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## A review of Oriental *Rheotanytarsus* Thienemann & Bause, with descriptions of some new species

(Insecta, Diptera, Chironomidae)

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Ten new Oriental species are described: *R. falcatus* as male and female, and *R. beccus*, *falcpedius*, *koraensis*, *kuantanensis*, *pallidus*, *phaselus*, *sessilipersonatus*, *soelii*, and *verticillus* as males only. Seven species are redescribed: *R. additus* (Johannsen) and *R. trivittatus* (Johannsen) as male, female and pupa, *R. adjectus* (Johannsen) as male and female, and *R. acerbus* (Johannsen), *R. aestuarius* (Tokunaga), *R. madarihatensis*, nom. nov. (for *R. pellucidus* Chaudhuri & Datta, 1994 nec (Walker, 1848), and *R. tamaquartus* Sasa as males only. Specimens of *R. curtistylus* (Goetghebuer), *R. reissi* Lehmann, and *R. orientalis* Moubayed were re-examined. *R. tobaseptidicimus* Kikuchi & Sasa, *R. amamiflavus* Sasa and *R. okisimplex* Sasa were re-examined from literature.

*Rheotanytarsus tumidus* Chaudhuri & Datta is a junior synonym of *R. aestuarius* (Tokunaga). A lectotype is newly designated for *R. additus* (Johannsen). *R. formosae* Kieffer belongs in the genus *Tanytarsus* v. d. Wulp.

The genus *Rheotanytarsus* has recently been tentatively divided into 18 species groups of which 10 occur in the Oriental region. Keys to males and pupae of described Oriental *Rheotanytarsus* are given, and zoogeography is discussed.

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### Introduction

The larvae of *Rheotanytarsus* are rheobiontic, filter-feeding using nets suspended between arms at the anterior end of their characteristic cases (Pinder & Reiss 1983). The larvae live in moderately fast to moderately slow flowing rivers, streams, creeks and ponds. The larvae of the *trivittatus* group, however, live in temporary, stagnant waters. The genus is particularly plentiful, both in numbers of species and in individuals, in tropical rain forests (Kyerematen 1996).

Up to now 94 species of *Rheotanytarsus* have been described, from all zoogeographical regions except the Antarctic. In an unpublished manuscript by Sæther & Kyerematen, the species were tentatively grouped into 21 more or less distinct groups of which 10 occur in the Oriental region. Prior to the present authors' review, sixteen described species had been recorded from this region, most of them also as pupae. In a previous paper (Kyerematen et al. 2000), the *pellucidus* group was treated and *R. minusculus* Kyerematen described from Thailand. This group also includes two species previously

recorded from the Oriental region, *R. thailandensis* Moubayed and *R. oss* Cranston. In the present paper we describe 10 new species, redescribe 7, and give comments on the remaining Oriental species.

After completion of the work presented here the authors have been made aware of several additional new species and undescribed life stages. Undoubtedly, this review still covers only a fraction of the *Rheotanytarsus* fauna present in the Oriental region.

### Methods, terminology and material

The general terminology follows Sæther (1977, 1980). The counts of setae on the wing veins include both dorsal and ventral setae, setae which stand at the margin of a vein are regarded as belonging to the vein. The broad, flattened setae of the pupal exuviae are called taeniae in accordance with Langton (1994).

Meristic data are given as the observed range, followed by a mean when four or more measurements were made, followed by the number of measurements in parentheses. Linear measurements are given in  $\mu\text{m}$  unless stated.

The types and other material examined are from The Natural History Museum, London, England (BMNH); the Deutsches Entomologisches Institut, Eberswalde, Germany (DEI); the Zoologische Staatssammlung Munich, Germany (ZSM); the Burdwan University Entomological Collection, West Bengal, India (BUEC); the collection of Xinhua Wang, Nankai University, Tianjin, China (XW); and the collection of Joël Moubayed, Montpellier, France (JM). Some of this material are uncleared full mounts on which it is not possible to see all details such as the tentorium and the stipes, and several other measurements might be slightly doubtful. The type material of all newly described species is deposited in the Museum of Zoology, Bergen, Norway (ZMBN).

### Genus *Rheotanytarsus* Thienemann & Bause

*Syantanytarsus* (*Rheotanytarsus*) Thienemann & Bause in Bause, 1913: 120.

*Tanytarsus* (*Rheotanytarsus*) auct.

*Rheotanytarsus* Thienemann & Bause; Fittkau 1960: 397.

Type species. *Tanytarsus pentapoda* Kieffer, 1909 by subsequent designation of Goetghebuer (1954: 132).

**Diagnosis.** As in Pinder & Reiss (1983, 1986), Cranston et al. (1989), Sæther (1977), and Kyerematen (1996).

### Systematics

The described species of the genus can be grouped into 21 more or less distinct groups (Sæther & Kyerematen, unpublished). Many species remain to be associated and placement of all adult specimens is not possible for the moment. However, some features allow placement of some of the species.

Type material (from DEI) of *R. formosae* Kieffer, 1921 from Taiwan was examined and the species found to belong to the genus *Tanytarsus* v. d. Wulp. The new combination, *T. formosae* (Kieffer, 1921), is a homonym of *T. formosae* Kieffer, 1912 which according to Ekrem (1998) is a junior synonym of *Tanytarsus formosanus* Kieffer, 1912. The type material of *T. formosae* (Kieffer, 1921) has been re-examined by Torbjørn Ekrem (pers. comm.) and shown to contain two species both different from *T. formosanus*.

**Key to adult males of Oriental *Rheotanytarsus* Thienemann & Bause**

1. Median volsella very long, extending beyond apex of inferior volsella ..... 2.  
 – Median volsella shorter, not extending beyond apex of inferior volsella ..... 4.
2. Median volsella apically with two distinct plates (Figs 2A-C). Indonesia ..... *adjectus* (Johannsen)  
 – Median volsella with distal lamelliform setae never fused into plate ..... 3.
3. Anal tergite bands transverse; superior volsella with single apicolateral seta in addition to 3 stronger median setae; anal point narrow (Kyerematen et al. 2000: figs 57-60). Thailand .....  
 ..... *minusculus* Kyerematen  
 – Anal tergite bands V-shaped; superior volsella with 2-5 apicolateral setae in addition to 3 stronger median setae; anal point broad (Cranston 1997: figs 2, 7b; Kyerematen et al. 2000: figs 45-48). Australia, Thailand ..... *oss* Cranston
4. Tergite IX posterior margin with projections or shoulders to each side; median volsella not reaching apex of superior volsella ..... 5.  
 – Tergite IX posterior margin triangular, rounded, or at most straight ..... 6.
5. Tergite IX posterior margin with well pronounced projections (Figs 4A-C). Indonesia .....  
 ..... *additus* (Johannsen)  
 – Tergite IX without such projections, but with distinct shoulders (Figs 4D-H). Indonesia, Australia ..... *trivittatus* (Johannsen)
6. Digitus well developed, extending beyond margin of superior volsella at least in some views . 7.  
 – Digitus small or absent, not extending beyond margin of superior volsella ..... 12.
7. Median volsella not reaching apex of superior volsella; if gonostylus abruptly tapered distally, then apical portion nearly completely parallel-sided and straight ..... 8.  
 – Median volsella at least reaching apex of superior volsella; if gonostylus abruptly tapered, then apical portion not parallel-sided and straight ..... 11.
8. Superior volsella with knob- or hook-like posterior extension ..... 9.  
 – Superior volsella rounded, ovoid, oblong or thumb-like ..... 10.
9. Gonostylus abruptly tapered with parallel-sided apical portion; superior volsella with posterior extension hook-like; apex of anal point broad (Lehmann 1970: figs 26-29). Europe, Lebanon, ?Thailand ..... *reissi* Lehmann  
 – Gonostylus not abruptly tapered; superior volsella with posterior extension knob-like; apex of anal point spatulate (Moubayed 1989: figs 9-10). Thailand ..... *orientalis* Moubayed
10. Anal point spatulate (Sasa 1993: figs 10.6, 10.7). Japan (Okinawa) ..... *okisimplex* Sasa  
 – Anal point tapering (Sasa 1990: fig. 11). Japan (Nansei Islands)..... *amamiflavus* Sasa
11. Gonostylus abruptly tapered with apical portion curved; superior volsella with large, bluntly triangular posterior extension; median volsella apparently without apical plate (Figs 2D-G). Indonesia, China, India ..... *acerbus* (Johannsen)  
 – Gonostylus not abruptly tapered; superior volsella subquadrangular; median volsella with wide apical plate (Figs 3A-D). Japan, China ..... *tamaquartus* Sasa
12. Abdomen banded; anal point crests long, proximally fused forming an arc; superior volsella rounded; median volsella without plate; gonostylus not abruptly tapered (Figs 1A-D; Sasa & Kikuchi 1995: plate 40A, figs 1A-D). Japan, China, India ..... *aestuarius* (Tokunaga)  
 – Abdomen not banded; hypopygium not with above configuration ..... 13.
13. Gonostylus more or less abruptly tapered, with distinctly parallel-sided apical portion or with curved apex; superior volsella with pronounced posterior extension; median volsella extending beyond apex of superior volsella ..... 14.

