



Title	POLISTINE WASPS FROM NEPAL (HYMENOPTERA, VESPIDAE)
Author(s)	Yamane, Soichi; Yamane, Seiki
Citation	Insecta matsumurana. New series : journal of the Faculty of Agriculture Hokkaido University, series entomology, 15, 1-37
Issue Date	1979-01
Doc URL	http://hdl.handle.net/2115/9796
Type	bulletin (article)
File Information	15_p1-37.pdf



[Instructions for use](#)

**POLISTINE WASPS FROM NEPAL
(HYMENOPTERA, VESPIDAE)**

Scientific Results of the Hokkaidō University Expeditions
to the Himalaya, Entomology No. 32

Contribution from the Tethys Society, No. 29

By SŌICHI YAMANE and SEIKI YAMANE

Abstract

YAMANE, S. and YAMANE, SK. 1979. Polistine wasps from Nepal (Hymenoptera, Vespidae). *Ins. matsum. n.s.* 15: 37 pp., 2 tabs., 12 figs. (11 text figs., 1 pl.).

Sixteen forms belonging to three polistine genera, *Ropalidia*, *Parapolybia* and *Polistes*, are recorded from Nepal with diagnosis for each form. The males of *Polistes adustus* and *Parapolybia nodosa* are described for the first time. Larvae and nests are described for *P. adustus*, *Ropalidia variegata variegata* and *R. stigma rufa*, with brief notes on the biology. A key to the Nepalese forms of the subfamily studied in this paper is given.

Authors' addresses. YAMANE, S.: Biological Laboratory, Faculty of Education, Ibaraki University, Mito, 310 Japan. YAMANE, SK.: Entomological Institute, Faculty of Agriculture, Hokkaidō University, Sapporo, 060 Japan.

Contents

Introduction	3
Key to the Nepalese forms of Polistinae studied in this paper	3
Genus <i>Ropalidia</i> Guérin-Ménéville	
1. <i>Ropalidia spatulata</i> van der Vecht	6
2. <i>Ropalidia stigma rufa</i> van der Vecht	7
3. <i>Ropalidia fasciata</i> (Fabricius)	10
4. <i>Ropalidia variegata variegata</i> (Smith)	11
5. <i>Ropalidia cyathiformis</i> (Fabricius)	14
Genus <i>Parapolybia</i> Saussure	
6. <i>Parapolybia nodosa</i> van der Vecht	15
Genus <i>Polistes</i> Latreille	
7. <i>Polistes</i> (<i>Polistella</i>) <i>strigosus mimus</i> Bequaert	18
8. <i>Polistes</i> (<i>Polistella</i>) <i>sagittarius</i> subsp.	19
9. <i>Polistes</i> (<i>Polistella</i>) <i>maculipennis</i> Saussure	19
10. <i>Polistes</i> (<i>Polistella</i>) <i>stigma</i> (Fabricius)	21
11. <i>Polistes</i> (<i>Polistella</i>) <i>adustus</i> Bingham	23
12. <i>Polistes</i> (<i>Nygmopolistes</i>) <i>tenebricosus sulcatus</i> Smith	27
13. <i>Polistes</i> (<i>Megapolistes</i>) <i>olivaceus</i> (DeGeer)	27
14a. <i>Polistes</i> (<i>Megapolistes</i>) <i>rothneyi rothneyi</i> Cameron	28
14b. <i>Polistes</i> (<i>Megapolistes</i>) <i>rothneyi sikkimensis</i> van der Vecht	29
15. <i>Polistes</i> (<i>Megapolistes</i>) sp.	29
Concluding remarks	30
References	34
Plate	35

INTRODUCTION

Three polistine genera, *Ropalidia* (15 forms belonging to 13 species), *Parapolybia* (4 forms, 3 species) and *Polistes* (23 forms, 19 species), have hitherto been known from the Subcontinent of India (Saussure 1853, Bingham 1897, van der Vecht 1941, 1962, 1966, 1968). But the faunistic study of these sociologically important groups is still incomplete, especially in the Himalayas. Recently, a total of 202 individuals belonging to the three genera have been brought from Nepal by a series of expeditions made by Hokkaidô University in 1965, 1968 and 1975, a private trip by Dr. Takeo Kawamichi in 1967 for his ecological survey of pikas, and a private trip by Mr. Takeshi Matsumura in 1972.

As to the vespines of the genus *Vespa* occurring in Nepal an account was given by one of us (Sk. Yamane 1974) on the basis of a collection made by the Hokkaidô University Expeditions. The present paper deals with the polistine wasps of Nepal, giving some taxonomic and biological notes. Five species of *Ropalidia*, one species of *Parapolybia* and ten forms (in 8 or 9 species) of *Polistes* are recorded. The males of *Polistes adustus* Bingham and *Parapolybia nodosa* van der Vecht are described for the first time. Most forms are given diagnostic characters including those hitherto not used and especially concerning the body structure. The larval stage and nest are described for *P. adustus*, *R. variegata* (Smith) and *R. stigma rufa* van der Vecht.

To show structural differences among the species, the following lengths are given (Table 1): Head width (HW), head height (HH) measured from vertex to the apex of clypeus, width (A_3W) and length (A_3L) of antennal joint III (=flageller joint I), thoracic width (TW) measured across the widest part of pronotum in front of tegulae, width of gastral tergite I (T_1W), and length of gastral tergite I (T_1L) measured from the posterior end of basal slit to the apical margin of the tergite. Some other parts were also measured if necessary. Body length was measured from the anterior margin of head to the end of gastral tergite II along the mid dorsal line, thus comprising the lengths of head, thorax, and gastral tergite I and II. Names of the collectors are abbreviated as follows: Dr. Takeo Kawamichi (T. Kw.), Dr. Toshio Kumata (T.K.), Mr. Takeshi Matsumura (T.M.), Dr. Sadao Takagi (S. T.) and Mr. Isao Yoneta (I.Y.).

Before going further, we wish to express our sincere thanks to all the members of the expeditions as well as the entomologists mentioned above, who made intensive collections and offered us valuable materials. We are also indebted to Dr. J. van der Vecht of the Netherlands for his kindness in identifying some *Polistes* and *Ropalidia* specimens, to Prof. S.F. Sakagami and Dr. S. Takagi of Hokkaidô University for their incessant encouragement in the course of the present study and reading through the manuscript, and to Dr. H. Abe of Hokkaidô University for his taking photographs of the *Ropalidia variegata variegata* nest described herein.

KEY TO THE NEPALESE FORMS OF POLISTINAE STUDIED IN THIS PAPER

This key refers to the female except otherwise stated, and is partially based on van der Vecht (1941, 1966) and Richards (1973).

1. Posterior angle of pronotum with a well-defined narrow margin, which meets the transverse carina (or keel) at anterolateral angle. Gastral segment I rarely petiolate; when petiolate the tergite and sternite of gastral segment II never fused. 2
 Posterior angle of pronotum without well-defined margin. Gastral segment I always petiolate and strongly nodose in posterior portion. Tergite and sternite of gastral segment II often fused. Genus *Ropalidia* Guérin-Ménéville. 3
2. Gaster oblong and gastral segment I non-petiolate. Body usually with distinct punctation at least locally. Genus *Polistes* Latreille 7
 Body very slender and almost entirely impunctate. Gastral segment I forming a petiole, much narrower than segment II. . . Genus *Parapolybia* Saussure.
 Occipital carina incomplete in both sexes. Gastral segment I strongly nodose ($T_1W/T_1L=0.40$ in ♀ and 0.38 in ♂); the length of tergite usually shorter than head width ($T_1L/HW=0.97$ in both sexes). Male antenna shortest among all the Oriental congeners; relative length of joint III to head width (A_3L/HW) about 0.28. *Parapolybia nodosa* van der Vecht
3. A large species; length 11–13 mm in ♀. Head distinctly wider than height ($HW/HH=1.16$). Mesopleuron anteriorly with a distinct vertical carina (this character is common to the species of the subgenus *Anthreneida* White). Propodeum basally with a pair of carinae apically converging. Body almost entirely with strong and dense punctation. General colour reddish brown. Gastral segment II apically with a broad yellow fascia. *Ropalidia spatulata* van der Vecht
 Medium to small species; length 6–11 mm in ♀. Propodeum without apically converging carinae. 4
4. Median furrow of propodeum narrow and shallow, even indistinct near the base. Gastral tergite I slender, nearly $2\frac{1}{2}$ times as long as wide. Tergite and sternite of gastral segment II not fused. Body largely ferruginous brown. Yellow markings not extensive and confined to scutellum, postscutellum, propodeum, gastral tergite II, etc. Clypeus yellowish brown, basally rufous, with a dark brownish, longitudinal median bar not reaching the apex. Apical yellow band of tergite II narrow. Length about 9.5 mm in ♀.
 *Ropalidia stigma rufa* van der Vecht
 Median furrow of propodeum well pronounced. Gastral tergite I somewhat wide compared with that of *R. stigma*, usually less than twice as long as wide. Tergite and sternite of gastral segment II fused. Body largely ferruginous brown. 5
5. Gastral segment I nearly twice as long as wide. Segment II cylindrical, distinctly longer than wide as seen from above and obliquely cut off at apex. Clypeus yellow with a black, longitudinal bar tapering apically. Space between antennae and a broad apical fascia of gastral tergite II yellow. Length about 11.5 mm in ♀. *Ropalidia fasciata* (Fabricius)
 Gastral segment I distinctly less than twice as long as wide. Gastral segment II cylindrical, longer than wide and nearly vertically cut off at apex. Distal two-thirds of radial cell with a well-defined fuscous cloud. Gastral tergite II basally with a pair of yellow spots, apically with a narrow fascia of the same colour. Smaller species; length 6–8 mm in both sexes. 6
6. Gena with distinct punctation which is denser in the middle. Clypeus densely punctate except in the periphery. Gastral tergite I about $1\frac{1}{2}$ times as long as wide. Mandible without dark spot at base. Clypeus basally with a dark, longitudinal median bar (♀) or with only a dark median spot (♂). Length 7–8 mm in both sexes. *Ropalidia variegata variegata* (Smith)
 Punctation sparse and inconspicuous on gena. Clypeus with only sparsely set finer punctures. Gastral segment I less than $1\frac{1}{2}$ times as long as wide. Mandible with a dark spot at base. Clypeus yellow, with a dark median spot. Smaller than *R. variegata*; length 6–7 mm in ♀.
 *Ropalidia cyathiformis* (Fabricius)
7. Medium to large species; length 12–19 mm in ♀ and 15–20 mm in ♂. Pronotum

- with a distinct fovea in each side in front of the transverse carina. Epicnemial groove either present or absent. 8
- Small to medium species; length 7–16 mm in ♀ and 9–16 mm in ♂. Pronotum without such a fovea. Mesopleuron without epicnemial groove. As a rule body largely or at least on head and thorax conspicuously punctate. Anal lobe of hind wing large and separated by a linear incision. . . Subgenus *Polistella* Richards . . . 12
8. Mesopleuron with dorsal groove but without epicnemial groove. Body largely coarsely and even reticulately punctate. Body largely ferruginous red. Subgenus *Nygmopolistes* Richards Following parts black: a band across ocelli, thorax except for pronotum and a large portion of legs except for tarsi. *Polistes tenebricosus sulcatus* Smith
- Mesopleuron with both distinct dorsal and epicnemial grooves. As a rule punctation distinct but in some forms much weaker or even inconspicuous Subgenus *Megapolistes* van der Vecht . . . 9
9. Pale-coloured species. Body largely light yellow with black markings. Head strongly swollen; occipital carina incomplete. Mesopleuron with round ventral edge¹⁾. Propodeum without distinct lateral edges²⁾; transverse striae weak, indistinct near the lower margin of side. Feebly punctate, even impunctate on mesoscutum. *Polistes olivaceus* (DeGeer)
- General colour reddish brown. Head strongly swollen; occipital carina complete. Mesopleuron with clearly defined ventral edge. Propodeum with round, but rather defined lateral edges; transverse striae distinct, reaching the lower margin of side. Punctuation strong; metapleuron ventrally with defined punctures. 10
10. Punctuation strong and even irregularly striate on pronotum, superficial and rather indistinct on vertex and frons; entirely impunctate on mesoscutum as in *P. watti* Cameron. Punctures on the ventral side of metapleuron superficial and ill defined. Body largely reddish brown as in the nominate form of *P. rothneyi* Cameron; clypeus and inner orbits above the clypeus including lower half of ocular sinus yellowish. *Polistes* sp.
- Punctuation relatively dense and strong on vertex, upper frons, ocular sinus and mesopleuron. Pronotum even irregularly striate. Mesoscutum with sparse but distinct punctation. Metapleuron ventrally with defined punctures. *Polistes rothneyi* Cameron . . . 11
11. Body largely reddish brown; mesoscutum black with four reddish lines; yellowish colour confined to tarsi. *Polistes rothneyi rothneyi* Cameron
- General colour reddish brown; mesoscutum entirely black. Following parts yellowish: a pair of longitudinal median lines on propodeum, apical narrow bands of gastral tergites I–VI, and tarsi of all legs. *Polistes rothneyi sikkimensis* van der Vecht
12. Fore wing subapically with a fuscous cloud. Punctuation weakest among the *Polistella* species so far known from Nepal. Gaster slender; tergite I nearly as long as wide. A small species; length 8.5–12 mm in ♀. *Polistes stigma* (Fabricius)
- Fore wing without such a cloud. Punctuation much stronger. 13
13. Pronotum distinctly shouldered and ribbed. Thorax distinctly wider than head (TW/HW=1.08). Body strongly and reticulately punctate. Black colour confined to vertex, mesoscutum, lines on meso- and metapleura, propodeum, a basal band of gastral tergite I, whole of sternite I, gastral segments III and IV, etc. Apical broad fascia on tergite II yellow. Length about 16 mm in ♀. *Polistes strigosus mimus* Bequaert
- Pronotum not shouldered or ribbed. Thorax nearly as wide as, or slightly wider than, head. Medium to small species. 14
14. Gastral sternite II distinctly angulated at base in both sexes. Thorax wider

1) Ventral edge: see Figs. 10A & C (*mve*).
 2) Lateral edge: see Figs. 10B & D (*ple*).

