeus smooth; face smooth; length of malar space distinctly longer than basal width of mandible. Mesosoma (Figs. 4–5): length of mesosoma 1.20–1.53 times its height; side of pronotum largely reticulate; zone behind epicnemial carina crenulate; epicnemial suture longitudinally reticulo-rugose, as is precoxal suture; metapleural flange large; notauli anteriorly and posteriorly crenulate; scutellar suture wide, deep, with medial carina crenulate; scutellum smooth, its lateral carina indistinct; propodeal tubercle small; surface of propodeum largely reticulated. Wings (Fig. 7): stigma rather large; r2 vein straight; length of 1CUa vein 0.35–0.47 times length of 1CUb vein; 1st discoidal cell anteriorly wide. Length of fore wing 2.0–2.19 mm. Legs; basitarsus of fore leg curved, with a row of setae beneath; length of femur, tibia and basitarsus of hind leg 4.75–5.50, 8.30–9.66 and 6.25–7.33 their width, respectively; hind femur pimply; hind coxa dorsally rugose; arolia large. Metasoma; length of 1st tergite (Fig. 5) 1.77–2.08 its apical width, finely reticulate, dorsal carinae distinct through its length. Genitalia (Fig. 9): aedeagus bifid with two apical lobes, a medial deep canal and apical pits; gonoforceps wide, slightly directed outward, with many apical setae and some at its base; digitus with three teeth: cuspis rounded, lamina volsellaris with four-six setae; volsellar ridge not evident.

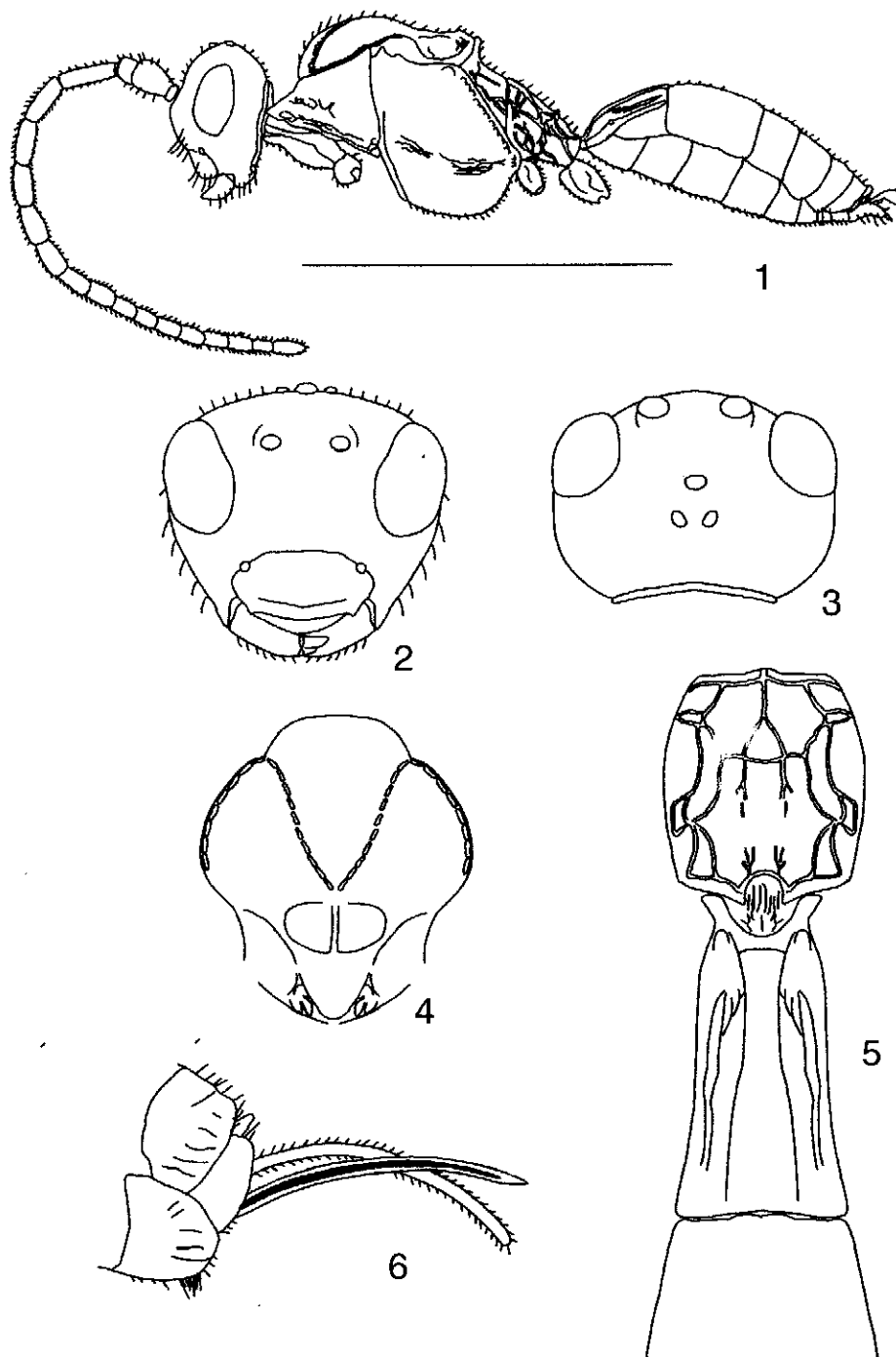
*Female*.—(Figs. 6, 8). Similar to male. Length of fore wing 1.7 mm; antenna stouter and shorter than in male; antenna with 17 segments; length of eye 0.7 times the length of temple; length of ovipositor sheath 0.29 times as long as fore wing.