- If gonostylus abruptly tapered, then without parallel-sided or curved apex ..... 15.
- 14. Gonostylus with apical portion distinctly parallel-sided; superior volsella with posterior extension long, digitiform (Figs 6E-H). Malaysia ..... *phaselus*, spec. nov.
- Gonostylus with apex curved; superior volsella with posterior extension broad and rounded (Moubayed 1990: figs 1-2, Kyerematen et al. 2000: figs 20-23). Thailand ..... *thailandensis* Moubayed
- 15. Antenna with 12 flagellomeres; wing length < 0.9 mm; superior volsella rounded; gonostylus not abruptly tapered ..... 16.
- Antenna with 13 flagellomeres; wing length usually > 0.9 mm ..... 17.
- 16. Apex of anal point narrow (Figs 2H-K); thorax pale. Malaysia ..... *kuantanensis*, spec. nov.
- Apex of anal point broad (Figs 7I-L); thorax pale to dark. Malaysia, India ..... *madarihatensis*, nom. nov.
- 17. Tergite IX posterior margin straight; anal tergite bands V-shaped and medially joined; AR > 0.6 (Kikuchi & Sasa 1990: fig. 23). Indonesia ..... *tobaseptidecimus* Kikuchi & Sasa
- Tergite IX posterior margin triangular or rounded; if anal tergite bands V-shaped, then not medially joined ..... 18.
- 18. Apex of anal point spatulate; gonostylus tapering abruptly or gradually ..... 19.
- Apex of anal point parallel-sided or tapering; gonostylus tapering gradually ..... 24.
- 19. Superior volsella with pronounced, hook-like posterior extension (Figs 3I-L). Thailand ..... *falcipedi*, spec. nov.
- Superior volsella rounded ..... 20.
- 20. Gonostylus tapering gradually ..... 21.
- Gonostylus abruptly tapered in apical portion ..... 23.
- 21. Anal point crests proximally fused, forming an arc (Figs 4I-L). Thailand ..... *beccus*, spec. nov.
- Anal point crests V-shaped ..... 22.
- 22. Median volsella short, not reaching apex of superior volsella; basal anal tergite bands present (Figs 7A-D). Thailand ..... *falcatus*, spec. nov.
- Median volsella reaching beyond apex of superior volsella; basal anal tergite bands absent (Lehmann 1970: figs 2-4). Europe, Lebanon, ?Thailand ..... *curtistylus* (Goetghebuer)
- 23. Median volsella recurved, AR about 0.7 (Figs 1E-H). Thailand ..... *sessilipersonatus*, spec. nov.
- Median volsella not markedly recurved, AR about 0.4 (Figs 1I-L). Thailand ..... *soelii*, spec. nov.
- 24. Median volsella not reaching beyond apex of superior volsella; anal point crests V-shaped .... 25.
- Median volsella extending beyond apex of superior volsella; anal point crests proximally fused, forming an arc (Figs 6A-D). Thailand ..... *pallidus*, spec. nov.
- 25. Anal point broad, parallel-sided; AR about 0.1-0.3 (Figs 6I-L). Thailand ..... *koraensis*, spec. nov.
- Anal point lanceolate; AR about 0.3-0.4 (Figs 3E-H). Thailand ..... *verticillus*, spec. nov.

#### Key to known pupae of Oriental *Rheotanytarsus* Thienemann & Bause

- 1. Tergite VIII with caudolateral comb; T II-V with anterior paired patches of spinules; thoracic horn with knee-like bend, heavily sclerotized ..... 2.
- Tergite VIII with single spur; T II-IV, II-V or II-VI with paired patches of spinules; thoracic horn may be sharply bent, but not knee-like ..... 3.

2. Hook row of about 90 hooklets; anal lobe fringe of much less than 20 taeniae (Figs 5A-F). Indonesia ..... *additus* (Johannsen)
- Hook row of 60-70 hooklets; anal lobe fringe of about 20 taeniae (Figs 5G-L). Indonesia, Australia ..... *trivittatus* (Johannsen)
3. Thoracic horn sharply bent at midlength; tergites II-IV with oral, paired, rounded patches of spinules ..... 4.
- Thoracic horn not sharply bent; tergites II-V or II-VI with spinule patches ..... 5.
4. Tergite VIII with 3 lateral taeniae (Moubayed 1990: figs 3-6; Kyerematen et al. 2000: figs 28-31). Thailand, Malaysia ..... *thailandensis* Moubayed
- Tergite VIII with 5 lateral taeniae (Cranston 1997: figs 7b, 9j). Thailand, Australia ..... *oss* Cranston
5. Tergites II-VI with sharply defined, paired spinule patches ..... 6.
- Sharply defined patches of spinules limited to tergites II-V ..... 7.
6. Anal lobe with one long dorsal seta; thoracic horn with few fine spinules (Lehmann 1970: fig. 5). Europe, Lebanon, ?Thailand ..... *curtistylus* (Goetghebuer)
- Anal lobe with two short dorsal setae; thoracic horn with many fine spinules in distal half (Moubayed 1989: figs 11-16). Thailand ..... *orientalis* Moubayed
7. Anal lobe without dorsal setae; distal half of thoracic horn with many spinules. Indonesia ..... *adjectus* (Johannsen)
- Anal lobe with long dorsal setae; distal half of thoracic horn with few to many spinules ..... 8.
8. Tergites II and III with transversely elongated or rectangular spine patches (Lehmann 1970: fig. 24). Europe, Lebanon, ?Thailand ..... *reissi* Lehmann
- Tergites II and III with circular or elliptical spine patches (Sasa 1980: plate 12). China, Japan ..... *tamaquartus* Sasa

## The species

### The *aestuarius* group

The group is characterised by the banded abdomen (otherwise found only in the Afrotropical *R. ceratophylli* (Dejoux) and in *R. trivittatus* (Johannsen) which, however, have projections or shoulders to each side of the anal point), by an anal point with long, proximally fused crests (otherwise found in the *trivittatus* group, in *R. pallidus*, spec. nov., and in *R. tamasecundus* Sasa), by an ovoid superior volsella, and median volsellae with setae not fused into an apical plate.

### *Rheotanytarsus aestuarius* (Tokunaga) (Figs 1A-D)

*Tanytarsus aestuarius* Tokunaga, 1938: 360.

*Rheotanytarsus aestuarius* (Tokunaga); Sasa & Kikuchi 1986: 26; Wang & Zheng 1993: 91; Sasa & Kikuchi 1995: 133.

*Rheotanytarsus tumidus* Chaudhuri & Datta in Chaudhuri et al., 1994: 153, **syn. nov.**

**Material examined.** Holotype ♂ of *R. tumidus* Chaudhuri & Datta (BUEC type No. 196), INDIA: West Bengal, Alipurduar, 26°25'N, 91°5'E, 609 m a.s.l., pond side, 15.IV.1987, A. K. De.

**Diagnosis.** The banded abdomen combined with a spatulate anal point, gradually tapering gonostylus, and the absence of caudolateral anal tergite projections separates the species from all other known members of the genus.

## Description

### Adult male (n=1).

Wing length 1.35 mm. Wing length / length of profemur 1.86. Abdomen yellow, tergites caudally with dark transverse bands.

