

TEN NEW SPECIES OF *RHAGOVELIA* (HETEROPTERA: VELIIDAE) FROM SULAWESI (INDONESIA).

Notes on Malesian aquatic and semiaquatic bugs (Heteroptera), VII

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Ten new species of *Rhagovelia* from the province of Sulawesi are described: *R. abra*, *R. gyrsta*, *R. krama*, *R. ochra*, *R. ptychona*, *R. sterea* from the main island of Sulawesi, *R. abra* from Togian Island, *R. cylindros* and *R. skoura* from Sangihe Island and *R. tsouloufi* from Salibabu and Taulaud Islands. Two new species groups, the *R. gyrsta*- and *R. ptychona*-groups are erected, some species are transferred to other groups and the species groups in the area are redefined. Some additional records for several species, a check-list and keys to species groups and species of *Rhagovelia* for the Sulawesi area are also given.

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The ten species of *Rhagovelia* Mayr, 1865, described below have partly been collected on islands belonging to the provinces of Sulawesi Utara and Sulawesi Tengah. Three species belong to a small collection of aquatic bugs made by the first author in the Sangihe-Talaud group. The fourth is based on a few specimens collected on the Togian group which belongs to Sulawesi Tengah which were in the NHMW. In addition there are six new species and additional records from the main island of Sulawesi collected by J. P. & M. J. Duffels (ZMAN) and J. van Tol (RMNH). So all localities are within the administrative entity Sulawesi of the Republic of Indonesia. As there is at present great interest in the taxonomy and biogeography of Australasian Rhagoveliinae (Polhemus & Polhemus 1988, Lansbury 1993, Nieser & Chen 1994, Yang & Polhemus 1994, Zettel 1994, 1995) it was decided to publish the descriptions of these species in advance of a report on the Sangihe-Talaud collection. The Sulawesi area seems to be especially rich in species, in ten years of collecting (1985-1994) 29 species have been discovered.

Measurements are in mm, angles in radians. Measurements have been based, when sufficient specimens available, on five specimens of each sex and

morph, preferably from the sample containing the holotype. Measurements refer to the maximum value and have been taken with the axis along which the body or body part is measured in a horizontal plane. The width of a leg segment is its maximum width measured to the bases of eventual teeth or spines, length of a leg segment is measured to the tip of eventual apical teeth or spurs. The presentation of measurements may vary in the number of digits behind the decimal point. This is on purpose, the same part of the body may in one species display more variation than the next so 0.2 (0.15-0.25) can be found next to 0.20 (0.195-0.205). Distinction is sometimes made between macropterous (with complete wings) and dealate (with wings partly or nearly entirely torn off) as the frequency of the dealate condition differs between species and species groups. However, dealate specimens are cited as macropterous in the records of material.

Locality indications between braces, { }, are not on the labels but have been added by the authors as explanation.

Specimens have been deposited in the following collections: 1) registered in Arnett et. al. (1993): BMNH (London, U. K.), MBBJ (Bogor, Indonesia),

JTPC (Englewood, Co. U.S.A.), MUDH (The Hague, The Netherlands), NHMW (Vienna, Austria), OXUM (Oxford, U. K.), RMNH (Leiden, The Netherlands), SEMC (Snow Entomological Museum, Lawrence, Kansas, U.S.A.), USCP (Cebu, Philippines), ZMAN (Amsterdam, The Netherlands). Not registered: NCTN (Nieser Collection, Tiel, The Netherlands).

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SYSTEMATIC PART

Species groups in Indo-Pacific *Rhagovelia*

Polhemus & Polhemus (1988) divided the Indo-Pacific *Rhagovelia* species in eight species groups. A few species are reassigned below to other, partly newly erected, groups due to the increased knowledge of Indo-Pacific *Rhagovelia*. As a rule, however, the 'Polhemi'-groups seem to be monophyletic with the exception of the large *R. papuensis*-group. Our concept of the *papuensis*-group is mainly based on its Sulawesian and Philippine species which may constitute a restricted section of the group as compared to the interpretation of this group by Polhemus & Polhemus (1988). Apparently the largest number of species of this group is found in Sulawesi (Lansbury 1993, Nieser & Chen 1993, this paper). Nevertheless we decided against an evaluation of the entire group mainly for two reasons, this paper was meant to restrict its scope to Sulawesi and J.T. Polhemus (JTPC) informs us that he still has a number of undescribed species of this group from more eastern regions. It seems better to wait for a description of these additional species before attempting a final evaluation of the *papuensis*-group.

Five species were found to be sufficiently aberrant that they are considered to constitute two new species groups: the *gyrista*- and *plychona*-groups (with three and two species respectively) which, at least superficially seem to be related to each other. Since the study by Matsuda (1956) it is known that the knowledge of macropterous and dealate specimens is very important for the delimitation of species groups in the genus *Rhagovelia*, so these two new groups are mainly based on characteristics of the macropterous morph.

The occurrence of the *R. sarawakensis*-group in

Sulawesi is doubtful. There is only one record, a macropterous female of the Bornean species *R. samarinda* Polhemus & Polhemus (1988).

Keys to the species-groups of Sulawesi

Apterous specimens

1. Pronotum shorter than length of an eye, mesonotum exposed *R. sarawakensis*-group
- Pronotum much longer than length of an eye (fig. 21, mesonotum covered by pronotum, at most its hind margin visible 2
2. Males 3
- Females 6
3. Hind femur with teeth or granules in proximal third (figs. 2, 4) 4
- Hind femur without teeth or granules in proximal third (figs. 1, 13) 5
4. Body dorsally and antennae with dense appressed golden pubescence, inner side of hind tibia regularly and sharply indented (fig. 11) *R. gyrista*-group
- Body dorsally and antennae without conspicuous golden pubescence, inner side of hind tibia irregularly indented (figs. 2, 8) *R. papuensis*-group
5. Anterior trochanter with a tuft of hairs, body dorsally with conspicuous golden pubescence, hind femur basally yellow . . *R. ptychona*-group
- Anterior trochanter without a tuft of hairs, body dorsally without conspicuous golden pubescence, hind femur basally black in most species *R. orientalis*-group
6. Hind femur curved, its anterior face (partly) flattened and densely pubescent, hind femur without teeth or with some small teeth on the posterior face (fig. 12) *R. gyrista*-group
- Hind femur without these combination of characters, in most species with teeth on the ventral margin, only rarely without teeth 7
7. Dorsum covered with golden pubescence, hind femur without teeth ventrally (fig. 14) *R. ptychona*-group
- Dorsal pubescence sometimes yellow but without golden metallic shine, hind femur usually with some teeth or spines 8
8. Legs slender, with metallic shine, middle and hind femur basally black (except in *R. kastanoparuphe*), connexiva black (except in *R. kastanoparuphe*), abdomen short, its outlines convergent (fig. 21), tergite 7 frequently with a process (fig. 34), jugae and proepisterna without black spicules *R. orientalis*-group
- Legs stouter (figs. 3, 8, 9), without metallic . . .

shine, middle and hind femur basally yellow, connexiva yellow (except: brown in *R. pruinosa*), tergite 7 without process, abdomen longer, its outlines (not that of the connexiva) less convergent (figs. 17, 20), jugae and proepisterna with or without black spicules . . . *R. papuensis*-group

Macropterous specimens

Macropterous specimens of the *R. gyrista*-group are unknown.

1. Hairs on fore wing restricted to costal margin 2
 - Hairs on fore wing covering a large area in the anterior part of its base *R. ptychona*-group
2. Closed cells of fore wing reaching the apical third 3
 - Closed cells of fore wing reaching only the apical half, abdominal carinae reaching tergite *R. sarawakensis*-group
3. Fore wing brown or black, without a longitudinal yellowish streak basally, abdominal carinae reaching tergite 2 *R. orientalis*-group
 - Fore wing brown or black, with a longitudinal white or yellowish streak basally, abdominal carinae reaching tergite 3 . . . *R. papuensis*-group (See also characteristics used for identification of apterous specimens of these two groups.)

Dealate specimens

Dealate specimens of the *R. ptychona*- and the *R. papuensis*-group are unknown.

1. Fore wing broken at middle, behind its cells *R. sarawakensis*-group
 - Fore wing broken at base 2
2. Hind femur in male with a row of small teeth in proximal third, in female curved, flattened and anteriorly pubescent *R. gyrista*-group
 - Hind femur in male without teeth in proximal third, not curved flattened, or pubescent in female *R. orientalis*-group

The *Rhagovelia papuensis*-group

Diagnosis: Variable in size, length 2.6 - 5.3 mm, generally slender. Colour variable, from black to yellowish, in most species at least connexiva yellowish or reddish. Legs extensively yellowish in most species. Pronotum of apterous specimens long, covering the mesonotum completely or nearly so. Fore wing with three or four closed cells reaching its apical third. Fore wing with a longitudinal white or yellowish streak basally. Dorsal abdominal carinae of winged specimens extending posteriorly to tergite 3. Dealate specimens unknown. Hind femur of males strongly thickened in most species.

Distribution: Sri Lanka, India, Taiwan, Philippines, Borneo, Sulawesi, Moluccas, New Guinea, Australia, Solomon Islands.

This is the largest species-group in Sulawesi and in the Philippines, whereas from the other parts of its distribution area only a few species have been recorded.

Key to the species of Sulawesi and adjacent islands (apterous specimens)

Male of *R. unica* unknown.

1. Females 2
 - Males 20
2. Connexiva strongly convergent, folded over abdomen and touching or nearly touching each other posteriorly part, consequently at least partly covering tergite 7 (figs. 18, 19) 3
 - Connexiva, although strongly convergent in some species, distinctly separated in posterior part, tergite 7 largely uncovered (figs. 15-17, 20) 9
3. Hind femur petiolate, outline from its base to the base of the first tooth concave (fig. 9), outer rim of connexiva, sometimes indistinctly, narrowly shining on segments 4 and 5 4
 - Hind femur not petiolate, outline from its base to the base of the first tooth convex or, rarely, straight (fig. 3) 7
4. Connexiva of segment 6 with many long hairs, process of connexiva directed upward (figs. 18, 29) *R. tsouloufi* sp.n.
 - Connexiva of segment 6 without long hairs, process of connexiva directed more or less horizontally posteriorly 5
5. Mesopleurae anteriorly rugulose, but without pit punctures *R. minahasa*
 - Mesopleurae anteriorly with distinct pit punctures 6
6. Length 3.5 - 3.8 mm, sternite 7 laterally on hind margin with a tuft of long black hairs (fig. 27) *R. krama* sp.n.
 - Length 2.8 - 3.0 mm, sternite 7 laterally on hind margin without long black hairs, but gonocoxa with longer hairs *R. blogiokommena*
7. Connexiva on segments 2 and 3 with long, erect hairs and on segment 7 with a long and slender process, predominately black species *R. trichota*
 - Connexiva of segments 2 and 3 without long hairs, process on segment 7 different, predominately yellowish to brown species 8
8. Process of connexiva very long and flattened, middle and hind femora flattened *R. lorelinduana*
 - Process of connexiva shorter, triangular, middle

- and hind femora not flattened *R. grayi*
9. Tergite 8 horizontal, in the same plane as tergite 7 (figs. 25, 26) 10
- Tergite 8 vertical or obliquely directed downward, not in the same plane as tergite 7 (figs. 28, 30) 15
10. Connexiva of segment 4 with a distinct tuft of long hairs (fig. 16) 11
- Connexiva of segment 4 without long hairs (fig. 20) 12
11. Hind femur without teeth proximally of the long spine in the middle, connexiva of segment 7 internally and posterior corners of tergite 8 with distinct tufts of quite long hairs . . . *R. tropidata*
- Hind femur with at least one spine-like smaller tooth proximal of the long spine in the middle (fig. 8), connexiva of segment 7 internally and tergite 8 with some hairs which are not grouped in tufts (fig. 16) *R. achna* sp.n.
12. Connexiva dark, on segment 4 with a swollen shining area, and with longer hairs internally on segments 6 and 7, tergite 8 with many long hairs in caudal third *R. pruinosa*
- Connexiva yellow, without swollen shining area on segment 4, with or without longer hairs on segment 6 and 7, tergite 8 at most with longer hairs in the posterior corners 13
13. Body completely yellow, connexiva without longer hairs (except serial setae, fig. 25) *R. ochra* sp.n.
- Body partly dark, connexiva with longer hairs on segments 4, 6 or 7 14
14. Connexiva on segment 4 strongly convergent, on segment 7 internally with long hairs, metanotum with a pair of tubercles laterally, tergites 4 - 5 with a distinct carina along middle *R. robina*
- Connexiva more or less straight, gradually convergent from base to tip, on segment 7 internally without long hairs, metanotum without a pair of tubercles, tergites without carina . . . *R. kalami*
15. Connexiva densely set with many long erect hairs, especially on segments 6 and 7 . . . *R. unica*
- Connexiva without erect hairs or at most with 1 - 5 bristle-like hairs on each segment 16
16. Connexiva of segment 7 produced in an elongate spiniform process (figs. 27, 28, 30), hind femur slightly petiolate and with a few small denticles in basal third 17
- Connexiva of segment 7 produced in a short triangular process, hind femur not petiolate and without small denticles in basal third 19
17. Sternite 7 laterally on hind margin with a tuft of long black hairs (figs. 27, 30) 18
- Sternite 7 laterally without long black hairs (fig. 28) *R. abra* sp.n.
18. Sternites black, outer margin of connexiva dull brownish, little contrasting; tergites 1-3 with a few scattered bristles (fig. 17), connexiva with 1-4 bristles per segment (fig. 30) . . . *R. skoura* sp.n.
- Sternites partly yellow, outer margin of connexiva of a well contrasting medium brown to dull orange; tergites 1-3 without bristles (fig. 19), connexiva on each side with two bristles on segment 1 only *R. krama* sp.n.
19. Hind femur strongly incrassate, less than 3.5 times as long as wide, laterotergites 3 and 4 with longer hairs than laterotergite 5 . . . *R. wallacei*
- Hind femur more slender, more than 4.0 times as long as wide (without teeth), laterotergites 3 - 5 with equally short hairs *R. horaia*
- Males**
20. Hind femur with a long spine in the middle of its length, followed by a row of spines of gradually decreasing length distally, proximally of the long spine with a single row of short black granules of which the last may be slightly longer and tooth-like (figs. 2, 4-6, 10); hind tibia variable 21
- Hind femur ventrally with two larger spines of subequal length, one in proximal third and one distally of the middle, each followed by a row of spines of decreasing length (fig. 7), proximal third with a row of short black granules; hind tibia sinuate and with a larger tooth in distal third *R. achna* sp.n.
21. Sternite 7 with a distinct tuft of hairs medially 22
- Sternite 7 without a tuft of hairs, but sometimes with longer hairs on a median carina 23
22. Tuft of hairs near to the anterior margin of sternite 7, hairs on tergites short *R. pruinosa*
- Tuft of hairs about halfway on sternite 7, hairs on tergites longer, slightly shorter than length of tergite 4 *R. kalami*
23. Tergites with numerous erect black hairs which are distinctly longer than length of tergite 4, connexiva reddish to dark brown, body length usually over 2.9 mm 24
- Tergites without hairs or with shorter, more oblique hairs which are much shorter than length of tergite 4, only in one small species (body length up to 2.92 mm) with yellow connexiva the hairs more erect and only slightly shorter than tergite 4 26
24. Hind femur relatively slender, more than 3.5 times longer than wide, proximal row with more than ten granules, tip of paramere slender *R. trichota*
- Hind femur stouter, less than 3.0 times longer than wide, basal row with less than ten granules,