- than head in ♀ (TW/HW=1.04) and slightly narrower than head in ♂ (0.98). Propodeum with defined lateral edges (right-angled or nearly so); transverse striae complete. Punctuation strong on head and thorax, coarser on gastral segments. Body black and reddish brown. *Polistes adustus* Bingham
 Gasteral sternite II not angulated but round at base. Propodeum with the lateral edges round. 15
15. A medium-sized species; length about 13 mm in ♀. Body nearly entirely reddish brown. Thorax almost as wide as head. Clypeus longer than wide. Punctuation very strong. *Polistes sagittarius* Saussure
 A smaller species; length 8–10 mm in ♀. Body largely reddish brown, but black and yellowish markings present. Thorax distinctly narrower than head (TW/HW=0.94 in ♀). T_1W/T_1L ratio about 1.2, being distinctly larger than in *P. stigma* (ca. 1.02) but smaller than in *P. adustus* (1.27).
 *Polistes maculipennis* Saussure

GENUS ROPALIDIA GUÉRIN-MENÉVILLE

1. *Ropalidia spatulata* van der Vecht

Icaria ferruginea: Saussure, 1853, Mon. Guép. Soc., 2: 38, pl. 5, fig. 6 (misidentification).
Ropalidia marginata indica van der Vecht, 1941, Treubia, 18: 121–122 (part).
Ropalidia spatulata van der Vecht, 1962, Zool. Verh., Leiden, 57: 9–11.

Data. Lumbari (1200 m), “West Nepal”, 2♀, 6 XI, 1967, H.K.

This species was formerly confused with *R. marginata* but recently qualified as a distinct species by van der Vecht (1962). He says that this species is readily distinguished in the male from *R. marginata* by the terminal joint of the antennae strongly curved and the aedeagus broadly spatulate apically, and also that it is very similar in the female to the latter, being distinguishable only in coloration. The present specimens well agree with the original description of *R. spatulata*. Fortunately, we have had the opportunity to compare them with some *R. marginata jucunda* specimens from New Guinea which were identified by Dr. van der Vecht. They are in structure very similar to each other, but differ in some biometric characters as well as in coloration.

Diagnosis. ♀-Structure: Head distinctly wider than high (wider than in *R. marginata jucunda*: HW/HH=1.16 vs. 1.09). Gena much developed, slightly wider than eye seen in profile. Ocelli small and space enclosed by ocelli elevated to the level of the tip of lateral ocelli. Ocellocular distance about twice as long as the distance between the lateral ocelli. Clypeus distinctly wider than long (CW/CL=1.31 & 1.34 vs. ca. 1.28 in *marginata*), without distinct apical tooth. The third antennal joint slightly less than three times as long as wide at apex; the fourth a little longer than wide; the fifth nearly as long as wide and the subsequent joints wider than long except for the terminal one. Punctuation much as in *R. marginata*: dense and strong at the base of clypeus, on frons, vertex, upper gena and interantennal space, and sparser near the apex of clypeus. Punctures on mandible, lower gena and lower inner-orbit above the clypeus scattered, shallow and ill defined. Thorax distinctly narrower than head; TW/HW ratio almost the same as in *R. marginata* (ca. 0.90 in both). Thorax seen from above slightly less than 1 1/3 times as long as wide. Pronotum seen from above moderately convex laterally (rather concave in *marginata*) (Fig. 1A vs. 1B). Pronotal keel complete and distinct. Mesoscutum a little longer than wide. Scutellum elevated and distinctly convex, with a black impressed line at base. Mesopleuron not much

swollen. Punctuation strong, and rather reticulate on pronotum, mesoscutum, mesopleuron behind the raised carina in anterior part, scutellum, postscutellum and vertical side of metapleuron. On mesopleuron the punctuation becoming sparser anteroventrally. Metapleuron dorsally with distinct but irregular striae and ventrally with weaker vertical striae near the anterior margin and on lower portion. Propodeum without distinct lateral edges; dorsal face with a pair of longitudinal, apically converging carinae at base and with a pronounced median depression; transverse striae distinct in posterior half, reaching the lower margin of the side; the side nearly entirely punctate and even reticulate in some parts. Gastral segment I much swollen in the posterior two-thirds, but more slender than in *R. marginata* ($T_1L/T_1W=1.84$ & 2.00 vs. ca. 1.75). Gastral segment II distinctly obliquely cut off at apex; the tergite and sternite fused. Segment I impunctate in basal half, but sparsely punctate in the apical half of tergite and rather rugoso-striate in the apical half of sternite. Segments II-VI densely and superficially punctate (punctures often not defined posteriorly).

Colour: Almost as described by van der Vecht (1941, 1962).

Length ($H+Th+T_1+T_2$): about 12 mm in the female.

Distribution. Nepal, India and Pakistan.

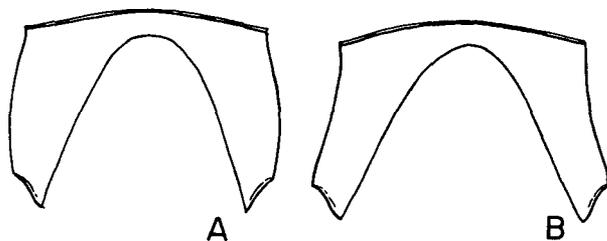


Fig. 1. Pronotum, seen from above. A: *Ropalidia spatulata* (♀); B: *R. marginata jucunda* (♀) from New Guinea.

2. *Ropalidia stigma rufa* van der Vecht

Ropalidia stigma rufa van der Vecht, 1941, Treubia, 18: 130.

Data. Bhainse (320 m), Narayani, 4 ♀ from Nest RN-7502, 19 X, 1975, S.T.

One of the specimens was identified as *R. stigma rufa* by Dr. van der Vecht. The present specimens certainly well agree in major structures with the description of *R. stigma* (Smith) by him (1941), but some biometric differences were found between them and his description. In the Nepalese specimens some characters are considered transitional between van der Vecht's *R. stigma* (VRS) and *R. mathematica* (Smith).

Diagnosis. ♀-Structure: Head wider than high ($HW/HH=1.11$). Gena more than $3/4$ as wide as eye seen in profile, more developed than in VRS and fairly less than in *R. mathematica* (GW/EW 0.68-0.79 in the present specimens; ca. 0.50 in VRS; ca. 1.00 in *R. mathematica*). Occipital carina distinct and complete. Interocular distance distinctly longer near vertex than at clypeus (34:27) as in the above two forms. Ocelli not arranged in an equilateral triangle; distance between median and one of the lateral ocelli longer than that between lateral ocelli (7.5:6); distance between lateral ocelli slightly shorter than ocellar diameter and slightly

less than $1/3$ as long as ocellocular distance as in *VRS*. Clypeus slightly convex and slightly wider than long. Antenna slender; scape curved; the fourth joint almost square and subsequent joints slightly wider than long except for the terminal one. Punctuation very dense on frons, slightly sparser and rather superficial on gena. Clypeus with scattered, large punctures in apical half and with scattered fine punctures in basal half, while basally impunctate in *VRS* and *R. mathematica*. Mandible with a few large punctures except basally. Thorax distinctly narrower than head ($TW/HW=0.85-0.87$), about $1\ 1/4$ times as long as wide seen from above. Pronotum slightly converging anteriorly, with a sharp and distinct carina. Mesoscutum obviously wider than long ($1.1:1.0$). Scutellum strongly convex, with a short median impression at base. Mesopleuron strongly swollen. Punctuation dense and coarse, rather reticulate on pronotum, mesoscutum, mesopleuron behind the anterior vertical carina and scutellum, and sparser at anterior angles of postscutellum. Metapleuron ventrally with scattered, shallow punctures. Propodeum with a shallow and narrow median furrow; lateral edges indistinct; transverse striae fine and indistinct. Gastral tergite I long and slender, slightly less than $2\ 1/2$ times as long as wide ($T_1L/T_1W=2.31-2.50$); the relative length of tergite I longer than in *VRS* ($T_1L/T_1W=2.0$) and nearly equal to that in *R. mathematica*. Gastral segment II obliquely cut off; the sternite strongly convex as in the two forms; suture separating the tergite from sternite distinct.

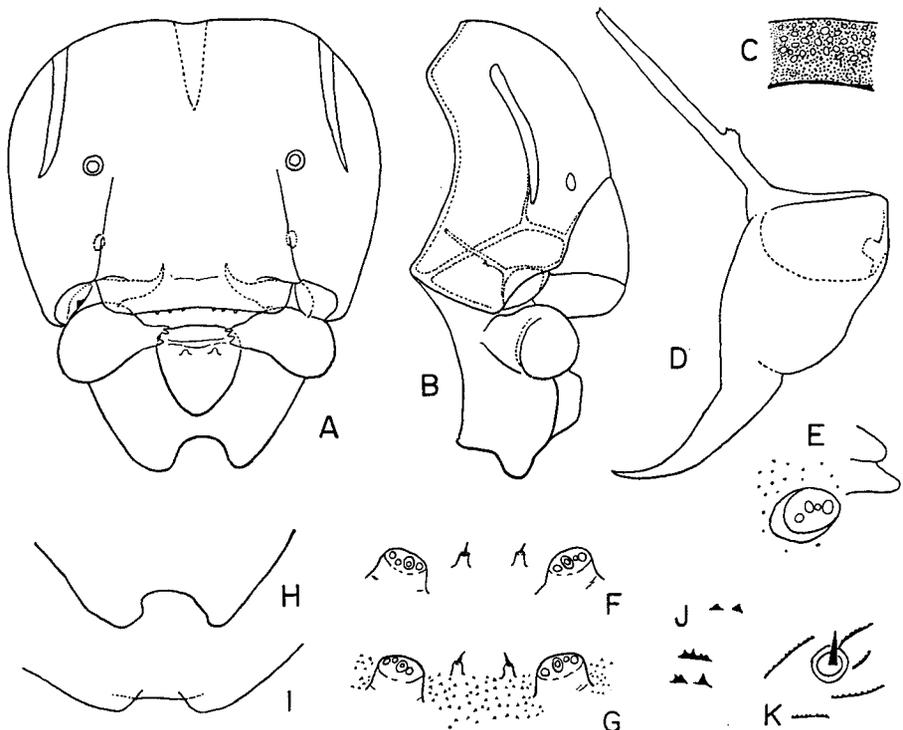


Fig. 2. Mature larva. A-F, H, J, K: *Ropalidia stigma rufa*; G, I: *R. variegata variegata*. A: Head, frontal view; B: Ditto, lateral view; C: Temporal band (part); D: Mandible; E: Maxillary palp and galea; F, G: Labial palpi; H, I: Ventral emargination of postlabium; J, K: Microscopic denticles on body integument.

Gastral segment I impunctate in the basal linear portion, punctate sparsely and superficially in apical half. Punctuation on gastral segments II–VI somewhat dense, but very superficial and not defined posteriorly.

Colour: Very much as in *R. stigma stigma*, *R. s. rufa* (original description) and *R. mathematica*. Body ferruginous brown. Black and yellow markings not much developed. Black: a pentagonal space enclosing ocelli, a narrow line along the posterior margin of mesoscutum, mesopleuron ventrally, a relatively broad band along the suture separating the mesopleuron from metapleuron, propodeum (with yellow markings), dorsal and ventral narrow lines at the base of gastral segment I, and the base of coxae of all legs. Yellow: antenna below, clypeus (somewhat rufous basally, and with a ferruginous median bar relatively broad, extending to the basal three quarters, and darker apically), mandible except at apex, tegula, postscutellum, a broad, elongate median marking and a pair of broad lateral ones on propodeum, narrow lateral lines near the base of gastral segment I, basal spots and a relatively narrow apical fascia on tergite II and sternite II, large part of coxae, and tarsi except for basitarsi in all legs.

Length (H+Th+T₁+T₂): 9.5 mm in the female.

Larval stage. Two dried, wholly blackened mature larvae from Nest RN-7502 were available for study. The coloration of the head and body was not precisely inferred. Head: Cranium possibly coloured brown at least partly, nearly circular in frontal view (Fig. 2A), posteriorly deeply concave at the level of antennae in profile (Fig. 2B). Integument moderately sclerotized, with minute setae. Mid-cranial sulcus distinct in upper half, wide but shallow. Frons not separated from the epicranium and clypeus by distinct lines. Antenna moderate in size, with three very minute sensillae, two of which come in touch with each other. Temporal band distinct and wide; outer two-thirds netted (Fig. 2C). Anterior tentorial pit distinct, located on epistoma and ventral to antenna. Postoccipital and hypostomal sulci moderately developed; pleurostomal sulcus not so developed; epistomal sulcus developed but lacking in upper portion. Clypeus with lateral sides nearly parallel; mid point of the ventral margin at the level of mandibular bases. Labro-clypeal suture weak. Labrum strongly transverse, ventrally not emarginate medially, without conical sensillae; palate with several conical sensillae. Mandible weak, circular in cross section, fairly curved, with a constriction at half distance from base, bearing a single, apically pointed tooth; adductor apodeme long, with a short branch at some distance from base; abductor apodeme rudimentary (Fig. 2D). Maxilla nearly spherical, narrowed towards apex; upper surface bearing numerous microscopic denticles; stipes not distinctly separated from cardo, with maxillary palp and galea; galea divided into two palps (Fig. 2E). Salivary lips not conspicuous; prelabium long, narrowed below; labial palp with four small sensillae; sensory bristle behind labial palp not bifid, with raised socket; no microscopic denticles around labial palp (Fig. 2F). Postlabium fairly developed, ventrally deeply emarginate (Fig. 2H). Body: Integument with sparsely set setae, and densely set microscopic denticles connected into rows especially on the thoracic segments (Figs. 2J, K). Spiracles irregular in size, the first being about twice as large as the rest; atrium without visible spines.

Nest. Nest RN-7502 was found on a twig of a small tree in a sunny place. It is stelocytтарous, gymnodomous and laterinidal (Figs. 3A, B). Petiole and cells made of fibrous material of plants. Greyish brown as a whole, with some white and brownish stripes caused by the alternative use of materials from different

sources. Petiole blackish, compressed, 2.4 mm long and 0.8×0.6 mm thick, not coated with any sticky substance which is often used in stenogastrine nests to prevent the invasion of enemies, attached to the bottom of the uppermost cell. The outer surface of the cell bottoms around the petiole blackish to brown and lustrous owing to salivary coating. Comb very slender, about 140 mm long and 5.8–6.2 mm wide, consisting of two vertical rows each composed of 37 cells ranging one below one. Cells not precisely hexagonal, rather round on the outer side; wall about 0.1 mm thick; inner diameter between opposite walls 3.1–3.3 mm at the opening; depth corresponding with the development of larvae in growing cells and 11.0–11.3 mm in completed ones. Basal vacated cells shaven to less than 8 mm deep. Cocoons slightly projecting above the level of cell top, moderately convex and not applied with pulp; colour uniform, nearly the same as of the cells. The emerging hole ragged (Fig. 3C). The present nest nearly agrees in structure with that of *R. stigma stigma* from Java and that of *R. variegata jacobsoni* from Java and India, both reported by van der Vecht (1962).

