

# THE INDO-AUSTRALIAN SPECIES OF THE ANT GENUS STRUMIGENYS: GROUP OF SZALAYI

(Hymenoptera: Formicidae)

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*Abstract.* The Melanesia-centered *S. szalayi* group includes 2 known species: *szalayi* (N. Queensland, Samoa, and Solomons to Luzon) and *nidifex* (Fiji), plus 6 new species — *hemichlaena*, *nigra*, *disarmata*, *figris* and *yasumatsui* from the highlands of New Guinea, and *stemoniynys* from Palau. The group is characterized by prominent bulging eyes, depressed occipital lobes, straight slender mandibles with a single preapical tooth, slender alitrunk, nodes and gaster, very sparse pilosity, and reduction or obsolescence of spongi-form appendages. Three of the New Guinea highland species (*hemichlaena*, *figris*, *yasumatsui*) show a vivid zonal body coloration (yellow-black-yellow-black) in place of the usual dacetinae concolorous ferruginous or reddish-brown. Some form of mimicry relationship is assumed for these three species, though the adaptive basis of the mimicry remains unknown.

## INTRODUCTION

This paper treats a number of related species of *Strumigenys* that occur in Melanesia and lands peripheral to it. The descriptions and figures are standardized with my previous sections on the genus (see Brown, 1953). When the species-group sections are all complete, I shall offer a synopsis with a practical illustrated key to all the *Strumigenys* species of this broad region. One trouble with this project is that undescribed species are still being found at a rate greater than the rate at which, in my present circumstances, formal descriptions can be prepared and published. Even the present section had to be redone twice because new species belonging to the *szalayi* group were received after previous versions were essentially complete.

The measurements and indices are those standard in previous dacetinae papers; for a fuller explanation see Brown 1953 and 1962. Total length (TL) is the length of the body, including closed mandibles, measured axially through each tagma and then summed. HL is the length of the head in full-face view, including clypeus and occipital lobes. HW is the greatest transverse width of the head. ML is the distance to which the closed mandibles extend beyond the clypeal margin as seen in full-face (dorsal) view. Alitrunk length (WL) is measured diagonally in side view from anterior pronotal slope, normally omitting cervix, to mesopleural extremity. Cephalic index (CI) is  $HW \times 100/HL$ ; MI is  $ML \times 100/HL$ .

Deposition of specimens is indicated by abbreviations as follows: MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U. S. A.; BMNH, British Museum (Natural History), London; ANIC, Australian National Insect Collec-

tion, Commonwealth Scientific and Industrial Research Organization, Canberra, Australia; QM, Queensland Museum, Brisbane, Queensland, Australia; BPBM, Bernice P. Bishop Museum, Honolulu; MCSNG, Museo Civico di Storia Naturale, Genoa, Italy; MHNG, Muséum d'Histoire Naturelle, Geneva; HNM, Hungarian National Museum, Budapest.

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#### GROUP OF *szalayi*

*S. szalayi*, *S. hemichlaena*, *S. nigra*, *S. disarmata*, *S. tigris*, *S. yasumatsui*, *S. stemoniys*, *S. nidifex*. Worker: A series of species related to the *chyzeri* group, but having the head less ruggedly modelled and the mandibles slender, each with a single long slender preapical tooth, separated from the apical fork by a distinct space. Apical fork normally with a minute intercalary denticle on inner base of ventral tooth. Eyes large, convex, more or less prosopient. Preocular excision distinct on dorsal as well as ventral margin of head (except in *yasumatsui*), limiting the posterior extension of the antennal scrobe, which thus ends in the vicinity of the eye. Occipital lobes depressed below level of vertex. Most species (not *yasumatsui*) have a weak median sulcus or impression on the vertex, at least on its anterior part. Antennal scapes slender, coadaptively curved to fit against sides of head when in repose.

Alitrunk slender, with a deep "sway-back" concavity in the posterior mesonotal-anterior propodeal area (Figs. 1, 2, 8). Propodeal teeth free, acute, elevated (obsolescent in *S. disarmata*); infradental lamellae obsolete or reduced to cariniform vestiges. Petiole and postpetiole narrow, with reduced spongiform appendages (obsolete on the petiole and reduced to mere margins on postpetiole, except in *S. nidifex*, in which they are better developed but still small). Body densely punctate-reticulate, opaque (but sculpture variably effaced and smooth in *S. nigra*, *S. yasumatsui* and *S. tigris*, especially on the alitrunk), mandibles and gaster always smooth and shining, with a few brief costulae at base of the first gastric segment.

Ground pilosity vestigial, inconspicuous, consisting of appressed and reclinate hairs forming a dilute covering on appendages, mandibles and front of head with clypeus. Erect hairs forming usually stiff but slender, truncate or bluntly pointed: 2-4 hairs on each occipital lobe near margins, 1-2 pairs on vertex, 1 pair on humeri, 1 pair on mesonotum (*S. nidifex* has an extra pair each on pronotum and posterior mesonotum), 1 pair each on petiole and postpetiole, 1 pair on anterior gastric dorsum and a transverse row of 2 to 4 near the posterior border of the first and each succeeding gastric segments, the latter sometimes becoming flagelliform apical. Anterior border of clypeus and scapes with a fringe of narrow linear-spatulate hairs, on the scapes reclinate, directed apicad. Oblique sensory hairs on inner mandibular margins fine, curved, 3-4 in number on each side.