- tip of paramere wide 25
25. Proepisterna with small black denticles in anterior part, sides of pronotum black *R. skoura* sp.n.
– Proepisterna without small black denticles, sides of pronotum yellow *R. tsouloufi* sp.n.
26. Hind tibia distinctly curved, with a larger tooth in the distal third, colour of pronotum completely yellow, orange brown, or brown, parameres apically with a ventral broadening (fig. 40) 27
– Hind tibia straight or only very slightly curved, without larger tooth, colour of pronotum partly black, at least in the middle of posterior half, apex of paramere not ventrally widened (figs. 35, 37) 30
27. Proximal row on hind femur with more than 25 black granules *R. grayi*
– Proximal row on hind femur with less than 23 black granules 28
28. Lateral parts of tergites with scattered small black denticles, extending at least in low numbers to laterotergites 29
– Tergites and laterotergites without small black denticles *R. lorelinduana*
29. Laterotergites with numerous black denticles, connexiva of segments 2 - 6 without any longer hairs *R. ochra* sp.n.
– Laterotergites with very few scattered black denticles, connexiva with at least one longer hair in the posterior corner of each segment *R. horaia*
30. Sternites 5 and 6 medially with tufts of long dark hairs, black denticles scarce on the lateral parts of the thorax and lacking or very scarce on lateral parts of sternites, on laterotergites and tergites *R. wallacei*
– Sternites 5 and 6 medially only with slightly longer, yellow hairs, if with a small tuft on sternite 5, then black denticles numerous in these parts 31
31. Black denticles restricted to proepisterna, small species (body length up to 2.92 mm) with rather long suberect hairs on tergites *R. blogiokommene*
– Black denticles extending to mesopleura, metapleura, sternites, laterotergites and the lateral parts of tergites, hairs on the tergites shorter 32
32. Abdomen and metathorax completely yellowish to orange brown, tergites only with short appressed hairs, hind femur slender, about 3.5 times as long as wide, paramere with broadened apex and sternite 7 with a blunt carina *R. robina*
– Abdomen extensively black, tergites with scattered longer, suberect hairs, hind femur stouter, at most 3.0 times as long as wide, parameres with simple tip or sternite 7 with a strongly developed narrow keel 33
33. Sternite 7 laterally compressed, with a strongly developed median carina, which is accentuated by a well developed fringe of hairs, paramere with broadened apex *R. tropidata*
– Sternite ventrally flattened, with a low median carina, paramere with simple tip 34
34. Black denticles all over the anterior margin of the pronotum, numerous in the median yellowish area, median carina of sternite 7 very faintly indicated *R. abra* sp. n.
– Black denticles lacking in the middle part of the anterior margin of the pronotum, median carina in posterior part of sternite 7 low, but distinct, and accentuated by shallow lateral impressions 35
35. Pro-, meso- and metapleura densely set with black denticles, hind margin of pronotum black *R. minahasa*
– Pro-, meso- and metapleura set with at most a few black denticles, hind margin of pronotum yellow *R. krama* sp.n.

Rhagovelia blogiokommene Nieser & Chen

Rhagovelia blogiokommene Nieser & Chen 1993: 268, figs. 2-6, 82.

Material. – Sulawesi Selatan, Batusitanduk {2°48'S 120°10'E} N of Palopo, narrow river, 2.XI.1993, leg. J. P. & M. J. Duffels 1♂ 10♀ apterous, 2♂ 3♀ macropterous (ZMAN, 1♂ 1♀ macr. NCTN); Onang {3°07'S 118°49'E}, Sungai Parabaya, 19.XI.1993, leg. J. P. & M. J. Duffels, 4♂ 7♀ apt. (ZMAN, 1♂ 1♀ NCTN, 1♂ 1♀ NHMW).

Previously known from three localities in the S half of Sulawesi all under 100 m asl.

Rhagovelia kalami Nieser & Chen

Rhagovelia kalami Nieser & Chen 1993: 273-274, figs. 24-29, 82.

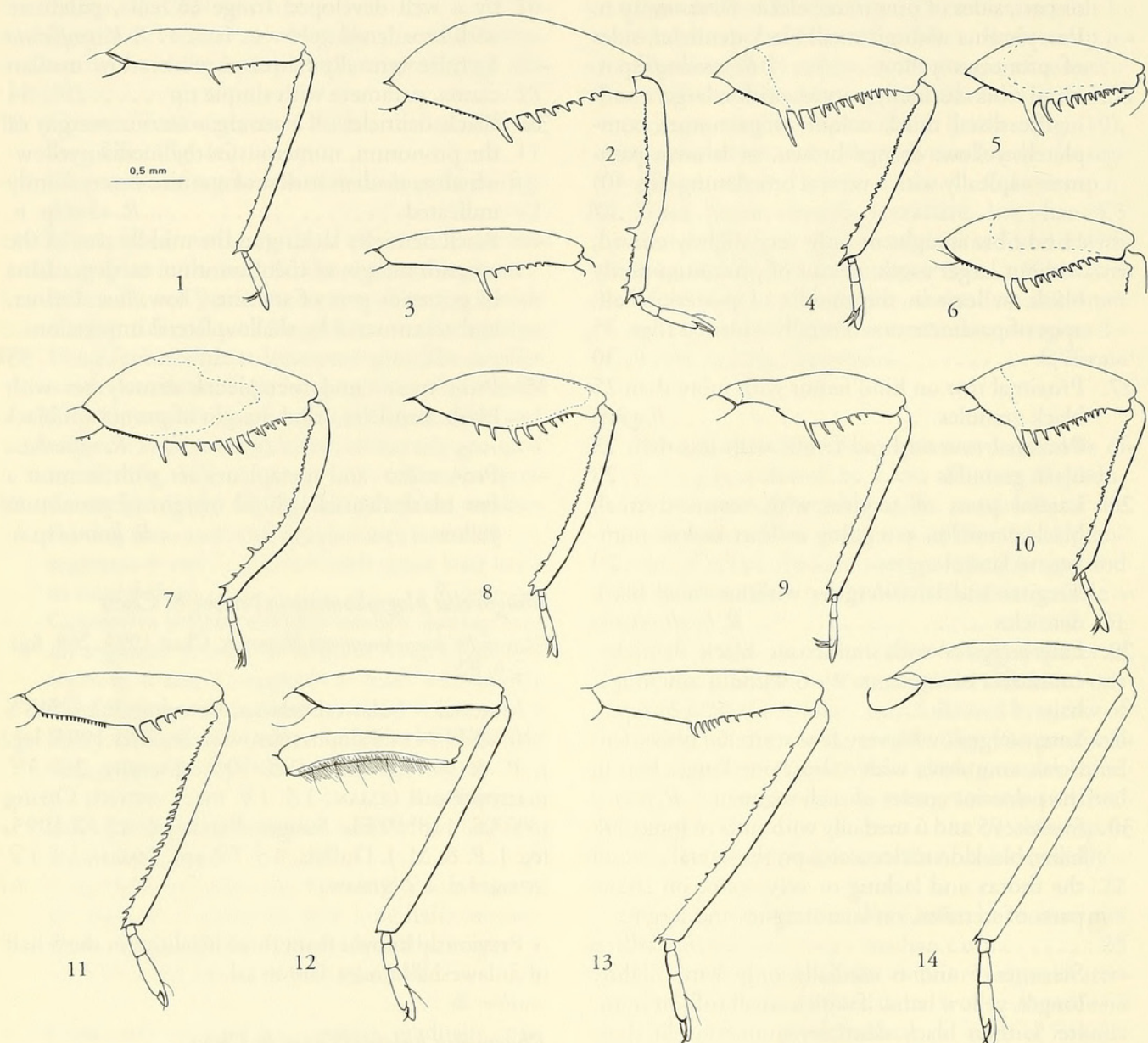
Material. – Sulawesi Selatan, Zuid Celebes, Nang-gala, 800m, Rantepao, VIII. 1937, leg. F. C. Drescher, 1♂ apt. (BMNH)

This specimen has a much darker colour than the type series from Buton Island, however, structurally we have found no differences. Previously known by the type series from Buton only.

Rhagovelia pruinosa Polhemus & Polhemus

Rhagovelia pruinosa Polhemus & Polhemus 1988: 195-195, figs. 149-157, 229.

Material. – Sulawesi Selatan, SW Celebes, 1100m, Mt. Lompobatang area, Malino {ca 5°15'S



Figs. 1-14. Hind legs or hind femur of apterous specimens of *Rhagovelia*: 1 *R. cylindros* ♂, 2 *R. ochra* ♂, 3 *R. ochra* ♀, 4 *R. skoura* ♂, 5 *R. abra* ♂, 6 *R. krama* ♂, 7 *R. achna* ♂, 8 *R. achna* ♀, 9 *R. tsouloufi* ♂, 10 *R. tsouloufi* ♀, 11 *R. gyrista* ♂, 12 *R. gyrista* ♀ (inset: femur in frontal view), 13 *R. plichona* ♂, 14 *R. plichona* ♀.

119°48'E}, 2, 8-10.VI.1982, M. A. Lieftinck, 1 ♂ (RMNH); Sulawesi Selatan, C. Sulawesi, Batusitanduk, NW of Palopo {ca 120°09'E 2°50'S}, narrow river 2.XI.1993, leg. J. P. & M. J. Duffels, 1 ♂ (ZMAN).

Widely distributed in South and East Sulawesi and Buton (Nieser & Chen 1993)

Rhagovelia abra sp. n.
(figs. 5, 15, 28, 35, 45)

Type material. – Holotype apterous ♂ (ZMAN): IN-

DONESIA: Sulawesi Selatan, E side lake Matana, Sg. Salura, 450m, 20 Oct 1993, narrow tributary to lake Matana, 2°32'S, 121°28'E, J. P. & M. J. Duffels (fig. 45). – Paratypes, same data as holotype 3 ♂ 5 ♀ all apterous (1 ♂ 3 ♀ including allotype ZMAN, 1 ♂ 1 ♀ NCTN, 1 ♂ 1 ♀ NHMW).

Description. – Apterous form. Dimensions. Length ♂ 2.98-3.05, ♀ 3.10-3.23; width ♂ 1.05-1.12, ♀ 1.18-1.21; width of head ♂ 0.72-0.74, ♀ 0.75-0.79; width of pronotum ♂ 0.90-0.98, ♀ 0.98-1.03.

Colour generally dark grey-brown to blackish, an-

Table 1

Measurements of leg segments in *Rhagovelia*. Tarsal segments 1 and 2 of fore and hind legs have not been measured for most species. When not given, they measure together 0.05-0.07 and 0.12-0.15 respectively and do not seem to provide specific characters.

| | | | | | | (continued) | | | | | |
|-----------------------|-------|-------|-------|-------|-------|------------------------------|-------|-------|-------|-------|-------|
| | femur | tibia | tars1 | tars2 | tars3 | | femur | tibia | tars1 | tars2 | tars3 |
| <i>R. abra</i> ♂ | | | | | | <i>R. ochra</i> ♀ | | | | | |
| fore leg | 0.85 | 0.90 | - | - | 0.22 | fore leg | 0.96 | 0.96 | - | - | 0.21 |
| middle leg | 1.40 | 1.14 | 0.06 | 0.42 | 0.67 | middle leg | 1.57 | 1.27 | 0.07 | 0.44 | 0.71 |
| hind leg | 1.25 | 1.12 | - | - | 0.25 | hind leg | 1.39 | 1.49 | - | 0.10 | 0.40 |
| <i>R. abra</i> ♀ | | | | | | <i>R. ptychona</i> ♂ | | | | | |
| fore leg | 0.85 | 0.88 | - | - | 0.25 | fore leg | 1.21 | 1.35 | - | - | 0.31 |
| middle leg | 1.42 | 1.09 | 0.07 | 0.41 | 0.68 | middle leg | 2.01 | 1.64 | 0.09 | 0.77 | 0.86 |
| hind leg | 1.19 | 1.17 | - | - | 0.26 | hind leg | 1.53 | 1.79 | 0.07 | 0.18 | 0.40 |
| <i>R. achna</i> ♂ | | | | | | <i>R. ptychona</i> ♀ | | | | | |
| fore leg | 0.90 | 0.98 | - | - | 0.27 | fore leg | 1.28 | 1.37 | - | - | 0.33 |
| middle leg | 1.54 | 1.21 | 0.08 | 0.41 | 0.67 | middle leg | 1.95 | 1.67 | 0.07 | 0.79 | 0.88 |
| hind leg | 1.56 | 1.42 | 0.07 | 0.10 | 0.33 | hind leg | 1.50 | 1.86 | 0.08 | 0.18 | 0.42 |
| <i>R. achna</i> ♀ * | | | | | | <i>R. skoura</i> ♂ | | | | | |
| fore leg | 0.83 | 0.91 | - | - | 0.25 | fore leg | 0.90 | 1.00 | - | - | 0.27 |
| middle leg | 1.43 | 1.06 | 0.07 | 0.37 | 0.65 | middle leg | 1.51 | 1.17 | 0.08 | 0.40 | 0.70 |
| hind leg | 1.28 | 1.22 | 0.06 | 0.08 | 0.30 | hind leg | 1.34 | 1.23 | - | 0.10 | 0.33 |
| <i>R. cylindros</i> ♂ | | | | | | <i>R. skoura</i> ♀ | | | | | |
| fore leg | 0.93 | 1.01 | - | - | 0.23 | fore leg | 0.91 | 0.96 | - | - | 0.26 |
| middle leg | 1.59 | 1.18 | 0.09 | 0.57 | 0.71 | middle leg | 1.46 | 1.10 | 0.08 | 0.43 | 0.72 |
| hind leg | 1.34 | 1.31 | 0.06 | 0.09 | 0.26 | hind leg | 1.32 | 1.30 | 0.07 | 0.10 | 0.31 |
| <i>R. cylindros</i> ♀ | | | | | | <i>R. sterea</i> ♀ * | | | | | |
| fore leg | 0.92 | 0.97 | - | - | 0.22 | fore leg | 1.10 | 1.12 | - | - | 0.30 |
| middle leg | 1.52 | 1.12 | 0.07 | 0.51 | 0.73 | middle leg | 1.72 | 1.47 | 0.08 | 0.60 | 0.78 |
| hind leg | 1.23 | 1.36 | 0.07 | 0.10 | 0.27 | hind leg | 1.30 | 1.65 | 0.07 | 0.12 | 0.40 |
| <i>R. krama</i> ♂ | | | | | | <i>R. tsouloufi</i> ♂ | | | | | |
| fore leg | 0.93 | 0.98 | - | - | 0.24 | fore leg | 0.82 | 0.88 | - | - | 0.23 |
| middle leg | 1.57 | 1.20 | 0.08 | 0.50 | 0.68 | middle leg | 1.35 | 1.12 | 0.07 | 0.40 | 0.66 |
| hind leg | 1.34 | 1.24 | 0.07 | 0.10 | 0.30 | hind leg | 1.26 | 1.20 | 0.06 | 0.09 | 0.28 |
| <i>R. krama</i> ♀ | | | | | | <i>R. tsouloufi</i> ♀ | | | | | |
| fore leg | 0.95 | 1.00 | - | - | 0.23 | fore leg | 0.84 | 0.90 | - | - | 0.23 |
| middle leg | 1.54 | 1.23 | 0.08 | 0.50 | 0.71 | middle leg | 1.36 | 1.11 | 0.08 | 0.41 | 0.68 |
| hind leg | 1.36 | 1.36 | 0.06 | 0.09 | 0.28 | hind leg | 1.16 | 1.22 | 0.07 | 0.10 | 0.24 |
| <i>R. ochra</i> ♂ | | | | | | * based on a single specimen | | | | | |
| fore leg | 1.08 | 1.11 | - | - | 0.24 | | | | | | |
| middle leg | 1.64 | 1.42 | 0.08 | 0.50 | 0.72 | | | | | | |
| hind leg | 1.71 | 1.55 | - | 0.12 | 0.38 | | | | | | |

terior quarter of pronotum orange-yellow, connected with yellowish to light brown propleura and prosternum. Dorsal half (males) to two thirds (females) of connexivum brownish, not very contrasting. Venter castaneous, medial area darker, juga, prosternum, abdominal sternite 7 and genital segments of male lighter. Basal half of first antennal segment, basal part of rostrum, basal three quarters of fore femur, basal third of hind femur, acetabula, coxae and trochanters

pale; hind femur in ventral view medium brown. Paler parts of fore femur variable between specimens, ventrally more extensive than dorsally.