Biology. Four females were captured on Nest RN-7502, but their castes are unknown. Since the nest was carried back as a dried specimen, the brood composition could not precisely be determined. It consists of 74 cells, in which 29 cocoons and eight larvae were found. It might have harboured eggs and other larvae at least in the shallow, apical cells. Fourteen uppermost cells had already been vacated. Of the 29 cocoons, 26 were found to contain female pupae and the others prepupae or postdefecating larvae unknown about sex. From these facts the following will be inferred: 1) The cocoons and larvae present were of the first series for each cell. 2) The vacated cells were about to be reused for rearing the second series of immatures. 3) The nest might have been producing females alone. 4) In that case the nest was at the expanding phase rather than at the end of activity. So far as extrapolated from the incubation period known in other polistine species, the nest might have been founded 70–80 days before the collection, i.e., early in August. It is not clear whether it was founded by a single female or more than one female.

Distribution. Nepal, India (Assam) and China (Hainan).

3. *Ropalidia fasciata* (Fabricius)

Ropalidia picta: van der Vecht, 1941, Treubia, 18: 145–149.

Ropalidia fasciata: van der Vecht, 1962, Zool. Verh., Leiden, 57: 23–27.

Data. Ramche (1670 m), No. 1 West, 1♀, 28 V, 1968, T.K.

This specimen was determined as *R. fasciata* by Dr. van der Vecht. It quite resembles *R. fasciata* specimens from Okinawa and Taiwan, though it differs from them in the larger body and narrower head. It is described below in comparison with the specimens from Okinawa and Taiwan (*SOT*).

Diagnosis. ♀—Structure: Head nearly as high ($HW/HH=1.01$) (distinctly wider than high in *SOT*: 1.08). Occipital carina distinct and complete. Interocular distance distinctly longer near vertex than at clypeus ($35/28=1.25$; $32/25=1.28$ in *SOT*). Ocelli arranged in an equilateral triangle; distance between lateral ocelli about half as long as ocellocular distance. Clypeus slightly convex and wider than long. Third joint of antenna distinctly shorter than the fourth to sixth combined; subsequent joints except the terminal each wider than long. Punctuation very strong and dense on upper frons, but almost absent on lower frons,

i.e., in the area surrounded by eyes, clypeus and antennal sockets (in *SOT* the impunctate part of the frons is somewhat restricted to the lower part of the area). Clypeus wholly with scattered, relatively large punctures. Mandible with a few large punctures. Thorax barely narrower than head: TW/HW ratio distinctly larger than in *SOT* (0.96 vs. 0.84). Pronotum moderately converging anteriorly, with a sharp and distinct carina. Mesoscutum slightly longer than wide as in *SOT*. Scutellum projecting and strongly convex, with median impression. Mesopleuron strongly swollen. Punctuation dense and coarse, rather reticulate on pronotum, mesoscutum, mesopleuron behind the anterior vertical carina, and scutellum, sparser near the anterior angles of postscutellum; almost impunctate on postscutellum except near the anterior angles, and on mesopleuron anteriorly. Metapleuron dorsally with weak striae and ventrally with scattered, superficial punctures. Propodeum with a well-developed median furrow; lateral edge round; transverse striae fine and weak. Gastral tergite I slightly less than twice as long as wide (more than twice in *SOT*: 1.97 vs. 2.10). Tergite and sternite of segment II fused but with the suture at base. The segment II obliquely cut off apically. Punctuation absent in the basal linear portion of segment I, sparse and superficial in the apical half of segment I and denser and more superficial on the second and subsequent segments. Punctures except on segment I ill defined posteriorly.

Colour: Much as in *SOT*, but more ferruginous and yellow markings less abundant. Body largely ferruginous brown. Black: vertical lines running on lower frons through antennal sockets down to clypeus and connected to a thick and apically tapering median bar on clypeus, an irregular marking on metapleuron running along the border of mesopleuron, a narrow median line on propodeum, coxae of all legs behind. Yellow: clypeus except for the black bar, a pair of narrow lines on upper gena along eye, a line on pronotal keel, scutellum, postscutellum and apical broad fascia on gastral tergite II.

Length (H+Th+T₁+T₂): 11.2 mm in the female.

Distribution. Nepal, India, Burma, Indonesia, Malaysia, Philippines, Taiwan and Okinawa.

4. *Ropalidia variegata variegata* (Smith)

Icaria variegata: Saussure, 1853, Mon. Guêp. Soc., 2: 237-238; Bingham, 1897, Fauna Brit. Ind., Hym., 1: 388.

Ropalidia variegata variegata: van der Vecht, 1941, Treubia, 18: 156-157; van der Vecht, 1962, Zool. Verh., Leiden, 57: 29.

Data. Keelatchap (1250 m), No. 2 East, 1♀, 25 VI, 1968, T.M. Pati Bhanjyang (1840 m), No. 1 West, 1♀, 31 I, 1968, T. Kw. Betrawate (700-760 m), Bagmati, 10♀ 59♂ from Nest RN-7501, 12 IX, 1975, S.T. Biratanti (1150-1450 m), No. 4 West, 1♀, V, 1968, T.K.

A small species very close to *R. cyathiformis* (Fabricius), but readily distinguished from the latter by the slightly larger body, distinct punctuation on gena and the absence of basal black spot on mandible.

Diagnosis. ♀-Structure: Head wider than high (HW/HH=1.10). Gena in profile thick, nearly as wide as eye, wider below the middle. Ocelli small, forming an equilateral triangle; space between the ocelli elevated to the level of the tip of lateral ocelli, with a flat top. Ocellocular distance about 2 2/5 times as long

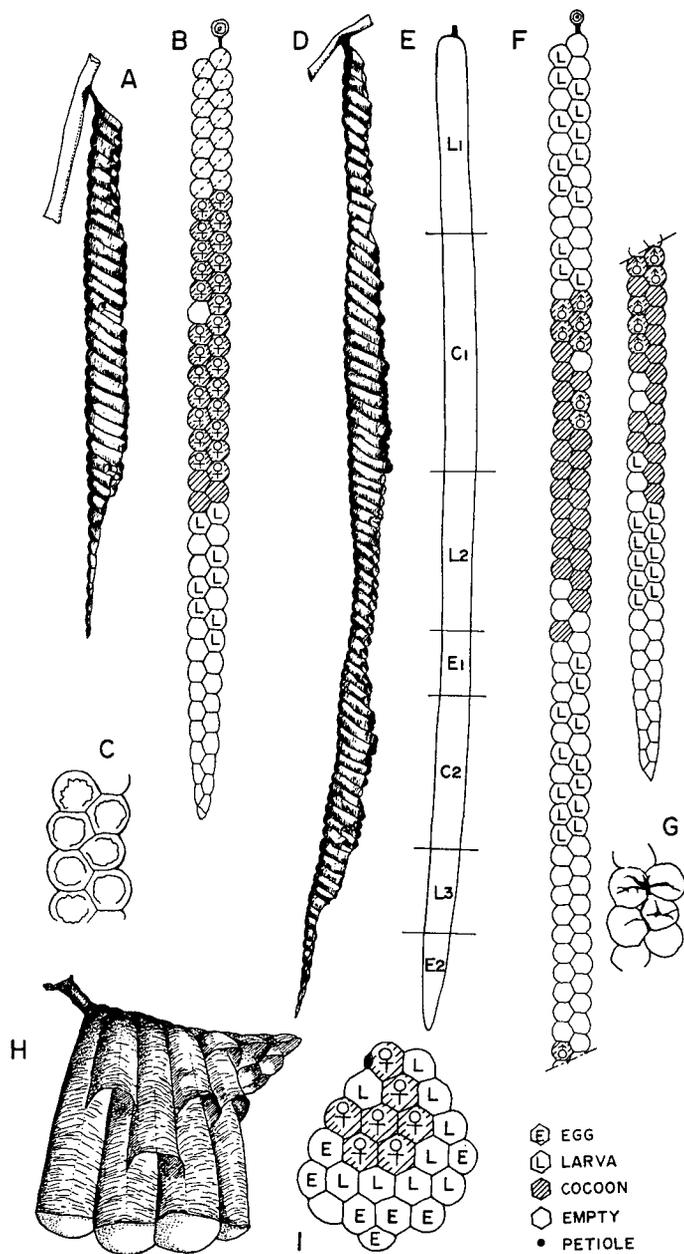


Fig. 3. Nest. A-C: *Ropalidia stigma rufa*; D-G: *R. variegata variegata*; H, I: *Polistes adustus*. A, D, H: lateral view; B, F, I: Cell maps; C: Emerging holes made in cocoon caps; E: Estimated pattern of distribution of immature stages (Zones E₁, E₂: Eggs; L₁-L₃: Larvae; C₁, C₂: Cocoons); G: Cocoon caps applied with pulp.

as the distance between lateral ocelli; interocellar distance about $2 \frac{1}{3}$ times as long as the ocellar diameter. Antennal joint III about twice as long as wide at apex. Punctuation dense on frons, vertex and clypeus; that of gena distinct and dense in the middle, but sparser in upper and lower parts. Thorax narrower than head ($TW/HW=0.94$). Mesoscutum slightly longer than wide. Mesopleuron swollen below. Scutellum and postscutellum convex. Punctuation dense, reticulate on pronotum, mesoscutum, mesopleuron behind the vertical carina, and scutellum; postscutellum with scattered punctures except in the posteromedian flat triangle polished. Metapleuron dorsally with irregular transverse striae, ventrally without visible sculpture. Propodeum with a pronounced median furrow and fine transverse striae which are not easy to observe owing to tomentum. Gastral segment I about $1 \frac{1}{2}$ times as long as wide. Segment II distinctly longer than wide, nearly vertically cut off at apex; tergite and sternite fused.

Colour: Ferruginous brown. Black: mandibular teeth, a vertical broad bar on clypeus extending to two-thirds from the base, two supraclypeal lines running across antennal sockets and converging below, mesoscutum peripherally, a narrow median line in the anterior part of scutellum, metapleuron, and a median line on propodeum. Yellow: clypeus, supraclypeal area, mandible and lower gena (rather dark), antenna below, a line along pronotal keel, tegula peripherally, a small spot below tegula, anterior half of scutellum, postscutellum, a pair of broad longitudinal bars on propodeum, basal spots and apical fascia on gastral tergite II, and some markings on legs.

♂-Colour: Nearly as in the female, but yellow markings more extensive. Yellow: Nearly whole clypeus (with a black, short median line in some specimens), upper frons largely, mandible, lower gena and mesopleuron anteriorly (bright). Frons with a black circle across the ocelli down to the antennal socket, interrupted by yellow on interantennal space.

Length ($H+Th+T_1+T_2$): 7-8 mm in both sexes.

Larval stage. Six dried mature larvae were obtained from Nest RN-7501. Morphology of the head and spiracle is very similar to that of *R. stigma rufa*, except in the following details. In *R. variegata* there are numerous microscopic denticles around labial palps (Fig. 2G), and the emargination of the ventral part of postlabium is rather shallow (Fig. 2I). However, it is not certain to us whether this offers constant specific differences between the two.

Nest. The nest was found on a twig of a small tree growing in a sunny place (Pl. 1). It is stelocytтарous, gymnodomous and laterinidal (Figs. 3D, F), and very similar to the nest of *R. stigma rufa*. General colour brownish grey (more greyish than in *stigma* nest). Judging from variously coloured stripes, one cell seems to have been applied with 13-15 pulp pellets. Petiole and outer surface of cell bottom around it blackish owing to salivary coating. Petiole compressed, 1.6 mm long and 1.8×1.2 mm thick, not coated with any sticky substance, and attached to the bottom of the uppermost cell. Comb very slender, consisting of two vertical rows with 153 cells, and 255 mm long and 5.5-5.7 mm wide. Cells round on the outer side and arranged orderly; cell axis slightly slanting downward so as to prevent rains; wall about 0.1 mm thick; inner diameter 2.9-3.2 mm at the opening. Depth corresponding to the development of larvae in incipient cells and 10.0-11.0 mm in completed cells. The cells might have been shaven after the emergence of adult. Cocoon cap projecting above the level of cell top and distinctly convex, applied with pulpy material (Fig. 3G); darker than cell in colour.

Biology. As stated above, ten females, of which the caste is unknown, and 59 males were captured on Nest RN-7501. The nest consists of 153 cells in which 52 cocoons and 35 larvae were found, though more immatures might have been present at the time of collection. Not a small number of eggs might have been present in certain zones — Zones E₁ and E₂ in Fig. 3E. Larvae were found in Zones L₁, L₂ and L₃ and cocoons in Zones C₁ and C₂. Of the 52 cocoons found 30 belong to Zone C₁ and 22 to C₂. Ten cocoons in C₁ and seven in C₂ each contained a male pupa and the others a prepupa or a postdefecating larva. In either of C₁ and C₂, younger stages tended to be found in the lower portion. The cells in Zone L₁ had probably produced adults twice and those in C₁, L₂ and E₁ once. In that case the number of adults produced is estimated at least at 99.

On the basis of the above we can assume as follows. First, certain cells had been repeatedly used. Most cells in the upper half of the comb had been used to rear the second series of immatures (cf. C₁, L₂ and E₁ in Fig. 3E), and the larvae in Zone L₁ may belong to the second or even third series. Repeated use of one and the same cell has also been observed in certain congeners (*R. fasciata* in Okinawa and Taiwan, and *R. taiwana* in Taiwan: S. Yamane, unpub.). Second, the presence of male adults and pupae indicates that the nest had already entered into the reproductive period¹⁾ and therefore it had attained the maximum size.

Distribution. Nepal and India (Patiala State, Poons, Benares, Calcutta, Bihar, etc.).

5. *Ropalidia cyathiformis* (Fabricius)

Ropalidia cyathiformis: van der Vecht, 1941, Treubia, 18: 158-162; van der Vecht, 1962, Zool. Verh., Leiden, 57: 31-32.

Data. Betrawate (700-760 m), Bagmati, 2♀, 11 IX, 1975, S.T.

This species is very similar to the preceding one, but is easily distinguished from the latter by the smaller size, indistinct punctures on gena and the presence of a small, black median spot on clypeus and of a dark spot at the base of mandible.