Male: Head with occiput produced posteriad (not laterad), but deeply depressed. Mandibles

small, with rounded basal angle, beyond this strongly falcate, with sharp apices, not opposable. Notauli indistinct, only the anterior extremities visible. Forewing (both sexes) with basals, M+CuA, CuA, Rs+M, Rs and 2r present and fairly distinct. Volsella of *S. szalayi* shown in Fig. 5.

The *szalayi* group is related to the *wallacei* and *chyzeri* groups on the one hand, and to the *godffroyi* group through the *mayri* group on the other. *S. szalayi* itself is widespread, occurring locally in the Philippines, lower elevations in New Guinea, the Solomons, Micronesia (Ponape), Samoa, northern Queensland and the New Hebrides. The very closely related *S. hemichlaena* replaces *szalayi* in the mid-mountain zone on New Guinea, and is itself replaced by *S. tigris*, *S. yasumatsui*, *S. disarmata* and *S. nigra* at still higher altitudes. *S. nidifex* (Fiji) and *S. stemoniys* (Palau) are two aberrant group members that appear to have diverged in isolation. An apparently closely related species, still undescribed, has recently been collected by me in the forest of eastern Madagascar.

#### Strumigenys *szalayi* Figs. 1, 3, 5.

*Strumigenys Szalayi* Emery, 1897: 578, pl. 14, figs. 10, 11, worker, female, worker pupae. Type loc.: Seleco Island, near Berlinhafen (=Aitape), New Guinea, by present selection. Other original locs.: Beiliao Island, near Friedrich Wilhelmsafen (=Madang), New Guinea. Syntypes in HNM, USNM, etc., several seen.

*Strumigenys Szalayi* subsp. *australis* Forel, 1910, Rev. Suisse Zool., 18: 50, worker, male. Type loc.: Kuranda, near Cairns, northern Queensland. NEW SYNONYMY. Syntypes in Coll. Forel (MHNG), MCZ, 3 seen.

Worker: TL 2.6-3.5, HL 0.68-0.91, ML 0.35-0.45, WL 0.68-0.91 mm; CI 64-74, MI 48-56.

Habitus and proportions as shown in Figs. 1 and 3. Propodeal teeth about as long as distance between centers of their bases, or slightly shorter. Apical fork of mandible with ventral tooth shorter than dorsal tooth; between them is a minute intercalary denticle. Postpetiole disc subcircular in outline as seen from above, slightly wider than long. Some samples (e.g., Samoa) have the lower mesepisterna with a small patch where the sculpture is effaced, smooth and shining. Costulae at base of gaster varying in length and density, extending 1/5 to 1/3 or more of the length of basal segment.

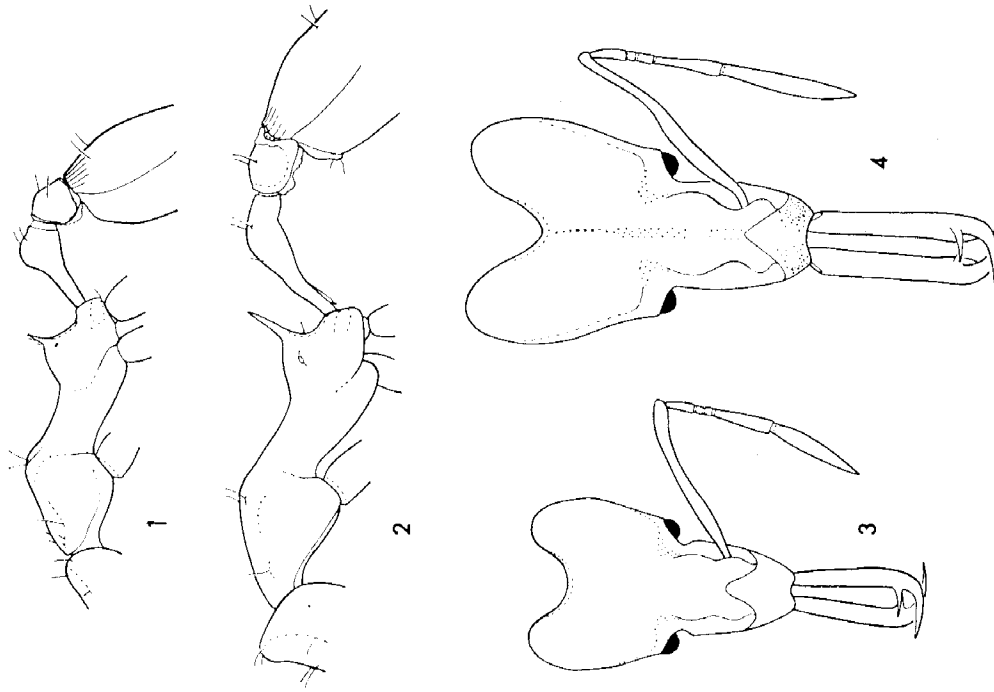
The female is much like the worker, with the usual caste differences, slightly larger size, etc.

Variation in size, color and proportions of head and mandibles is considerable and shows interesting geographical trends, summarized below.

#### Variation (workers):

Samples having the gaster piceous or dark brown, contrasting with the light ferruginous forebody, are called "bicolorous"; samples in which the gaster is little or not at all darker than the forebody are called "concolorous". Figures in parentheses are numbers of specimens measured.