*Host*.—Unknown.

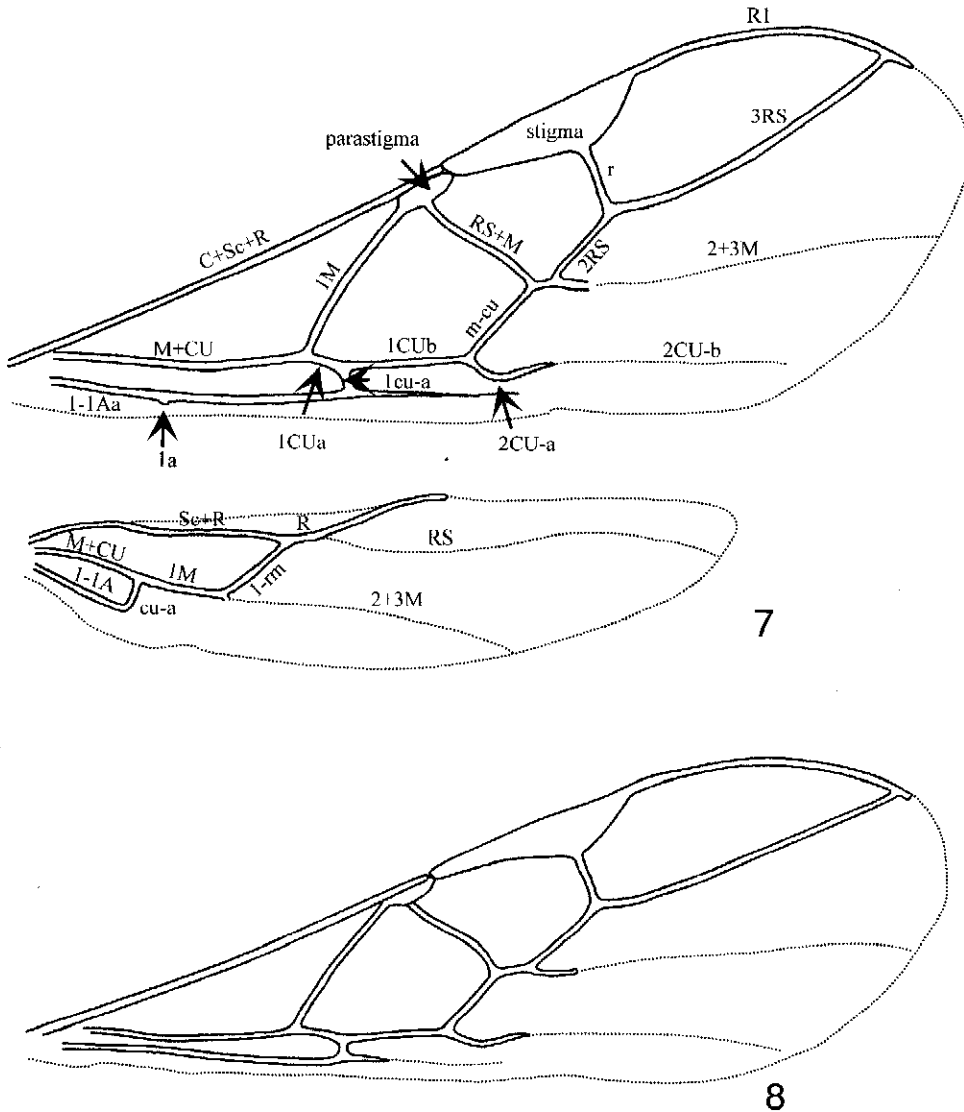
*Distribution*.—MÉXICO: Aguascalientes, Chiapas, Guanajuato, Guerrero, Jalisco, Michoacán, Nuevo León, Oaxaca, Puebla and Tamaulipas.