Diagnosis. ♀—Structure: Head wider than high. Gena rather developed, nearly as wide as eye in profile, (distinctly narrower than eye—5: 7.5— in van der Vecht's description). Ocelli arranged in an equilateral triangle; median ocellus as large as lateral ocelli; ocellular distance slightly more than twice as long as the distance between lateral ocelli; space between lateral ocelli not much elevated. Antennal joint III slightly more than twice as long as wide at apex. Punctures coarse and dense on upper frons and on ocular sinus above, finer and sparser on clypeus, mandible and vertex. Gena with only inconspicuous, ill-defined and scattered punctures. Thorax narrower than head (TW/HW=0.94). Mesopleuron swollen in the lower portion. Scutellum and postscutellum slightly convex but not much elevated. Punctures coarse and dense on pronotum, mesoscutum, mesopleuron except in anterior part, and sparser on scutellum and postscutellum (posteromedially without punctures and polished). Metapleuron without punctures. Propodeum with a pronounced median furrow; transverse striae very fine, even invisible on the sides. Gastral segment I less than 1 1/2 times as long as wide. Tergite and sternite of segment II fused. Tergite I with only scattered

1) The reproductive period is the one lasting from the emergence of sexual forms to the disintegration of colony (cf. S. Yamane and Kawamichi 1975).

punctures on the posterior one quarter. Punctures on segments II–VI coarse and not defined posteriorly.

Colour: Mostly agreeing with van der Vecht's description. Largely reddish brown.

Length (H+Th+T₁+T₂): 6–7 mm in the female.

Distribution. Nepal, Ceylon, India (Assam), Burma, Philippines, Indonesia and Malaysia.

GENUS PARAPOLYBIA SAUSSURE

6. *Parapolybia nodosa* van der Vecht

Parapolybia nodosa van der Vecht, 1966, Zool. Verh., Leiden, 82: 39–40.

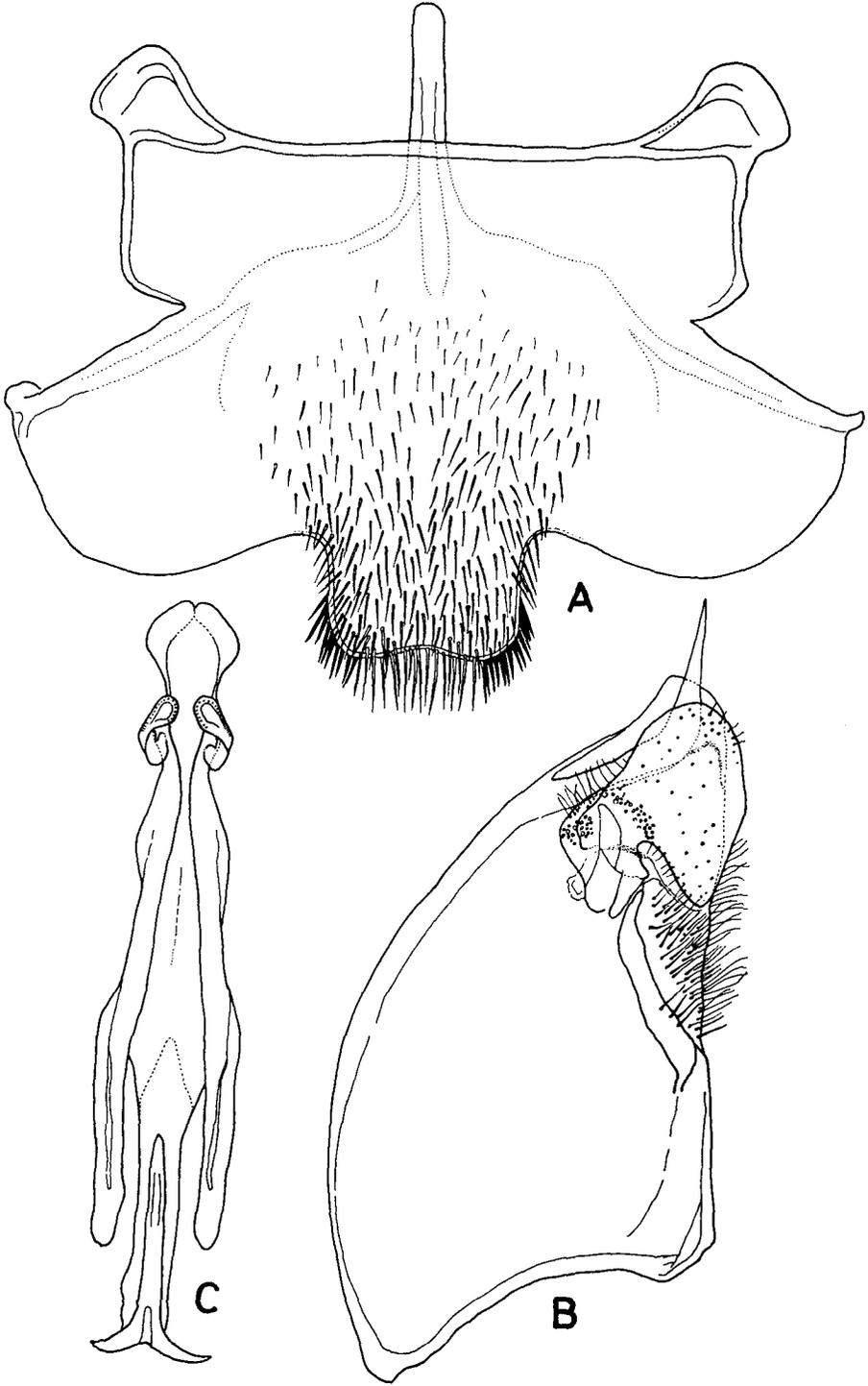
Data. Kathmandu (1300–1400 m), Nepal Valley, 1♀, 23 III, 1968, T.M.; 1♀, 14 IV, 1968, T.K.; 3♀, 15 IV, 1968, T.K.; 5♀, 14 VI, 1968 (from a nest hung under the eaves of a house), T.M.; 2♀, 16 VIII, 1975, S.T.; 3♀, 25 VIII, 1975, S.T. Balaju, Nepal Valley, 1♀, 22 IV, 1968, T.K.; 2♀, 1 VII, 1968, T.K. Godavari (ca. 1600 m), Nepal Valley, 1♀, 17 VI, 1968, T.K. Phulchoki, Nepal Valley, 1♀, 14 VIII, 1975, S.T.; 1♀, 18 VIII, 1975, S.T. Sundarijal (1450 m), Nepal Valley, 1♀ 8♂, 13 X, 1975, S.T. Sheopuri (ca. 2000 m), Nepal Valley, 1♀, 26 VIII, 1975, S.T. Thare (2000 m), No. 1 West, 1♀, 29 V, 1968, T.K. Ramche (1670 m), Bagmati, 1♀, 15 IX, 1975, S.T. Gotikhola (900 m) — Satsu (1180 m), No. 3 West, 1♀, 28 III, 1972, T.M.

In the Oriental Region three species have so far been known in the genus *Parapolybia*. Among them *P. indica* (Saussure) is readily distinguished from the others, *P. nodosa* van der Vecht and *P. varia* (Fabricius), by having a complete occipital carina in the female and distinctly longer antennae in the male. However, *P. nodosa*, described solely from the female, much resembles *P. varia*. Here the male is described for the first time and differences between these two species are mentioned based on biometric and other characters.

Diagnosis. ♀ – Structure: Very similar to *P. varia*. Gastral tergite I more strongly nodose ($T_1W/T_1L=0.40$ in *nodosa* and 0.35 in *varia*, Fig. 5D); relative length of tergite I against head width distinctly shorter than in *P. varia* ($T_1L/HW=0.97$ vs. 1.05, Fig. 5C). Irregular striae in the anterior region of the ventral side of metapleuron more distinct than in *P. varia*.

Colour: The colour pattern is, at least at certain localities within their distribution (e.g., in Taiwan; see van der Vecht, 1966), distinctly different between the two species. The present specimens are almost the same as those of *P. nodosa* from Taiwan in respect of darker ground colour, less extensive yellow markings and an ill-defined U-shaped brown marking extending from the base of clypeus. Unfortunately, we have no specimen of *P. varia* from Central Nepal to compare with the present specimens.

♂ – Structure: Basically the same as in other congeneric species. Very similar to *P. varia*, but larger in head and thorax, though in the female almost as large as *varia* (Figs. 5A, B). HW/HH ratio slightly smaller than in *P. varia* (1.18 vs. 1.20, Fig. 5A). Eye very large, about four times as wide as gena in profile. Clypeus longer than wide, forming the shape of a bell. Mandible with four teeth; innermost tooth slightly smaller than the others. Depression behind the vertex normal. Occipital carina weak and incomplete, absent on more than lower third of



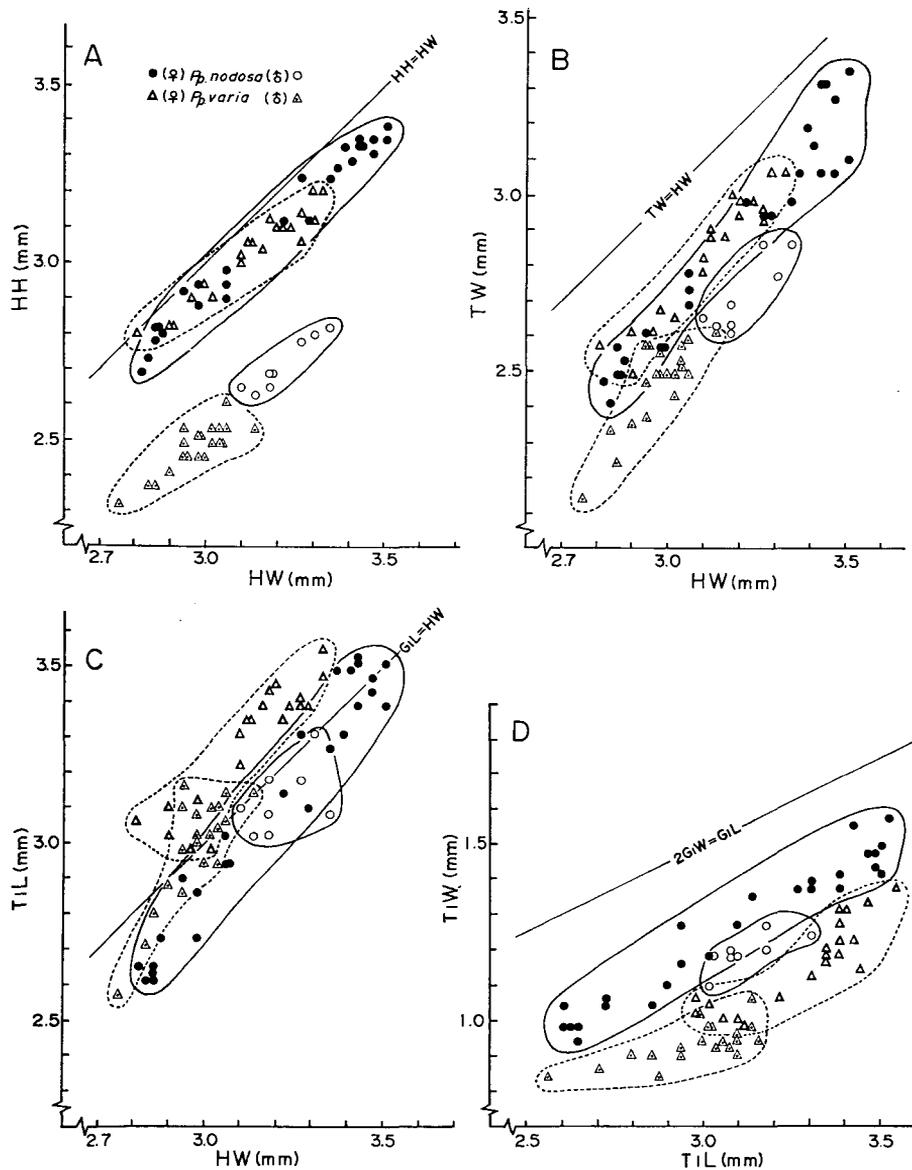


Fig. 5. Comparisons of some biometric characters between *Parapolybia nodosa* and *P. varia*. A: Head width against head height; B: Head width against thoracic width; C: Head width against length of gastral tergite I; D: Length of gastral tergite I against its width.

gena as in *P. varia*. Relative length of antenna shortest among all the Oriental species ($A_3L/HW=0.28$ in *nodosa*, 0.31 in *varia* and ca. 0.46 in *indica*). Thorax narrower than head, but TW and TW/HW ratio larger than in *P. varia* (Fig. 5B);

Fig. 4. Terminal sternites and genitalia of male *Parapolybia nodosa*. A: Gastral sternites VII+VIII; B: Inner aspect of right paramere with volsella; C: Aedeagus.

without sculpture, except on pronotum and metapleuron. Pronotum laterally with weak irregular striae; anterior region of the ventral part of metapleuron with rather distinct striae (these striae are more distinct than in *P. varia* as in the case of female). Although the absolute length of the gastral tergite I longer than in *P. varia* ($T_1L=3.12$ vs. 2.98), its relative length against head width shorter ($T_1L/HW=0.97$ vs. 0.31, Fig. 5C). Structure of sternites VII+VIII and genitalia very similar to that of *P. varia* (Fig. 4); All segments without punctures.

Colour: Almost the same as in the female. Body dark brown. Yellow: ocular sinus down to mandible, gena, scape of antenna below, lines along anterior and posterior margins and lateral triangular markings of pronotum, two parallel lines on mesoscutum, mesopleuron largely, tegula, a line anteriorly on scutellum, whole of postscutellum, and metapleuron largely. Two parallel and rather oblong markings on the dorsum and lateral sides of propodeum, whole of fore leg, mid and hind legs below, two spots on each gastral tergite and sternite (spots on sternites often fused into one).

According to our unpublished data in Taiwan, the colony of this species is relatively small, with the number of workers seemingly less than a hundred at any one time, and certainly annual there. The nest is composed of a single oblong or semiconcentric comb which is vertically attached to the nesting substrate by a single petiole. Such ethological characteristics are similar to those of *P. indica* rather than of *P. varia*.

Length ($H+Th+T_1+T_2$): 10–13 mm in the female and 10–12 mm in the male.

Distribution. Nepal, India (United District of Mikir and Kashgar Hills, Umbaso, 690 m), Burma, Thailand, China and Taiwan.

GENUS POLISTES LATREILLE

7. *Polistes (Polistella) strigosus mimus* Bequaert

Polistes strigosus var. *mimus* Bequaert, 1940, Trans. Amer. Ent. Soc., 56: 269–272, fig. 1.

Data. Kathmandu (1340 m), Nepal Valley, 1♀, 16 VIII, 1975, S.T.