New Guinea: Seleco I. (2), HL 0.68-0.72 mm, CI 70-71, MI 50, bicolorous. Maifin Bay (1), HL 0.68 mm, CI 69, MI 52, bicolorous. Lae area (13), HL 0.68-0.77 mm, CI 64-69, MI 49-51, bicolorous. Boana (12), HL 0.80-0.87 mm, CI 67-70, MI 48-51, weakly bicolorous (gaster brown). Papua: Bisanumu (1), HL 0.77 mm, CI 69, MI 51, con-



Figs. 1-4. *Strumigenys* sp., workers. Fig. 1. *S. szalayii* from Boana, Bunbok Valley, N. E. New Guinea, side view of body. Fig. 2. *S. stemoniixys* n. sp., holotype, side view of body. Fig. 3. *S. szalayii*, same specimen as in Fig. 1, full-face view of head, pilosity omitted. Fig. 4. *S. stemoniixys* n. sp., holotype, full-face view of head, pilosity omitted. All to same scale.

Drawings by Nancy Buffer.

colorous. Kovetapa (2), HL 0.85 mm, CI 66, MI 50, bicolorous. Queensland. Cape York Peninsula: Cape York (2) HL 0.81-0.82 mm, CI 68-70, MI 51-52, concolorous. Rocky River (3), HL 0.75-0.79 mm, CI 72-74, MI 50-53, concolorous. Black Mt. Road north of Kuranda (3), HL 0.78-0.82 mm, CI 70-72, MI 49-50, concolorous. Kuranda, taken ca. 1900 (3), HL 0.88-0.91, CI 70-71, MI 50, concolorous. Kuranda-Cairns area, taken in 1950's (11), HL 0.83-0.87 mm, CI 67-73, MI 49-51, concolorous. Solomons Is.: Guadalcanal (13), HL 0.72-0.76 mm, CI 66-68, MI 54-55, concolorous. New Hebrides: Maewo (not measured), concolorous. Samoa: Upolu (15), HL 0.81-0.90 mm, CI 67-70, MI 53-56, bicolorous. Ponape: (7), HL 0.74-0.79 mm, CI 64-67, MI 55-56, concolorous. Philippines: Negros (8), 0.79-0.86 mm, CI 67-69, MI 51-54, concolorous. Mindoro (7), HL 0.75-0.78 mm, CI 67-69, MI 51-55. Southern Luzon (6), HL 0.80-0.84 mm, CI 66-69, MI 53-57, concolorous. This variation may be summarized as follows: The north coast of New Guinea has small, bicolorous populations, but even a short distance inland (Boana) the size is larger and the gaster more nearly like the rest of the body in color. Of the Papuan samples, the one from Bislanumu is medium-sized and concolorous, while the one from the Tapini area is bicolorous and large. The samples from Cape York Peninsula are all concolorous, medium-sized in the north and large at the base of the Peninsula; the sample taken in about 1900 at Cairns is very large in size. The samples from the extremes of the range, in the Philippines, Ponape and New Hebrides (excepting Samoa) are all medium in size, concolorous, and tend to have mandibles relatively longer than the average. The large Samoan sample, representing at least several different nests, is exceptional in being bicolorous, large in size and with rather long mandibles. The data suggest a centrifugal pattern, with small size and contrasting dark gaster as independently varying derivative characters found chiefly near the center of the range in lowland northern New Guinea.

Male: (1 specimen taken with workers, Negros I., Philippines, 18-V-22): TL 2.4, HL 0.52, WL 0.78, greatest diameter of eye 0.16, forewing L. about 1.7 mm.

Occipital depression moderate. Scutellum and metanotum both projecting, the latter medially angulate. Propodeal teeth well-developed, acute. Petiole and postpetiole without appendages, their surfaces densely reticulate-punctulate. Color ferruginous brown, legs and appendages dull yellow.

Distribution: Philippines, New Guinea, Ponape, Samoa, Solomons, New Hebrides, Cape York Peninsula of Australia.

Philippines: Cuernos Mts., near Dumaguete, Negros, 500 m and 1200 m, several collections, J. W. Chapman. San Jose, Mindoro, 25-IX-45, E. S. Ross. Mt. Makiling, Lagunas Prov., Luzon, Jan.-Apr., 1968, R. A. Morse.

Ponape: Jokaj; Mt. Nanalaut; Peipalap Peak, all by P. A. Adams. Nanpil. Nett District, leaf litter of ivory-nut palm, 13-III-48, H. S. Dybas.

Samoa, Upolu I.: Malololelei Road, ca. 560 m, dead leaf sheath of *Clinostigma*; Tiavi, ca. 730 m, 15-V-40; Afiamalu, ca. 700 and 730 m, 11-VI-40 and 13-VI-40, beating shrubs, all E. C. Zimmerman. (See also Wilson and Taylor, 1967.)

New Hebrides: above Nasara, ca. 200 m, Maewo I., 4-IX-58, rain forest, B. Malkin. New Guinea (northern): Seleo I., near Berlinhafen (now Aitape), New Guinea, L. Biró (syntypes). Maffin Bay, June, 1944, E. S. Ross. Didiman Creek, 29-III-55, and

lower Busu River, 15-V-55; both near Lae, lowland rainforest, nest in small rotten log and foraging in leaf litter, E. O. Wilson. Boana, Bunbok Valley, ca. 1100 m, small colony in *Pussillus*-stage rotten log, 25-V-55, E. O. Wilson.

Papua: Bisanumu, near Sogeri, 500 m, rain forest, March, 1955, E. O. Wilson. Kove-tapa, near Tapini, 1000 m, July 1962, nest under bark of cucujid stage log, R. W. Taylor, No. 2214.