Head. AR 0.83; Fm13 length 405. Temporal setae 9, including 2 inner verticals, 5 outer verticals, and 2 postorbitals. Clypeus with 20 setae. Tentorium length 131, 30 wide at sieve pore. Palpomere lengths 30, 34, 90, 105, 131; Pm5/Pm3 1.46.

Thorax. Acrostichals 13, dorsocentrals 7, scutellars 6.

Wing. VR 1.44. Sc and M bare, R with 23 setae, R<sub>1</sub> 32, R<sub>4+5</sub> 66, RM 2, M<sub>1+2</sub> 64, M<sub>3+4</sub> 44, Cu 20, setae on other veins not countable. Cell m with 12 setae, r<sub>4+5</sub> about 250, m<sub>1+2</sub> about 220, setae in other cells not countable.

Legs. Spur of fore tibia 23 long including 8 of basal scale, spurs of mid ti 30 and 34 long including 15 of comb, hind ti spurs 38 and 42 including 19 of comb. Width at apex of fore ti 34, mid ti 38, hind ti 41. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	728	387	—	—	—	—	—	—	—	—	—
p <sub>2</sub>	690	524	298	161	118	76	52	0.57	3.72	4.08	7.3
p <sub>3</sub>	765	662	444	250	284	137	66	0.67	3.60	3.21	7.3

Hypopygium (Figs 1A-D). Anal tergite bands V-shaped, not fused. Tergite IX with about 6 weak dorsal setae anterior of anal point, and 6 caudal setae around the latter. Anal point 90 long, spatulate; crests well developed, proximally fused forming an arc. Phallapodeme 90 long, transverse sternapodeme 53 long. Gonocoxite 113 long, gonostylus 105 long. Superior volsella (Fig. 1C) 49 long, apically rounded; inferior volsella 68 long; median volsella (Fig. 1D) 68 long, with 3 foliate, about 3 subulate, and several simple distal setae. HR 1.07.

**Remarks.** Measurements from the holotype of *R. tumidus* do not quite agree with all those given for *aestuarius* by previous authors. No type specimen of Tokunaga's species has been seen for the present study, but the characteristic coloration combined with an apparently identical hypopygium are considered sufficient for synonymization.

**Distribution.** Japan, China and India (Wang & Zheng 1993, Sasa & Kikuchi 1995).

### The pentapoda group

The pupae have tergites II-VI with paired anterior circular patches of spines, tergite II bare or with posterior shagreen not arranged into two groups, and anal lobe without dorsal seta.

The male adults have basal tergite bands and V-shaped anal tergite bands; spatulate or narrow and tapering anal point with V-shaped crests; superior volsella with reduced digitus except in the Afrotropical *R. samaki* Lehmann; median volsella extending beyond superior volsella but not reaching apex of inferior volsella, and with apical plates; and abruptly tapered gonostylus (except in *R. samaki*) with the apical portion not parallel-sided.

### *Rheotanytarsus sessilipersonatus*, spec. nov.

(Figs 1E-H)

**Material examined.** Holotype: ♂ (ZMBN type No. 324; slide-mounted in Canada balsam), THAILAND: Krabi Province, Tham Pheung, 19-23.I.1997, Malaise trap, L. O. Hansen / G. E. E. Söli.

**Diagnosis.** The combination of a recurved median volsella reaching beyond the superior but not to the apex of the inferior volsella, triangular posterior margin of tergite IX, reduced digitus, oval superior volsella, spatulate anal point, and abruptly tapering gonostylus will separate the species from other members of the genus.

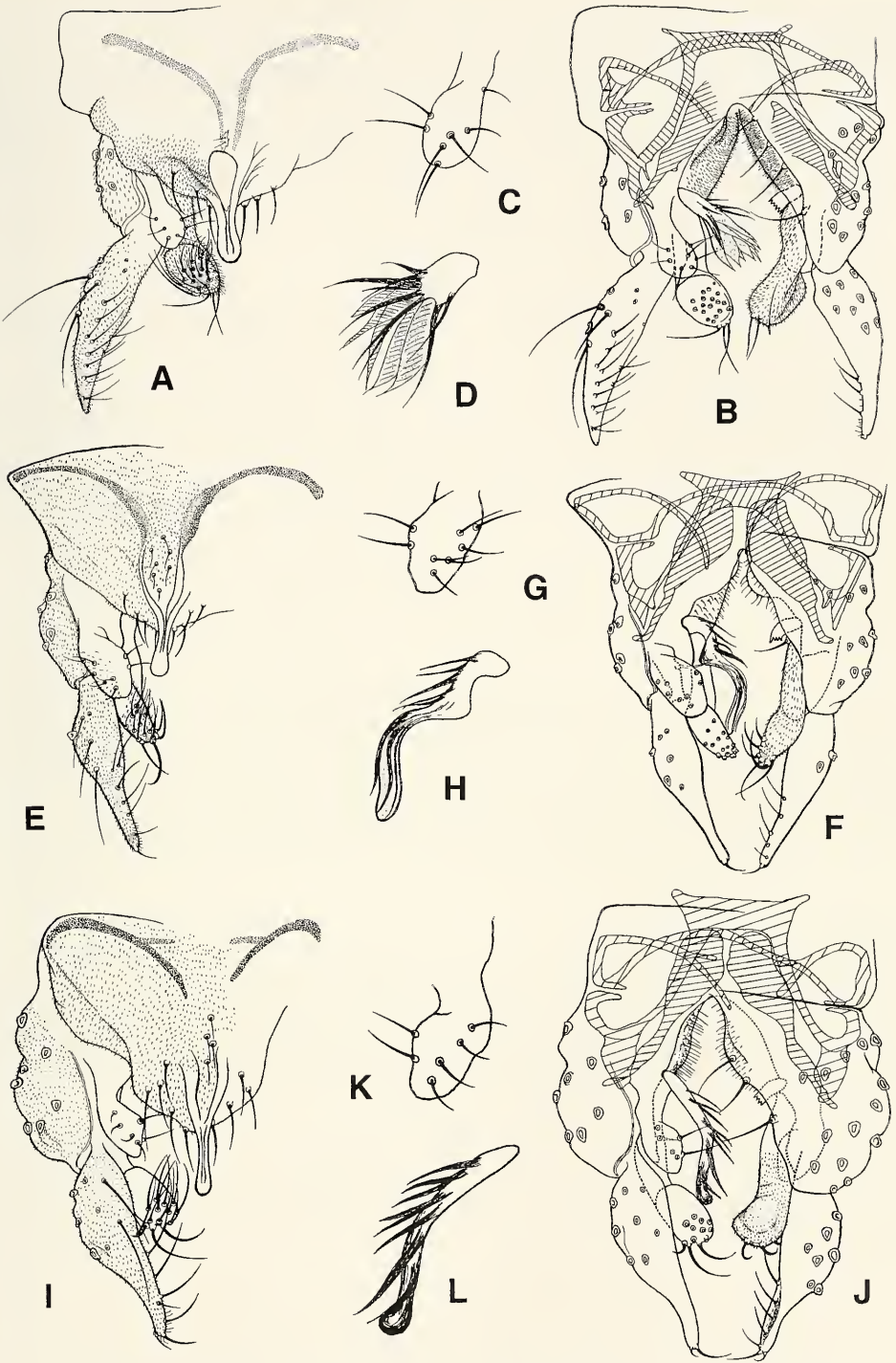


Fig. 1. Male genitalia of *Rheotanytarsus aestuarius* (Tokunaga) (holotype of *R. tumidus* Chaudhuri & Datta). (A-D); *R. sessilipersonatus*, spec. nov. (E-H); *R. soelii*, spec. nov. (I-L). A, E, I. Hypopygium, dorsal aspect. B, F, J. Hypopygium, tergite IX removed; left: dorsal, right: ventral. C, G, K. Superior volsella. D, H, L. Median volsella.

**Description**

**Adult male (n=1).**

Total length 2.24 mm. Wing length 1.27 mm. Total length / wing length 1.76. Wing length / length of profemur 1.71. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.72; Fm13 360 long. Temporal setae 7, including 3 inner verticals, 2 outer verticals and 2 postorbitals. Clypeus with 15 setae. Tentorium 70 long, 20 wide at sieve pore, 8 wide at posterior tentorial pit. Stipes 86 long, 20 wide. Palpomere lengths 30, 30, 70, 80, 136; Pm5/Pm3 1.94.