Diagnosis. ♀ – Structure and colour: A large species structurally similar to *P. sagittarius* Saussure, but readily distinguished from the latter by the larger body and shouldered and distinctly ribbed pronotum (Bequaert 1940), and also by the larger TW/HW ratio (1.08 vs. 1.01.). The specimen well agrees in structure with Bequaert's description of *strigosus*, and is very similar in coloration to his var. (or subspecies) *mimus*, except in the following points. Black markings less extensive than in the "typical" *mimus*, confined to the following parts: vertex, pedicel and flagellum of antenna below, mesoscutum (with a pair of longitudinal lines), meso- and metapleura, propodeum (with a pair of longitudinal markings on the dorsum), coxae and trochanters of all legs, a basal band of gastral tergite I, whole of gastral sternite I, and gastral segments III and IV. A broad apical fascia of tergite II yellow.

Whether the present specimen represents another distinct subspecies or not is yet uncertain. Further intensive collections are required from the Himalayas and adjacent districts.

Length ($H+Th+T_1+T_2$): 15 mm in the female.

Distribution. Nepal, Philippines and Malaysia (Borneo¹).

8. *Polistes (Polistella) sagittarius* subsp.

Data. Rupakot Tal (750 m), No. 3 West, 1 ♀, 20 V, 1968, T.K.

The specimen well agrees in structure with the descriptions of *P. sagittarius* by Bingham (1897) and Bequaert (1940). But in coloration it is somewhat different from all the subspecies of this species so far described. More specimens must be examined to decide the status of the Nepalese form at subspecific level.

Diagnosis. ♀ - Structure. Head wider than high (HW/HH=1.07). Gena rather developed, in profile nearly as wide as eye. Clypeus longer than wide, forming the shape of a bell (Fig. 6A). Occipital carina incomplete, reaching the lower one quarter of gena. Interantennal ridge undeveloped. Ocelloccipital distance a little longer than ocellular distance. Antenna slender, each flageller joint longer than wide or at least as wide as long. Punctuation dense on vertex except in posterior part, frons and ocular sinus above, and sparse on clypeus, mandible, lower gena and oculo-malar space; impunctate on upper gena and ocular sinus below. Thorax nearly as wide as head. Mesopleuron with ill-defined ventral edge. Scutellum elevated with a flat top; postscutellum not elevated. Punctuation very strong, rather reticulate on pronotum, mesoscutum, scutellum, and mesopleuron behind the sternopleural groove except for mesepimeron; dense but not reticulate on mesopleuron in anterior and ventral portions, and sparse on postscutellum. Metapleuron dorsally with distinct striae and ill-defined and shallow punctures, ventrally with densely set punctures which gradually become denser toward the posterior half. Propodeum with a shallow median furrow; transverse striae distinct, but not very strong. Gaster silky; sternite II strongly convex, not angulate at base; all segments impunctate.

Colour: Mostly reddish brown. Black: mandibular teeth apically, apical margin of clypeus, a band across ocelli, margins of mesoscutum, mesopleuron ventrally, a line along pleural sulcus, metapleuron anteriorly, propodeum dorsally (with a pair of lines) and also on the side locally, gastral tergite I basally, whole of gastral sternite I, mid leg partly and hind leg mostly. Yellow: tarsi of all legs except for basitarsi.

Length (H+Th+T₁+T₂): 13.5 mm in the female.

Distribution. Nepal.

9. *Polistes (Polistella) maculipennis* Saussure

Polistes maculipennis Saussure, 1853, Mon. Guêp. Soc., 2: 61, pl. 4, fig. 4; Bingham, 1897, Fauna Brit. Ind., Hym., 1: 396, 397.

Data. Kathmandu (1300-1400 m), Nepal Valley, 4 ♀, 23 III, 1968, T.M.; 1 ♀, 15 IV, 1968, T.K.; 5 ♀, 22 IV, 1968, T.M. Balaju, Nepal Valley, 1 ♀, 3 VII, 1968, T.K. Sanupaka (1600 m), No. 1 East, 1 ♀, 17 VII, 1968, T.M.; 1 ♀, 19 VII, 1968, T.M. Ramche (1670 m), No. 1 West, 1 ♀, 28 V, 1968, T.K. Gulb Bhanjyang (2300 m), No. 1 West, 1 ♀, 9 V, 1968, T.K.; 1 ♀, 9 VI, 1968, T.K. Thare (2000 m), No. 1 West, 1 ♀, 29 V, 1968, T.K. Lumbari (1200 m), West Nepal, 1 ♀, 6 XI, 1967, H.K. Tansing (1020 m), West Nepal, 1 ♀, 30 IX, 1965, I.Y.; 1 ♀, 1 X, 1965, I.Y. Chutra Basi (1050 m), West Nepal, 1 ♀, 11 X, 1965, I.Y. Without data, 1 ♀,

1) We have examined two male specimens from Borneo (Sabah; 5 IX, 1966).

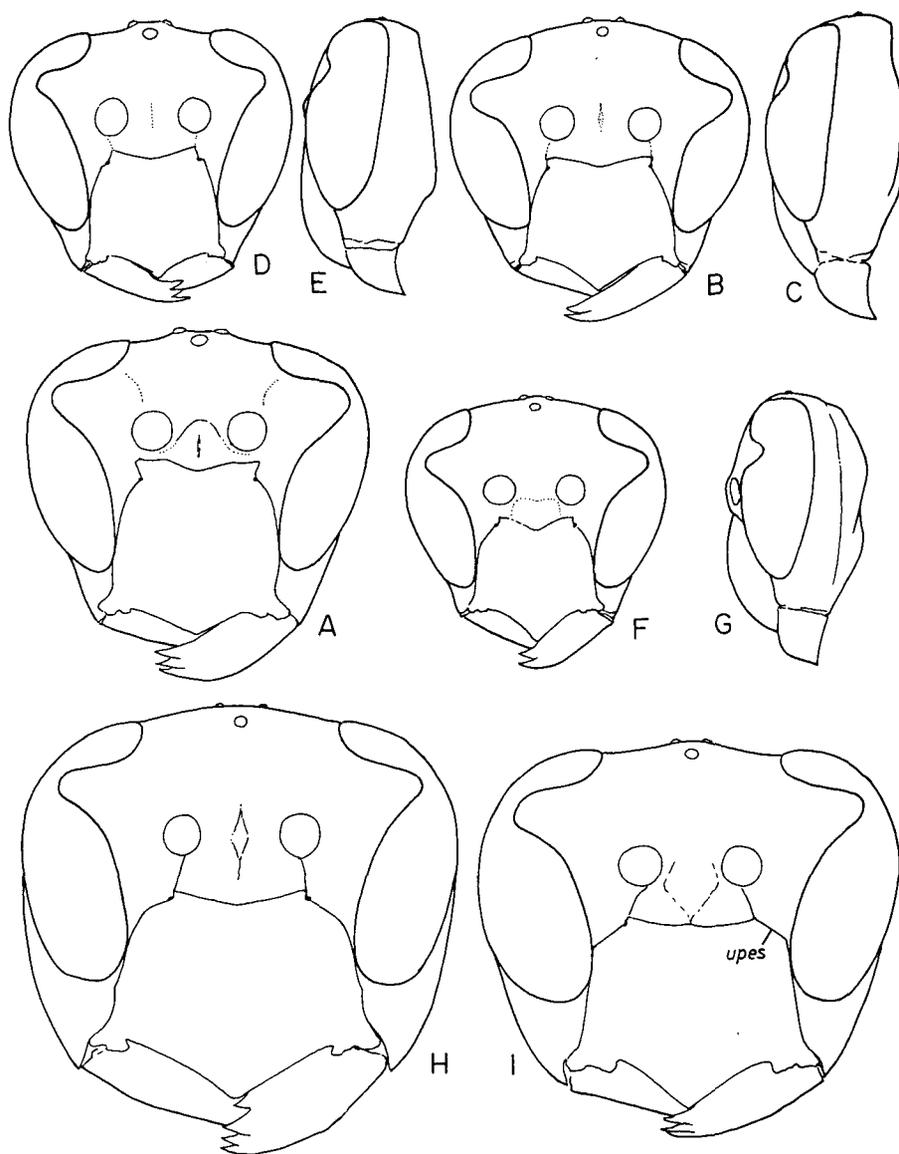


Fig. 6. Female head of some *Polistes* species. A: *P. sagittarius*; B, C: *P. maculipennis*; D, E: *P. stigma*; F, G: *P. adustus*; H: *P. rothneyi rothneyi*; I: *P. (Megapolistes) sp.* (*upes*: upper portion of the lateral arm of epistomal suture). C, E, G: Lateral view; others frontal view.

The specimens agree in most characters with the original description by Saussure (1853). This species distinctly differs from any other *Polistella* species from Nepal, while it is not easily distinguished in structure from *P. snelleni* Saussure of Japan and *P. shirakii* Sonan of Taiwan from which, however, it is different in coloration. If based upon the adult structure alone, they may be regarded merely as subspecies of the same species. There is, however, an

important biological difference at least between *P. snelleni* and *P. shirakii*. Though the nests of both the species are alike in architecture, the cells are always used only once to rear offspring in *P. snelleni*, while at least twice in *P. shirakii*. No information is available as to the biological characters of the present species.

Diagnosis. ♀ - Structure: Head wider than high ($HW/HH=1.08$, Figs. 6B, 7A). Gena developed (Fig. 6C). Occipital carina distinct but not reaching the level of the lower margin of eye. Diameter of median ocellus equal to that of lateral ocelli. Ocellocular distance a little longer than ocelloccipital distance. Clypeus pentagonal and distinctly convex. Scape of antenna slightly longer than the first joint of the flagellum; the flagellar joints gradually shortened toward apex; the second to fourth joints each longer than wide; terminal joint longer than wide and apically tapering but not pointed. Punctuation dense and strong. Thorax distinctly narrower than head ($TW/HW=0.94$, Fig. 7C). Punctuation very strong on pronotum, mesoscutum, mesopleuron except in anterior part, and scutellum; even granular on mesopleuron which has weak transverse striae dorsally; metapleuron ventrally with scattered, ill-defined shallow punctures. Propodeum with rather round lateral edges; longitudinal furrow on the dorsum relatively shallow; transverse striae distinct but not very strong and weakening toward the lower margin of the side. Gaster with fine short hairs giving a silky appearance. Gastral tergite I distinctly narrower than head ($T_1W/HW=0.79$, Fig. 7B) and wider than long ($T_1W/T_1L=1.19$, Fig. 7D). T_1W/T_1L ratio distinctly larger than in *P. stigma* (Fabricius) (1.02) but smaller than in *P. adustus* Bingham (1.27). Tergites II-VI with only a few and inconspicuous punctures. Sternite II fairly convex but not angulated basally; sternites II-VI sparsely punctate.

Colour: Very variable. General colour reddish brown. Black: frons, vertex and behind it, two spots on clypeus (faint in some specimens), mandibular teeth apically, the fifth to terminal joints of antenna above, mesoscutum, mesopleuron, propodeum, base of gastral tergite I, basal triangular marking on tergite II, markings on coxae and trochanters, lines on the mid and hind femorae below. Yellow: lateral and lower margins of clypeus, lines along the lowest margin of eye, lines on inner and outer orbits above, lines along the transverse carina and posterior margin of pronotum, two spots on mesopleuron, basal narrow lines on scutellum and postscutellum, two longitudinal lines on the dorsum and a longitudinal line on the lateral side of propodeum, apical narrow bands on the gastral tergites I-IV and sternites II-IV (absent in some individuals), spots on fore and mid femorae.

Length ($H+Th+T_1+T_2$): 9-12 mm in the female.

Distribution. Nepal, India and Indonesia (Java).

10. *Polistes (Polistella) stigma* (Fabricius)

Vespa stigma Fabricius, 1793, Ent. Syst., 2: 275.

Polistes stigma: Saussure, 1853, Mon. Guêp. Soc., 2: 64, pl. 6, fig. 3; Bingham, 1897, Fauna Brit. Ind., Hym., 1: 396.

Data. Adhabar (300 m), Terai Forest, 1♀, 15 VII, 1968, T.K.; 16♀, 21 X, 1975, S.T. Rupakot Tal (750 m), No. 3 West, 1♀, 20 V, 1968, T.K.

The specimens nearly agree in structure and colour pattern with specimens from India (cf. Bingham, 1897). This species is easily distinguished from the other Nepalese congeners by the possession of the fore wing subapically with a fuscous cloud. Punctuation is weakest among all the *Polistella* species known from Nepal.

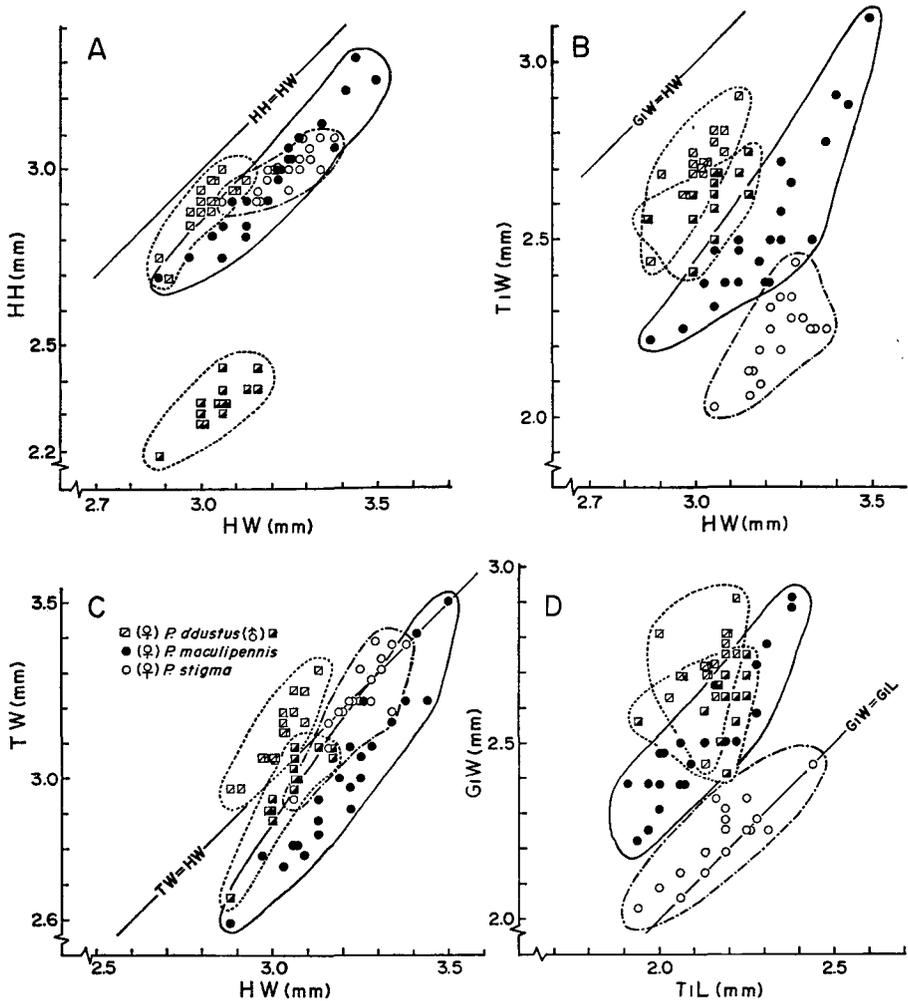


Fig. 7. Comparisons of some biometric characters among *Polistes maculipennis*, *P. stigma* and *P. adustus*. A: Head width against head height; B: Head width against width of gastral tergite I; C: Head width against thoracic width; D: Length of gastral tergite I against its width.