Queensland, Cape York Peninsula: northern Peninsula and Lockerbie scrub, rain forest, Jan. 1958, P. F. Darlington. Roeky River Scrub, Coen district, early June, 1958, eucalypt forest and rain forest, P. F. Darlington. About 8 mi. up Black Mt. Road, N. of Kuranda, rain forest, 400-600 m, P. F. Darlington. Crystal Cascade, near Cairns, P. F. Darlington. Kuranda, ca. year 1900, R. Turner. Kuranda, ca. 360 m, 30-X-50, W. L. Brown.

Solomon Islands, Guadalcanal: Mt. Austin, 17-H and 23-VI, 1963, P. Greenslade, Nos. 4439 and 6874.

**Biology:** The colony I collected at Kuranda, Queensland (see above) consisted of about 60 workers and 2 dealate females nesting beneath a sheet of fungus on the underside of a piece of bark lying on the floor of rain forest. The colony was transferred to a small glass-topped plaster nest and was offered various small, living soft-bodied arthropods during a 3-day observation on the ants' food preferences. Although offered small nematoceros Diptera, aphids, various mites, minute spiders and an assortment of springtails, the *S. szalayii* took only entomobryoid Collembola during this period. I had no opportunity to observe the ants under circumstances of prolonged food scarcity; so I do not know whether such conditions would lead to acceptance of other prey organisms, but it is reasonably clear the *S. szalayii* is predominantly a collembolan predator. The preferred prey were members of subfamily Patonellinae, common in the rain forests of northern Queensland; poduroids were avoided. Hunting by *S. szalayii* is relatively active and efficient; in striking, the mandibles are opened to more than 180°.

#### *Strumigenys hemichlaena* n. sp.

Holotype worker: TL 3.4, HL 0.86, ML 0.44, WL 0.88 mm; CI 69, MI 51. Very similar to the larger examples of *S. szalayii*, but a trifle more slender and with a slightly more deeply concave posterior alitruncal profile. Narrow oblique band on lower sides of mesothorax smooth and shining; sculpture and pilosity otherwise as in *S. szalayii*. Color in a striking alternating pattern of light and dark, as follows: Head, posterior alitrunk, appendages, etc. bright ferruginous yellow; petiole and postpetiole slightly darker yellow; anterior alitrunk, including prothorax and anterior half of mesonotum, blackish-brown; gaster mahogany. The transition between the blackish anterior and yellow posterior parts of the alitrunk is quite abrupt, coming at the level of the posterolateral prothoracic margins, so that the entire convex portion of the pronotum is blackish; from this comes the specific name, from the Greek words for "half" and "cloak".

Paratype workers: 44 workers from type nest: TL 2.94-3.53, HL 0.78-0.90, ML 0.40-0.46, WL 0.79-0.92 mm.; CI 67-70, MI 50-52. Varying chiefly in size and depth of coloration. Paler, probably teneral specimens light yellow, with the darker areas reddish-brown, pattern constant. Queen, dealate (from type nest series): TL 3.75, HL 0.88, ML 0.43, WL 0.95 mm.; CI 72, MI 49.

Eyes very large, their anterior borders narrowly rounded and overhanging the deep narrow pre-ocular groove. Mesonotum with a weak anterior median sulcus; posterior half with about 8 separated, continuous and slightly vermiculate longitudinal rugulae. Scutellum convex, with a median carinula; mesonotal ground sculpture the usual dense punctulation. Propodeal teeth stouter than in worker. Petiolar node as broad as long. Anterior corner of anepisternum, most of katepisternum, and procoxae smooth and shining. Mesonotum with a few fine erect hairs like those of head and gaster.

Ground color ferruginous yellow; dorsum of head, except occipital lobes, slightly infuscated; pronotum (not cervix) and mesonotum entirely deep ferruginous-black, metanotum deep ferruginous; gaster dark castaneous. Deposited with holotype.

Pupae with mandibles open to more than 180° as figured by Emery for *szalayii*. (see above). Larvae described as "*Strumigenys* sp. (*szalayii* group)" by G. C. and J. Wheeler, 1960, Proc. Ent. Soc. Wash., 62: 27.

Holotype, worker (Zoological Museum, Bogor, Indonesia) from a type nest series of 45 workers and a single queen, Baliem River, Netherlands New Guinea, 1600 m, in rotten branch, 14 Dec., 1938, L. J. Toxopeus. For particulars concerning type locality, see Toxopeus, 1940, Treubia, 17: 273-274, 278-279, or Archibald, Rand and Brass, 1942, Bull. Amer. Mus. Nat. Hist., 79: 246-250.

Distribution: Mountains of northern New Guinea, 1110-1900 m.

Neth. New Guinea (in addition to type loc.): Mt. Lina, Cyclops Mts., ca. 1150 m, Mar. 1936, L. E. Cheesman, 1 damaged worker in British Museum.

NE New Guinea: 1-2 miles east of Joangeng, Mongi Watershed, Huon Peninsula, ca. 1500 m, 8 Apr., 1955, E. O. Wilson, 2 colonies (one with alate females) from red-rotten, moss-covered log and stump, 1 worker found carrying an entomobryid collembolan. Wana, upper Jimmi Valley, 1500 m, 11 July, 1955, J. L. Gressitt, 1 alate female. Kunai Creek, 1300 m, SW side of Wau Valley, rain forest gully, June 1962, R. W. Taylor, No. 1980, nest in grass packed in split in fallen branch on grass by roadside, Aiyura, 1900 m, June 1962, R. W. Taylor, No. 2072, a single worker under bark of a cucujid stage log in rain forest.