Minute black denticles spread over propleura and the orange band on pronotum, on mesosternum reaching to mesoacetabula but not much on mesopleura. Mesopleuron in front of acetabulum with a group of 6-8 coarse punctures more distinct in females than in males. Dorsum, especially pronotum

rather bare, punctures on posterior three quarters of pronotum distinct. Vertex interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae.

Length of antennal segments (δ and η) I : II : III : IV 0.72 : 0.37 : 0.50 : 0.43. Pronotum long, covering mesonotum, length : width 0.78 : 0.96. Length of metanotum on midline, 0.10. Abdominal tergites 1-5 subequal in length (0.15-2.0), tergite 6 slightly longer (0.30) in female, tergite 7 0.30 in male, 0.38 in female.

Male. Posterior trochanter with 2-3 small but distinct blunt teeth. Posterior femur three times as long as wide (1.25/0.4), ventral margin in proximal third with about eight minute and closely set teeth followed by a row of about eight larger spines decreasing in size, of which the first (proximal) is half as long as the width of femur (fig. 5). A row of five smaller spines located in distal part ventrally of the main row. Larger spines black tipped, smaller spines and teeth entirely black or nearly so. Posterior tibia virtually straight, armed beneath with a row of about 15 rather coarse pegs. Connexiva more or less horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 and 8 subequal to their median lengths. Abdominal sternites 2-6 of subequal length (0.15-0.20), sternite 7 longer (0.3) with a pair of shallow impressions separated by a narrow and low keel, sternite 8 with an indistinct ventral keel. Parameres as in fig. 35.

Female. Posterior trochanter without small teeth. Posterior femur nearly three and a half times as long as wide (1.2/0.35), proximal row of minute teeth replaced by 4-5 coarser teeth, larger spines except for the first shorter than in male. Posterior tibia with somewhat smaller and less distinct pegs as in male. Connexiva more or less vertical, on tergites 4 and 5 somewhat sinuate, otherwise gradually converging caudally, caudally leaving most of tergites uncovered (fig. 15, apices pointed, accentuated by a tuft of caudally directed bristles. Tergite 8 slanting ventrad at an angle of about 0.25π . Proctiger vertical. Sternite 7 about half as long as remaining abdominal sternites (0.5/1.0). Gonocoxa hidden in segment 7 (fig. 28).

Etymology. – Abros, greek adjective meaning coarse, referring to the extensive cover of fine denticles.

Comparative notes. – Similar to *R. blogiokommena*, *R. tropidata*, *R. wallacei* and, in males, *R. minahasa*. Of these *R. blogiokommena* has the black denticles restricted to the posterior part of jugum and the anteroventral part of propleura alongside the rostrum. The others have the minute black denticles distinctly present on pro- and meso-pleura. *R. minahasa* lacks mesothoracic punctures and has the connexiva of the

female folded over the abdomen on segments 5-7, *R. tropidata* has a prominent ventral keel on sternite 7 in males, *R. wallacei* has characteristic tufts of bristles abdominal sternites 5 and 6 and the connexiva slanting upward in males. The latter two species have the minute black denticles not extending onto the orange transverse band dorsally on pronotum as in *R. abra*. Females of *R. tropidata* and *R. wallacei* have the apices of connexiva more truncate than *R. abra*, only 0-2 small teeth on proximal ventral margin of hind femur and, moreover, in *R. wallacei* females the connexiva are straight.

Rhagovelia achna sp. n.

(figs. 7, 8, 16, 26, 36, 45)

Type material. – Holotype apterous δ (NHMW) INDONESIA: Sulawesi, Togian Inseln, 3 Feb 1995 leg. Seifert & Greindl (59) (fig. 45). – Paratypes same data as holotype 3 δ 2 η (NHMW, 1 δ NCTN).

Description. – Apterous form. Medium sized relatively slender and pale species. Dimensions. Length δ 3.10-3.15, η 3.26; width δ 1.15-1.18, η 1.18; width of head δ 0.76-0.78, η 0.75; width of pronotum δ 1.01-1.07, η 1.02.

Colour generally brownish. Anterior quarter of pronotum orange-yellow, connected with equally pale propleura and prosternum, meso- and meta-pleura orange-brown. Disk of pronotum medium to light brown, with an ill-defined lighter median longitudinal stripe. Abdomen dorsally and laterally medium brown, outer half of connexiva orange-yellow. Venter orange-brown. Antenna grey-brown basal half to three quarters of first segment pale. Acetabula, coxae, trochanters and most of anterior and posterior femur sordid pale yellowish. Middle femur except for base, tibiae and tarsi grey-brown. Apex of anterior femur and variable dorsal and ventral stripe on hind femur greyish.

Minute black denticles prominent on thoracic and abdominal venter to sternite 6, spreading on propleura and bases of jugae. A line of pits anteriorly and posteriorly on orange-yellow band of pronotum, pitting of posterior three quarters of pronotum and mesopleuron (fig. 26) distinct. Body clothed with short pubescence with some sparse fine longer hairs, thicker and more prominent laterally and ventrally (especially caudally in males), disc of pronotum rather bare. Most of abdominal tergite 7 (and genital tergites of male) free of pubescence, shining. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae.

Length of antennal segments (δ and η) I : II : III : IV 0.75 : 0.40 : 0.56 : 0.43. Pronotum long, covering mesonotum, shorter than wide (0.8/1.0). Length

of metanotum on midline, 0.1. Abdominal tergites 1-5 subequal in length (0.2), tergite 6 subequal in male slightly longer (0.25) in female, tergite 7 0.35 in ♂, 0.40 in ♀. Abdominal sternites 2-6 subequal (0.2) and 7 longer (0.30) in male. In female sternites 2-5 subequal (0.2), 6 slightly (0.25) and 7 distinctly (0.45) longer.

Male. Posterior trochanter with about four small but distinct blunt teeth. Posterior femur strongly incrassate, on average two and a half times as long as wide (1.55/0.62). Ventral margin in proximal quarter with about twelve very small closely set teeth followed by an irregular row of about ten larger spines of which the larger ones are about as long as one fifth the width of femur (fig. 7) dorsally and a row of about four smaller spines (of the same size as the apical ones in the dorsal row) ventrally in distal third. Posterior tibia distinctly curved, armed beneath with a double row of about 30 small teeth in proximal three quarters, followed by 4-6 larger teeth of which the first, marking distal quarter is the most prominent. Spines and teeth brown tipped, the smaller ones nearly entirely brown. Connexiva slanting upward about 0.25π gradually converging posteriad leaving tergite 7 exposed. Basal width of abdominal tergite 7 less than its median length (0.30/0.35). Venter with a low broad keel, abdominal sternite 7 flattened with median keel more prominent. Sternite 8 shorter than sternite 9 (0.25/0.30), sternite 8 with an indication of a median keel basally. Parameres rather long (fig. 36).

Female. Posterior trochanter without small teeth. Posterior femur about 3.5 times as long as wide (1.28/0.37), with an irregular row of spines about seven in apical two thirds only, consisting of one larger spine (about half as long as the width of femur) preceded by one and followed by five smaller, distally decreasing, teeth dorsally and a row of about four smaller spines (of the same size as the apical ones in the dorsal row) ventrally in distal third (fig. 8). Posterior tibia with a double row of about 30 small but distinct teeth in proximal three fourth. Connexiva more or less vertical, curved inward and with a somewhat thickened rim accentuated by somewhat stronger developed pilosity on paratergite 4, caudal part virtually parallel, converging slightly on last segment only, leaving the tergites uncovered (fig. 16), apices truncate with a few bristles only. Tergite 8 and proctiger horizontal. Gonocoxa distinctly protruding (fig. 26).

Macropterous form unknown.

Etymology. – Achnos, greek adjective meaning sal-low, referring to the somewhat indefinite general colour.

Comparative notes (see key). – Separated from all other Sulawesi species in this group by the armature

of the hind femur in both sexes. This characteristic and the shape of the parameres set this species closer to some Philippine species (*R. cotabatoensis* Hungerford & Matsuda and related species).

Rhagovelia krama sp. n.

(figs. 6, 19, 27, 37, 45)

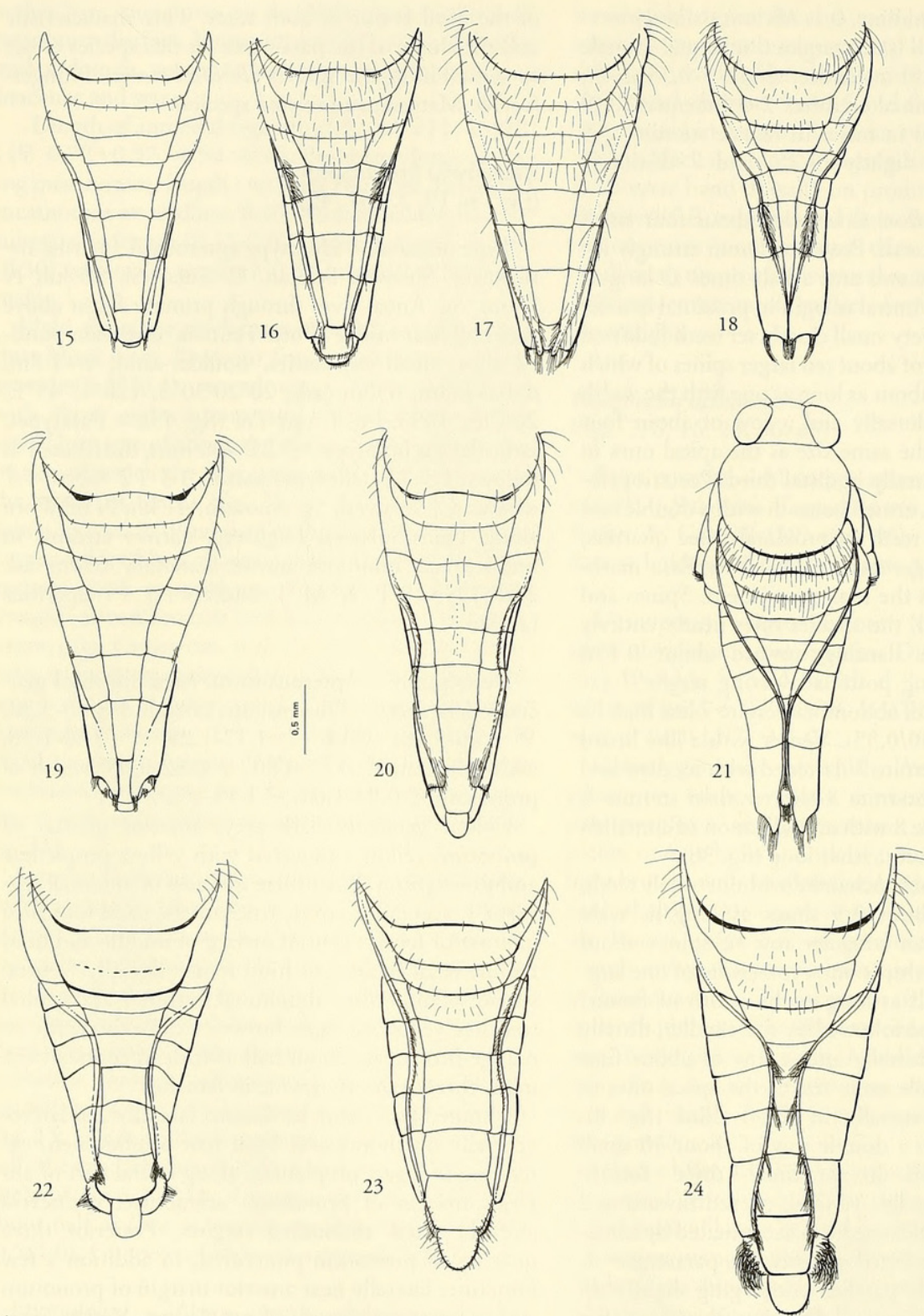
Type material. – Holotype apterous ♂ (RMNH) INDONESIA: Sulawesi Selatan: C. Sulawesi, 30 km N Wotu, Sg. Anoa, river through primary forest above waterfall near bridge Wotu-Tentena, upstream ponded sites, small tributaries, boulder-sand, w=4-8m, d=0.2-0.8m, 650m (asl), 20°20'30"S, 120°47'45"E, 26 Oct. 1993, leg. J. van Tol (fig. 45). – Paratypes, same data as holotype 3 ♂ 2 ♀ apterous, distributed as follows, 1 ♂ 1 ♀ (allotype) RMNH, 1 ♂ 1 ♀ NCTN, 1 ♂ NHMW; C. Sulawesi, Sg. Anowah, 41 km N of Wotu along Trans-Sulawesi Highway, narrow streams in undisturbed rainforest above waterfall, 650m asl. 24.X.1993, J. P. & M. J. Duffels 1 ♂ 1 ♀ apterous (ZMAN)

Description. – Apterous form. Medium sized generally dark species. Dimensions. Length ♂ 3.20-3.38, ♀ 3.50-3.78; width ♂ 1.12-1.25, ♀ 1.30-1.38; width of head ♂ 0.77-0.80, ♀ 0.82-0.83; width of pronotum ♂ 0.97-1.04, ♀ 1.11-1.12.

Colour generally dark grey, anterior quarter of pronotum yellow connected with yellow propleurae and prosternum. Basal three quarters of antennal segment 1, acetabula, coxae, trochanters, basal four fifth of anterior femur, ventral surface of middle and hind femur, basal quarter of hind femur dorsally, ventral surface of hind tibia, abdominal sternite 7 and genital sternites yellow to light brown. Connexiva with an orange-brown rim about half as wide as connexiva in male, three quarters as wide in female.

Minute black denticles distinct laterally and latero-ventrally on thorax and basal half of abdomen, extending to jugae, propleurae, along lateral part of anterior margin of pronotum, acetabulae, connexiva and the basal abdominal tergites. Posterior three quarters of pronotum punctured, in addition a few punctures laterally near anterior margin of pronotum and at posterior margin of propleurae. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body clothed with sordid yellowish pubescence, dorsally more distinct in males than in females. Caudal segments of abdomen with some more distinct pilosity.