*Types*.—Holotype, male: MÉXICO: CHIAPAS: Balún Canal, 29 Oct 1996, V. Galdamez, yellow pan trap; deposited: Colección Entomológica del Instituto de Fitosanidad, Colegio de Postgraduados, Montecillo, Estado de México, México (CEIFIT). Allotype, female: MÉXICO.

CHIAPAS.—Balún Canal, 28 Jul 1997, M. Anzucta, yellow pan trap; deposited: Colección Entomológica del Instituto de Fitosanidad, Colegio de Postgraduados, Montecillo, Estado de México, México (CEIFIT). Paratypes: MÉXICO. AGUASCALIENTES: 2 km W. Of Calvillo, 2 May 1998, J. A. Sánchez, 1 male. CHIAPAS: same data as holotype, 27 males; same data as allotype, 15 males; same locality, 23 Oct 1996, V: Galdamez & S. Gómez, yellow pan trap, 1 male; same locality, 23 Oct 1996, V. Galdamez, yellow pan trap, 1 male; same locality, 25 Oct 1996, V. Galdamez & L. Ruiz, yellow pan trap, 9 males; same locality, 31 Oct 1996, L. Ruiz & V. Galdamez, yellow pan trap, 1 male; same locality, 18 Nov 1996, V. Galdamez and S. Gómez, yellow pan trap, 1 male; same locality, 27 Nov 1996, V. Galdamez & S. Gómez, 2 males; same locality, 1 Dec 1996,