Samples from the additional localities are very similar to the type series. This species is apparently widespread in mid-mountain altitudes in New Guinea, where it replaces *S. szalayii*. No sign of intergradation toward *S. szalayii* has been found in *S. hemichlaena*.

#### *Strumigenys nigra* n. sp.

Holotype worker: TL 3.5, HL 0.91, HW 0.65, ML 0.46, WL 0.92, scape L 0.65 mm.; CI 71, MI 51.

A large species closely resembling *S. szalayii* in form, but differing as follows:

1. Petiole longer and more slender, with lower and more gently rounded node.
2. Vertex and occiput with fine irregular longitudinal rugulae superimposed on the punctulation. Alitrunk, legs and nodes with sculpture weaker than in *S. szalayii*, and effaced over much of the sides of the alitrunk and prothoracic coxae, as well as the postpetiolar disc, which are consequently smooth or nearly smooth and shining when clean.
3. Color piceous black (gaster deep mahogany in some lights); mandibles, antennae and legs ferruginous yellow, the legs grading into reddish brown in femora and coxae; clypeus

ferruginous; apex of gaster yellowish.

The holotype and 3 paratype workers all came covered with a dull whitish crust, possibly a hardened secretion. Color and sculpture are best seen only after this has been removed, but the act of removal usually destroys some of the delicate erect hairs.

The holotype and two slightly larger paratype workers from the type locality exceeded in size by a fourth paratype worker from the Al Valley: TL 4.0, HL 1.02, HW 0.73, ML 0.49, WL 1.04, scape L 0.72 mm.; CI 72, MI 48. Female and male unknown.

Holotype, worker (Queensland Museum), Gominagu Valley (Collins Bros., via Goroka), Ramu-Purari Divide, about 3 miles southwest of Mt. Otto, Eastern Highlands, altitude about 2400 m, 16 August 1956, T. E. Woodward. Paratypes (QM, MCZ), 3 workers: 1 taken with holotype; 1 taken near type locality at about 2450 m altitude, near Nondigl, Western Highlands; 1 from Al Valley (a side branch of Wangi Valley), Woodward. All collections were made by Berlese funnel from moss collected in mountain rain forest.

Distribution: New Guinea, highlands above 2000 m.

**Strumigenys disarmata** n. sp. Fig. 6.

Holotype worker: TL 3.8, HL 0.99, HW 0.70, ML 0.57, WL 0.92, scape L 0.72 mm.; CI 71, MI 58.

Similar in form to *S. szalayi* and *S. kemichlaena*, but larger, with longer mandibles, and with the following additional differences:

1. Propodeal dorsum convex posteriorly, terminating in a pair of obtuse tubercles or angles representing the reduced propodeal teeth.
2. Petiole longer and more slender, with a low, gradually rounded node (but much less extreme in this than *S. stemonixys*). Basigastric costulae few and very short.
3. Color orange brown; vertex and middle of head, middle of alitrunk, and gaster more or less infuscated with darker brown; appendages, occipital lobes, anterior part of petiole and apex of gaster yellow to ferruginous-yellow.

Ten paratype workers from the type nest series varied in size and proportions: TL 3.6-4.0, HL 0.96-1.02, HW 0.68-0.73, ML 0.55-0.60, WL 0.90-0.96, scape L 0.67-0.73 mm.; CI 71-72, MI 57-59. Some workers, presumably half-callows, are lighter and more yellowish in color.

Female: The larger of two dealate females has TL 4.2, HL 1.06, HW 0.74, ML 0.57, WL 1.02, scape L 0.70 mm.; CI 74, MI 57. Propodeum with short but acute triangular teeth. Color mahogany; with central dorsum of head and dorsum of alitrunk almost black; clypeus and occipital lobes orange-brown; mandibles, antennae and legs bright ferruginous yellow. Male unknown.

Holotype (Queensland Museum) with type nest series of numerous workers and two dealate females (paratypes in Queensland Museum, MCZ) from Benaga, about 25 miles southwest of Aiyura, N. E. New Guinea, taken in leaf mold of *Nothofagus*

forest (by Berlese funnel) at an altitude of about 2000 m, 12 August, 1956, T. E. Woodward.

Distribution: Eastern Highlands of New Guinea; known only from type locality.

**Strumigenys stemonixys** n. sp. Figs. 2, 4.

Holotype worker: TL 3.5, HL 1.07, HW 0.72, ML 0.59, WL 1.04 mm.; CI 67, MI 55.

Similar to *S. szalayi*, but larger and with a much more attenuated body, particularly the propodeal teeth (about twice as long as distance between centers of their bases), petiole (L 0.43 mm), and postpetiole (slightly longer than broad). Occiput more extensively and more deeply depressed than in *szalayi*. Sculpture and pilosity as in *szalayi*. Color yellowish ferruginous, gaster piceous brown.

Holotype worker, (B. P. Bishop Museum) a unique taken by means of Berlese funnel at 65 m altitude, E. Ngatpang, Babelthuap Island, Palau Group, western Caroline, 8 July, 1952, J. L. Gressitt.

Distribution: Babelthuap, Palau Group; known only from type locality.

