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FIRST DOCUMENTED RECORD OF MONOMACHIDAE (HYMENOPTERA: PROCTOTRUPOIDEA) IN NEW GUINEA, AND DESCRIPTION OF TWO NEW SPECIES

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Abstract.—The occurrence of the genus *Monomachus* Klug (Hymenoptera: Proctotrupoidea, Monomachidae) in New Guinea is documented for the first time. Two new species, ***M. cracens*** and ***M. comptus,*** are described. These are distinguished from the three known Australian *Monomachus* as well as the numerous New World species.

Key Words: *Monomachus,* New Guinea, Australia, Proctotrupoidea, Hymenoptera, parasitoid

The family Monomachidae is a small group of parasitic Hymenoptera (Proctotrupoidea) with austral disjunct distribution. Only two genera have been recognized, *Monomachus* Klug and *Tetraconus* Szépligeti. The latter is known only from a single female specimen from Brazil. We are studying the family with the goal of elucidating the phylogenetic relationships among species and understanding their biogeography. Nineteen species-group taxa have been described from the New World from Mexico to Chile and Argentina, and these were last revised by Schulz (1911). Three additional species of *Monomachus* were recognized in the recent revision of the Australian fauna (Naumann 1985). Masner (1993) noted that the family is also to be found in New Guinea, but no species have been described. The Papuan material in fact represents two species distinct from those known in Australia. We describe them here because they do not appear to be closely related to the numerous Neotropical species; these will be the focus of a separate paper.

MATERIALS AND METHODS

Specimens for this study from New Guinea are found in the collections of the American Entomological Institute, Gainesville, FL (AEIC) and the Bishop Museum, Honolulu, HI (BPBM). Australian material is found in the Australian National Insect Collection, Canberra; Canadian National Collection of Insects, Ottawa; the Museum of Comparative Zoology, Cambridge, MA; The Natural History Museum, London; and The Ohio State University, Columbus.

The mandibles in Monomachidae are remarkably diverse in shape. We use the following terms to describe their structure. The mandible is generally divided into two areas, a basignath and distignath, separated by a subbasal groove. The groove allows for greater range of abduction of the mandibles. The distal margin of the groove is sometimes sharply marked; this corresponds to the mandibular fold of Naumann (1985) and the Basalfalte of Schulz (1911). The lowermost part of the subbasal groove is sometimes clearly visible as a sharply de-