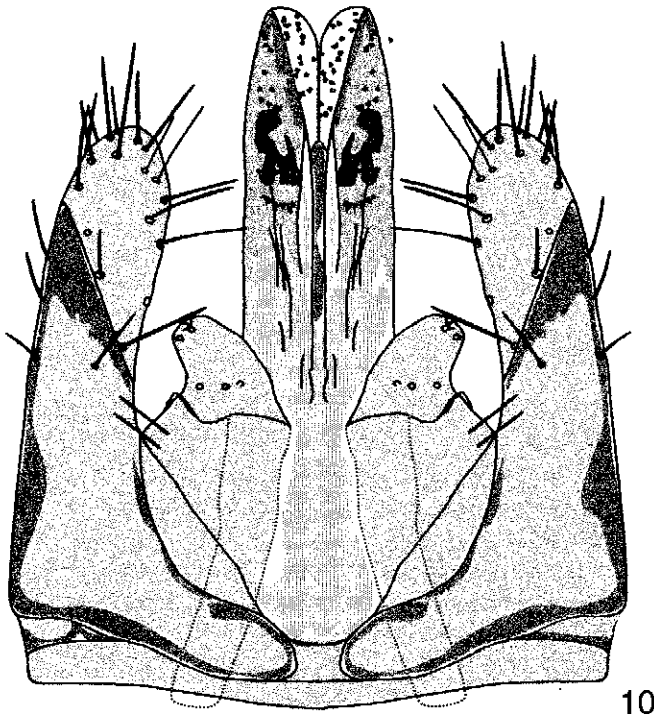
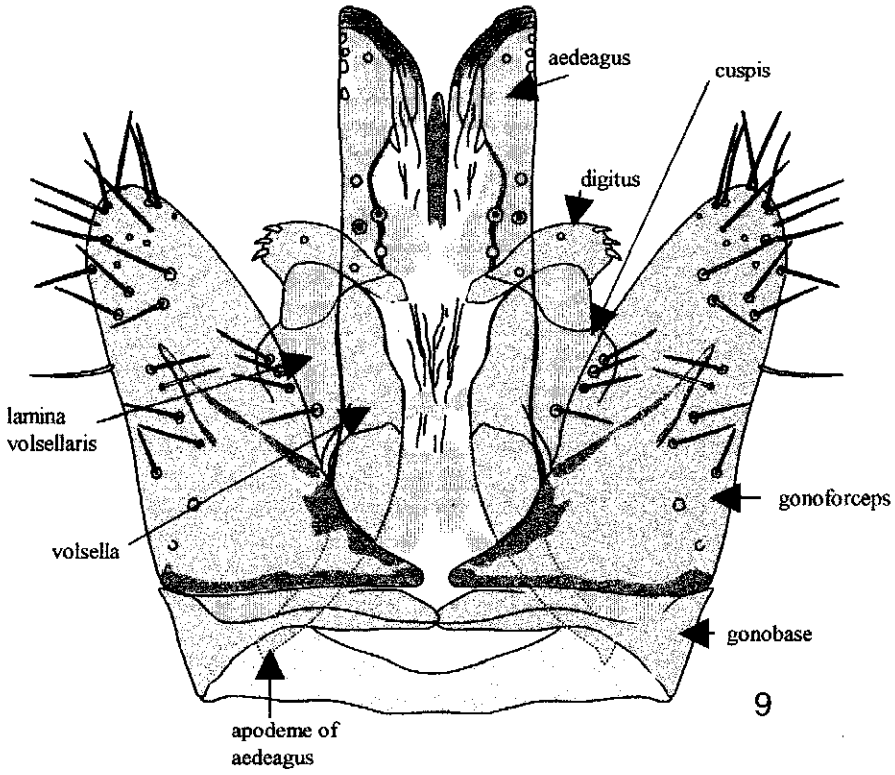
Figures 1–6. *Blacus parastigmaticus* n. sp. Figure 1, habitus in lateral view. Figure 2, head in frontal view. Figure 3, head in dorsal view. Figure 4, mesosoma in dorsal view. Figure 5, propodeum and tergite I in dorsal view. Figure 6, ovipositor.



Figures 7–8. *Blacus parastigmaticus* n. sp. Figure 7, male fore- and hind wings. Figure 8, female forewing.

V. Galdamez, yellow pan trap, 1 male; same locality, 3 Mar 1997, H. Segura, 1 male; same locality, 20 Mar 1997, M. Meza, 2 males; same locality, 21 Apr 1997, M. Anzueta & H. Segura, 1 male; same locality, 20 Jun 1997, V. Galdamez, yellow pan trap, 7 males; Reserva Huitepec, 26 Apr 1996, O. Gómez & M. Giron, 1 male. GUANAJUATO: El Saucillo, Cuerámara, 11 Oct 1996, corn, J.A. Sánchez, 15 males; Cuerámara, 27 Dec 1995, alfalfa, J.A. Sánchez, 5 males; Cañada de Caracheo, 14 Apr 1996, corn, J.A. Sánchez,

Figures 9–10. Figure 9, male genitalia of *Blacus parastigmaticus* n. sp. Figure 10, male genitalia of *Blacus humilis* (Nees).