Length of antennal segments I : II : III : IV ♂ 0.76 : 0.40 : 0.51 : 0.45, ♀ 0.80 : 0.41 : 0.50 : 0.45. Pronotum long, covering mesonotum, shorter than wide (♂ 0.8/1.0, ♀ 0.9/1.1). Length of metanotum on middle line, 0.10-0.12. Abdominal tergites 1-4



Figs. 15-24. Dorsal view of abdomen of apterous females of *Rhagovelia*: 15 *R. abra*, 16 *R. achna*, 17 *R. skoura*, 18 *R. tsouloufi*, 19 *R. krama*, 20 *R. ochra*, 21 *R. cylindros* (body without extremities), 22 *R. gyrsta*, 23 *R. sterea*, 24 *R. plichona*.

subequal in length (0.2), tergite 5 subequal, 6 slightly (0.23) and 7 distinctly (0.4) longer in male. Tergite 5 slightly (0.25), 6 clearly (0.33) and tergite 7 distinctly (0.6) longer in female. Abdominal sternites 3-5

subequal, 0.2 in both sexes; sternite 2 equal (0.2), 6 (0.25) and 7 (0.35) slightly longer in male. Sternites 2 (0.25) and 6 (0.33) slightly, sternite 7 distinctly (0.65) longer in female.

Male. Posterior trochanter with 2-4 small but distinct blunt teeth. Posterior femur incrassate, on average three times as long as wide (1.37/0.46). Ventral margin in proximal half with a somewhat irregular row of 10-15 very small closely set teeth followed by a double row of about ten larger spines decreasing in size distally, of which the first (proximal) is two fifth as long as the width of femur (fig. 6) dorsally and a row of 1-6 small spines (of the same size as the apical ones in the dorsal row) ventrally. Posterior tibia softly curved to virtually straight, armed beneath with an irregular double row of about 20 small teeth, distal teeth very slightly larger and sharper than proximals. Larger spines brown tipped, smaller ones nearly entirely brown. Connexiva more or less horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 three quarters its median length (0.3/0.4). Tergite 8 basally as wide as long (0.35). Abdominal venter with a, rather indistinct, median keel on sternites 4-7, accentuated in sternites 4 and 5 by pilosity, on 7 by flattening of the sternite. Sternite 8 laterally compressed basally, suggesting a continuation of the ventral keel. Parameres rather long (fig. 37).

Female. Posterior trochanter without small teeth. Posterior femur 'petiolate' proximally, nearly four times as long as wide (1.35/0.35), a few small teeth in proximal part only, row of spines in apical half consisting of one large spine (over half as long as the width of femur) followed by about 8 much smaller, distally decreasing, teeth. Posterior tibia with about 20 small but distinct teeth. Connexiva more or less horizontal on segments 1 and 2, on segment 3 and 4 torsion to vertical, on tergites 5 and 6 curved back outward and converging caudally, the prolonged apices nearly meeting over tergite 8 which is horizontal (fig. 19). Gonocoxa distinctly protruding, with a very shallow lateral impression (fig. 27).

Etymology. – Krama, Greek noun meaning mixture referring to this species combining various characteristics of related species.

Comparative notes. – This species belongs to a subgroup within the *papuensis* group consisting of relatively squat species with orangeish anterior band of pronotum connected with similarly coloured propleura, in males rather strongly inflated hind femur and virtually straight tibia without larger subapical tooth. In Sulawesi this set is represented by *R. blo-giokommena*, *R. tropidata* and *R. wallacei*, the females of these three have tergite 8 more exposed, males can be separated by the characteristics mentioned in the key.

Rhagovelia ochra sp. n.

(figs. 2, 3, 20, 25, 40, 45)

Type material. – Holotype apterous ♂ (RMNH) INDONESIA: C. Sulawesi, 30 km N Wotu, Sg. Anoa, river through primary forest above waterfall near bridge Wotu-Tentena, upstream ponded sites, small tributaries, boulder-sand, w=4-8m, d=0.2-0.8m, 650m (asl), 20°20'30"S, 120°47'45"E, 26 Oct 1993, leg. J. van Tol (fig. 45). – Paratypes, same data as holotype 6♂ 2♀ apterous, 2♂ macropterous distributed as follows: 4♂ 2♀ (1 apt. allotype, 1 macr.) RMNH, 1♀ 1♂ apt., 1♂ macr. NCTN, 1♂ NHMW.

Description. – Apterous form. Medium sized slender and pale species. Dimensions. Length ♂ 3.55-3.58, ♀ 3.52-3.55; width ♂ 1.08-1.15, ♀ 1.16-1.19; width of head ♂ 0.74-0.80, ♀ 0.76-0.79; width of pronotum ♂ 0.98-1.00, ♀ 1.03-1.04.

Colour generally pale, yellow and light orange. Dorsal side mainly orange, eyes dark grey to brown, interoculus somewhat darker than rest of dorsal side, apex of rostrum brown. Anterior quarter of pronotum pale yellow, connected with equally pale propleura and prosternum. Lateral third to half of connexivum yellow. Venter mostly orange. First antennal segment yellowish, segments 2-4 brownish. Legs mostly yellowish, tarsi and apices of femurs and tibiae infuscated in most specimens.

Minute black denticles spread over body surface except anterior and dorsal parts of head and the pitted posterior three quarters of pronotum. Punctures on posterior three quarters of pronotum distinct. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body at first sight looking rather bare as its pubescence is short, appressed and in the same colour as body. Caudal segments of abdomen with some more distinct pilosity.

Length of antennal segments I : II : III : IV ♂ 0.81 : 0.49 : 0.69 : 0.54, ♀ 0.80 : 0.45 : 0.68 : 0.52. Pronotum long, covering mesonotum, shorter than wide (0.8/1.0). Length of metanotum on middle line, 0.12. Abdominal tergites 1-5 subequal in length (0.2), tergite 6 slightly longer 0.25 in male 0.30 in female, tergite 7 0.40 in both sexes. Abdominal sternites 3-5 subequal 0.15-0.20 in male, 0.20 in female; sternites 2 and 6 slightly (0.22) sternite 7 distinctly (0.40) longer in male. In female abdominal sternites 2 and 6 0.30 and sternite 7 0.50.

Male. Posterior trochanter with 4-6 small but distinct blunt teeth. Posterior femur variably incrassate, on average two and a half times as long as wide (1.68/0.69). Ventral margin in proximal half with about 20 very small closely set teeth followed by a double row of about 10 larger spines decreasing in

size distally, of which the first (proximal) is one third as long as the width of femur (fig. 2) dorsally and a row of 4-7 small spines (of the same size as the apical ones in the dorsal row) ventrally. Posterior tibia softly distinctly curved, armed beneath with a double row of about 40 (25 in inner, 15 in outer row) small teeth, most specimens with a somewhat larger tooth at apical third. Both curvature and development of larger tooth on tibia correlated with thickness of femur. Spines and teeth brown tipped, those on tibia nearly entirely brown. Connexiva more or less horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 less than its median length (0.35/0.40). Abdominal sternite 7 flattened medially, flat area diverging posteriorly in most specimens, with an indication of a broad, low median keel, lateral margins of flattened area accentuated in posterior half by tufts of bristles. Parameres rather long (fig. 40).

Female. Posterior trochanter without small teeth. Posterior femur slightly over five times as long as wide (1.39/0.27), with a single row of spines in apical half only, consisting of one large spine (about 3/4 as long as the width of femur) followed by 4-6 much smaller, distally decreasing, teeth (fig. 3). Posterior tibia with a single row of about 12 small but distinct teeth. Connexiva more or less vertical, on tergites 4 and 5 curved inward and with a somewhat thickened rim, otherwise gradually converging caudally, leaving most of tergites uncovered (fig. 20), apices only slightly pointed (fig. 25), more or less triangular. Tergite 8 and proctiger about horizontal in allotype, slanting ventrad at an angle of over 0.25π in the other female. Gonocoxa distinctly protruding, with a shallow lateral impression in apical half.

Macropterous specimens (2♂ only). – Essentially as apterous form except for the development of thorax, wings and some details mentioned below. Length 3.70-3.75, humeral width of pronotum 1.40-1.41, median length of pronotum subequal to humeral width 1.33-1.40. General colour slightly darker than in apterous specimens, hemielytra dark, smoky brown-grey, proximal two thirds of lateral (anterior) proximal cell sordid white. Hemielytra reaching halfway to just over proctiger, with four cells two proximal elongate, reaching nearly halfway hemielytron. Outer (anterior) apical cell narrow reaching distal three quarters of hemielytron, central cell broad reaching distal two thirds. Hind wings dark smoky grey. Carinae on basal part of abdomen reaching to caudal margin of tergite 3. Connexiva horizontal, virtually parallel in the basal two thirds, curved medially in caudal two thirds.

Etymology. – Ochros, greek adjective meaning pale, referring to the general colour.

Comparative notes. – Its pale orange colour sets this species apart from anything seen in Sulawesi and the Philippines. Other comparatively light reddish species such as *R. robina* Nieser & Chen or *R. horaia* Nieser & Chen are, nevertheless, much darker and have the third antennal segment relatively shorter. *R. ochra* belongs to a subgroup of the *R. papuensis*-group characterized by a strongly inflated hind femur and a curved hind tibia with one or more larger subapical teeth in males and a relatively long third antennal segment (Nieser & Chen 1993). However, the third antennal segment in *R. ochra* is much longer than in the above mentioned species.

Rhagovelia skoura sp. n.
(figs. 4, 17, 30, 38, 44)

Type material. – Holotype apterous ♂ (RMNH): INDONESIA: Sulawesi Utara, P. Sangihe, Bowokulu, 19.XI.1994, leg. N. Nieser, N9477 (fig. 44). Upper reaches of mountain stream, not much water, boulders, narrow stretches with strong current alternating with quiet pools. *Rhagovelia* on quiet stretch up and down stream of bridge. – Paratypes (NCTN unless otherwise stated): Same data as holotype 180♂ 106♀ apt., 2♂ macropterous, distributed as follows: 2♂ 3♀ (including allotype) RMNH; JTPC, NHMW, ZMAN each 2♂ 2♀ apt.; MBBJ, MUDH, SEMC each 1♂ 1♀ apt. – Additional paratypes (adults only), all Pulau Sangihe and leg. N. Nieser: Naha, Sungai Laine, 27.VI.1994, N9454. Lower reaches of stream, about 10m wide, mostly about 0.5 m deep, water slightly turbid (after a night of rain), bottom, coarse sand and pebbles. *Rhagovelia* at the edges between vegetation, 12♂ 10♀ apt. (2♂ 2♀ uscp); Naha, Sungai Laine, at last bridge upstream, 27.VI.1994, N9456. Slowly flowing river partly filled with *Hydrilla*, water faintly bluish (probably soap from washing cloth), 3♂ 3♀ apt.; Akembawu, ford & bridge in Sungai Dali, 16.XI.1994, N9470. Open terrain with some xerophytic plants, stones & boulders (the ford is an outlet in case of banjir). Sample from mouth at sea to 1.5 km inland, 27♂ 37♀ apt., 2♂ 1♀ macr., 1 lvV; Desa Simuang (near Malahu), Sungai Simuang, 28.VI.1994 (for details see *R. cylindros*), 24♂ 27♀ apt., 1♀ macr.; Desa Laine, Sungai Laine, pothole at water fall, 12.XI.1994, N9463 (for details of habitat see under *R. cylindros*). *Rhagovelia* at open to moderately open spots, 48♂ 56♀ apt., 34♂ 30♀ macr., 5 lvV. (JTPC, MBBJ, NHMW, OXUM, SEMC, ZMAN each 1♂ 1♀ macr.); Lelepu, Sura (=Sungai) Lelepu, 13.XI.1994, leg. N. Nieser, N9464. Mainly lowland stream aspect, some *Rhagovelia* also from stretch with mountain stream aspect, 59♂ 53♀ apt., 7♂ 8♀ macr., 40 lvV; Desa Utaurano, Sungai Apanukang, 14.XI.1994, N9465, (for details see *R. cylindros*).

19♂ 42♀ apt., 12♂ 14♀ macr.; same, pothole, N9465A 8♂ 7♀ apt., 2♂ 1♀ macr.; Sungai Masalihe, 16.XI.1994, N9468, mountain stream in rather deep (c. 20m) gorge. Main stream rather rough, mainly boulders and rapids, some quieter bays with pebbles and sand. Most *Rhagovelia* from N9468A, narrow parallel stream with sand bottom, mostly c. 2-5m wide, 54♂ 45♀ apt., 5♂ 8♀ macr., 5 lvv.; Sungai Kendahe, bridge at Poto, mountain stream, 17.XI.1994, N9471. Medium sized, fast flowing stream, bottom coarse pebbles, width 3m, at bridge much wider, and slower (spot extensively used for washing cloth), specimens taken from quiet bays at edges of stream, 16♂ 10♀ apt., 11♂ 7♀ macr.; N. side, near Poto, stream, 17.XI.1994, N9472. Small mountain stream through overgrown coconut grove, some boulders, bottom pebbles, some plant debris, water clear, hyaline, 12♂ 12♀ apt. (3♂ 3♀ OXUM, 2♂ 2♀ USCP); N. side, near Poto, stream, 17.XI.1994, N9473. Mountain stream, narrower and quieter than N9471, some boulders, bottom small pebbles, coarse sand, 15♂ 8♀ apt., 2♂ 1♀ macr., 6 lvv.; Small stream at Kampung Lapango-Hakadele (near Desa Sawaeng), 18.XI.1994, N9474. Mountain stream, sample from slowly flowing rather flat part. Bottom with some mud. *Ipomoea* growing into the water which has a bluish tinge (soap ?), 76♂ 92♀ apt., 13♂ 17♀ macr., 2 lvv.; Sungai Makariahe, near Gunung, 19.XI.1994, N9478. Upper reaches of mountain stream, more or less a trickle of water between boulders, some small pools from which the sample was taken, 1♂ 1♀ apt., 1♀ macr.; E. side, Sungai Miulu, 20.XI.1994, N9480, 7♂ 9♀ apt., 1♀ macr., 2 lvv.

Description. – Apterous form. A medium sized rather broad and generally dark species. Dimensions. Length ♂ 3.20-3.28, ♀ 3.38-3.50; width (at base of abdomen) ♂ 1.23-1.28, ♀ 1.35-1.38; width of head ♂ 0.80-0.82, ♀ 0.82-0.85; width of pronotum ♂ 1.11-1.15, ♀ 1.13-1.18.

Colour generally dark grey to black, juga and basal part of rostrum lighter, narrow anterior transverse band anteriorly on pronotum (reaching laterally halfway eyes) orange-yellow, covered with grey pruinosity which becomes more distinct laterally. Outer rim of connexiva brownish, not very contrasting, in most specimens best visible on segments 3-6. Basal half of first antennal segment and fore femur, basal third ventrally, basal sixth dorsally of hind femur, acetabula, coxae and trochanters pale.