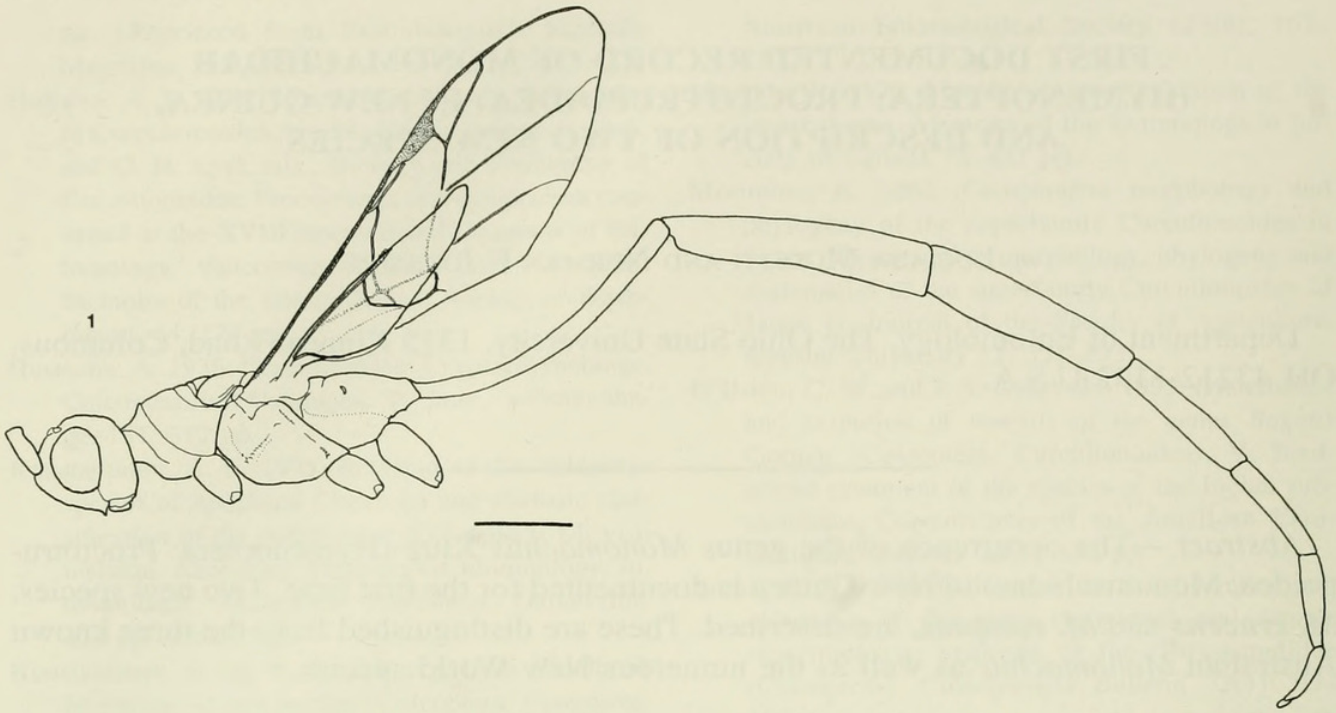


Fig. 1. *Monomachus cracens,* lateral habitus. Scale line = 1 mm.

fined diagonal sulcus. The basignath is convex and invaginated into the oral cavity when the mandibles are widely opened. The nomenclature for thoracic sulci follows Huber and Sharkey (1993).

The label data for all specimens is available in electronic format in Hymenoptera On-Line at the URL http://iris.biosci.ohio-state.edu/hymenoptera (Johnson and Musetti, in press). The OSUC numbers quoted are the individual unique identifiers for the specimens in this study.

Monomachus cracens Musetti and Johnson, new species

(Fig. 1)

Female.—Measurements for the two females are reported in pairs separated by a slash; first value refers to female bearing ID number OSUC 117646 (holotype ♀), second value refers to OSUC 117653 (paratype ♀). Fore wing length 5.0/5.8 mm. *Color:* Head, lateral margins of pronotum, central disc of mesoscutum on either side of notauli, metanotum, upper portion of mesopleuron, all of metapleuron, lateral and posterior portions of propodeum, entire metasoma brown to dark brown; mesosoma otherwise light brownish yellow; coxae and trochanters brownish yellow, legs otherwise distinctly darker brown; wing membrane clear.

Head: Clearly transverse in frontal view, width across eyes 2.10/1.96× greater than length, head width across the compound eyes (2.48 mm/2.69 mm) not differing significantly from head width across gena (2.40 mm/2.70 mm respectively). Eye height 3.54/4.71 × malar length. Vertex posteriorly with moderately dense deep setigerous punctures, each separated by approximately diameter of one puncture; punctures sparser, more irregularly sized and spaced near ocelli; punctures densely packed, but irregularly shaped near antennal insertions; vertex otherwise smooth, without microsculpture; outer margins of ocelli bordered by distinct furrows; vertex immediately behind ocelli largely glabrous. Occipital carina widely separated from oral margin ventrally, occiput with dense setigerous punctures continuing from vertex, continuing on to gena. Gena in frontal view not swollen. Frons (above clypeus, below antennal sockets) slightly convex, with dense setigerous punctures nearly throughout, i.e., extending to clypeus and beyond

level of lower margin of compound eyes; with a central area immediately above clypeus smooth and glabrous, extending dorsally ⅓ height of frons. Clypeus convex, predominantly smooth and glabrous, dorsal margin marked by line of large setigerous punctures, hairs long and erect, margin broadly angled and raised medially, epistomal sulcus narrow and distinct medially, broad and poorly defined laterally. Malar space mostly punctate and pilose; malar sulcus present. Mandible with sparse setigerous punctures on distignath, hairs elongate; gradually narrowed apically; bidentate, teeth broadly rounded, ventral tooth larger, longer than dorsal; distignath broadly convex; subbasal groove fairly broad, margins rounded and somewhat indistinct, bottom of groove angled, appearing as a diagonal sulcus extending from posterior mandibular articulation to lateral clypeal lobes; basignath distinctly widest near anterior articulation, distignath reaching posterior articulation.