**Strumigenys nidifex**

*Strumigenys nidifex* Mann, 1921: 464, fig. 23, worker, ♀ ♂, biology. Type locality: Nadarivatu, Viti Levu, Fiji. Additional localities: Waiyanitu and Vesari, Viti Levu; Buke Levu, Kadavu. Syntypes in MCZ and USNM.

*Strumigenys nidifex*: Brown, 1954: 85, Navai, Viti Levu, discussion.

Worker: TL 4.7-5.7, HL 1.30-1.53, ML 0.61-0.70, WL 1.30-1.52 mm; 67-75, MI 45-48.

A large, robust, dark-colored version of *S. szalayi* confined to Fiji. The occiput is more extensively impressed, and both nodes bear small but distinct and complete sets of spongiform appendages. Sculpture and pilosity as in *S. szalayi*, but postpetiole sometimes with a tendency toward longitudinal striation. Preapical tooth of mandible a little closer to apical fork than in *szalayi*. Color dark brown in fresh material, more brownish-red in faded samples; legs and antennae yellowish-ferruginous.

Female showing the usual differences from worker; sculpture coarser, rugulose on alitrunkal dorsum; postpetiolar disc striate; basigastric costulation denser and much longer than in worker.

Male (1 specimen from a nest taken at Nadala, Fiji): TL 3.9, HL 0.83, HW (without compound eyes) 0.52, greatest diameter of compound eye 0.29, forewing L ca 3.4, WL (without cervix) 1.27 mm; CI 63.

Head slender, strongly depressed across occiput and deeply excised medially behind, forming narrow occipital lobes. Cervix prominent, depressed. Scutellum and metanotum protruding, both rounded; propodeal teeth low, rectangular. Nodes slender, without appendages, finely sculptured and opaque. Gaster smooth and shining, with a finely shagreened area at extreme base. Color dark brown, appendages lighter and more yellowish.

Distribution: Fiji: Viti Levu and Kadavu. In addition to series from the localities listed in the synonymy, I have examined samples from Nadala, Viti Levu, Dec 2, 1954, E. O. Wilson, and additional samples from the type locality (R. W. Taylor).

Biology: Mann and Wilson both found *S. nidifex* a rather common ant in parts of Viti Levu, where it forms nests of up to 100 or more workers either in rotten wood

on the densely shaded forest floor, between layers of stone, or in the earth under stones. Wilson found larvae in nests feeding on a worker-sized entomobryoid collembolan and on the femur of an orthopterous insect.

This indication of wide prey preference was fully borne out by observations made over 2 years on a laboratory nest of *S. midifex* (70-80 workers and several dealates) that was sent by Wilson to the United States from Nadala, Fiji. This colony, kept in a small glass-topped plaster nest at home room temperature (68°-85° F), did exceedingly well in these artificial circumstances, and produced broods of males and queens 3 times in 2 years. The ants killed and fed to the larvae a wide variety of small arthropods, including mosquitoes, *Drosophila*, mites, aphids, beetles, blattarian nymphs, geophilomorph centipedes, and several different families of Collembola; in fact, they took almost all types of small arthropods offered to them. Poduroid collembolans were, however, definitely avoided, and on several occasions when I maneuvered living poduroids so as to cause the ants to strike at them defensively, the ants immediately recoiled and began vigorous grooming of mandibles and anterior head, as though attempting to remove some noxious substance derived from the collembolans.

In hunting, the *Strumigenys* attacked quickly and directly, striking with the mandibles open to more than 180°, and stinging if the prey continued to struggle after being caught. Defensive behavior, observed when workers of the dacetine ants *Strumigenys loriae*, *Kydiris yateogyna*, and *Smithistruma nigrescens* were introduced into the *S. midifex* foraging chamber, consists of repeated strikes with the mandibles followed by hurried retreats from the enemy.

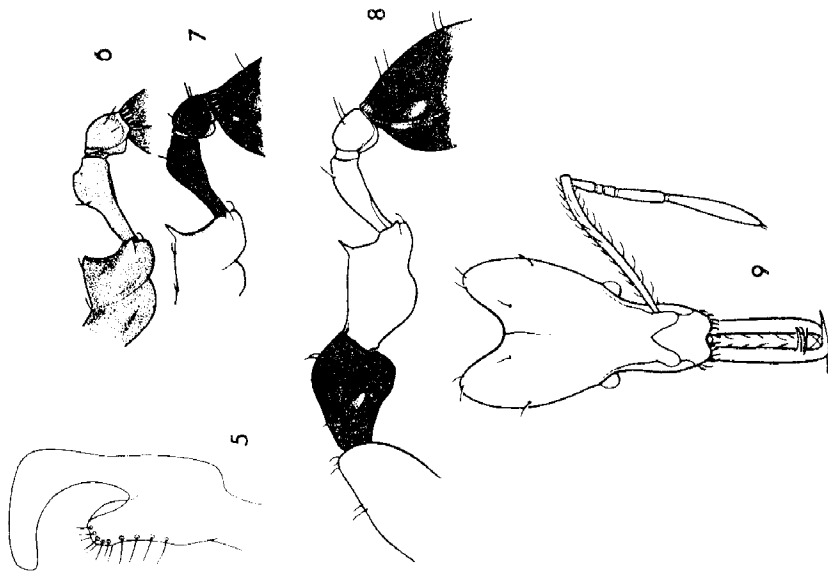
Oviposition by queens was observed twice, and each time was accomplished in the same way. The gaster is brought forward under the head, and the head is held with the mandibles perpendicular to the floor; the stance is on all 6 legs. The egg slowly appears at the tip of the gaster, but it is not glossated or touched by the under-mouthparts; only occasionally is it touched gently by the antennae. After 8 or 10 minutes, the egg is received directly into the mandibles near their apices without touching the floor; the queen then carries it herself to the egg pile and places it there, after which she leaves it and shows no further interest in it.