Thorax. Acrostichals 10, dorsocentrals 11, scutellars 3.

Wing. VR 1.47. Sc and M bare, R with 17 setae, R<sub>1</sub> 28, R<sub>4+5</sub> 57, RM 1, M<sub>1+2</sub> 65, M<sub>3+4</sub> 28, Cu 15, Cu<sub>1</sub> 20, PCu 43, An 21. Cell m with 6 setae, r<sub>4+5</sub> about 250, m<sub>1+2</sub> about 200, m<sub>3+4</sub> about 110, cu and an combined about 100.

Legs. Spur of front tibia 16 long, spurs of mid ti 22 and 32 long including 12 of comb, hind ti spurs 40 and 42 long including 14 of comb. Width at apex of front ti 40, mid ti 34, hind ti 42. Lengths of front to hind femur 744, 664, 752; of front to hind tibia 320, 488, 584; all tarsi lost.

Hypopygium (Figs 1E-H). Anal tergite bands V-shaped, not fused. Tergite IX with 7 dorsal setae between anal tergite bands, and with 9 caudal setae around base of anal point. Anal point 62 long, 26 wide at base, 10 wide at apex; crests well developed, V-shaped. Phallapodeme 76 long, transverse sternapodeme 40 long. Gonocoxite 100 long, gonostylus 90 long. Superior volsella (Fig. 1G) 40 long, oval; inferior volsella 78 long; median volsella (Fig. 1H), markedly curved and long (70), almost reaching apex of inferior volsella, with subulate setae fused into plate without apical points. HR 1.11, HV 2.49.

**Etymology.** Referring to the shape of the median volsella which looks like a seated person.

**Distribution.** Known only from southern Thailand.

*Rheotanytarsus soelii*, spec. nov.

(Figs 1I-L)

**Material examined.** Holotype: ♂ (ZMBN type No. 325; slide-mounted in Canada balsam), THAILAND: Krabi Province, Tham Pheung, 19-23.I.1997, Malaise trap, L. O. Hansen / G. E. E. Söli.

**Diagnosis.** The species can be separated from *R. sessilipersonatus* by having a lower AR (about 0.4 vs about 0.7) and the median volsella not markedly recurved.

**Description**

**Adult male (n=1).**

Total length 2.06 mm. Wing length 1.18 mm. Total length / wing length 1.75. Wing length / length of profemur 1.73. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.43; Fm13 228 long. Temporal setae 8, including 3 inner verticals, 3 outer verticals and 2 postorbitals. Clypeus with 15 setae. Tentorium 60 long, 14 wide at sieve pore, 8 wide at posterior tentorial pit. Stipes 80 long, 18 wide. Palpomere lengths 32, 32, 80, 92, Pm5 lost.

Thorax. Acrostichals 14, dorsocentrals 9, scutellars 3.

Wing. VR 1.62. Sc and M bare, R with 12 setae, R<sub>1</sub> 28, R<sub>4+5</sub> 53, RM 2, M<sub>1+2</sub> 58, M<sub>3+4</sub> 29, Cu 15, Cu<sub>1</sub> 15, PCu 46, An 29. Cell m with 6 setae, r<sub>4+5</sub> about 250, m<sub>1+2</sub> about 200, m<sub>3+4</sub> about 110, cu and an combined 83.

Legs. Spur of front tibia 18 long, spurs of mid ti 29 and 28 long including 12 of comb, hind ti spurs 26 and 30 long including 16 of comb. Width at apex of front ti 40, mid ti 32, hind ti 46. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	680	304	896	400	280	232	88	2.95	1.88	1.10	—
p <sub>2</sub>	600	440	240	112	72	32	32	0.54	5.16	4.33	7.5
p <sub>3</sub>	648	608	344	168	176	112	64	0.57	3.08	3.65	7.6

Hypopygium (Figs 1I-L). Anal tergite with medially interrupted basal tergite band and well developed, separate, V-shaped anal tergite bands; with 4 dorsal and 9 caudal setae. Anal point 56 long,



19 wide at base, 4 wide at apex; crests well developed, V-shaped. Phallapodeme 73 long, transverse sternapodeme 31 long. Gonocoxite 93 long, gonostylus 71 long. Superior volsella (Fig. 1K) 33 long, oval; inferior volsella 69 long; median volsella (Fig. 1L) 54 long, reaching beyond apex of superior volsella, with distal subulate setae fused into ovoid plate without apical points. HR 1.30, HV 2.90.

**Etymology.** Named after Dr. Geir E. E. Söli who collected the holotype.

**Distribution.** Known only from southern Thailand.

### The *photophilus* group

The pupae of this group are characterised by a thoracic horn with median bend and points in the distal half, tergites II-V with circular anterior spine patches, an undivided posterior shagreen patch on tergite II, and an anal lobe without dorsal setae.

The males have antennal ratio lower than 2.0; at least 4 setae between anal tergite bands; spatulate or broad and parallel-sided anal point with V-shaped crests; superior volsella usually with posterior extension; median volsella reaching apex of inferior volsella, with apical setae fused into plate(s) with or without apical points; and gonostylus abruptly tapered in apical portion – except in *R. adjunctus* (Johannsen) – or occasionally with parallel-sided apical portion.

### *Rheotanytarsus adjunctus* (Johannsen) (Figs 2A-C)

*Tanytarsus adjunctus* Johannsen, 1932: 547.

*Rheotanytarsus adjunctus* (Johannsen); Thienemann in Zavrel 1934: 146, 153, 154.

**Material examined.** 4♂♂, 2♀♀ syntypes (all INDONESIA, leg. A. Thienemann, at BMNH): 1♂ (B3=101, B.M. 1937-703), W. Java, Buitenzorg, Botanical Garden, tributary to Tjiliwong River, 11.IX.1928; 1♀ (B4, B.M. 1937-703), as previous except from outlet of acid pond; 1♂, 1♀ (B21, B.M. 1937-703), as previous except from Hotel Bellevue, outlet of swimming pool, 15.IX.1928; 2♂♂ (144, B.M. 1937-703), E. Java, tributary to Ranu Lamongan, 12.X.1928.

**Diagnosis.** The species can be separated from other members of the genus by having a long median volsella reaching apex of inferior volsella and carrying two apical plates.

### Description

**Adult male** (n=3-4 except when otherwise stated).

Total length 1.74-2.07, 1.95 mm. Wing length 0.99-1.15, 1.10 mm. Total length / wing length 1.75-1.80, 1.78. Wing length / length of profemur 1.57-1.62, 1.60. Thorax pale yellow, possibly greenish in life, with vittae only feebly indicated.

Head. AR 0.32-0.40; Fm13 165-180 long. Temporal setae 7-8 (2), including 2 inner verticals, 2-3 outer verticals and 3 postorbitals. Clypeus with 14-19 (2) setae. Tentorium and stipes not measurable. Palpomere lengths 30-34, 32; 34-45, 40; 79-94, 86; 81-90, 88; 158-188.

Thorax. Acrostichals 18-20, 20; dorsocentrals 9-10, 10; scutellars 4.

Wing. VR 1.47-1.64. Sc and RM bare, R with 13-17 setae, R<sub>1</sub> 19-30, R<sub>4+5</sub> 41-52, M 1-2, M<sub>1+2</sub> 45-55, M<sub>3+4</sub> 26-32, Cu 22-26, Cu<sub>1</sub> 15-20, PCu 50-60, An 20-25 (2). Cell m with 10-25 setae, r<sub>4+5</sub> and m<sub>1+2</sub> each with more than 200, setae in other cells not countable.