Mesosoma: Pronotum predominantly smooth and glabrous dorsally; transition between pronotal neck and collar broadly rounded in profile, marked by a weak transverse fold, laterally with sparse hairs and fine punctures. Mesoscutum predominantly smooth, very sparsely setose. Notauli arcuate, separated from transscutal articulation by short distance subequal to their width, without crenulae. Parapsidal furrows very indistinct. Scutellar pit wide, extending laterally beyond notaulus, deep, without crenulae, crescentic, lateral margins of pit angled posteriorly; central convex portion of scutellum quadrate, separated from axilla by simple sulcus; posterior margin of scutellum with single transverse row of small foveae. Scutellum, axillae smooth, nearly glabrous. Dorsellum transverse, slightly bulging, anteriorly with a narrow crenulate sulcus, posteriorly mostly smooth. Metapostnotum (anterior to transverse groove at base of propodeum) with pair of indistinct or broadly rounded posterior projections. Mesopleuron punctate and pilose nearly throughout, save for smooth, glabrous, concave area adjacent to mesopleural suture. Mesepisternal groove indicated by a row of foveae extending ventrally from near base of fore wing to scrobal groove, then turning anteriorly and extending below fore coxa, widely separated from the discrimen ventrally; scrobal groove indicated by transverse line of deep foveae; mesepisternum finely punctate and pilose, relatively flat ventrally, broadly rounded toward medial articulations, discrimen shallow, inconspicuous, widened posteriorly to form small depression near coxae, with densely pilose, distinctly fingerlike lobe projecting above depression on each side. Metapleuron distinctly separated from propodeum by row of deep, broad foveae; densely setose. Propodeum moderately globose in dorsal view, punctate along midline and around posterior end, dorsal surface otherwise smooth; dorsolaterally rugose, densely setose; anterior margin without teeth opposite metapostnotal projections. Fore wing with radial cell closed, length 4.5/4.0 × width, base of m-cu only slightly displaced basad of bifurcation of Cu_1; in hind wing M between Cu_1 and 1rm/Rs absent.

Metasoma: First segment (petiole) distinctly elongate, slender, strongly curved; remaining segments elongate, cylindrical, not laterally compressed; second segment longer than third, length of second 1.3/1.2× length of third; second and third segments with tergite loosely wrapped around the sternite, not closely appressed and leaving very visible separation between tergum and sternum; length of metasomatic segments as a percentage of total length: 1: 23.6/23.5; 2: 23.9/22.4; 3: 18.3/18.6; 4: 11.2/12.3; 5: 8.9/9.3; 6: 8.0/8.1; 7 to apex: 6.2/5.8.

Male.—Other than characters of sexual dimorphism in metasoma and antenna typical for family, differing from ♀ as follows: Body color generally brown above, yellowish brown below; base of legs including femora brownish yellow, brown apically. Fore wing length 4.2–4.9 mm ($\bar{x}$ = 4.54, SD = 0.268, n = 6). Sculpture on body

other than frons generally with punctures much less dense and largely smooth. Propodeum with sculpture along midline more extensive, extending from anterior to posterior margins. Antenna with dense short hairs, tyloid on A4–A8 small, with fine seta. Fore wing with closed radial cell, length 3.7–4.8 × width ($\bar{x}$ = 4.20, SD = 0.379). Hind wing sometimes with a short stem of M arising from 1rm/Rs.

Material examined.—Holotype ♀: PAPUA NEW GUINEA: Wau, 1,250 m, 3.ix.1965, malaise trap, J.& M. Sedlacek (OSUC 117646, BPBM). Specimen in good condition; lacking A3–A15 from right antenna, A4–A15 from left. Paratypes: PAPUA NEW GUINEA: (NE) Wau, Morobe Distr., 1,200 m, 5.x.1962, malaise trap, J. Sedlacek, ♀ (OSUC 117653), 26.x.1961, ♂ (OSUC 117654), 23.x.1965, J. & M. Sedlacek, ♂ (OSUC 117647); (NE), Wau, Morobe Distr., 1,050 m, 11.ix.1961, malaise trap, J. Sedlacek, ♂ (OSUC 117651), 30.ix.1961, ♂ (OSUC 117652); ; NE Wau, Little Wau Ck., 1,200–1,300 m, 3.xii.1965, malaise trap, J. Sedlacek, ♂ (OSUC 117650); NE Karimui, 1,080 m, 14.vii.1963, M. Sedlacek (OSUC 117655). All specimens in BPBM.