#### *Strumigenys tigris* n. sp. Fig. 7.

Worker: Holotype and 14 paratypes from 3 colonies: TL 3.4-3.8, HL 0.87-0.97, HW 0.63-0.72 (CI 72-74), ML 0.44-0.45 (MI 47-52), scape L 0.62-0.70, WL 0.90-1.05, greatest diameter of eye 0.09-0.10, petiole L (side view) 0.62-0.70 mm.

Very similar to *S. hemichlaena*, but slightly larger and with a broader head; also the following differences:

1. Sculpture more extensively effaced; lower half of sides of pronotum and virtually all of the posterior (yellow) half of the alitrunk smooth and shining. Summits of both nodes still densely punctulate, but weakly shining in some views.
2. Petiole averaging longer (L 0.34-0.37 mm vs. 0.30-0.36 mm for *S. hemichlaena* workers), node low, narrow, and not distinctly set off from its anterior or posterior peduncles in either lateral or dorsal view, its dorsum gently convex in profile from side view.
3. Color pattern as in *S. hemichlaena*, except that the petiole and postpetiole are blackish-



Figs. 5-9. *Strumigenys* spp. Fig. 5. Volsella of *S. szalayii* male from Negros I., Philippine Islands. Fig. 6. *S. disarmata* n. sp., paratype worker, side view of posterior trunk, petiole and postpetiole. Fig. 7. *S. tigris* n. sp., paratype worker, side view of posterior trunk, petiole and postpetiole. Fig. 8. *S. yasumatsui* n. sp., paratype worker, side view of most of body. Fig. 9. *S. yasumatsui*, same paratype, full-face view of head, principal pilosity included. All except Fig. 5 to same scale as Figures 1-4. Drawings by Nancy Buffer and the author (Fig. 5) and by Turid Holldobler and the author (Figs. 6-9).

brown like the gaster, and the yellow parts (head, appendages, posterior half of alitrunk) are lighter and brighter.  
Queen, dealate, from holotype nest series: TL 3.9, HL 0.98, HW 0.75 (CI 77), ML 0.48 (MI 49), scape L 0.66, WL 1.10, greatest diameter of eye 0.17, petiole L 0.42 mm.

Head, appendages, meso- and metapleura and propodeum yellow; pronotum, mesonotum, petiole, postpetiole and gaster black or nearly so. Mesopleura largely smooth and shining. Scutum longitudinally rugulose and with some faint reddish-brown markings.

Holotype nest series (Taylor Accession No. 2101) and two additional series (Taylor Nos. 2090 and 2106), all collected at 2000 m in rain forest at Aiyura, N. E. New Guinea, in June, 1962, by R. W. Taylor. No. 2090 came from a rotten patch in a fairly sound branch lying on the forest floor. No. 2101 came from a wood fragment at the "passalid stage" of rot. No. 2106 also came from a nest in a fragment of rotten wood.

Holotype and paratypes in the Australian National Insect Collection, at Canberra; paratypes in MCZ.

Distribution: N. E. New Guinea highlands, known only from the types.

*Strumigenys yasumatsui* n. sp. Figs. 8, 9.

Worker: Holotype and 3 paratypes from a single colony: TL 3.4-3.6, HL 0.90-0.92, HW 0.57-0.60 (CI 63-65), ML 0.44-0.48 (VI 49-53), scape L 0.61-0.66, WL 0.91-0.96, greatest diameter of eye .08-.09, petiole L (side view) 0.33-0.38 mm.

Form of head and alitrunk as in Figures 8 and 9. Superficially at low magnification, this species looks like *S. hemichlaena*, but a closer look reveals some striking differences.

1. Head narrow, as in most slender *S. szalayii* workers; occipital lobes similarly depressed, but in *S. yasumatsui* the compound eyes farther forward, and there is no distinct preocular excision on the dorso-lateral cephalic margin above each eye (compare Figures 3 and 9). No antennal scrobes, and no median dorsal sulcus, though a slightly wavy median carinula extends anteriorly from posterior margin. Scape and mandibles much as in *S. szalayii* and *S. hemichlaena*.
2. Alitrunk slender, propodeal dorsum straight in profile and therefore less concave anteriorly than in *S. szalayii* and *S. hemichlaena*. Teeth acute, about as long as distance between centers of their bases.
3. Petiole arched, slender-clavate, without a distinct node (node even less developed than in *S. tigris*) or any traces of spongiform appendages. Postpetiole slightly longer than broad; appendages reduced to a translucent posterolateral cariniform margin on each side. Base of gaster has a feebly subspongiform dorsal margin with a few weak basal costulae.
4. Sculpture of whole body reduced. Trunk, mandibles, both nodes and gaster smooth and shining almost throughout; antennae, legs and surface of head with variably distinct, superficial reticulate-punctulate sculpture, more or less shining nearly everywhere.
5. Color bright ferruginous yellow; pronotum and anterior mesonotum shining black; gaster deep brownish-black.