Legs. Spur of front tibia 19-30, 25 long; spurs of mid ti 32-34, 34 long including 15-19, 18 of comb; hind ti spurs 34-38, 36 long including 19 of comb. Width at apex of front ti 34-39, 37; mid ti 32-34, 34; hind ti 41. Sensilla chaetica 3-5 at apical 0.13-0.30. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>
P <sub>1</sub>	633-728, 688	284-350, 324	638	321	255	194	85
P <sub>2</sub>	605-709, 666	416-482, 459	236-274	113-132	85-104	57-66	43-47
P <sub>3</sub>	652-756, 714	501-605, 559	312-338	198-250	198-236	109-137	61-66

	LR	BV	SV	BR
p <sub>1</sub>	1.57	1.82	1.44	3.8
p <sub>2</sub>	0.56-0.57	4.17-4.22	4.32-4.76	4.2-4.8
p <sub>3</sub>	0.62-0.66	2.51-2.61	3.45-3.70	-

Hypopygium (Figs 2A-C). Anal tergite bands V-shaped, separate. Tergite IX triangular; with 12-15, 14 dorsal and 6-8, 7 caudal setae. Anal point 38-49, 43 long; crests well developed, separate to near apex. Phallapodeme 75-90 long, transverse sternapodeme 41 (1) long. Gonocoxite 109-120, 112 long; gonostylus broad, gradually tapering, 101-109, 106 long. Superior volsella (Fig. 2B) 38-45, 40 long; inferior volsella 75-79, 77 long; median volsella (Fig. 2C) 71-75, 74 long, with distal setae fused into double plate. HR 1.00-1.10, 1.06, HV 1.72-2.01, 1.85.

#### Female (n=1-2)

Total length 1.59-1.77 mm. Wing length 1.02-1.12 mm. Total length / wing length 1.56-1.58. Wing length / length of profemur 1.66-1.71. Coloration as male.

Head. AR 0.28-0.38; flagellomere lengths 75-79, 49-54, 56-60, 45-51, 68. Temporal setae about 12-14. Clypeus with about 14-16 setae. Tentorium and stipes not measurable. Palpomere lengths 30-34, 41, 94-99, 83-94, 169-173.

Thorax. Acrostichals 20, dorsocentrals 12-14, scutellars 2-4.

Wing. VR 1.66-1.67. Sc bare, R with 20-22 setae, R<sub>1</sub> 26-27, R<sub>4+5</sub> 58-59, M 0-1, RM 1-2, M<sub>1+2</sub> 67, M<sub>3+4</sub> 43, Cu 23, Cu<sub>1</sub> 18, PCu 60, An 38 setae. Cell m with 24 setae, setae in other cells not countable.

Legs. Spur of front tibia 24-26 long, spurs of mid ti 26-34 long including 15-19 of comb, hind ti spurs 38 long including 15-23 of comb. Width at apex of front ti 38-39, mid ti 34, hind ti 39-43. Sensilla chaetica 21-22 at apical 0.55-0.56. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	614-652	312-331	671	340	260	98	76	2.15	1.82	1.38	3.0
p <sub>2</sub>	548-605	378-435	217-236	104-113	76	47-52	38-43	0.54-0.58	4.32-4.50	4.26-4.40	4.0-4.2
p <sub>3</sub>	576-662	473-520	284	170	180	85	47	0.60	2.76	3.70	3.5

Genitalia. Tergite IX with about 20-25 setae. Gonocoxite apparently without setae. Cercus 54-68 long. Seminal capsule 53 long, 38 wide. Notum not measurable.

**Remarks.** Johannsen (1932) reports his type series to have been "reared from larvae", but for the present study no associated immature material could be found in the Thienemann collection at ZSM. According to Zavrel (1934), *R. adjectus* (Johannsen) is not separable from the European *R. muscicola* (Kieffer) in the juvenile stages.

**Distribution.** Known only from Java in Indonesia.

### The *curtistylus* group

The pupa of this monobasic group has thoracic horn with median bend and spinules in distal half, spine patches on tergites II-V, tergite II with posterior shagreen arranged into two groups, and anal lobe with hair-like dorsal seta.

The male has dark thorax, abdomen and legs; wing vein M with setae; few setae between anal tergite bands; spatulate anal point with V-shaped crests; superior volsella rounded without extension; median volsella extending beyond superior volsella but not reaching apex of inferior volsella, with apical plate with apical points; and gonostylus gradually tapered.

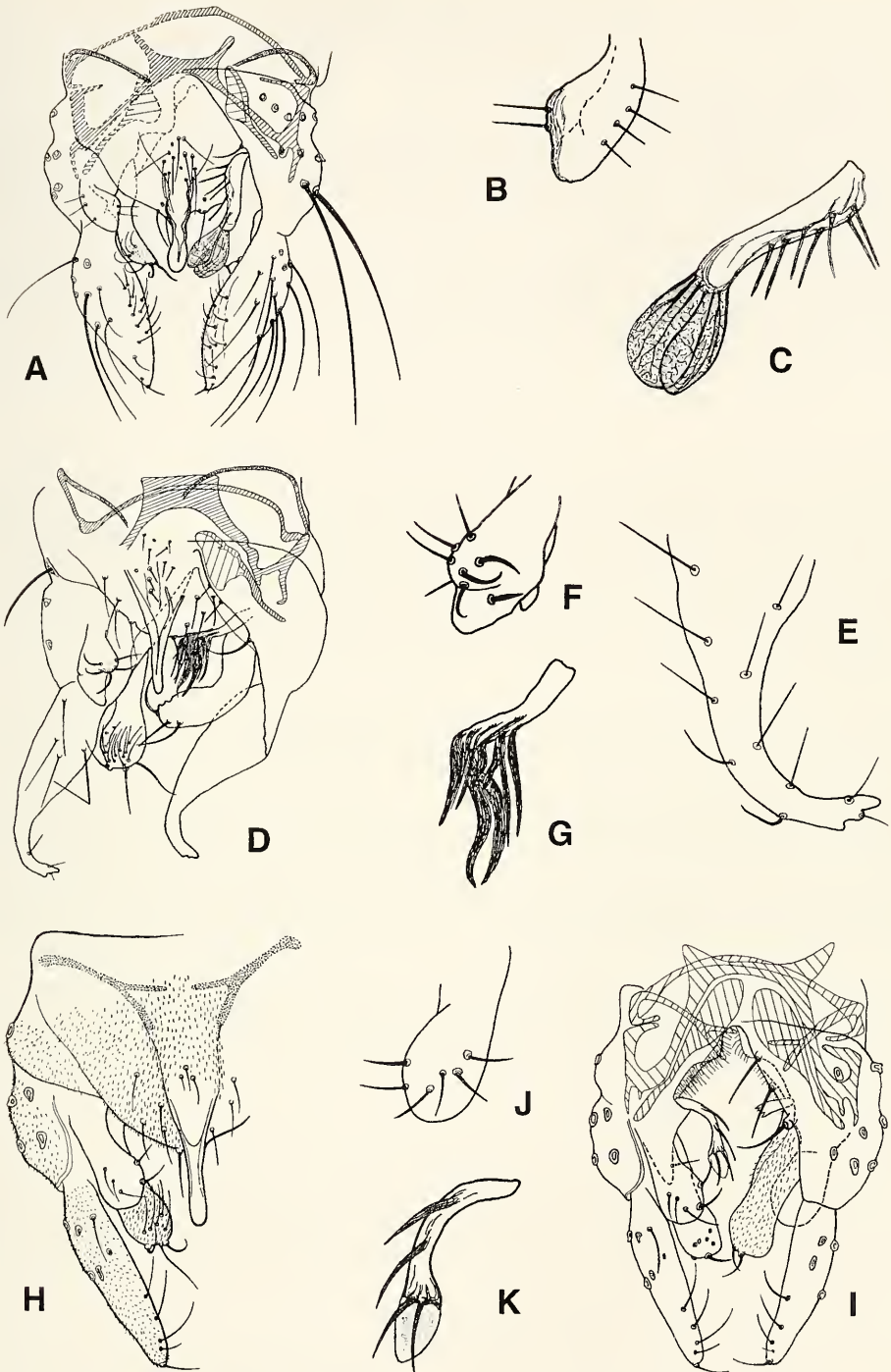


Fig. 2. Male genitalia of *Rheotanytarsus adjectus* (Johannsen) (A-C); *R. acerbus* (Johannsen) (D-G); *R. kuantanensis*, spec. nov. (H-K). A, D. Hypopygium; left: dorsal, right: ventral. H. Hypopygium, dorsal aspect. I. Hypopygium, tergite IX removed; left: dorsal, right: ventral. E. Distal portion of gonostylus. B, F, J. Superior volsella. C, G, K. Median volsella.