Diagnosis. ♀ - Structure: Head wider than high ($HW/HH=1.08$, Figs. 6D, 7A). Occipital carina incomplete, reaching the level at about lower one quarter of eye. Gena undeveloped above (Fig. 6E vs. 6C, G). Punctuation sparse on clypeus, mandible and lower gena, indistinct on vertex and upper frons. Thorax nearly as wide as head seen from above ($TW/HW=0.99$, Fig. 7C). Pronotum, mesopleuron except in the raised square area of mesepimeron, scutellum and metapleuron dorsally impunctate. The absence of punctures in these thoracic parts is unique among the *Polistella* species from the Subcontinent of India. Propodeum with the longitudinal furrow relatively shallow; transverse striae weak, becoming indistinct toward the lower margin of the side. Gaster slender; tergite I almost as wide as long ($T_1W/T_1L=1.02$, Fig. 7D); sternite I with fine transverse

striae as in other *Polistella*; sternite II convex and basally round. All the segments impunctate, more silky than head and thorax.

Colour: Relatively stable in the 18 specimens examined. They well agree with Bingham's redescription for specimens from India and also resemble specimens collected in Calcutta by one of the members (T.K.) of the expedition in 1968, though in the latter the head is almost wholly ferruginous.

Length (H+Th+T₁+T₂): 8.5–12.0 mm in the female.

Distribution. Nepal, India, Ceylon, Burma, Malaya, Thailand, Indonesia (Celebes), Philippines¹⁾, China and Taiwan.

11. *Polistes (Polistella) adustus* Bingham

Polistes adustus Bingham, 1897, Fauna Brit. Ind., Hym., 1: 397, 398; Richards, 1973, Rev. Brasil. Ent., 17 (13): 98.

Data. Godavari, Nepal Valley: 12 ♀ 15 ♂, 17 VIII, 1975 (Phulchoki, 1450 m), S.T. Ramche — Dunche (1400–2000 m), Bagmati: 2 ♀, 16 IX, 1975, S.T. Gulb Bhanjyang (2300 m), No. 1 West: 1 ♀, 9 VI, 1968, T.M. Dana (1500 m), Palpa: 1 ♀ from Nest NP-6801, 9 V, 1968, T.M.

This species resembles *P. maculipennis*, but is readily distinguished from the latter by the smaller body and distinctly angulated base of sternite II (Fig. 8D). We have examined two other *Polistella* forms with the basally angulated second sternite from Taiwan. *P. adustus* and the two Taiwanese forms, probably forming a natural group, clearly differ in structure from one another. A detailed discussion on the relation of these forms will be given in a separate paper.

Diagnosis. ♀ — Structure: Head wider than high, but somewhat high in comparison with that of the other *Polistella* species from Nepal (HW/HH=1.04, Figs. 6F, 7A). Gena rather developed, nearly as wide as eye in profile (Fig. 6G). Occipital carina incomplete. Ocellocular distance slightly longer than ocellocapital distance. Oculo-malar length slightly shorter than the diameter of antennal socket. Clypeus pentagonal and strongly convex, with scattered erect hairs. Punctuation dense and strong in supraantennal area, somewhat sparser on vertex and gena, and sparse and coarse on clypeus. Thorax wider than head (TW/HW=1.03, Fig. 7C). Scutellum much elevated. Punctuation very strong, reticulate on pronotum partly, mesoscutum, scutellum and postscutellum. Posterior half of mesopleuron with rather deep, defined punctures. Punctuation sparse on mesopleuron anteriorly and metapleuron. Propodeum with defined lateral edges (right-angled or nearly so); transverse striae distinct and reaching the lower margin of the side (the side sparsely punctate). Gaster covered with short hairs and not very shining. Tergite I distinctly wider than long (T₁W/T₁L=1.27, Fig. 7D); T₁W/HW ratio largest among all the *Polistella* species from Nepal (0.90, Fig. 7B). Sternite II angulated at base (this character separates *P. adustus* from every other Nepalese species of the genus). Punctuation feeble and sparse on tergite I and in the basal part of tergites II–VI (stronger and denser in lateral and apical parts, though weaker than on thorax). Punctuation on sternites such as in the lateral part of tergites II–VI. Punctures always circular with a flat bottom.

Colour: Black. The following parts dark red: clypeus (periphery black), mandible, oculo-malar space, lower gena, upper gena partly (usually a line behind

1) Recently one female was collected from Leyte (Kojima, personal communication).

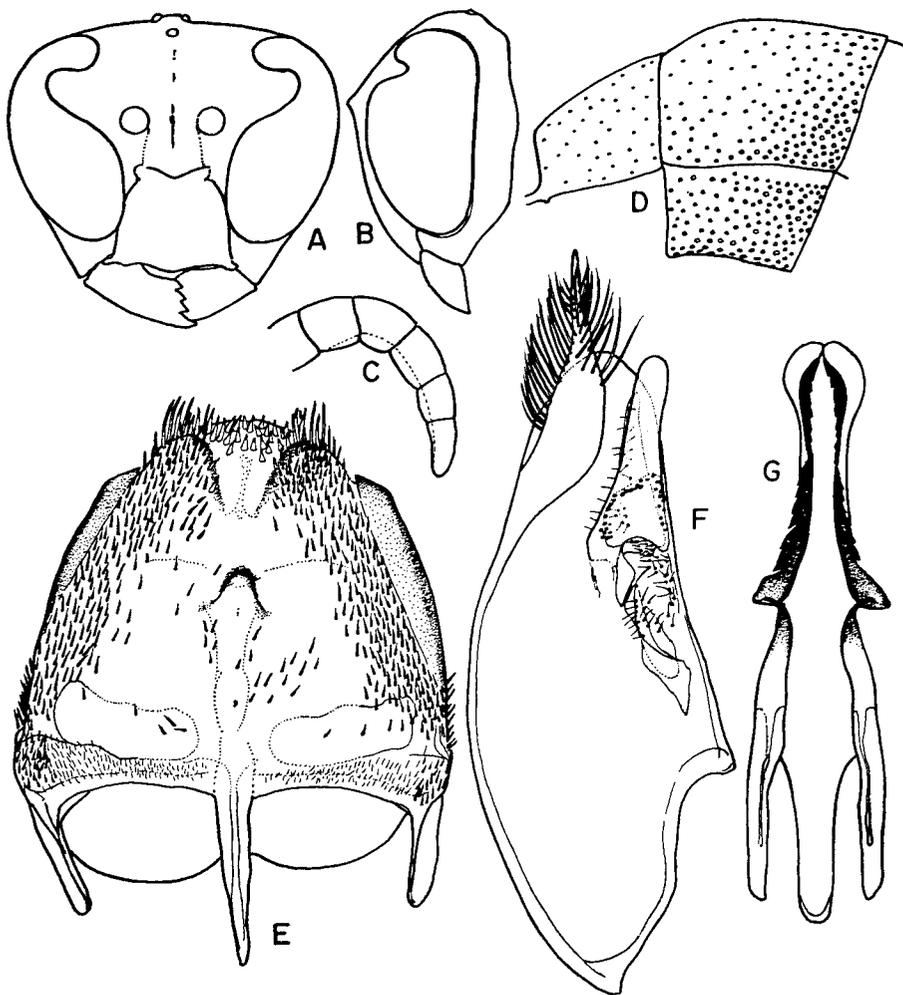


Fig. 8. *Polistes adustus* (♂). A: Head, frontal view; B: Ditto, lateral view; C: Apical joints of antenna; D: Gastral segments I and II, lateral view; E: Gastral sternites VII+VIII; F: Inner aspect of right paramere with volsella; G: Aedeagus.

eye), scape and pedicel of antenna, pronotum (with a black triangular patch adjacent to mesopleuron), tegula, scutellum, postscutellum (partly black), apical bands of gastral tergites I-V and sternites II-V, whole of the terminal segment, femora above and basal halves of tibiae below of all legs and basitarsi of mid and hind legs.

♂ - Structure: Much as in the female. Head wider than high ($HW/HH=1.30$, Figs. 7A, 8A), strongly converging posteriorly. Interantennal ridge low and blunt. Supraantennal area flat. Gena about $1/2$ as wide as eye (Fig. 8B). Occipital carina distinct but not reaching the level of the lower margin of eye. Terminal joint of antenna tapering apically but not sharply pointed (Fig. 8C). Scape nearly as long as the first segment of flagellum. Clypeus, lower gena and

oculo-malar space with short velvet hairs, and weak and scattered punctures. Supraantennal area with long erect hairs, and strong and densely set punctures. Thorax almost as wide as head ($TW/HW=0.97$, Fig. 7C). Scutellum much elevated. Punctuation on mesoscutum, scutellum and postscutellum strong and dense. Pronotum and mesopleuron rugoso-punctate. Metapleuron with weak striation and punctuation. Propodeum with defined lateral edges (right-angled or nearly so); transverse striae strong; rather rugoso-punctate on the side. Gaster covered with short velvet hairs, and not very shining. Tergite I distinctly wider than long ($T_1W/T_1L=1.20$, Fig. 7D). Sternite II distinctly angulated at base as in the female (Fig. 8D). Sternite VIII with a median tubercle which has been observed only in this species among *Polistella* (Fig. 8E; cf. Richards 1973). Punctuation feeble and sparse on tergite I and in mediobasal part of tergite II; more conspicuous and denser in lateral and medioapical parts of tergite II, and nearly whole of the subsequent tergites. Punctuation on sternites nearly the same as in the lateral parts or tergites. Punctures circular with a flat bottom. Genitalia: gonostipes with a moderate, bluntly pointed spine which has long hairs except apically. Digitus moderately swollen at base; distal process gradually narrowed toward the tip but not pointed (Fig. 8F). Ventral teeth of aedeagus well developed (Fig. 8G).

Colour: Almost as in the female.

Larval stage. Only mature larvae are available for the present study. Head with nearly parallel sides in frontal view (Fig. 9A); integument moderately sclerotized. Cranium and appendages nearly entirely blackish brown; cranium with numerous setae especially on frons and clypeus. Vertex nearly naked, flattened rather than round, not indented. Mid-cranial sulcus weak and visible only in upper half; frons not separated from epicranial area by distinct lines. Antenna of moderate size, not projecting conically, with three minute sensillae.

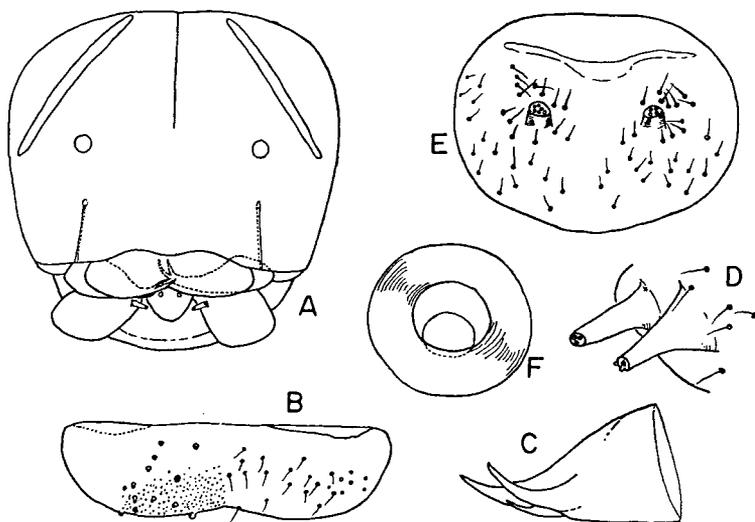


Fig. 9. Mature larva of *Polistes adustus*. A: Head, frontal view; B: Labrum (right) and palate (left); C: Mandible; D: Maxillary palp and galea; E: Prelabium; F: Spiracle, surface view.

Temporal band somewhat wide and long. Epistomal sulcus completely obsolete in upper portion; anterior tentorial pit weak, located at the upper end of each of remaining lateral arms of epistomal sulcus; postoccipital, hypostomal and pleurostomal sulci developed. Mid-point of the ventral margin of clypeus nearly at the level of mandibular bases. Labrum narrower than clypeus, with a gentle, median emargination ventrally, with sensory bristles and punctures; palate with several conical sensillae and numerous microscopic spinous processes, without sclerotized patch (Fig. 9B). Mandible not very elongate, bidentate, tapered apically; the lower and larger tooth with a subsidiary tooth (Fig. 9C). Maxilla not remarkably developed in comparison with that in the subgenus *Polistes*, with setae shorter than those on cranium; separation of cardo from stipes indistinct; stipes with elongate maxillary palp and galea; maxillary palp and galea each with three minute sensillae (Fig. 9D). Prelabium not very developed, with transverse salivary opening; labial palp with many setae similar to those on maxilla; labial palp with at least four sensillae (Fig. 9E); postlabium not much developed. Body without striking features, with setae on the ventral surface of the first to third thoracic and the first abdominal segments (these setae are absent or considerably minute in other segments), with numerous microscopic denticles all over the body surface especially on anterior two-thirds. Spiracle simple, without spines or denticles on the inner wall; primary tracheal opening distinctly smaller than atrial opening (Fig. 9F); the first spiracle largest and most sclerotized.

Nest. Nest NP-6801 was found on a stem of an urticaceous herb on a sunny road in Dana (1500 m alt.), and it was in a pre-emerging period with the supposed foundress. It is stelocytтарous, gymnodomous and rectinidal (Fig. 3H) and very similar to the nest of *P. snelleni*. Colour principally grey as in many other *Polistes* nests. Petiole and outer surface of cell bottom around it coated with saliva and blackish. Petiole like a thin plate, 5.2 mm long and 1.7×0.6 mm thick, attached to the dorsum of one of the longest cells located at basal end of the comb, and not coated with any sticky substance. Comb semi-concentric, 21.0 mm long and 14.5 mm wide. Since cells were multiplied in unilateral direction the comb would have become rectangular or somewhat apically swollen when completed. Inner cells hexagonal but outer side of peripheral cells round. Completed cells with a cocoon 14.1–15.6 mm ($m=14.7$, $n=6$) in depth and 4.3–5.2 mm ($m=4.7$, $n=6$) in diameter at the opening. Cells with a larva or an egg vary in depth and diameter according to the size of occupants. Cocoon cap convex, moderately projecting above the level of cell top, not applied with pulp, and greyish white.