Minute black denticles spreading from prosternum to propleura reaching just behind eyes, moreover some on jugae and acetabula especially dorsally on metacetabulum. Meso- and metapleuron in anterodorsally of acetabulum with distinct punctures

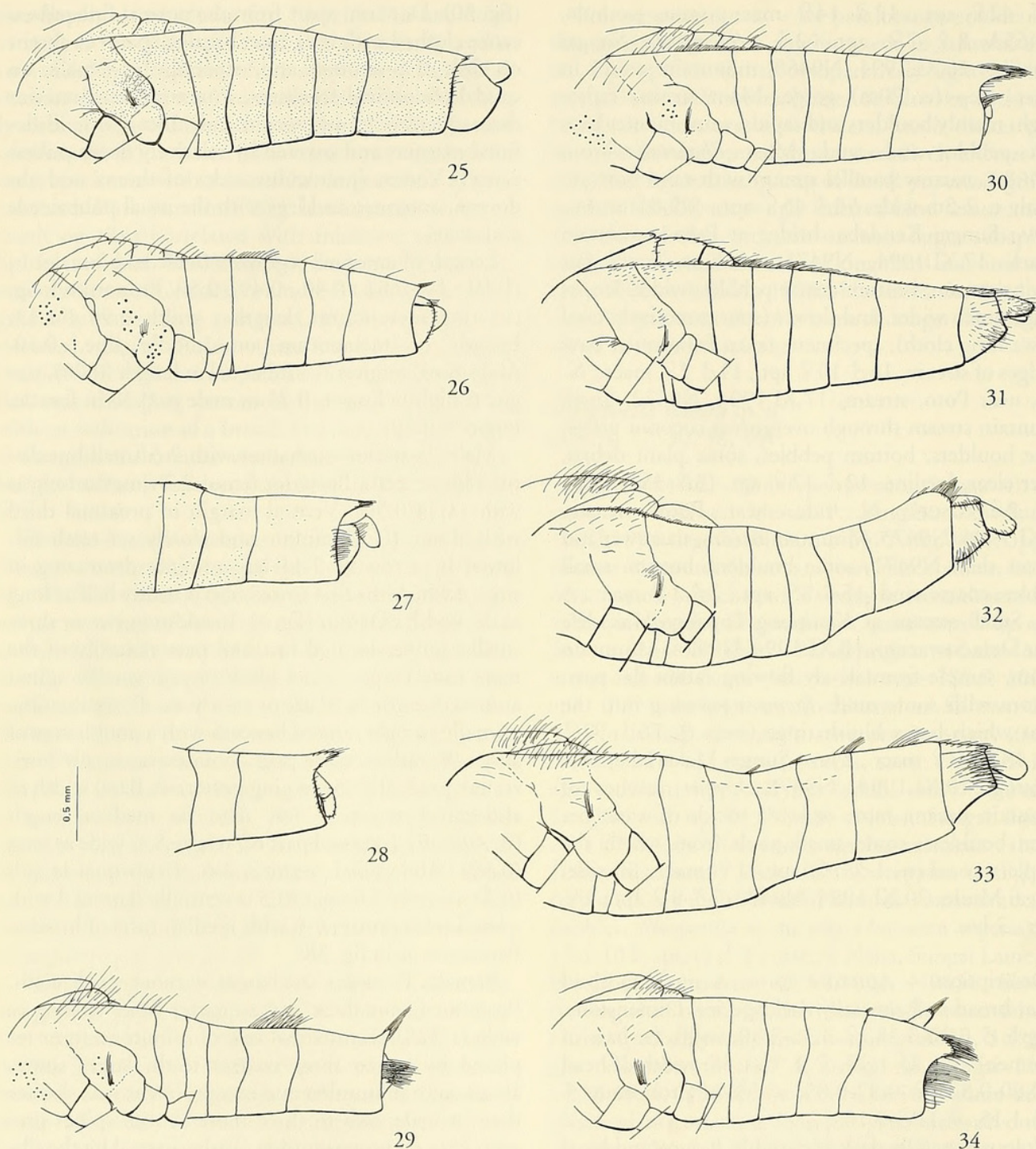
(fig. 30). Dorsum, apart from the normal fine pubescence clothed with long erect bristles, sparse or absent on disk of pronotum and, especially in female, on caudal abdominal segments. Punctures on posterior three quarters of pronotum indistinct (with ill-defined margins and covered by relatively dense pubescence). Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae.

Length of antennal segments (male and female) I : II : III : IV 0.81 : 0.40 : 0.49 : 0.50. Pronotum long, covering mesonotum, length : width 0.90 : 1.13. Length of metanotum on middle line, 0.10. Abdominal tergites 1-5 subequal in length (0.20), tergite 6 slightly longer, 0.25 in male to 0.30 in female, tergite 7 0.40.

Male. Posterior trochanter with 2-5 small but distinct blunt teeth. Posterior femur 2.7 times as long as wide (1.34/0.50), Ventral margin in proximal third with about 10-15 minute and closely set teeth followed by a row of 9-11 larger spines decreasing in size, of which the first (proximal) is nearly half as long as the width of femur (fig. 4). In addition two or three smaller spines located in distal part ventrally of the main row. Larger spines black tipped, smaller spines and teeth entirely black or nearly so. Posterior tibia virtually straight, armed beneath with a double row of about 30 rather coarse pegs. Connexiva usually horizontal, gradually converging posteriad. Basal width of abdominal tergite 7 less than its median length (0.30/0.40); (exposed part of) tergite 8 as wide as long (0.30) Abdominal sternites 2-6 of subequal length (0.2), sternite 7 longer (0.35) ventrally flattened with a low keel, sternites 5-6 with median tufts of bristles. Parameres as in fig. 38.

Female. Posterior trochanter without small teeth. Posterior femur three and a quarter times as long as wide (1.32/0.4), proximal row of minute teeth or replaced by up to three coarser teeth, larger spines about eight in number and except for the first shorter than in male, two to three more ventral spines present. Pegs on posterior tibia nearly covered by the tibial pilosity. Connexiva more or less horizontal to slanting upward to 0.15π . Converging caudally in a nearly straight line (fig. 17), leaving most of tergites uncovered, apices pointed, accentuated by a tuft of caudally directed bristles in addition a smaller tuft of bristles more ventrally on hind margin of segment 7 (fig. 30). Position of tergite 8 and proctiger slanting nearly vertically ventrad. Sternite 7 about twice as long as sternite 6 (0.30/0.60) median length of remaining abdominal sternites about 0.2. Gonocoxa hidden in segment 7.

Macropterous form. – Essentially as apterous form except for development of hemielytra and thorax. Length 3.3-3.4, humeral width of pronotum 1.38-



Figs. 25-34. Lateral view of abdomen (27-28 caudal segments only) of apterous females of *Rhagovelia*: 25 *R. ochra*, 26 *R. achna*, 27 *R. krama*, 28 *R. abra*, 29 *R. tsouloufi*, 30 *R. skoura*, 31 *R. sterea*, 32 *R. gyrsta*, 33 *R. plichona*, 34 *R. cylindros*.

1.42, median length of pronotum 1.20-1.30. Pronotum black with a sharply contrasting orange-yellow transverse band at anterior margin, sometimes covered with whitish pubescence. Hemelytra reaching 0.2 beyond apex of abdomen, dark brown with black veins. A pair of elongate proximal cells marked with sordid white bands, reaching slightly beyond halfway hemelytron, a pair of shorter central cells,

outer one (near costal margin) reaching to one fourth from apex, inner one to one third from apex of hemelytron. Keels on base of abdomen strongly developed, reaching to caudal margin of tergite 3. Brownish rim of connexiva (partly not covered by hemelytra) more strongly developed than in apterous form, a shining brownish patch on tergite 7.

Etymology. – Skouros, greek adjective meaning dark, referring to the generally dark colour compared to its nearest relatives.

Comparative notes. – See key, general shape similar to *R. wallacei*, including the tufts of bristles on sternites 5 and 6 of male, but this species has the yellowish transverse band of pronotum broad, reaching to propleurae and the long erect bristle-like hairs dorsally restricted to connexiva.

Rhagovelia tsouloufi sp. n.
(figs. 9, 19, 18, 29, 39, 44)

Type material. – Holotype apterous ♂ (RMNH) INDONESIA: Sulawesi Utara, Pulau Salibabu, Sg. Musi, downstream stretch in agricultural area, quiet, shallow, mostly 2-3m wide and 0.05-0.1m deep, bottom pebbles, stones and a few boulders, water clear, hyaline, N9489, 26 Nov. 1994, leg. N. Nieser (fig. 44). – Paratypes (NCTN unless otherwise indicated): Same data as holotype 35♂ 13♀ apterous, 7♂ 5♀ macropterous distributed as follows: 3♂ 2♀ apt., 1♂ 1♀ macr. NHMW; 2♀ (including allotype) apt., 1♂ macr. RMNH. – Additional paratypes, all leg. N. Nieser: P. Salibabu, Lirung, narrow stream on rocks, very steep, draining small marsh on top of hill (c. 350 m asl), various shallow pools with much plant debris connected by trickles of water, shaded by remnants of (? primary) forest, N9483, 24. XI. 1994, 6♂ 4♀ apt., 1♂ macr. (1♂ macr. JTPC, 3♂ 3♀ OXUM, 2♂ 1♀ USCP); Pulau Karakelong, D(esa) Ambela, at inlet of irrigation system, 30.XI.1995, N9493. Sungai Ambela, broad river bed with sand & pebbles, with little water. One side still forested, other side disturbed, 13♂ 4♀ apt., 1♂ macr. (JTPC 3♂ 1♀, MBBJ 2♂ 1♀ apt. 1♂ macr., MUDH 1♂ 1♀, SEMC 2♂, ZMAN 2♂ 1♀. P. Karakelong, Sungai Ambela at waterfall, 2.xii.1994, pool slightly downstream in lowland rain forest, N9497A, 45♂ 26♀ apt. P. Karakelong, Sungai (at) Sawang, 3.xii.1994, N9498. Lowland stream trough agricultural (small scale) area, light brown very turbid (after rain), 2♂ 4♀ apt., 2♂ 2♀ macr., 1 lvv.

Description. – Apterous form. Rather small generally dark species. Dimensions. Length ♂ 2.89-3.08, ♀ 3.28-3.48; width (across base of abdomen) ♂ 1.08-1.12, ♀ 1.15-1.23; width of head ♂ 0.72-0.75, ♀ 0.75-0.80; width of pronotum ♂ 0.93-0.98, ♀ 1.01-1.10.

Colour generally dull dark brown to grey, eyes dark castaneous, yellowish transverse band anteriorly on pronotum distinctly contrasting, narrow, reaching slightly beyond the inner margins of eyes. Basal half of antennal segment 1, acetabula, coxae, trochanters, proximal three quarters of anterior femur and proxi-

mal one third of hind femur pale. Connexiva with a narrow orange-brown rim. Venter and sides and lateral parts of first tergites in female somewhat pruinose grey. Minute black denticles present on anterolateral angles of pronotum, due to grey back ground rather indistinct. Row along anterior margin and posterior three quarters of pronotum distinctly punctured, pro- and meso-pleura with well-developed coarse punctures. Vertex, interoculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body clothed with short pubescence, virtually absent laterally in females, superimposed by sparse longer bristles in males which are hardly developed in females.

Length of antennal segments (♂, ♀) I : II : III : IV 0.72 : 0.39 : 0.49 : 0.42. Pronotum long, covering mesonotum, shorter than wide (♂ 0.80/0.96, ♀ 0.85/1.05). Length of metanotum on midline, 0.1. Abdominal tergites 1-6 in male, 1-5 in female subequal in length (0.15-0.20), tergite 7 in male 0.40 tergite 6 in female 0.35, tergite 7 0.50. Abdominal sternites 2-5 in male, 3-5 in female subequal, about 0.15 long. In male sternite 6 slightly longer 0.20, sternite 7 distinctly longer, 0.35; in female sternite 2 0.20, 6 0.30 and 7 0.6.

Male. Posterior trochanter with 1-4 small black teeth. Posterior femur incrassate, on average slightly over two and a half times as long as wide (1.26/0.48). Ventral (inner) margin with 8-10 very small black teeth in proximal third, followed distally by a double row of spines, the posterior (dorsal) row consisting of about 12 spines of apically decreasing spines, the larger spine about one third as long as the width of femur. The anterior (ventral) row consisting of about six smaller spines (fig. 10). Posterior tibia virtually straight, armed beneath with a, proximally double distally single row of 24-30 small teeth which are partly covered by the pilosity of the femur. Connexiva more or less horizontal to slanting slightly upward (about 0.15π), gradually converging posteriorly. Abdominal tergite 7 bare, shining, its basal width three quarters its median length (0.30/0.40). Tergite 8 basally as wide as long (0.30). Abdominal sternite 7 brownish flattened, with a faint indication of a median keel only. Sternites 8 and 9 medium brown, sternite 8 flattened without keel. Parameres stout (fig. 39).

Female. Middle femur distinctly and broadly dorsoventrally compressed halfway its length. Posterior trochanter without small teeth. Posterior femur with a narrow part in proximal third ('petiolate') remainder less incrassate than in male, slightly over three times as long as wide (1.17/0.37); its armament restricted to a single row of about seven distally decreasing spines in distal two thirds, of which the largest is about half as long as the width of femur (fig.

9). Posterior tibia armed with an irregular inner row of about 25 small spines largely hidden in the pilosity of the tibia. Connexiva more or less vertical, curving inward over segments 4-5, strongly converging on segments 6-7, meeting over abdomen on posterior half of segment 7 (fig. 18) including the upwards pointing caudal connexival angles which are accentuated by some bristles (fig. 29). The dorsal part of the caudal margin of segment 7 accentuated by a dense fringe of large bristles. Tergites 8 and 9 vertical, only visible in caudal view. A tuft of erect somewhat caudally pointed golden brown bristles on laterosternite 4. Sternites 5-7 flattened.

Macropterous form. – Essentially as apterous form except for development of wings and thorax. Length ♂ 3.20-3.38, ♀ 3.48-3.55, humeral width of pronotum ♂ 1.30-1.34, ♀ 1.37-1.42, median length of pronotum ♂ 1.20-1.30, ♀ 1.26-1.40. Pronotum black, orange-yellow transverse band at anterior margin reaching slightly beyond inner margins of eyes, rather indistinct due to cover by whitish pubescence. Propleura with a distinct row of punctures near ventro-posterior margin. Hemelytra reaching apex of abdomen in males and about 0.1 beyond apex of abdomen in females, brown to dark grey with darker veins. A pair of elongate proximal cells marked with sordid white (especially the one at costal margin) reaching halfway hemelytron, a pair of distal cells of which the one near costal margin is distinctly smaller reaching two thirds the length of hemelytra. Dorsum of abdomen castaneous, brownish rim of connexiva broader than in apterous form, keels on base of abdomen well developed and long, reaching to the base of tergite 4. Connexiva of female sinuate, slanting upward nearly 0.4π .

Etymology. – Tsouloufi (tsoulouphi), Greek noun meaning tress (of hair), referring to various tufts of bristles on abdomen in female.

Comparative notes. – Apparently related to *R. trichota* Nieser & Chen and *R. minahasa* Polhemus & Polhemus females of which have the caudal part of connexiva more or less folded over abdomen, the characteristics in the key will serve to separate these species.

The *R. gyrsta*-group

Diagnosis: Medium sized to rather large *Rhagovelia*, length 3.6-4.1 mm, ground colour dark grey to black, body dorsally and antennae with conspicuous golden pubescence. Posterior femur in males slender, proximal granulate teeth rather large. Posterior femur in females dorsoventrally flattened. Dealate specimens relatively common, basal abdominal carinae (only observed in *R. gyrsta*) in macropters broad and low, reaching to posterior margin of tergite 2.