Queen, dealate, from type nest series: TL 4.2, HL 1.00, HW 0.71 (CI 71), ML 0.50 (MI 50), scape L 0.68, WL 1.11, greatest diameter of eye 0.15, petiole L (side view) 0.46 mm.

With the usual caste differences from the worker; pterothorax well-developed and bulky, sculpture better-developed than in worker; vertex rugulose-punctulate around the infuscated ocellar triangle, and 4-5 rugules leading back from ocellus to posterior border of head, but occipital lobes shining as in worker. Pronotum densely reticulate-punctulate, with a smooth shining area on each side wall. Scutum smooth and shining discal, with spaced fine punctures; lateral and anterior faces finely and densely punctulate, subopaque, as are also the

upper sides of mesopleura and propodeum, declivity of propodeum, and both petiole and postpetiole. Scutellum rugulose-punctate. Most of mesopleura and sides of propodeum, as well as propodeal disc and all of gaster (except basal costulae), smooth and shining. Pro-, meso- and metanota, as well as gaster, brownish-black; rest of body bright ferruginous yellow.

Holotype nest series (Taylor Accession No. 2116), 4 workers and a dealate queen collected in a "Zoraptera-stage" rotten log in rain forest at about 1900 m elevation at Aiyura, N. E. New Guinea, in June, 1962, by R. W. Taylor. Holotype and paratypes in ANIC; paratypes in MCZ.

The coloration of *S. hemichlaena*, *S. tigris* and *S. yasumatsui*, with their broad zonal "striping" of yellow and black, is highly aberrant for dacetine ants. Drab uniform ferruginous, reddish-brown or dark brown, or a weakly bicolorous pattern with the gaster darker than the forebody, is the usual dacetine condition. Bold yellow-and-black "striping" are otherwise found in the Dacetini only in a few *Orectogathus* (including *Arnoldidris*) from New Guinea and eastern Australia, and in an as yet undescribed species of *Micostruma* from the forests of West Africa.

The adaptive reason for this pattern in the three *Strumigenys* species is unknown. Such patterns generally are aposomatic or "warning" advertisements found in animals with noxious properties, or in the mimics of such animals. It is hard to see what would-be predators would be warned by color patterns, however striking, in an insect only 3-4 mm long. If the color is a warning, then what are the noxious qualities of some or all of these ants (or their common model) that enforce the warning? Despite these questions, these 3 species meet some of the specifications of a mimicry complex. *S. hemichlaena* occurs widely in the mountains of northern New Guinea at middle elevations, and the other two species are known from a single locality near its upper altitudinal limits. The 3 species are thus sympatric, or nearly so, in the vicinity of Aiyura. They look much alike to the naked human eye. They are so much like *S. szalayii* and *S. midjex* in structure that it is hard to imagine that they defend themselves any more aggressively than do these two timid species. Nevertheless, the mandibular "snap-defense" that *Strumigenys* employ at the nest against arthropod intruders may be more effective than it seems to me, and the color pattern may just be the one most visible to compound eyes with poor resolution. Then, too, some sort of protective allomone could be involved in the situation. Only further observation will tell.

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## THE SUBGENERA MEGAPOLISTES AND STENOPOLISTES IN THE SOLOMON ISLANDS

(Hymenoptera: Vespidae, *Polistes* Latreille)

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The genus *Polistes* Latreille, taken in a broad sense, is the only well-defined group of social wasps which has a cosmopolitan distribution. Evidently it would be important to study the relationships and evolution within this group on a world-wide scale. From a series of studies on the "life economy" of these wasps, Yoshikawa (1962: 6f) concluded that they are the best material for studying the social evolution in wasps, and that it would perhaps be possible "to elucidate the evolution of wasp society by accumulating and analysing more data on the life mode of various *Polistes* wasps all over the world."

Such investigations should obviously be based on a sound body of data on taxonomy and distribution, but in this respect the present state of our knowledge is still far from satisfactory. The morphology of these wasps has never been as thoroughly studied as for example that of the Vespinae (Duncan, 1939) or of the South American genus *Mischocyttarus* (Richards, 1945). The species of some parts of the world are fairly well known, but our knowledge of the members of the genus in certain tropical areas is very incomplete. This is especially true for the Indo-Australian area, and more in particular for the Solomon Islands. Of the approximately 185 species<sup>1</sup> enumerated in Yoshikawa's world list of *Polistes* (1962: 19-41), only a single species, *P. praenoiatus* Kohl, is recorded from this archipelago. Yet no less than eight species will be discussed in the following pages, whereas the subgenus *Polistella* Ashmead, to be dealt with in another paper, has proved to be represented in these islands by about as many species. Most of the material on which the present study is based, approximately 600 specimens, has been obtained from three sources.

My first contacts with the Vespidae of the Solomon Islands date from more than 30 years ago, when Mr. H. T. Pagden kindly sent me a very interesting collection made by him in several islands of this archipelago in 1933 and 1934. A preliminary study of this material indicated that most of the species were undescribed and that the representation of the genus *Polistes*, besides one species of *Ropalidia* the only other social wasp genus occurring there, is of particular interest. Unfortunately a detailed study of this material was not possible until several years after the war, when there arose the occasion to study most of the types of the species previously described from the Indo-Australian area.

Meanwhile valuable additional material had been collected by Mr. J. D. Bradley

1) Yoshikawa (l. c.: 19) speaks of "a list of 286 *Polistes* species of the world," but it should be noted that about a hundred of the numbered forms are "varieties" (mainly subspecies).