Biology. Nest NP-6801 comprises 24 cells. The contents of the cells are as follows: six cells each with a female pupa (some pigmented) probably of worker, nine each with a larva, seven each with an egg, and the remaining one empty (Fig. 3I). None of the cells had produced adults. From the facts mentioned above the following will be remarked: 1) The nest was just about to attain the matrifilial period¹⁾. 2) The nest was seemingly founded late in March or early in April by a single queen. 3) The total number of cells made before the emergence of the first workers is estimated at about 24. It is significantly smaller than in *P. snelleni* in northern Japan where some forty cells are made by a single queen. 4)

1) The matrifilial period is the one in which the foundress and workers co-operate in nesting activities.

Judging from the practical absence of empty cells, the new cell construction by the queen followed Deleurance's rule, *la règle des cellules libres*. 5) Cells may have been elongated with the larval growth.

Distribution. Nepal and India (Sikkim up to 1800 m alt.).

12. *Polistes (Nygmopolistes) tenebricosus sulcatus* Smith

Polistes sulcatus Smith, 1852, Trans. Ent. Soc. Lond. N.S., 2: 38; Saussure, 1853, Mon. Guêp. Soc., 2: 59; Bingham, 1897, Fauna Brit. Ind., Hym., 1: 395; Richards, 1973, Rev. Brasil. Ent., 17: 99.

Polistes tenebricosus sulcatus: Bequaert, 1934, Bull. Mus. R. Hist. Nat. Belgique, 10 (28): 5-11; Bequaert, 1940, Trans. Amer. Ent. Soc., 66: 265.

Data. Balaju, Nepal Valley, 1♀ (perhaps queen), 16 IV, 1968, T.K.; 1♀ (perhaps worker), 1 VII, 1968, T.K. Gokarna, Nepal Valley, 1♀ (perhaps queen), 16 VIII, 1975, S.T.

A very large species closely allied to *Megapolistes* species, but easily distinguished from the latter by the absence of the epicnemial groove on mesopleuron. The present specimens almost entirely agree in structure with the descriptions by Bingham (1897) and Bequaert (1934, 1940). This form was originally described as a distinct species by Smith, then in 1934 it was regarded as a subspecies of a polytypic species, *P. tenebricosus*, by Bequaert based on closer structural analyses. We could not find any significant structural differences between the present form and the nominate *P. t. tenebricosus* occurring in Taiwan so that we would treat it as a subspecies of *P. tenebricosus*.

Length (H+Th+T₁+T₂): 16-19 mm in the female.

Distribution. Nepal, Northern India and Southern China.

13. *Polistes (Megapolistes) olivaceus* (DeGeer)

Vespa olivacea DeGeer, 1773, Mem. Hist. Ins., 3: 582.

Polistes hebraeus: Saussure, 1853, Mon. Guêp. Soc., 2: 53; Bingham, 1897, Fauna Brit. Ind., Hym., 1: 398.

Polistes olivaceus: Liu, 1937, Peking Nat. Hist. Bull., 11: 211; Sonan, 1943, Trans. Nat. Hist. Soc. Formosa, 33: 477-479; Richards, 1973, Rev. Brasil. Ent., 17: 99.

Data. Ramche (1670 m), No. 1 West, 1♀ (worker), 28 V, 1968, T.K. Pokhara (830 m), No. 3 West, 1♀, 25 IV, 1968, T.K.; 1♀, 26 IV, 1968, T.K.; 1♀, 22 V, 1968, T.M.; 3♀, 9 IV, 1972, T.M. Chutra Basi (1050 m), Palpa, 2♀ (worker), 11 X, 1965, I.Y. Bijuri (750 m), Palpa, 1♀ (worker), 13 X, 1965, I.Y. Wamitaksar (640 m), Palpa, 1♂, 15 XI, 1965, I.Y.

A large and pale-coloured species. Colour pattern is somewhat variable. This species resembles other *Megapolistes* species from the Subcontinent of India and Southeast Asia, but is distinguished by the paler coloration and the combination of the following structural characters: incomplete occipital carina, strongly swollen head (GW/EW=1.09 in ♀ and 1.29 in ♂), weak thoracic punctation, round ventral edge of mesopleuron (Fig. 10C), weak transverse striae on propodeum in both sexes (Fig. 10D) and the separation of the clypeus from eye in the male.

Length (H+Th+T₁+T₂): 13-18 mm in the female and 14 mm in the male.

Distribution. Nepal, India, Ceylon, Burma, Cambodia, Viet Nam, Philippines, China, Taiwan, Okinawa, Marquesas, Tongas, New Caledonia, Fiji, Tahiti, Hawaii, Borneo, Madagascar, Seychelles, Zanzibar, etc.

14a. *Polistes (Megapolistes) rothneyi rothneyi* Cameron

Polistes rothneyi Cameron, 1900, Ann. Mag. Nat. Hist., (7) 6: 410.

Polistes rufolineatus Cameron, 1900, *Ibid.* (7)6: 411.

Polistes rothneyi rothneyi: van der Vecht, 1968, Bijdr. Dierk., 38: 98.

Data. Ramche (1670 m), No. 1 West, 1♀, 29 V, 1968, T.M.

A large species. *P. rothneyi* is a polytypic species consisting of 16 subspecies and widely distributed in southeastern parts of the Palaearctic Region and Oriental Region. The present female specimen, which is perhaps a worker, well agrees with the description by van der Vecht (1968) and is distinguished from three closely allied species, *P. jadwigae* Dalla Torre, *P. olivaceus* and *P. watti* Cameron, as remarked below.

Diagnosis. ♀ - Structure: Well agrees with the Japanese form, subsp. *iwatai* van der Vecht, so far as some selected measurements are concerned (Table 1). Head wider than high. Gena much developed (not so developed in *watti*); occipital carina distinct and complete, reaching the base of mandible (incomplete in *olivaceus* and *jadwigae*). Median ocellus as large as lateral ocelli as in other forms of the species, but the lateral ocelli rather close together as compared with those in subsp. *iwatai*, subsp. *gressitti* van der Vecht (Taiwan) and subsp. *sikkimensis* van der Vecht (Nepal). Punctuation much as in other forms, relatively dense and strong on vertex and upper frons involving ocular sinus. Mesopleuron with clearly defined ventral edge (Fig. 10A; rather round in *olivaceus* and *watti*). Pronotum with distinct punctures and weak transverse striae. Mesoscutum with scattered, distinct punctures. Mesopleuron including mesepimeron and ventral side of metapleuron closely and distinctly punctate. Metapleuron dorsally with a few shallow punctures and weak irregular striae. Propodeum with lateral edges rather defined (Fig. 10B); transverse striae distinct and strong, reaching the lower margin of the side (weaker and not reaching the lower margin in the other species). Gaster nearly as in the other three species, smooth and silky, with sparse erect pubescence.

Colour: Almost entirely agreeing with the descriptions by Cameron and van der Vecht.

Length (H+Th+T₁+T₂): 15 mm in the female.

Distribution. Nepal and India (Bengal, Khasia Hills and Assam).

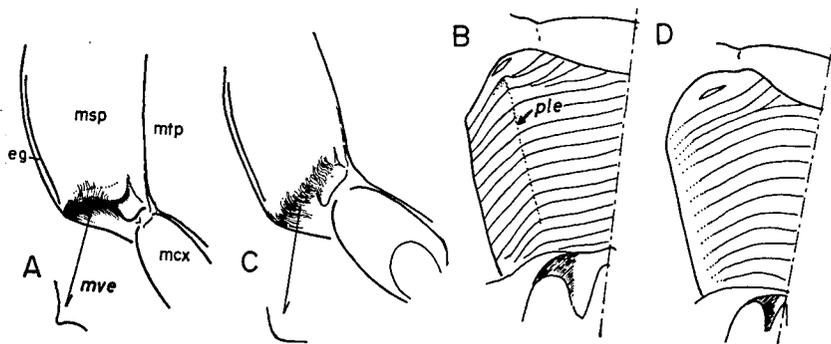


Fig. 10. A, C: Mesopleuron (eg: epicnemial groove; mcx: mid coxa; msp: mesopleuron; mtp: metapleuron; mve: ventral edge of mesopleuron); B, D: Left half of propodeum (ple: lateral edge of propodeum). A, B: *Polistes rothneyi*; C, D: *Polistes olivaceus*.

14b. *Polistes (Megapolistes) rothneyi sikkimensis* van der Vecht

Polistes rothneyi sikkimensis van der Vecht, 1968, Bijdr. Dierk., 38: 98.

Data. Madi Khola (1100–1300 m), No. 1 West, 1♀, 6 IV, 1972, T.M.

The specimen (perhaps queen) in structure almost agrees with specimens of other subspecies, except for the only feebly punctate mesepimeron. Bingham's (1897) "brown variety of *P. olivaceus*" appears to be this subspecies. The specimen nearly agrees in coloration with the descriptions by Bingham (1897) and van der Vecht (1968) for the female specimens from Darjeeling. But the apical narrow bands on gastral tergites are yellowish in the present specimens.

Length (H+Th+T₁+T₂): 19 mm in the female.

Distribution. Nepal and India (Sikkim and Assam).

15. *Polistes (Megapolistes) sp.*

Data. Kathmandu (1300–1400 m), Nepal Valley, 1♀, 6 IX, 1975, S.T.

At first sight the specimen is very similar in coloration to *P. rothneyi rothneyi*, but closer observations on the structure revealed some differences as given below. It is not certain to us whether the present specimen represents a variety of any known species or another distinct species.

Diagnosis. ♀ – Structure: This specimen shows a mixture of characters of *P. rothneyi*, *P. olivaceus*, *P. watti* and *P. jadvigae*. Gena well developed (not so developed in *watti*). Occipital carina complete (incomplete in *olivaceus* and *jadvigae*). Upper portion of the lateral arm of epistomal suture more straight and gentle than in the above forms (Fig. 6 I vs. H, *upes*). Punctuation coarse but sparse on mandible, lower gena and clypeus, and superficial and rather indistinct on vertex and frons. Mesopleuron with the ventral edge distinctly defined (round in *olivaceus* and *watti*). Punctuation distinct, strong and even irregularly striate on pronotum, sparser and weaker on scutellum and postscutellum; wholly impunctate on mesoscutum (sparsely punctate in *rothneyi* and *jadvigae*). Punctures on the ventral side of metapleuron superficial and ill defined (defined in *rothneyi* and impunctate in *olivaceus* and *watti*). Propodeum with rather defined lateral edges as in *P. rothneyi*; transverse striae strong and reaching the lower margin of the side. Gaster silky without sculpture.

Colour: Very much as in *P. rothneyi rothneyi*, but yellowish colour more extensive. General colour reddish brown. Black: mandibular teeth apically, narrow lines on the clypeal margin and along outer circumocular sulcus, a broad band across the ocelli, a median longitudinal line on mesoscutum, lines along the sutures on mesopleuron, three longitudinal markings on the dorsum of propodeum, basal part and a narrow line at some distance from apical margin of gastral tergite I, and a narrow basal band on tergite II, lines on inside of coxae, patches on trochanters of all legs, patches on mid femur at base and lines on hind femur, base of the outer side of mid and hind tibiae, and basal half of mid and hind basitarsi. Yellowish brown: clypeus and inner orbit above the clypeus up to the lower half of the ocular sinus (in *P. rothneyi rothneyi* clypeus is reddish brown as in frons).

Length (H+Th+T₁+T₂): 14 mm in the female.

CONCLUDING REMARKS

The present collection comprises 16 forms (14 or 15 species) of the three polistine genera. This number corresponds to half the number of forms known from the outskirts of the Himalayas and adjacent areas in India and Pakistan. Here only brief comments are given on the polistine fauna of the Nepal Himalaya, since the number of specimens for each species is too small to give detailed discussions.

Among the collected species, *Parapolybia nodosa* (26 ♀ 8 ♂), *Polistes adustus* (16 ♀ 15 ♂), *P. maculipennis* (22 ♀), *P. stigma* (18 ♀) and *P. olivaceus* (10 ♀ 1 ♂) were obtained in relatively large numbers and they seem to be common in the areas surveyed. *Ropalidia* species were obtained in smaller numbers. The altitudes of the collection points are shown in Fig. 11. The species collected at relatively low altitudes are *R. stigma rufa* (320 m), *R. variegata variegata* (700–1840 m), *R. cyathiformis* (700–760 m), *P. sagittarius* (760 m), *P. stigma* (760 m) and *P. olivaceus* (750–1670 m). On the other hand, *Pp. nodosa*, *P. adustus* and *P. maculipennis* were collected at higher altitudes, up to 2000 m (*Pp. nodosa*) or 2300 m (*P. adustus* and *P. maculipennis*). They seem to be inhabitants of the submontane and montane zones as in the other districts they inhabit. However, there is not enough information to discuss their vertical distribution.

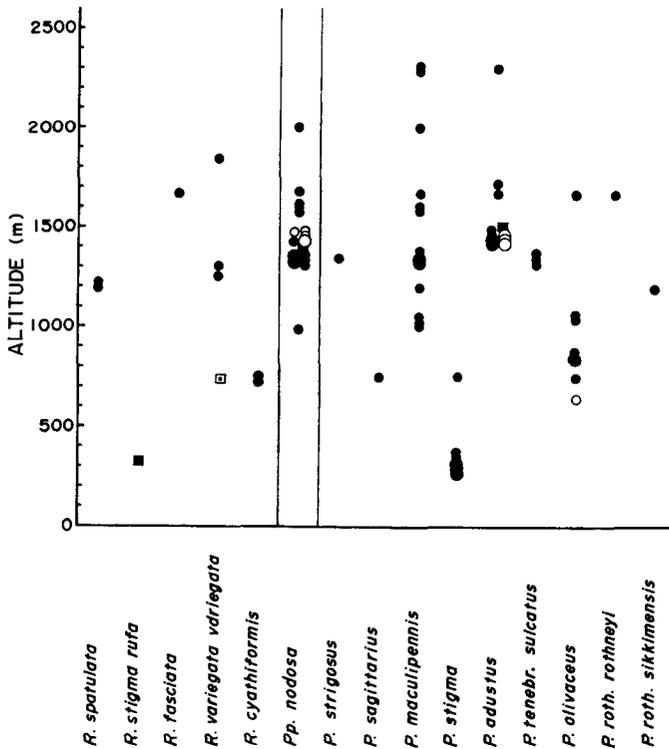


Fig. 11. Collection points in altitude. ■: Nest with the female alone; ◻: Nest with both sexes; ●: Female; ○: Male. Small circle stands for one individual and large one five individuals.