Distribution: Endemic to Sulawesi.

R. hamjadi Polhemus & Polhemus (1988) was originally placed in the *R. papuensis*-group. In view of the above mentioned characteristics which it shares with *R. gyrsta* we consider these two to form a separate group within the genus. *R. sterea* sp. n. so far only known by the unique apterous female holotype is included in this group because of its similarity to *R. hamjadi*.

Key to species of the *R. gyrsta* group (apterous specimens)

1. Orange-yellow transverse band anteriorly on pronotum wide, connected with the similarly coloured pleurae *R. sterea* sp. n.
- Orange-yellow transverse band anteriorly on pronotum narrow, reaching to inner margins of eyes, propleurae dark 2
2. Male, posterior femur proximally with a row of about 16 granulate teeth, distally with a row of six spines. Female, abdomen strongly curved upwards caudally (fig. 32), connexiva bent inward and folded over lateral parts of abdominal tergites 3-6 (fig. 22) *R. gyrsta*
- Male, posterior femur proximally with a row of about 20 granulate teeth, distally with a row of 8-9 spines. Female, abdomen straight, connexiva not folded over abdomen, their margin only slightly concave *R. hamjadi*

Rhagovelia gyrsta sp. n.

(figs. 11, 12, 22, 32, 41, 45)

Type material. – Holotype, apterous ♀ (ZMAN), INDONESIA: Sulawesi Selatan: SW Sulawesi, Mamasa, Sg. Loko, 1400m, 17 Nov 1993, leg. J. P. & M. J. Duffels (fig. 45). – Paratypes, same data as holotype, 1 ♂ (allotype) 2 ♀ apt., 2 ♂ 1 ♀ macropterous ZMAN (1 ♂ macr., 1 ♀ apt. NCTN). The macropters have the wings entirely broken off except for some remnants at the humeral angles of pronotum (dealate); Sulawesi Selatan: Zuid Celebes, Nanggala, 800m, Rantepao, VIII. 1937, leg. F. C. Drescher, 1 ♂ apt. (BMNH)

Description. – Apterous specimens. Dimensions length ♂ 3.93, ♀ 4.07-4.11; width (across base of connexiva) ♂ 1.30, ♀ 1.45-1.51; width of head ♂ 0.90, ♀ 0.90-0.91; width of pronotum ♂ 1.12, ♀ 1.29-1.30. Colour generally dark grey to blackish. Orange-yellow transverse band anteriorly on pronotum narrow, reaching the inner margins of eyes. Basal third of first antennal segment, acetabula, coxae and trochanters, basal half to two thirds of anterior femur and basis of hind femur, yellow. Outer rim of con-

nexiva narrowly brown in females, not obvious in male. Venter dull dark grey to black, sternites 7-10 brownish. Minute black denticles restricted to jugum and inner faces of fore and middle acetabula. Interoculus, thoracic and abdominal tergites clothed with dense appressed golden-yellow pilosity much more developed and distinct in male than in females. In addition dorsum of thorax and abdomen with sparse long erect dark cilia. Vertex sides of thorax, antennae and legs with the usual pubescence and setae.

Length of antennal segments (no apparent differences between male and female) I : II : III : IV 0.97 : 0.45 : 0.74 : 0.62. Pronotum long, covering mesonotum. Disk of pronotum with some indistinct punctures, obscured by pilosity, in posterior part. Length: width of pronotum about 1.2 (σ 1.28 / 1.05, f 1.50 / 1.17). Length of metanotum on midline, 0.10. Abdominal tergites 1-6 in male subequal in length (0.20), in female becoming gradually longer posteriorly, (from 0.22-0.30) but mostly covered by connexiva. Tergite 7 over twice as long as preceding tergites in male (0.45); 1.5 times as long as preceding in female (0.45/0.30).

Male. Posterior trochanter length: width 0.4 : 0.2, without teeth or warts. Posterior femur slender, five times as long as wide (1.5/0.3), on ventroposterior margin about halfway with a rather small spine, its length about one sixth the width of femur, with a row of about seven spines of gradually decreasing length distally (fig. 11). Posterior tibia straight, armed beneath with a row of about 20 short stout teeth giving a serrate impression (fig. 11). Connexiva slanting upward about 0.25π or somewhat less, virtually parallel on segments 1-5 strongly converging posteriad on segments 6-7, no caudal points. Basal width of abdominal tergite 7 less than 1.5 times its median length (0.55/0.45). Abdominal sternite 7 comparatively short, about 1.2 times as long as sternite 6 (0.30/0.25), sternite 6 somewhat, sternite 7 distinctly flattened medially, without a carina. Genital segments prominent (fig. 7), fusiform, tergite 8 longer than tergite 7 (0.55/0.45). Sternite 8 laterally compressed at base, resulting in a low broad carina ventrally. Median length of pygophore equal to median length of sternite 8 (0.30). Parameres as in fig. 41.

Female. Posterior femur six times as long as wide (1.5/0.25). Posterior femur and tibia without teeth or spines (fig. 12). Connexiva strongly curved inwards, folded over abdomen leaving on tergites 3-6 only a narrow median strip uncovered (fig. 22). Caudal apex of connexiva truncate with distinct tufts of pilosity; gonocoxae 1 (sternite 8) laterally with well-developed pilosity which anterolaterally forms additional tufts (fig. 22). Tergite 8 nearly horizontal, as long as tergite 7 (0.45) (fig. 32). Sternite 7 large, about two fifth

the length of the preceding abdominal sternites together (0.6/1.5). Gonocoxa clearly visible, about half the length of sternite 7, ventrally compressed, the sides reaching further ventrally than the flattened to somewhat impressed ventral part, forming a pair of lateral ridges. Proctiger large.

Macropterous form. Mostly as apterous except for modifications of the thorax and presence of wings. Dimensions, length σ 4.80-5.08, f 4.92-5.18, hemielytra reaching 0.55-0.67 beyond the apex of abdomen; humeral width of pronotum σ 1.75-1.80, f 1.85-1.90, median length of pronotum σ 1.71-1.78, f 1.75-1.85. Hemielytra dull dark grey to blackish, veins only slightly darker, forming two elongate basal and two more or less squared apical cells. Hind wings dark smoky brown-grey. Laterobasal quarter of hemielytra with golden-yellow pubescence, golden-yellow pubescence on abdominal dorsum restricted to a median band. Pronotum with obtuse humeral angles and a rounded caudal apex. Metanotum with a pair of sublateral pits. Second abdominal tergite with a transverse pitted groove, longitudinal carinae not developed. Caudal tufts of bristles on female abdomen less prominent than in apterous form.

Etymology. – Gyristos, a Greek adjective meaning curved refers to the general body form in females.

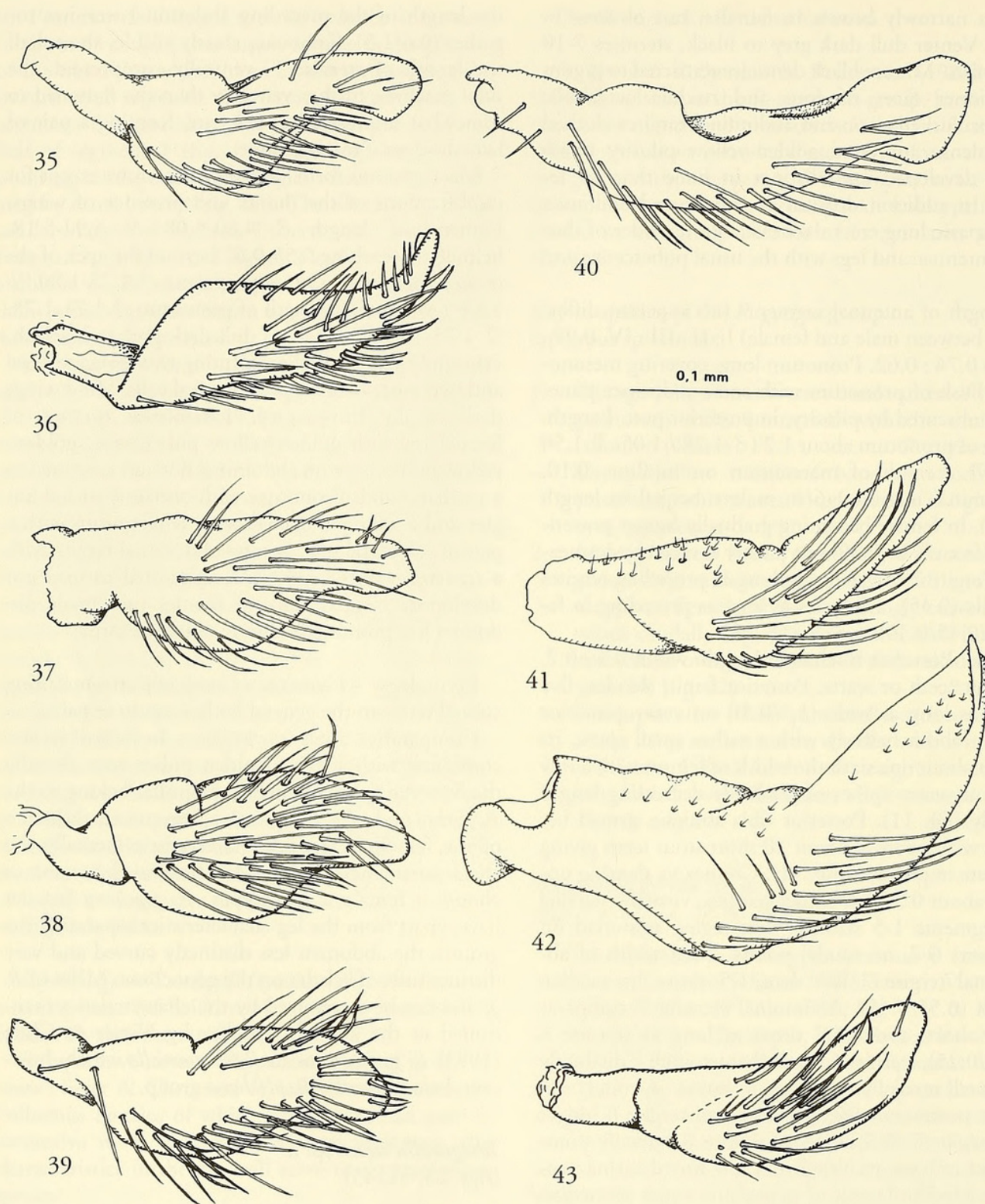
Comparative notes (see keys). – In view of its size combined with striking golden pubescence dorsally the Sulawesi species which look similar belong to the *R. gyrista* and *plychona* groups. The curved abdomen of the female is at once characteristic (actually the characteristic body form of females was the reason to choose a female as holotype). *R. plychona* females have, apart from the leg characteristics separating the groups, the abdomen less distinctly curved and very distinct tufts of bristles on the gonocoxae. Males of *R. gyrista* can be recognized by the characteristics mentioned in the keys. In the key by Nieser & Chen (1993) *R. gyrista* runs to *R. chrysomalla* which, however, belongs to the *R. plychona*-group.

Rhagovelia sterea sp. n.
(figs. 23, 31, 45)

Type material. – Holotype (unique specimen), apterous f (ZMAN), INDONESIA: SW Sulawesi, Mamasa, Sg. Loko, 1400m, 17 Nov 1993, leg. J. P. & M.J. Duffels (fig. 45).

Description. – Apterous female. Dimensions length 3.92, width (across base of connexiva) 1.40, width of head 0.88, width of pronotum 1.25.

Colour generally dark brown-grey to blackish. Anterior fifth of pronotum, propleura and prosternum orange-yellow anterior margin of pronotum



Figs. 35-43. Parameres of *Rhagovelia*: 35 *R. abra*, 36 *R. achna*, 37 *R. krama*, 38 *R. skoura*, 39 *R. tsouloufi*, 40 *R. ochra*, 41 *R. gyrista*, 42 *R. ptychona*, 43 *R. cylindros*.

narrowly dark, reaching halfway eyes. Jugae, basal fourth of first antennal segment, acetabula, coxae and trochanters, basal third of anterior femur laterally and most of its anterior ('under') surface orange-yellow.

Anterior surface of middle and hind femur brownish, depending on incidence of light accentuated by pale pilosity. Outer rim of connexiva, abdominal sternite 7 and most of gonocoxae brown. Venter dull dark

grey to black. Minute black denticles spreading from jugum and prosternum through propleurae to anterolateral parts of pronotum. Body dorsally clothed with short, not very dense golden pilosity, ventral pilosity somewhat longer and denser, yellowish. Vertex, sides of thorax, antennae and legs (except middle and hind femur) with the usual pubescence and setae.

Length of antennal segments I : II : III : IV 0.90 : 0.43 : 0.70 : 0.50. Pronotum long, covering mesonotum. Disk of pronotum with many relatively small punctures. Length: width of pronotum about 0.9 (1.10/1.25). Length of metanotum on midline, 0.10. Abdominal tergites 2-5 subequal in length (0.20), tergites 1 and 6 0.30, tergite 7 0.40.

Posterior trochanter length : width 0.35 : 0.16, without teeth or warts. Posterior femur slender, slightly over five times as long as wide (1.3/0.25), on posterior margin in apical part three small teeth. Posterior tibia straight without teeth. Connexiva vertical, strongly converging on segments 1-4, curved inward on segments 4-5 and slightly convex on segments 6-7, without caudal points or pilosity (fig. 23). Tergites 8 and 9, however, with some bristles partly combined in a tuft. Basal width of abdominal tergite 7 1.25 times its median length (0.50/0.40). Tergite 8 horizontal, as long as tergite 7 (0.40), proctiger fully visible, pointing caudally. Sternite 7 large, slightly less than half as long as the preceding abdominal sternites together (0.6/1.3). Gonocoxa extended, clearly visible, about half the length of sternite 7, ventrally slightly compressed, caudally distinctly hairy (fig. 31).

Male and macropterous form unknown.

Etymology. – Stereos, a Greek adjective meaning solid or stout, refers to the stout build of this species compared to most other *Rhagovelia*.

Comparative notes (see keys). – In the key to groups this species runs to the *gyrista*-group by the structure of the female hind femur which is similar to that of *R. hamjadi* Polhemus & Polhemus, which has also a similar general shape. *R. hamjadi* has, however, the anterior orange band on pronotum narrow, reaching inner eye margins, and is slightly smaller. *R. sterea* has the dorsal golden pubescence less developed than related species.

The *R. plychona*-group

Diagnosis: Large *Rhagovelia*, length 3.8-4.4 mm, ground colour dark grey to blackish, body dorsally with golden pubescence. Posterior legs slender, femur of male without proximal granulate teeth, femur of female not distinctly flattened. Hemelytra unicolorous, hairy in latero-proximal quarter, with four closed cells. Basal dorsal carinae of abdomen in macropterous form not developed.

Distribution: Endemic to Sulawesi.

Remarks. In general habitus, golden pubescence dorsally and slender hind legs the *R. gyrista* and *R. plychona* groups are quite similar. The structural characteristics of the hind legs and basal carinae on abdomen of macropterous form are, however, quite different. Unfortunately no specimen with complete hemelytra is known from the *R. gyrista*-group. *R. chrysomalla* Nieser & Chen (1993) provisionally placed with the *R. papuensis* group by the authors has to be transferred to the *R. plychona*-group.