Etymology.—The specific epithet *cracens,* Latin for neat, slender, graceful, refers to the elongate petiole in the female of this species and its overall graceful habitus.

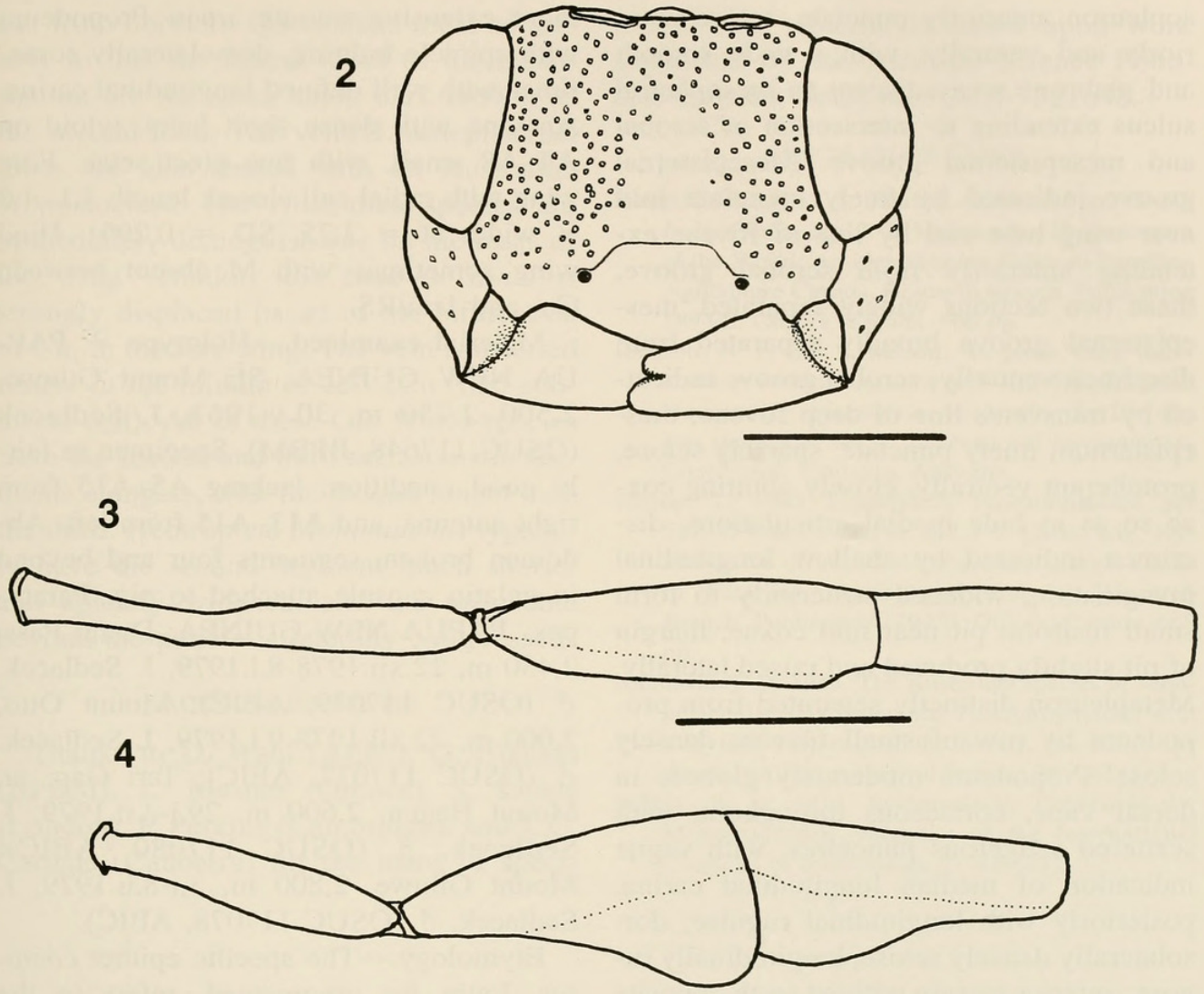
Comments.—*Monomachus cracens* may be most easily distinguished from *M. comptus* by the remarkably long and curved petiole in the female and, in both sexes, the single row of foveae at the apex of the scutellum. The ventral lobes found at the posterior end of the mesepisternum are very distinct in male and female specimens; these lobes are visible only as weak raised margins of the depression in front of the mid coxae in *M. comptus.* Additionally, the lateral profile of the pronotum is mostly smooth and rounded, with only a weak line marking the separation of the neck and the collar dorsally.