*Rheotanytarsus curtistylus* (Goetghebuer)  
(Lehmann 1970: figs 2-5)

*Tanytarsus curtistylus* Goetghebuer, 1921: 121.

*Rheotanytarsus curtistylus* (Goetghebuer); Lehmann 1970: 359.

**Material examined.** GERMANY: 1♂, Bavaria, Ldkr FFB, Schöngesing, Kellerbach, 11.IX.1962, W. Schacht (ZSM). SPAIN: 1♂, "Probe 13", 28.VIII.1953, E. J. Fittkau (ZSM). LEBANON: 1♂, 2 Pex, Anjar, 11.X.1981 J. Moubayed (JM).

**Diagnosis.** See group diagnosis.

*R. curtistylus* has been described in sufficient detail by Lehmann (1970). The species is distributed in south and central Europe, and the Middle East. It was recorded from Thailand by Moubayed (1988). We have, however, been unable to confirm this record.

**The acerbus group**

The known pupae have the thoracic horn bare or with points at most in distal  $\frac{1}{3}$ - $\frac{1}{4}$ ; paired, circular anterior spine patches on tergites II-V; posterior spinule patch on tergite II divided; hook row on tergite II occupying less than median  $\frac{1}{2}$ ; and anal lobe with hair-like dorsal seta.

In the males the anal point is spatulate or narrow with V-shaped crests; the superior volsella is rounded and the digitus reduced except in *R. acerbus* (Johannsen) where the superior volsella has a large posterior extension and the digitus extends beyond the volsellar margin; the median volsella at most reaches beyond the apex of the superior volsella; and the gonostylus is abruptly tapered and has a curved apex.

*Rheotanytarsus acerbus* (Johannsen)  
(Figs 2D-G)

*Tanytarsus* (*Rheotanytarsus*) *acerbus* Johannsen, 1932: 547.

*Rheotanytarsus acerbus* (Johannsen); Thienemann in Zavrel 1934:147, 154; Wang & Zheng 1993: 92; Chaudhuri et al. 1994: 151.

**Material examined.** INDONESIA: Holotype ♂, hypopygium only (R5c=106, B.M. 1937-703; at BMNH); S. Sumatra, Wai Negri, a small forest stream near Ranau, 22.I.1929, A. Thienemann. CHINA: 1♂ Guangdong Province, Fengkai, 20.IV.1988, X. Wang (XW).

**Diagnosis.** The species can be separated from other members of the genus by having a superior volsella with a bluntly rounded, apical projection; digitus extending beyond volsellar margin; median volsella reaching apex of superior but not inferior volsella; and gonostylus abruptly tapered with curved apical portion.

**Description**

**Adult male** (n=1-2).

Total length 2.44 mm. Wing length 1.42 mm. Total length / wing length 1.72. Wing length / length of profemur 1.64. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.77; Fm13 385 long. Temporal setae 7, including 3 inner verticals, 3 outer verticals and 1 postorbital. Clypeus with 20 setae. Tentorium 70 long, 24 wide at sieve pore, 12 wide at posterior tentorial pit. Stipes 70 long, 24 wide. Palpomere lengths 32, 34, 106, 128, 210; Pm5/Pm3 1.98.

Thorax. Acrostichals 10, dorsocentrals 8, scutellars 3.

Wing. VR 1.57. Sc and RM bare, R with 20 setae, R<sub>1</sub> 28, R<sub>4+5</sub> 45, M 2, M<sub>1+2</sub> 46, M<sub>3+4</sub> 39, Cu 20, Cu<sub>1</sub> 19, PCu 48, An 31 setae. Cell m with about 4 setae, r<sub>4+5</sub> about 220, m<sub>1+2</sub> about 200, m<sub>3+4</sub> about 100, cu and an combined about 80.

Legs. Spur of front tibia 18 long, spurs of mid ti 26 and 30 long including 12 of comb, hind ti spurs 26 and 32 long including 12 of comb. Width at apex of front ti 46, mid ti 42, hind ti 46. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	864	480	992	456	360	288	120	2.07	1.19	1.35	3.2
p <sub>2</sub>	688	512	320	168	104	64	84	0.62	3.96	3.75	6.5
p <sub>3</sub>	800	624	504	280	256	120	80	0.81	2.62	2.82	4.4

Hypopygium (Figs 2D-G). Anal tergite bands separate, widely V-shaped. Tergite IX with about 11 dorsal setae between or anterior of anal point crests, and about 6-8 caudal setae around anal point. Anal point 49-74 long; crests well developed, separate to near middle of anal point. Phallapodeme 53-72 long, transverse sternapodeme 30-38 long. Gonocoxite 94-112 long, gonostylus (Fig. 2E) 90-106 long, with curved apex. Superior volsella (Fig. 2F) 36-41 long, with bluntly rounded apical projection; inferior volsella 64-84 long; median volsella (Fig. 2G) 50-53 long, with about 5 subulate to foliate distal setae. HR 1.04-1.06, HV 2.30.

**Distribution.** Known from Sumatra in Indonesia, India, and Guandong province in southern China (Wang & Zheng 1993).

### The *pellucidus* group

The group was revised by Kyerematen et al. (2000). There are three known Oriental species: *R. thailandensis* Moubayed, *R. oss* Cranston, and *R. minusculus* Kyerematen.

Note that the group name derives from *R. pellucidus* (Walker), not the junior homonym *R. pellucidus* Chaudhuri & Datta which does not belong in the *pellucidus* group.

### The *guineensis* group

Pupae of the *guineensis* group have spine patches on tergites II-V or usually on II-VI; at least on TII these are rectangular or transversely elongate instead of rounded. Many species lack a dorsal seta on the anal lobe, when present it is hair-like.

In the males the posterior margin of tergite IX is straight in *R. pela* (Roback), *R. procerus* Reiss, *R. rioensis* Langton & Armitage, and *R. tamaquintus* Sasa, a feature otherwise present only in the *trivittatus* group. The digitus extends beyond the margin of the superior volsella in a few species. In what can be distinguished as a subgroup *guineensis* sensu stricto (*R. akrina* (Roback) and above) the superior volsella has the posterior margin hook- or knob-like, while in the remaining species the superior volsella is rounded. The median volsella does not reach the apex of the inferior volsella and often not even that of the superior volsella.

### *Rheotanytarsus kuantanensis*, spec. nov.

(Figs 2H-K)

**Material examined.** Holotype: ♂ (ZMBN type No. 326; slide-mounted in Canada balsam), MALAYSIA: Dahong Region, Kuantan, Pandam Waterfalls, 8-10.VIII.1993, Malaise trap, G. E. E. Søli. – Paratype: 1♂ as holotype (ZMBN).

**Diagnosis.** The species is characterised by its small size, low antennal ratio and only 12 flagellomeres, by the oblong superior volsella, gradually tapering gonostylus, and narrow anal point.

### Description

#### Adult male (n=1-2).

Total length 1.36 mm. Wing length 0.78 mm. Total length / wing length 1.75. Wing length / length of profemur 1.77. Thorax, abdomen and legs pale.

Head. AR 0.22-0.24; Fm12 86-92 long. Temporal setae 7, including 3 inner verticals, 2 outer verticals and 2 postorbitals. Clypeus with 15-16 setae. Tentorium 40-60 long, 10-12 wide at sieve pore, 6 wide at posterior tentorial pit. Stipes 60-74 long, 12-16 wide. Palpomere lengths 16-20, 20-22, 50, 52, 90; Pm5 / Pm3 1.80.

Thorax. Acrostichals 10, dorsocentrals 7-9, scutellars 3.

Wing. VR 1.52-1.66. Sc and M bare, R with 8-10 setae,  $R_1$  12-13,  $R_{4+5}$  33, RM 1-2,  $M_{1+2}$  35-37,  $M_{3+4}$  13-14, Cu 5-8,  $Cu_1$  9, PCu 26-27, An 14-15. Cell m with 4 setae,  $r_{4+5}$  about 180,  $m_{1+2}$  about 200,  $m_{3+4}$  about 50, cu and an combined 36.