Key to species of the *R. plychona* group (apterous specimens)

1. Yellow anterior transverse band of pronotum connected with the yellowish propleurae (in some specimens dark spots behind the eyes), connexiva broadly yellowish. Connexiva of female straight, not folded over tergites, abdomen not curved upward, gonocoxae without tufts of long bristles *R. chrysomalla*
- Yellow anterior transverse band on pronotum narrow, at most reaching halfway eyes, propleura dark, connexiva narrowly yellowish brown. Connexiva of female curved inward and folded over tergites (fig. 24), abdomen curved upward (fig. 33), gonocoxae with distinct tufts of long bristles (fig. 24) *R. plychona*

Rhagovelia plychona sp. n.

(figs. 13, 14, 24, 33, 42, 45)

Type material. – Holotype, apterous ♂ (ZMAN), INDONESIA: SW Sulawesi, Karangan, ca. 30 km NE of Enrekang, 1450m, gardens, 10-11 Nov. 1993, leg. J. P. & M. J. Duffels (fig. 45). – Paratypes (adults only) with same data as holotype: 34♂ 20♀ apt., 20♂ 20♀ macr., 22lvIV/V distributed as follows: 1♂ apt., 1♂ macr. JTPC; 1♂ 1♀ apt., 1♂ 1♀ macr. MBBJ; 3♂ 3♀ apt., 3♂ 3♀ macr. NCTN; 2♂ 2♀ apt., 2♂ 2♀ macr. NHMW; 1♂ 1♀ apt., 1♀ macr. OXUM; 1♂ 1♀ apt., 1♂ 1♀ macr. SEMC, remaining specimens including allotype apt. ♀ in ZMAN. – Additional paratypes (adults only): SW. Sulawesi, ca. 30 km NE of Enrekang, Gowa camp. Pos 2. 6-9 Nov. 1993, 3°24'15"S 120°00'30"E. Gunung Rantemario, Sg. Gowa Sarumpa'pa. River through undistd. lower montane forest, w=3-4m, 1800 m asl. J. van Tol, 3♂ 2♀ apt. 12 lvIV/V (RMNH).

Description. – Apterous form. Dimensions. Length ♂ 4.05-4.16, ♀ 4.30-4.42; width ♂ 1.40-1.48, ♀ 1.62-1.68; width of head ♂ 0.93-0.97, ♀ 0.96-1.01; width of pronotum ♂ 1.25-1.31, ♀ 1.48-1.52.

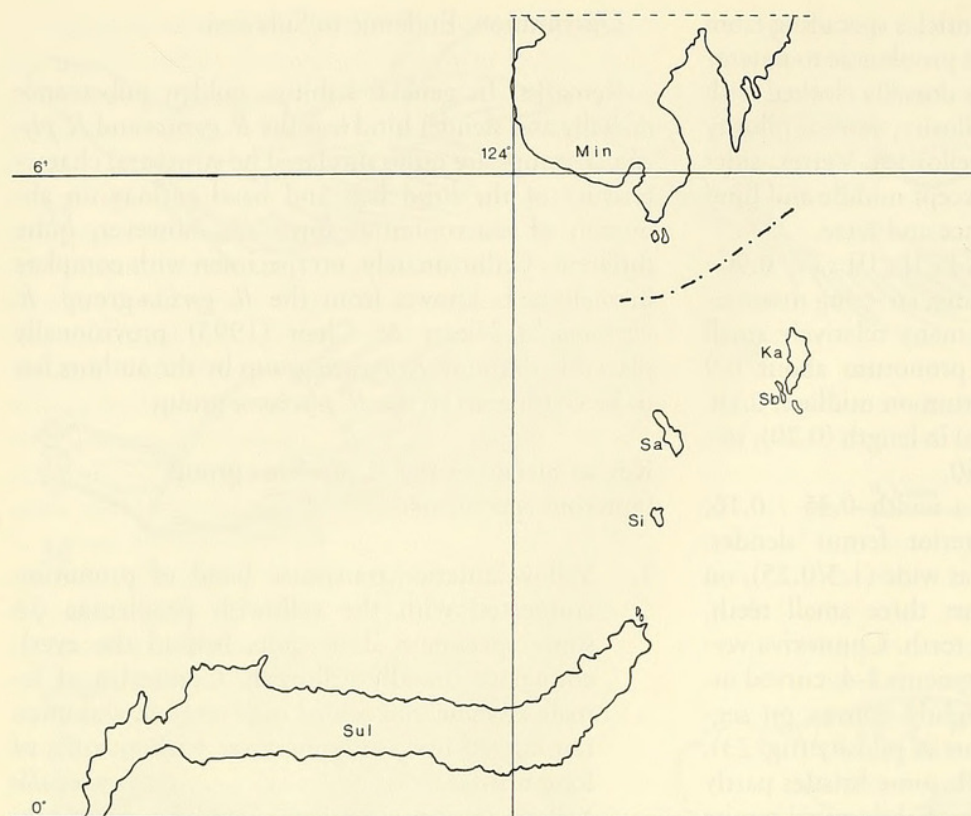


Fig. 44.

Localities of new species of *Rhagoelia*. The more important islands between Sulawesi (Sul), Indonesia and Mindanao (Min), Philippines: Si Siau, Sa Sangihe, type locality of *R. cylindros* and *R. skoura*; Sb Salibabu, type locality of *R. tsouloufi*, Ka Karakelong additional localities of *R. tsouloufi*.

Colour dark grey to blackish, eyes castaneous. Orange-yellow transverse band anteriorly on pronotum narrow, reaching the inner margins of eyes. Basal third of first antennal segment, acetabula, coxae and trochanters (middle trochanter slightly infuscated), basal half to two thirds of anterior femur and in some specimens basis of hind femur, pale. Outer rim of connexiva brown, more distinctly in female than in male. Venter dull dark grey to black, sternites 7-10 brownish in most specimens.

Minute black denticles restricted to jugum and proepisternum. Interoculus, thoracic and abdominal tergites clothed with dense appressed golden-yellow pilosity (this golden pilosity is also present in larva V). In addition dorsum of thorax and abdomen with sparse long erect dark cilia. Vertex sides of thorax, antennae and legs with the usual pubescence and setae except for hind femur and tibia in male which are clothed with long hairs.

Length of antennal segments (no apparent differences between male and female) I : II : III : IV 0.97 : 0.45 : 0.74 : 0.62. Pronotum long, covering mesonotum. Disk of pronotum with some indistinct punctures, obscured by pilosity, in posterior part. Length: width of pronotum about 1.2 (♂ 1.28/1.05, ♀ 1.50/1.17). Length of metanotum on midline, 0.10. Abdominal tergites 1-6 in male subequal in length (0.20), in female becoming gradually longer posteriorly, (from 0.22-0.30) but mostly covered by connex-

iva. Tergite 7 over twice as long as preceding tergites in male (0.45); 1.5 times as long as preceding in female (0.45/0.30).

Male. Posterior trochanter length: width 0.4: 0.2, without teeth or warts. Posterior femur slender, five times as long as wide (1.5/0.3), on ventroposterior margin about halfway with a rather small spine, its length about one sixth the width of femur, with a row of about seven spines of gradually decreasing length distally (fig. 13). Posterior tibia straight, armed beneath with a row of about 20 short stout teeth giving a serrate impression. Connexiva slanting upward about 0.25π or somewhat less, virtually parallel on segments 1-5 strongly converging posteriad on segments 6-7, no caudal points. Basal width of abdominal tergite 7 less than 1.5 times its median length (0.55/0.45). Abdominal sternite 7 comparatively short, about 1.2 times as long as sternite 6 (0.3/0.25), sternite 6 somewhat, sternite 7 distinctly flattened medially, without a carina. Genital segments prominent (fig. 7), fusiform, tergite 8 longer than tergite 7 (0.55/0.45). Sternite 8 laterally compressed at base, resulting in a low broad carina ventrally. Median length of pygophore equal to median length of sternite 8 (0.3). Parameres as in fig. 42.

Female. Posterior femur six times as long as wide (1.5/0.25). Posterior femur and tibia without teeth or spines (fig. 14). Connexiva strongly curved inwards, folded over abdomen leaving on tergites 3-6 only a

narrow median strip uncovered (fig. 24). Caudal apex of connexiva truncate with little pilosity at the tip, however, gonocoxae 1 (sternite 8) distinct tufts of rather long bristles (fig. 33). Tergite 8 nearly horizontal, as long as tergite 7 (0.45). Sternite 7 large, about two fifth the length of the preceding abdominal sternites together (0.6/1.5). Gonocoxa clearly visible, about half the length of sternite 7, ventrally compressed, dorsally with a distinct tuft of bristles. Proctiger distinctly visible.

Macropterous form. Mostly as apterous except for modifications of the thorax and presence of wings. Dimensions, length ♂ 4.80-5.08, ♀ 4.92-5.18, hemielytra reaching 0.55-0.67 beyond the apex of abdomen; humeral width of pronotum ♂ 1.75-1.80, ♀ 1.85-1.90, median length of pronotum ♂ 1.71-1.78, ♀ 1.75-1.85. Hemielytra dull dark grey to blackish, veins only slightly darker, forming two elongate basal and two more or less squared apical cells. Hind wings dark smoky brown-grey. Laterobasal quarter of hemielytra with golden-yellow pubescence, golden-yellow pubescence on abdominal dorsum restricted to a median band. Pronotum with obtuse humeral angles and a rounded caudal apex. Metanotum with a pair of sublateral pits, second abdominal tergite with a transverse pitted groove, longitudinal carinae not developed. Abdomen of female not curved upwards and with caudal tufts of bristles less prominent than in apterous form.

Etymology. – Plichonos, greek adjective meaning pleated, refers to the connexiva folded over dorsum in apterous females of this species.

Comparative notes (see keys). – In view of their general shape and dorsal golden pilosity the species of the *R. gyrsta* and *R. plichona* groups are superficially similar. Especially females of *R. plichona* and *R. gyrsta* look somewhat similar at first glance but are easily distinguishable by inspection of the leg characteristics separating the groups. In addition the curvature of the abdomen and the position of the connexiva are also somewhat different (figs. 22, 24, 32, 33). Other species can also be separated by the characteristics mentioned in the group and species keys. In addition the parameres of *R. chrysomalla* are very slightly broader than those of *R. plichona* but this is only recognizable when specimens are compared. The swollen caudal part of the proctiger is relatively longer in *R. chrysomalla* than in *R. plichona* (length flat basal part/ length swollen apical part 0.34/0.42 and 0.40/0.36 respectively).

The *Rhagovelia orientalis*-group

Diagnosis: Small or medium sized, length up to 3.7 mm, body generally squat, outlines of abdomen strongly convergent caudally*. Females not or only

slightly larger than males. Body colour completely black (except in *R. kastanoparuphe*), except for a small orange spot on anterior part of pronotum. Legs black, usually with a metallic shimmer*, only basal parts yellow in some species, middle and hind femur completely black in most of the species. Juga and proepisterna without black spicules. Pronotum long in apterous specimens, covering the mesonotum. Fore wing of macropterous specimens with three or four closed cells, the distal cells reaching the apical third of the wing. Dealate specimens common*. Abdominal carinae of macropterous specimens reaching the hind margin of tergite 2 at most*. Hind trochanter without teeth or granules, with dense pilosity*. Hind femur of male slightly to moderately thickened, generally with a distal row of teeth, proximally without teeth or granules. Parameres short, crescent-shaped in most of the species. Abdomen with modifications in most of the species, dorsally in females and ventrally in males.

Discussion: This species group is a clearly monophyletic group based on several diagnostic characters (proposed synapomorphies marked with * in diagnosis). It shows the close zoogeographical relations between the Philippines and Sulawesi. Twenty species are known, 14 from the Philippines (Zettel 1995), five from the main island of Sulawesi (Nieser & Chen 1933), and one from Sangihe Isle.

Distribution: Philippines (except Palawan), Sulawesi.

Key to the species of Sulawesi and adjacent islands (apterous specimens and macropterous males)

1. Females 2
- Males 8

Females

2. Hind margin of tergite 7 with a long, finger-like process (fig. 34) 3
- Hind margin of tergite 7 straight or with a short, triangular process 5
3. Process on tergite 7 directed backward, tergite 8 with two distinct tufts of hairs in its posterior corners *R. sulawesiana*
- Process on tergite 7 directed upward, tergite 8 without distinct tufts of hairs 4
4. Hind margin of sternite 7 laterally with long black hairs (fig. 34) *R. cylindros*
- Hind margin of sternite 7 laterally without long hairs *R. daktylophora*
5. Hind margin of tergite 7 straight . *R. celebensis*
- Hind margin of tergite 7 with a small hairy process in middle or broadly protruding 6
6. Connexiva and middle of sternite 7 brown, process of connexivum very long, hind margin of

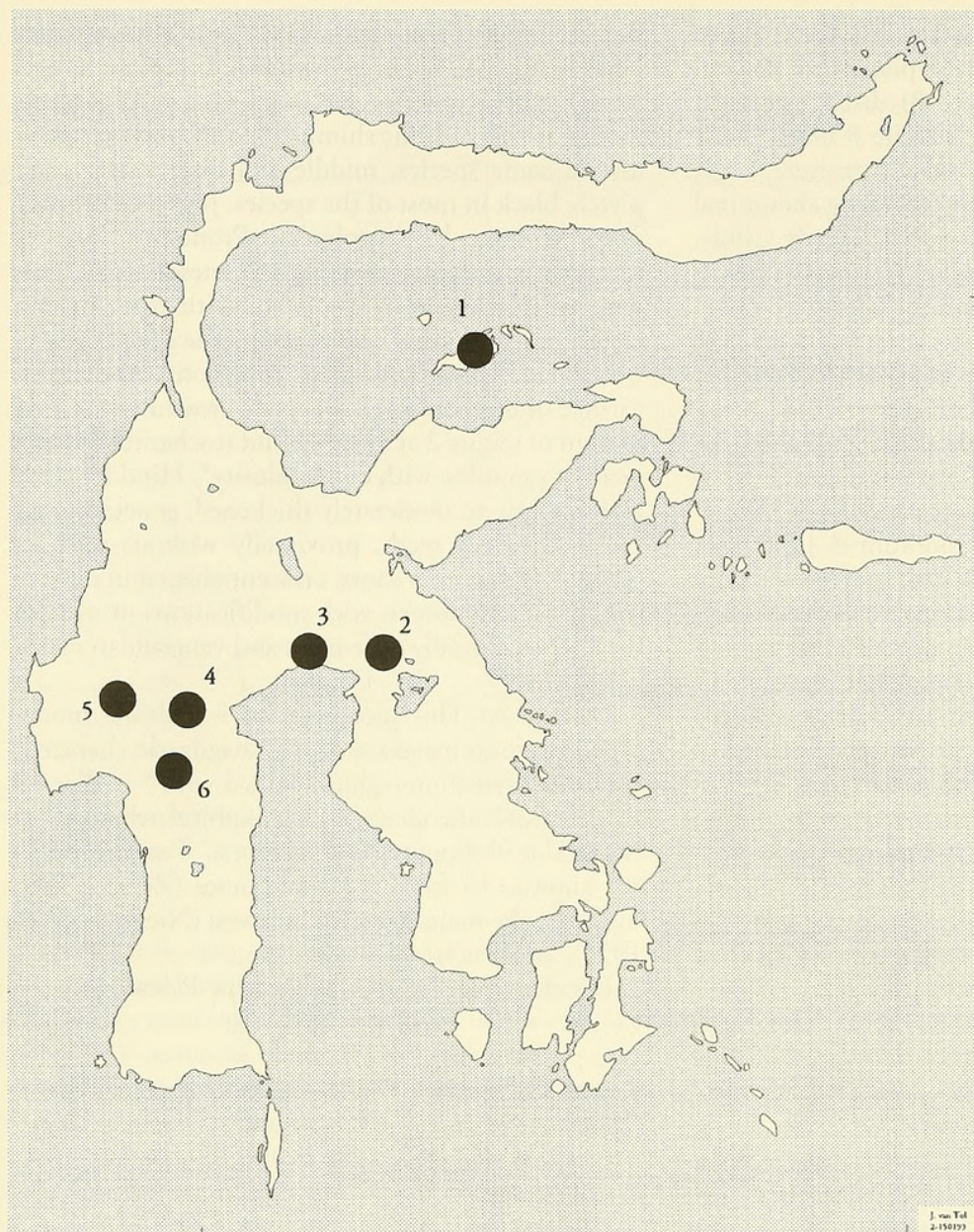


Fig. 45.