Monomachus comptus Musetti and Johnson, new species

(Figs. 2–3)

Female.—Fore wing length 5.9 mm. *Color:* Head generally dark brown, clypeus and mandibles brown; lateral portions of pronotum, disc of mesoscutum on either side of notauli (including prescutum), propodeum, mesopleuron and metapleuron dark brown; scutellum, axillae, dorsal pronotum, metanotum lighter in color, varying from brownish yellow to brown; metasoma brown; antenna brown; legs generally brownish yellow, hind leg beyond trochanter brown; wing membrane clear.

Head: Transverse in frontal view (Fig. 2), width across eyes 1.95 × wider than long, head width across the compound eyes (2.57 mm) slightly more than width across gena (2.46 mm). Eye height 3.13 × malar length. Vertex and gena with same pattern of sculpture as found in *M. cracens,* but generally more smooth and shallow; outer margins of ocelli bordered by distinct furrows. Occipital carina short, widely separated from oral margin, occiput with dense setigerous punctures. Gena in frontal view not swollen. Frons flatter than *M. cracens,* with fine setigerous punctures extending below level of the compound eyes; central smooth, glabrous area above clypeus larger, mostly flat, extending through ⅔ distance to antennal insertions; short raised carina present between antennae. Clypeus convex, smooth and nearly glabrous medially, shallowly punctate laterally, medially differentiated from frons by clear epistomal sulcus, without distinct line of large setigerous punctures, apical margin broadly angled and raised medially, epistomal sulcus poorly defined laterally. Malar area mostly smooth, with few sparse setigerous punctures near compound eyes, malar sulcus distinct. Mandible with sparse setigerous punctures on distignath, hairs elongate; gradually narrowed apically; bidentate, teeth broadly rounded, ventral tooth wider, longer than dorsal; distignath broadly con-



Figs. 2–4. Characters of *Monomachus* species. 2, *M. comptus,* head, frontal view. 3, *M. comptus,* metasomatic segments 1–3, lateral view. 4, *M. australicus,* metasomatic segments 1–3, lateral view. Stippled lines on metasoma indicate lower margin of sterna visible through cuticle of terga. Scale line = 1 mm.

vex; subbasal groove fairly broad, margins rounded and somewhat indistinct, bottom of groove angled, appearing as a diagonal sulcus extending from posterior mandibular articulation to lateral clypeal lobes; basignath distinctly widest near anterior articulation, distignath reaching posterior articulation.

Mesosoma: Pronotum predominantly smooth and glabrous dorsally; transition between pronotal neck and collar abrupt, marked by ruga; ventrally with sparse hairs and fine punctures. Mesoscutum predominantly smooth, very sparsely setose. Notauli arcuate, separated from transscutal articulation by short distance subequal to their width, finely crenulate. Parapsidal furrow present, extending over half length of mesoscutum from transscutal articulation. Scutellar pit slightly narrower, reaching laterally as far as notaulus, with fine longitudinal crenulae, only slightly crescentic, lateral margins of pit broadly rounded; central convex portion of scutellum slightly widest anteriorly, separated from axilla by finely crenulate sulcus, posterior margin of scutellum with a subapical row of large punctures, apically with 2–3 rows of smaller foveae. Scutellum, axillae nearly smooth, glabrous. Dorsellum less bulging than *M. cracens,* transverse, bordered anteriorly with sculptured sulcus half its length, posterior margin with narrow finely punctate band. Metapostnotum with pair of indistinct or broadly rounded posterior projections. Me-