4 males; Tarimoro, 20 Jan 1996, alfalfa, J.A. Sánchez, 1 male; Valle de Santiago, 26 Dec 1995, alfalfa, J.A. Sánchez, 1 male; Rincón de Tamayo, 24 Dec 1995, alfalfa, J.A. Sánchez, 1 male; Tenerife, 19 Dec 1995, alfalfa, J.A. Sánchez collector, 1 male; Coroneo, 30 Dec 1995, J.A. Sánchez, 1 female; La Aldca, Silao, 20 Dec 1995, alfalfa, J.A. Sánchez, 1 female; Silao, 20 Dec 1995, alfalfa, J.A. Sánchez, 1 male; El Copal, Irapuato, 20 May 1990, D. Salas, yellow pan trap, 3 males; *GUERRERO*: 7 mi SW of Filo de Caballo, 12 Jul 1985, J. Woolley & G. Zolnerowich (85/051), 3 males, 4 female; 6.6 mi SW of Filo de Caballo, 12 Jul 1985, J. Woolley & G. Zolnerowich, 3 males, 1 female; 5 mi SW of Filo de Caballo, 8000 ft 7 Jul 1984, J. Woolley, 1 female; 6.4 mi SW of Filo de Caballo, 9000 ft 8 Jul 1987, J. Woolley and G. Zolnerowic, 1 female, *JALISCO*: Parque Nac. de Volcán de Colima, 11 mi from Hwy, J. Wooley, 1 female, *MICHOACÁN*: 6 mi N of Cheran, 8 Jul 1985, J. Woolley and G. Zolnerowich (85/034), 1 female; Morelia, 16 Jul 1996, C.A. Suarez (CIB96029), 5 males; *NUEVO LEÓN*: Cola de Caballo, 18 Mar 1986, R. Wharton, 3 females, *OAXACA*: 10.7 mi N Guelatao de Juárez, 8500 ft 17 Jul 1987, R. Wharton, 1 female; Llano de las Flores, 15 mi NE of Ixtlán de Juárez, 21 Jul 1985, J. Woolley and G. Zolnerowich (85/082), 1 female; 19 mi S San Miguel Suchixtepec, 17 Jul 1985, J. Woolley and G. Zolnerowich, 1 female, *PUEBLA*: Puebla, Carr. Apizaco-Zacatlán, 30 Mar 1985, A. González H., 2 males. *STATE UNKNOWN* (Central México): summer 1984, J. Woolley, 2 females. *TAMAULIPAS*: Santa Engracia Hidalgo, 6 Mar 1988, J.C.L. & H.O.C.B., 1 male; La Peñita, 21 Apr 1988, Martinez, 1 male. Paratypes deposited: Colección Entomológica del Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas, México (ECOSC); Colección del Instituto de Fitosanidad del Colegio de Postgraduados, Montecillo, Edo. México, México (CEIFIT), Colección de Insectos Benéficos de la Universidad Autónoma de Nuevo León, México (UANL), Colección del CIIDIR-IPN Unidad Oaxaca, Santa Cruz Xoxocotlán, Oaxaca, México (JAS) and Texas A&M University, College Station, Texas, USA (TAMU).

*Etymology*.—The specific name was chosen because this species has an unusually large fore wing stigma.

*Diagnosis*.—*Blacus parastigmaticus* is similar to *B. humilis*, but the former has the head more ovoid, face without carinae, propodeal tubercle smaller; parastigma of forewing larger; arolia of legs larger; ovipositor sheath shorter, and color pattern of body is different. The genitalia is also different in both species: in *B. parastigmaticus* (Fig. 9) the gonoforceps are shorter and directed outward, and the number and position of their setae is different than in *B. humilis* (Fig. 10) which has the gonoforceps directed inward and curved; in *B. parastigmaticus* the lamina volsellaris has four to six setae while in *B. humilis* there are two setae.

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