Leg. Spur of front tibia 14-16 long, spurs of mid ti 14-18 and 22-24 long including 8-10 of comb, hind ti spurs 26-28 and 30-32 long including 10-14 of comb. Width at apex of front ti 26-30, mid ti 24-26, hind ti 28-30. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	440-452	192-208	552-570	252-280	200	156	80	2.77-2.87	1.72	1.14-1.15	-
p <sub>2</sub>	420	304-312	160-180	76-80	60	36-40	32-36	0.51-0.59	4.20-4.37	4.02-4.57	5.9
p <sub>3</sub>	460-464	360-372	220	132	124	76	48	0.61	2.74	3.73	-

Hypopygium (Figs 2H-K). Anal tergite with narrowly interrupted basal band and separate, V-shaped anal tergite bands; with 2-3 dorsal setae between anal tergite bands and 8-9 dorsal to caudal setae outside of bands and around anal point. Anal point 32-36 long, 10-14 wide at base, apex 3-4 wide, crests well developed and V-shaped. Phallapodeme 44-50 long, transverse sternapodeme 36-42 long. Gonocoxite 58-64 long, gonostylus 46-52 long. Superior volsella (Fig. 2J) 20-22 long, bulbous; inferior volsella 44-46 long; median volsella (Fig. 2K) 24-30 long, markedly curved with subulate setae fused into plate without apical points. HR 1.23-1.26, HV 2.62.

**Remarks.** Although the type material consists of only two specimens, the small size, short terminal flagellomere etc. indicate that the reduced number of flagellomeres is not an aberration, but a distinguishing character of the species. Intraspecific variation of the male antenna in chironomids more commonly occurs as 10-12 rather than 12-13 flagellomeres. Where the variation is indeed 12-13, the separation between the last two flagellomeres usually is incomplete. The same argument also applies to *R. pandamensis*, spec. nov.

**Etymology.** Named after the town of Kuantan, site of the type locality.

**Distribution.** Known only from Malaysia.

### *Rheotanytarsus tamaquartus* Sasa

(Figs 3A-D)

*Rheotanytarsus tamaquartus* Sasa, 1980: 16; Wang & Zheng 1993: 90.

**Material examined.** 1♂, CHINA: Guangdong Province, Fengkai, 20.IV.1988, X. Wang (XW).

**Diagnosis.** Separated from other species by having gonostylus gradually tapering; median volsella overreaching superior volsella, with a very large plate.

### Description

#### Adult male (n=1).

Total length 2.10 mm. Wing length 1.21 mm. Total length / wing length 1.73. Wing length / length of profemur 1.85. Coloration pale yellow, possibly greenish in life, vittae only feebly indicated.

Head. AR 0.56; Fm13 250 long. Temporal setae 7, including 3 inner verticals, 2 outer verticals and 2 postorbitals. Clypeus with 15 setae. Tentorium 84 long, 28 wide at sieve pore, 10 wide at posterior tentorial pit. Stipes not measurable. Palpomere lengths 30, 34, 80, 92, 140; Pm5/Pm3 1.75.

Thorax. Acrostichals 18, dorsocentrals 8, scutellars not countable.

Wing. VR 1.50. Sc, RM and M bare, R with 18 setae,  $R_1$  29,  $R_{4+5}$  51,  $M_{1+2}$  50,  $M_{3+4}$  28, Cu 17,  $Cu_1$  16, PCu 38, An 23 setae. Cell m with 12 setae,  $r_{4+5}$  about 300,  $m_{1+2}$  about 200,  $m_{3+4}$  about 100, cu and an combined 65.

Legs. Spur of front tibia absent, spurs of mid ti 26 and 28 long including 14 of comb, hind ti spurs 38 and 46 long including 16 of comb. Width at apex of front ti 42, mid ti 36, hind ti 46. Lengths and proportions of legs:

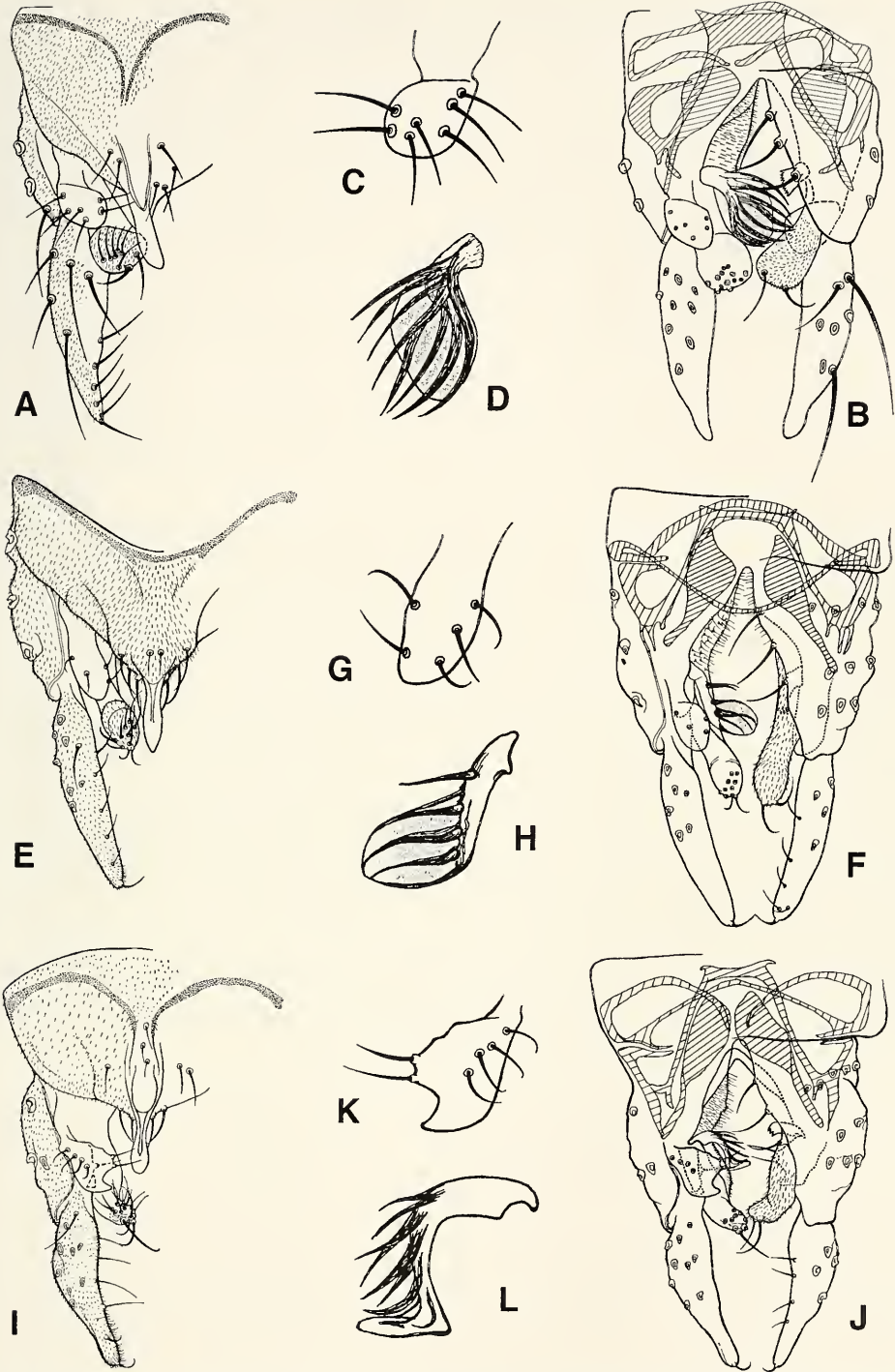


Fig. 3. Male genitalia of *Rheotanytarsus tamaquartus* Sasa (A-D); *R. verticillus*, spec. nov. (E-H); *R. falcipedijs*, spec. nov. (I-L). A,E,I. Hypopygium, dorsal aspect. B,F,J. Hypopygium, tergite IX removed; left: dorsal, right: ventral. C,G,K. Superior volsella. D,H,L. Median volsella.