Table 1. Comparisons of some biometric characters among polistine forms from Nepal and some other localities.

Species	Sex	N	HW (mm)	HH (mm)	HW/HH	TW (mm)	TW/HW	T ₁ W (mm)	T ₁ L (mm)	T ₁ L/T ₁ W	T ₁ L/HW
Gen. <i>Ropatidia</i>											
<i>spatulata</i>	♀	2	3.55	3.06	1.16	3.21	0.90	1.49	2.86	1.92	0.80
<i>marginata</i> (New Guinea)	♀	20	3.15±0.06	2.88±0.06	1.09	2.84±0.09	0.90	1.46±0.08	2.56±0.07	1.75	0.81
<i>stigma</i>	♀	4	2.80	2.52	1.11	2.40	0.86	1.07	2.57	2.41	0.92
<i>fasciata</i>	♀	1	2.67	2.65	1.01	2.57	0.96	1.18	2.33	1.97	0.87
<i>fasciata</i> (Taiwan)	♀	20	2.32±0.08	2.15±0.08	1.08	1.94±0.11	0.84	0.83±0.08	1.73±0.12	2.10	0.75
<i>variegata</i>	♀	13	2.47±0.06	2.24±0.05	1.10	2.32±0.06	0.94	1.05±0.05	1.38±0.09	1.31	0.56
	♂	20	2.34±0.04	1.96±0.08	1.19	2.22±0.08	0.95	1.03±0.05	1.38±0.06	1.34	0.59
<i>cyathiformis</i>	♀	2	2.18	2.00	1.09	2.05	0.94	0.90	1.23	1.37	0.56
										T ₁ W/T ₁ L	T ₁ L/HW
Gen. <i>Parapolybia</i>											
<i>nodosa</i>	♀	26	3.18±0.25	3.09±0.24	1.03	2.87±0.30	0.90	1.26±0.20	3.10±0.34	0.40	0.97
	♂	8	3.21±0.09	2.72±0.07	1.18	2.72±0.11	0.85	1.19±0.05	3.12±0.10	0.38	0.97
<i>varia</i> (Taiwan)	♀	20	3.13±0.15	3.03±0.12	1.03	2.84±0.18	0.91	1.16±0.12	3.29±0.18	0.35	1.05
	♂	20	2.97±0.09	2.48±0.07	1.20	2.46±0.12	0.83	0.93±0.06	2.98±0.15	0.31	1.00
Gen. <i>Polistes</i>											
<i>strigosus</i>	♀	1	4.55	4.20	1.08	4.90	1.08	4.06	3.13	1.30	0.89
<i>sagittarius</i>	♀	1	3.90	3.65	1.07	3.95	1.01	3.38	3.00	1.13	0.87
<i>maculipennis</i>	♀	22	3.20±0.16	2.97±0.17	1.08	3.00±0.22	0.94	2.53±0.23	2.13±0.16	1.19	0.79
<i>stigma</i>	♀	18	3.24±0.08	3.00±0.06	1.08	3.23±0.12	0.99	2.22±0.11	2.14±0.26	1.02	0.69
<i>adustus</i>	♀	16	3.01±0.06	2.90±0.08	1.04	3.13±0.10	1.04	2.72±0.10	2.14±0.06	1.27	0.90
	♂	14	3.04±0.07	2.34±0.07	1.31	2.98±0.12	0.98	2.61±0.09	2.17±0.09	1.20	0.86
<i>tenebricosus</i>	♀	3	5.25	4.75	1.11	5.08	0.97				
<i>olivaceus</i>	♀	10	4.49±0.29	4.27±0.26	1.07	4.33±0.44	0.96				
	♂	1	5.13	4.38	1.17	4.56	0.89				
<i>rothneyi rothneyi</i>	♀	1	4.75	4.25	1.12	4.45	0.94				
<i>roth. sikkimensis</i>	♀	1	4.95	4.45	1.11	5.00	1.01				
(<i>Megapolistes</i>) sp.	♀	1	4.59	4.25	1.08	4.47	0.97				

Values for some selected species are provided with standard deviations. HW. Head width, HH. Head height, TW. Thoracic width, T₁W. Width of gastral segment I, T₁L. Length of gastral segment I (as to the measured parts, see text, p. 3).

Table 2. Tentative list of the species of the genera *Ropalidia*, *Parapolybia* and *Polistes* from the Subcontinent of India.

Species	Distribution				Localities except Nepal
	Nepal	Himalaya & adjacent dists. in India	Other dists. in India		
Gen. <i>Ropalidia</i>					
<i>R. (Anthreneida) spatulata</i> Vecht	○		○		S. India
<i>R. (A.) marginata marginata</i> (Lep.)			○		S. India
<i>R. (A.) stigma rufa</i> Vecht	○	○			Assam, China
<i>R. (A.) rufocollaris rufocollaris</i> (Cam.)		○			Assam, Sikkim (200 m)
<i>R. (A.) fasciata</i> (Fab.)	○	○	○		Assam, Sikkim, Calcutta; Indo-China, China, Taiwan, Japan (Okinawa)
<i>R. (A.) colorata</i> Vecht		○			Punjab (1350 m); Pakistan (Peshawar)
<i>R. (A.) variegata variegata</i> (Sm.)	○	○	○		Himalaya and lowlands; Pakistan
<i>R. (A.) variegata jacobsoni</i> (Buyss.)			○		S. India
<i>R. (A.) cyathiformis</i> (Fab.)	○	○			Assam (660 m); Ceylon, Burma, Celebes, Sumba, etc.
<i>R. (A.) rufoplagiata graveleyi</i> (Dov. et Rao)			○		S. India
<i>R. (A.) rufoplagiata nursei</i> Vecht			○		S. India (Bombey)
<i>R. (A.) sumatrae lugubris</i> (Sm.)			○		W. Bengal (Calcutta) ?
<i>R. (Icarieia) scitula</i> (Bingh.)		○			Assam (Khasia Hills), Sikkim
<i>R. (I.) flavopicta ornaticeps</i> (Cam.)		○			Assam, Sikkim
<i>R. (I.) montana</i> Carl			○		S. India
Gen. <i>Parapolybia</i>					
<i>Pp. nodosa</i> Vecht	○	○			United Dist. of Mikir and North Kashgar Hills, Umbaso; Burma, Thailand, China, Taiwan
<i>Pp. indica tinctipennis</i> (Cam.)		○			Assam (Khasia Hills)
<i>Pp. indica fulviverva</i> (Cam.)		○			Assam (Khasia Hills)
<i>Pp. varia varia</i> (Fab.)		○	○		Assam (Khasia Hills), Bengal; Burma Malaya, China, Taiwan, Japan, etc.
Gen. <i>Polistes</i>					
<i>P. (Polistella) strigosus mimus</i> Beq.	○				Philippines, Borneo
<i>P. (Pl.) sagittarius</i> Sauss.	○	○	○		Greater part of India; Burma, China Philippines
<i>P. (Pl.) stigma</i> (Fab.)	○	○	○		Greater part of India; Malaya, Taiwan, etc.
<i>P. (Pl.) maculipennis</i> Sauss.	○	○			Assam; Burma, Java
<i>P. (Pl.) adustus</i> Bingh.	○	○			Sikkim up to 1800 m
<i>P. (Pl.) assamensis</i> Bingh.		○			Assam, Sikkim
<i>P. (Pl.) ephippium</i> Cam.		○			Assam (Khasia Hills)
<i>P. (Stenopolistes) khasianus</i> Cam.		○			Assam (Khasia Hills)
<i>P. (Sp.) nigratarsis</i> Cam.		○			Assam (Khasia Hills)
<i>P. (Polistes) indicus</i> Stolfa			○		Punjab
<i>P. (P.) gallicus</i> L.		○			N. W. India (Gilgit)
<i>P. (Gyrostoma) gigas</i> Kirby		○			Sikkim; China, Taiwan, etc.
<i>P. (Nygmpolistes) tenebricosus sulcatus</i> Sm.	○	○			Sikkim (Rangit Valley)
<i>P. (Np.) tenebricosus hoplites</i> Sauss.					India
<i>P. (Megapolistes) rothneyi rothneyi</i> Cam.	○	○	○		Assam, W. Bengal
<i>P. (Mp.) rothneyi sikkimensis</i> Vecht	○	○			Assam (Khasia Hills), Sikkim (Runjit Valley, 300 m), Darjeeling

Table 2 (Continued)

Species	Distribution			Localities except Nepal
	Nepal	Himalaya & adjacent dists. in India	Other dists. in India	
<i>P. (Mp.) rothneyi carletoni</i> Vecht		○		N. W. India (Kooloo, Kashmir and Simla, 1500–1800 m)
<i>P. (Mp.) rothneyi krombeini</i> Vecht			○	S. India (Coimbatore), Kumaon
<i>P. (Mp.) watti</i> Cam.			○	W. Bengal; Pakistan (Karachi), Iran
<i>P. (Mp.) schach</i> (Fab.)				India
<i>P. (Mp.) olivaceus</i> DeGeer	○	○	○	Greater part of India; Wide areas in Oriental and Pacific districts
<i>P. (subgenus unknown) atrophica</i> (Fab.)				India
<i>P. (subgenus unknown) bengalensis</i> (Fab.)				India

Records are mainly cited from Saussure (1853), Bingham (1897), Bequaert (1934, '40), van der Vecht (1941, '62, '66, '68) and Yoshikawa (1962).

The polistine fauna of the Subcontinent of India should briefly be reviewed in order to facilitate future studies. The species so far known from the Subcontinent are listed in Table 2.

Ropalidia: A total of 15 forms (13 species) have so far been recorded from the Subcontinent of India. Among them six species of the subgenus *Anthreneida* and two of the subgenus *Icarielia* are known from the outskirts of the Himalayas and adjacent areas. In this survey, however, five *Anthreneida* but no *Icarielia* species were obtained.

Parapolybia: Out of the four known forms (3 species), only one was obtained from Nepal.

Polistes: Twenty three forms (19 species) have been known from the Subcontinent of India. But the actual number of species may be smaller, because this number possibly involves some synonyms. Out of them, at least 13 forms (11 species) are known from the Himalayas and adjacent areas. In this paper ten forms (8 or 9 species) are recorded from Nepal. Further intensive collections will add some other species to the list, e.g., *P. assamensis* Bingham, *P. ephippium* Cameron, *P. khasianus* Cameron, *P. nigratarsis* Cameron, *P. gigas* Kirby, *P. indicus* Stolfa, *P. gallicus* Linné, etc.

Polistes (Megapolistes) rothneyi is a polytypic species consisting of at least 16 subspecies (van der Vecht 1968), and is widely distributed in the Oriental and Palaearctic Regions. Four subspecies are known from the Subcontinent of India. They are principally allopatric. However, both the nominate subspecies and the subspecies *sikkimensis* were recorded from Assam by van der Vecht, though it is not clear that they are truly sympatric. Also in the present survey both the forms were collected in places relatively close to each other (*rothneyi* from Ramche at 1670 m and *sikkimensis* from Madi-Khola at 1100–1300 m both in No. 1 West). The remarkable difference in body colour suggests that they are more than of subspecific status. If they really coexist, their taxonomic treatment

should be reconsidered.

We could have examined no specimens of the subgenus *Polistes*, although two species, *P. indicus* and *P. gallicus*, have been recorded by some authors from India. These records may need criticism as to the species, but at any rate the occurrence of the subgenus would offer some interesting problems. Most species of this group inhabit the subarctic to temperate zones in Europe, and some of their close relatives are also distributed in East Asia and southern parts of Siberia. Although the original centre of this group is unknown, their populations should have migrated between these remote districts in earlier days. If any species of the group really occurs in the Himalayas, it will offer important information for discussing the distribution and migration of the group.

REFERENCES

- Bequaert, J. 1934. Les races de coloration de *Vespa luctuosa* de Saussure et de *Polistes tenebricosus* Lepeletier. Bull. Mus. Roy. Hist. Nat. Belgique 10 (28): 1-11.
- 1940. Notes on Oriental *Polistes* wasps (Hymenoptera, Vespidae). Trans. Amer. Ent. Soc. 66: 265-272.
- Bingham, C.T. 1897. Fauna of British India, including Ceylon and Burma. Hymenoptera I. 579 pp., 4 pls., London.
- Richards, O.W. 1973. The subgenera of *Polistes* Latreille (Hymenoptera, Vespidae). Rev. Brasil. Ent. 17(13): 85-104.
- Saussure, H. de. 1853. Monographie des guêpes sociales, ou de la tribu des vespiciens. cxcix+257 pp., 37 pls., Paris and Geneva.
- van der Vecht, J. 1941. The Indo-Australian species of the genus *Ropalidia* (= *Icaria*) (Hym., Vespidae) (First part). Treubia 18: 103-190.
- 1962. The Indo-Australian species of the genus *Ropalidia* (= *Icaria*) (Second part). Zool. Verh., Leiden, 57: 1-72, 8 pls.
- 1966. The East-Asiatic and Indo-Australian species of *Polybioides* Buysson and *Parapolybia* Saussure (Hym., Vespidae). Zool. Verh., Leiden (82): 1-42.
- 1968. The geographic variation of *Polistes* (*Megapolistes* subgen. n.) *rothneyi* Cameron. Bijdr. Dierk. 38: 97-109.
- Yamane, S. 1969. Preliminary observations on the life history of two polistine wasps, *Polistes snelleni* and *P. biglumis* in Sapporo, northern Japan. J. Fac. Sci., Hokkaido Univ., Ser. VI, Zool. 17(1): 78-105
- and T. Kawamichi. 1975. Bionomic comparison of *Polistes biglumis* (Hymenoptera, Vespidae) at two different localities in Hokkaido, northern Japan, with reference to its probable adaptation to cold climate. Kontyû, Tokyo 43(2): 214-232.
- Yamane, Sk. 1974. On the genus *Vespa* (Hymenoptera, Vespidae) from Nepal. Kontyû, Tokyo 42(1): 29-39.
- Yoshikawa, K. 1962. Introductory studies on the life economy of polistine wasps. VI. Geographical distribution and its ecological significances. J. Biol. Osaka City Univ. 13: 19-43.

PLATE

Plate I

Nest of *Ropalidia variegata variegata* (Nest RN-7501). Betrawate, Nepal, 12 IX, 1975.
Left: profile. Right: frontal view.