Sulawesi proper: 1 *R. achma*, 2 *R. abra*, 3 *R. krama* and *R. ochra*, 4 *R. gyrasta* and *R. sterea*, 5 *R. gyrasta*, *R. plychona*.

- tergite 7 broadly triangular . . . *R. kastanoparuphe*
- Connexiva and middle of sternite 7 in fully developed specimens black 7
- 7. Process of connexivum short, but with long hairs, hind margin of tergite 7 with a very short, hairy process in middle *R. pseudocelebensis*
- Process of connexivum long, acute, process of tergite 7 generally longer *R. daktylophora*

Males

- 8. Sternites without conspicuous long pilosity, middle and hind femur basally yellow, connexiva brown, paramere distally truncate *R. kastanoparuphe*
- Sternites with conspicuous long hairs, middle and hind femur black, connexiva black, parameres distally rounded or pointed 9
- 9. Sternite 6 carinate, long pilosity restricted to this carina *R. daktylophora*

- Sternite 6 not carinate, pilosity different . . . 10
- 10. On sternite 5 and 6, pilosity laterally longer than along median line *R. cylindros*
- On sternite 5 and 6, pilosity along median line as long as or longer than laterally 11
- 11. Sternite 7 weakly carinate, ventral margin strongly concave in lateral view *R. pseudocelebensis*
- Sternite 7 strongly carinate, ventral margin straight in lateral view 12
- 12. Tergite 7 about 1.5 times as long as its basal width *R. sulawesiana*
- Tergite 7 about 1.1 times as long as its basal width *R. celebensis*

Rhagovelia celebensis Polhemus & Polhemus

Rhagovelia celebensis Polhemus & Polhemus 1988: 199-200, figs. 179-186, 229.

Material. – Sulawesi Selatan, E side Lake Matana, Kg. Salura, 2°32'S 121°28'E, 450m, narrow tributary Lake Matana, 15.X.1993, 1♂; same, 20.X.1993, 4♂ 4♀ apterous, leg. J. P. & M. J. Duffels (ZMAN). Sulawesi Utara, Mt. Ambang nr. Kotamobagu, 20 km E of alt. m 1210, 8.XI.1985, leg. J. Krikken, multistr. evergreen forest, soil litter sifted, 1♀ apt. (RMNH).

Rhagovelia kastanoparuphe Nieser & Chen

Rhagovelia kastanoparuphe Nieser & Chen, 1993: 274-275, figs. 30-34, 84.

Nieser & Chen (1993) stated a similarity of *R. kastanoparuphe* and '*R. celebensis* and related forms'. Because of some characters (especially in colour and shape of parameres) which are differing from the other species of the *R. orientalis*-group, this species was provisionally placed in the *R. papuensis*-group, which was regarded polyphyletic. The occurrence of a dealate specimen and most of the distinctive characteristics mentioned in the diagnosis show that *R. kastanoparuphe* can best be placed in the *R. orientalis*-group, although it seems not to be closely related with any other described species in this group.

Rhagovelia pseudocelebensis Nieser & Chen

Rhagovelia pseudocelebensis Nieser & Chen 1993: 275, figs. 35-40, 80-81.

Material. – Sulawesi Selatan, Batusitanduk {2°48'S 120°10'E} N of Palopo, narrow river, 2.XI.1993, leg. J. P. & M. J. Duffels, 4♂ 3♀; 15 km W of Palopo, 2°57'10"S 120°07'30"E, gardens and disturbed rain forest, 30.X.1993, leg. J. P. & M. J. Duffels, 1♀ (ZMAN).

Rhagovelia sulawesiana Polhemus & Polhemus

Rhagovelia sulawesiana Polhemus & Polhemus 1988: 198-199, figs. 158-164, 230.

Material. – Sulawesi Selatan, SW Celebes, 1100m, Mt. Lompobatang area, Malino {ca 5°15'S 119°48'E}, 2, 8-10.VI.1982, M. A. Lieftinck, 5♂ 2♀ apt., 1♂ 1♀ macr. (RMNH).

Although Polhemus & Polhemus (1988) stated the similarities between *R. sulawesiana* and *R. celebensis*, they decided to class them within different groups without explanation. *Rhagovelia celebensis* was correctly regarded as a species of the *R. orientalis*-group, but *R. sulawesiana* as a species of the *R. papuensis*-group. The classification of apterous specimens of these groups may be difficult using the characters given by Polhemus & Polhemus (1988), but the macropterous specimens studied show clearly that *R.*

sulawesiana also belongs to the *R. orientalis*-group. In addition the body shape, the teeth on hind femur, and the lack of spicules on proepisterna and juga are typical for this group. The shape of the paramere of male and the long process of the tergite 7 of female show a close relationship with *R. cylindros* sp.n. and *R. daktylophora*.

Rhagovelia cylindros sp. n.

(figs. 1, 21, 34, 43, 44)

Type material. – Holotype apterous ♀ (ZMAN) INDONESIA: Sulawesi Utara, Pulau Sangihe, Desa Laine, Sungai Laine, 12. Nov. 1994, N9463, leg. N. Nieser (fig. 44). Sungai Laine [different from N9454/56 which is on the other side of the island!], rather large pothole at water fall used for swimming (and picnics on the banks 'proyek wisata = tourist spot'), a lot of *Hydrilla*. *Rhagovelia* at open to moderately open spots. Paratypes (NCTN unless otherwise indicated), same data as holotype, 24♂ 10♀ apterous, 3♂ 5♀ macropterous, distributed as follows: 1♀ apt. (allotype) ZMAN, 1♂ 1♀ apt., 1♂ macr. NHMW, 3♂ 3♀ OXUM. Additional paratypes (adults only) all P. Sangihe and leg. N. Nieser: Desa Simuang (near Malahu), Sungai Simuang, 28.VI.1994, N9457. Mountain stream, water clear, hyaline, boulders, stones, stretches with sand, 1♂ 3♀ apt., 1♀ macr. (RMNH); Desa Utaurano, Sungai Apanukang, 14.XI.1994, N9465. Upstream tributary of S. Laine (N9454 & 56). Mountain stream, bottom boulders, large stones and conglomerate rock, 5-10m wide, depth variable (up to >1m, mostly about 0.3 m), velocity of current variable, 33♂ 32♀ apt., 2♂ macr. (MUDH, SEMC 1♂ 1♀ apt. each); N9465A: Rather large pothole, 40x15m c. 1m deep in mountain stream, virtually stagnant, bottom rock covered with fine silt. Used e.g. for rearing goldfish in cages in the 'pond', 35♂ 15♀ apt., 1♂ 4♀ macr. (2♂ 2♀ apt., 1♂ macr. NHMW, 4♂ 3♀ JTPC, 2♂ 2♀ MBBJ, 2♂ 2♀ USCP).

Description. – Apterous form. Rather small generally dark species. Dimensions. Length ♂ 2.88-3.00, ♀ 3.15-3.40; width (across mesoacetabula) ♂ 1.20-1.30, ♀ 1.32-1.40; width of head ♂ 0.76-0.80, ♀ 0.76-0.80; width of pronotum ♂ 0.98-1.00, ♀ 0.92-1.04.

Colour generally dark grey to black, yellowish transverse band anteriorly on pronotum narrow, reaching to inner margins of eyes, indistinct due to a cover of grey pubescence. Basal third of antennal segment 1, distal part of anterior and posterior acetabula, apical rim of mesoacetabula, anterior and posterior coxae, anterior and part of posterior trochanters and in most specimens variable part proximally of an-

terior femur yellow to light brown. Connexiva entirely grey to black. Pro- and mesopleura except for its dorso-posterior quarter, pruinose, light grey.

Minute black denticles absent. Posterior three quarters of pronotum indistinctly punctured, pleura smooth without recognizable rows of punctures. Vertex, inter oculus, sides of thorax and abdomen, antennae and legs with the usual pubescence and setae. Body clothed with short pubescence, virtually absent laterally in females, superimposed by longer yellow bristles which are especially strongly developed ventrally in males and caudally in both sexes but much more prominent in females (figs. 21, 34).

Length of antennal segments I : II : III : IV ♂ 0.81 : 0.42 : 0.48 : 0.46, ♀ 0.78 : 0.40 : 0.46 : 0.44. Pronotum long, covering mesonotum, shorter than wide (c. {0.8-0.9}/1.0). Length of metanotum on median line, 0.1. Abdominal tergites 1-4 subequal in length (0.15), remaining tergites in female covered by connexiva, in male tergite 5 subequal, 6 slightly (0.2) and 7 distinctly (0.4) longer. Abdominal sternites 3-5 subequal, about 0.15 long, sternites 2 and 6 slightly longer 0.20, sternite 7 distinctly longer, 0.35 in male. Sternite 2-5 subequal, 0.20; 6 slightly (0.25) and 7 distinctly (0.55) longer in female.

Male. Hind femur slightly incrassate, on average slightly over five times as long as wide (1.34/0.26). Ventral margin slightly distally of halfway with a single larger spine, half as long as the width of femur, followed by a double row of about seven small teeth (fig. 1). Posterior tibia virtually straight, armed beneath with a row of about 15 small teeth which are shorter than and covered by the pilosity of the tibia. Connexiva more or less horizontal to slanting slightly upward (less than 0.15π), gradually converging posteriad. Basal width of abdominal tergite 7 three quarters its median length (0.3/0.4). Tergite 8 basally as wide as long (0.35). Abdominal sternites 5 and 6 flattened with an indication of a keel and pilosity laterally longer than medially, sternite 7 ventrolaterally compressed with a distinct though low and comparatively broad, median keel. Parameres as in fig. 43.

Female. Posterior femur as in male, about five times as long as wide (1.23/0.25). Posterior tibia unarmed except for a small apical spine. Connexiva more or less vertical strongly converging on segments 1-5, nearly meeting over abdomen on segment 6 and anterior part of 7, then diverging to make room for the erect finger-like projection on tergite 7 (fig. 21). Apex of connexiva with a triangular caudal projection, caudal margin accentuated by a dense fringe of large bristles (fig. 34). Tergites 8 and 9 vertical, only visible in caudal view.

Macropterous form. – Essentially as apterous form except for development of hemielytra and thorax. Length ♂ 3.40-3.46, ♀ 3.58-3.62, humeral width of

pronotum ♂ 1.28-1.42, ♀ 1.37-1.41, median length of pronotum ♂ 1.18-1.22, ♀ 1.23-1.28. Pronotum black orange-yellow transverse band at anterior margin reaching to inner margins of eyes, rather indistinct due to cover by whitish pubescence. Propleura with a distinct row of punctures near ventro-posterior margin. Hemielytra reaching 0.4 beyond apex of abdomen, brown with darker veins. A pair of elongate proximal cells not reaching halfway hemielytron, an elongate outer apical cell (near costal margin) reaching to one fourth from apex, central cell absent. Keels on base of abdomen well-developed but short, reaching only to about halfway tergite 2. Connexiva of female vertical, not bent over abdomen.

Etymology. – *Cylindros* (kulindros), Greek noun meaning cylinder, referring to the form of caudal part of abdomen in female.

Comparative notes. – This species is closely related with *R. sulawesiana* and *R. daktylophora*, with which it shares the long process on tergite 7 of females. Females differ from *R. sulawesiana* in the upwardly directed process on tergite 7 (posteriorly directed in *R. sulawesiana*), from *R. daktylophora* in the blunt process of connexiva, which are nearly touching each other (but clearly separated in *R. daktylophora*), and from both in the long black hairs laterally on hind margin of sternite 7. Males differ from all the other species of the group in the hairs on sternites 5 and 6 which are laterally longer than medially.

The *Rhagovelia sarawakensis*-group

Diagnosis: Small and slender species, length less than 3 mm. Colour black with a short orange brown band on pronotum. Pronotum in apterous specimens shorter than length of an eye, about one third as long as the exposed mesonotum. Fore wing with three or four closed cells slightly reaching distal half. Abdominal carinae of winged specimens extending posteriorly to tergite 3. In dealate specimens fore wing broken in middle, behind closed cells. Tergite 8 of female horizontal.

Distribution: Sri Lanka, Southeast Asia and South China, Ryukyu Islands, Taiwan, Palawan, Borneo, Sumatera, Java, Bali, Nusa Tenggara.

Only one species, *R. samarinda*, is reported from Sulawesi by the record of a single macropterous female (Polhemus & Polhemus 1988). There are no further records from Sulawesi, and the species group is also not known from other parts of Wallacea including the Philippines (except Palawan). Therefore the authors regard this single record as doubtful.

A single male of *R. sumatrensis* Lundblad, which according to Polhemus (1990) belongs to this group, from Lombok (new record) is deposited in RMNH. As this species was previously recorded from Flores and

Sumbawa (Nieser & Chen 1992) it can probably be found in most of the Nusa Tenggara.

Check list of species groups and species of *Rhagovelia* Mayr known from the province of Sulawesi.

R. papuensis-group

- abra* sp. n.
- achna* sp. n.
- blogiokommena* Nieser & Chen, 1993
- grayi* Polhemus & Polhemus, 1988
- horaia* Nieser & Chen, 1993
- kalami* Nieser & Chen, 1993
- krama* sp. n.
- lorelinduana* Polhemus & Polhemus, 1988
- minahasa* Polhemus & Polhemus, 1988
- ochra* sp. n.
- pruinosa* Polhemus & Polhemus, 1988
- robina* Nieser & Chen, 1993
- skoura* sp. n.
- tsouloufi* sp. n.
- trichota* Nieser & Chen, 1988
- tropidata* Nieser & Chen, 1993
- unica* Polhemus & Polhemus, 1988
- wallacei* Polhemus & Polhemus, 1988

R. gyrista-group

- gyrista* sp. n.
- hamdjadi* Polhemus & Polhemus, 1988

R. plichona-group

- chrysomalla* Nieser & Chen, 1993
- plichona* sp. n.

R. orientalis-group

- celebensis* Polhemus & Polhemus, 1988
- cylindros* sp.n.
- daktylophora* Nieser & Chen, 1993
- kastanoparuphe* Nieser & Chen, 1993
- pseudocelbensis* Nieser & Chen, 1993
- sulawesiana* Polhemus & Polhemus, 1988

R. sarawakensis-group

- ? *samarinda* Polhemus & Polhemus, 1988

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