sopleuron anteriorly punctate, setose anteriorly and ventrally, with a wide smooth and glabrous area adjacent to mesopleural sulcus extending to intersection of scrobal and mesepisternal groove. Mesepisternal groove indicated by finely crenulate fold near wing base and by line of foveae extending anteriorly from scrobal groove, these two sections widely separated, mesepisternal groove broadly separated from discrimen ventrally; scrobal groove indicated by transverse line of deep foveae; mesepisternum finely punctate, sparsely setose, protuberant ventrally, closely abutting coxae so as to hide medial articulations, discrimen indicated by shallow longitudinal invagination, widened posteriorly to form small fusiform pit near mid coxae; margin of pit slightly produced and raised laterally. Metapleuron distinctly separated from propodeum by row of small foveae; densely setose. Propodeum moderately globose in dorsal view, coriaceous throughout, with scattered setigerous punctures, with vague indication of median longitudinal carina, posteriorly with longitudinal rugulae; dorsolaterally densely setose, longitudinally rugose; anterior margin without teeth opposite metapostnotal projections. Fore wing with radial cell closed, length 4.24 × width, base of m-cu only slightly displaced basad of bifurcation of Cu_1; in hind wing base of M present arising from 1rm/Rs.

Metasoma (Fig. 3): First segment slender, fairly straight; remaining segments elongate, cylindrical, not laterally compressed; length of second segment 1.3 × length of third; length of segments as a percentage of total metasoma length: 1: 22.3; 2: 19.7; 3: 15.8; 4: 14.4; 5: 11.8; 6: 9.4; 7 to apex: 6.7.

Male.—Other than characters of sexual dimorphism in metasoma and antenna typical for family, differing from female as follows. Body color displaying same pattern as female except sometimes with less contrast between dark brown and brownish yellow areas. Fore wing length 4.8–6.2 mm ($\bar{x}$ = 5.46, SD = 0.622, n = 4). Vertex with more extensive smooth areas. Propodeum with spiracle bulging, dorsolaterally sometimes with well defined longitudinal carina. Antenna with dense short hairs, tyloid on A4–A8 small, with fine erect setae. Fore wing with radial cell closed, length 3.1–4.0 × width ($\bar{x}$ = 3.75, SD = 0.295). Hind wing sometimes with M absent between Cu_1 and 1rm/RS.

Material examined.—Holotype ♀: PAPUA NEW GUINEA: SE Mount Giluwe, 2,500–2,750 m, 30.v.1963, J. Sedlacek (OSUC 117648, BPBM). Specimen in fairly good condition; lacking A5–A15 from right antenna, and A13–A15 from left. Abdomen broken, segments four and beyond in gelatin capsule attached to pin. Paratypes: PAPUA NEW GUINEA: Daulo Pass, 2,450 m, 22.xii.1978-8.i.1979, J. Sedlacek, ♂ (OSUC 117079, AEIC); Mount Otto, 2,000 m, 22.xii.1978-9.i.1979, J. Sedlacek, ♂ (OSUC 117077, AEIC); Tari Gap, nr. Mount Hagen, 2,600 m, 29.i-4.ii.1979, J. Sedlacek, ♂ (OSUC 117080, AEIC); Mount Giluwe, 2,800 m, 3.i-8.ii.1979, J. Sedlacek, ♂ (OSUC 117078, AEIC).

Etymology.—The specific epithet *comptus,* Latin for ornamented, refers to the more elaborate sculpture on the scutellum.

Comments.—See diagnosis under description of *Monomachus cracens* for the most useful characters to distinguish the two Papuan species.

Discussion

Schulz (1911) distinguished the New World species of *Monomachus* from those in Australia by means of the curvature of the petiole: strongly bowed in specimens from America, straight in those from Australia. *Monomachus cracens* (Fig. 1) clearly does not conform to this rule. Both species from New Guinea are very similar to *M. australicus* Girault in terms of the structure of the mandibles, the sculpture on the body, the shape of the head, and the shape of the clypeal margin. The color patterns observed differ from that "yellow form" described by Naumann for specimens of *M. australi-*

cus from northern Queensland most noticeably in that the lateral lobes of the mesoscutum are the same color, dark brown, as the medial lobe. The ventral mesepisternal lobes are also shared with all Australian *Monomachus*. The Australian species are immediately distinguishable on the basis of the wing venation: the base of m-cu is strongly displaced basad of the bifurcation of Cu_1 in the fore wing. The vein is inserted nearly in the middle of cell 2Cu (first subdiscal cell). All of these Old World species have the second and third metasomatic segments elongate, with the second longer than the third. Neotropical *Monomachus* typically have the second segment much shorter and apically widened, and the metasoma beyond the petiole is laterally compressed.

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