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
P <sub>1</sub>	654	304	—	—	—	—	—	—	—	—	—
P <sub>2</sub>	600	461	265	127	96	61	46	0.57	4.02	4.00	3.5
P <sub>3</sub>	685	538	385	211	192	115	81	0.72	2.68	3.18	3.8

Hypopygium (Figs 3A-D). Anal tergite apparently with V-shaped bands. Tergite IX triangular, with 8 caudal setae. Anal point 64 long, 28 wide at base, 8 wide at apex; crests well developed, V-shaped. Phallapodeme 70 long, transverse sternapodeme 36 long. Gonocoxite 90 long, gonostylus 94 long. Superior volsella (Fig. 3C) 30 long, sub-quadrangular; inferior volsella 76 long; median volsella (Fig. 3D) 34 long; subulate setae basally fused but ending in separate points along median volsellar margin. HR 0.96, HV 2.23.

**Distribution.** Known from Japan and Guangdong province in southern China (Wang & Zheng 1993).

*Rheotanytarsus verticillus*, spec. nov.

(Figs 3E-H)

**Material examined.** Holotype: ♂ (ZMBN type No. 327; slide-mounted in Canada balsam), THAILAND: Chiang Mai Province, Doi Suthep, What Phra That Temple, 15.IV.1991, sweep net, T. Andersen. – Paratypes: 5♂♂, as holotype (ZMBN).

**Diagnosis.** Characterised by medially joined, slightly V-shaped anal tergite bands; lanceolate anal point; oblong superior volsella; median volsella slightly longer than superior volsella and with distal subulate setae fused into plate; gonostylus gradually tapering.

**Description**

**Adult male** (n=5-6 except when otherwise stated).

Total length 1.48-1.69, 1.60 mm. Wing length 0.96-1.06, 1.02 mm. Total length / wing length 1.53-1.61, 1.57. Wing length / length of profemur 1.89-1.98, 1.95. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.31-0.37, 0.36; Fm13 140-174, 164 long. Temporal setae 6-7, 6; including 3 inner verticals; 2 outer verticals and 1-2, 1 postorbital. Clypeus with 11-17, 14 setae. Tentorium 60-80, 69 long; 12-14, 13 wide at sieve pore; 6-10, 8 wide at posterior tentorial pit. Stipes 80-90, 84 long; 12-20, 15 wide. Palpomere lengths 22-26, 25; 24-30, 27; 66-72, 68; 70-80, 75; 136-142, 139 (4); Pm5/Pm3 1.92-2.12, 2.05 (4).

Thorax. Acrostichals 10-18, 14; dorsocentrals 7-8, 7; scutellars 2-3, 3.

Wing. VR 1.54-1.65, 1.56. Sc and M bare, R with 10-15, 13 setae; R<sub>1</sub> 13-22, 16; R<sub>4+5</sub> 34-48, 40, RM 0-1, 0; M<sub>1+2</sub> 37-49, 43; M<sub>3+4</sub> 19-26, 21; Cu 12-15, 13; Cu<sub>1</sub> 10-16, 12; PCu 34-39, 36; An 16-21, 18. Cell m with 6 setae, r<sub>4+5</sub> about 250, m<sub>1+2</sub> about 200, m<sub>3+4</sub> about 110, cu and an combined 83.

Legs. Spur of front tibia 12-14, 13 long; spurs of mid ti 18-22, 19 and 24-28, 25 long including 10-12, 11 of comb; hind ti spurs 26-30, 28 and 26-32, 30 long including 12-14, 13 of comb. Width at apex of front ti 32-36, 34; mid ti 28-30, 29; hind ti 32-36, 34. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>
P <sub>1</sub>	488-560, 519	232-272, 246	640-670 (3)	312-352 (3)	248-272 (3)
P <sub>2</sub>	488-556, 517	356-400, 377	184-220, 202	88-100, 93	64-72, 68
P <sub>3</sub>	512-584, 553	436-480, 455	260-320, 294	156-180, 166	152-176, 162
	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
P <sub>1</sub>	192-208 (3)	80 (2)	2.53-3.10 (3)	1.68-1.69 (2)	1.00-1.21 (3)
P <sub>2</sub>	40-48, 45	32-40, 37	0.52-0.55, 0.53	4.42-4.82, 4.57	4.33-4.62, 4.47
P <sub>3</sub>	92-108, 100	52-60, 56	0.59-0.68, 0.64	2.66-2.75, 2.69	3.30-3.68, 3.45

Hypopygium (Figs. 3E-H). Anal tergite bands ending far anterior, in rudimentary V-shape, but linked by continuous anterior transverse band. Tergite IX with 1-2, 2 dorsal and 6-8, 7 caudal setae. Anal point 38-46, 42 long; 14-18, 15 wide at base; 4 wide at apex; crests well developed, V-shaped. Phallapodeme 52-58, 55 long; transverse sternapodeme 28-38, 33 long. Gonocoxite 70-80, 75 long;



gonostylus 58-68, 64 long. Superior volsella (Fig. 3G) 24-30, 27 long, oblong; inferior volsella 46-54, 50 long; median volsella (Fig. 3H) 28-36, 32 long, with subulate setae fused into whorl-like plate with about 5-6 apical points. HR 1.13-1.24, 1.18; HV 2.33-2.62, 2.51.

**Etymology.** From Latin 'verticillus' = whorl, referring to the shape of the plate on the median volsella.

**Distribution.** Known only from northern Thailand.

*Rheotanytarsus falcipediis*, spec. nov.

(Figs 3I-L)

**Material examined.** Holotype: ♂ (ZMBN type No. 328; slide-mounted in Canada balsam), THAILAND: Chiang Mai Province, Doi Suthep, What Phra That Temple, 15.IV.1991, sweep net, T. Andersen. – Paratypes: 5♂♂, as holotype (ZMBN).

**Diagnosis.** Easily distinguishable by the combination of spatulate anal point; superior volsella with hook-like posterior extension; very short, characteristically shaped median volsella; and gonostylus distinctly but not abruptly tapering.

**Description**

**Adult male** (n=5-6 except when otherwise stated).

Total length 2.21-2.48, 2.31 mm. Wing length 1.18-1.31, 1.26 mm. Total length / wing length 1.75-1.98, 1.83. Wing length / length of profemur 1.51-1.88, 1.77. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.52-0.57, 0.55; Fm13 260-300, 281 long. Temporal setae 7-8, 8; including 3 inner verticals, 2-3, 3 outer verticals and 2 postorbital. Clypeus with 16-19, 17 setae. Tentorium 80-96, 88 long; 22-24, 23 wide at sieve pore; 10 wide at posterior tentorial pit. Stipes 84-100, 95 long; 12-20, 18 wide. Palpomere lengths 28-32, 30; 28-34, 31; 90-114, 99; 98-110, 103; 160-192, 181 (4). Pm5/Pm3 1.60-1.86, 1.72 (4).

Thorax. Acrostichals 14-18, 16; dorsocentrals 7-10, 8; scutellars 3-4, 3.

Wing. VR 1.41-1.48, 1.45. Sc and M bare, R with 13-17, 15 setae; R<sub>1</sub> 19-25, 22; R<sub>4+5</sub> 50-63, 53; RM 0-1, 1; M<sub>1+2</sub> 40-57, 49; M<sub>3+4</sub> 29-34, 32; Cu 13-20, 17; Cu<sub>1</sub> 19-22, 21; PCu 35-43, 39; An 27-30, 29. Cell m with 12 setae, r<sub>4+5</sub> about 220, m<sub>1+2</sub> about 170, m<sub>3+4</sub> about 80, cu and an combined 60.

Legs. Spur of front tibia 14-18, 16; spurs of mid ti 19-24, 22 and 26-30, 28 long including 10-12, 12 of comb; of hind ti 24-32, 28 and 31 long including 12-14, 13 of comb. Width at apex of front ti 36-40, 38; of mid ti 32-36, 33; of hind ti 36-40, 39. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>
p <sub>1</sub>	664-784, 709	340-368, 353	784-896 (3)	400-448 (3)	316-360 (3)	260-320 (3)
p <sub>2</sub>	604-660, 631	448-512, 471	248-312, 282	128-148, 140	88-108, 98	52-60, 57
p <sub>3</sub>	680-724, 689	556-584, 572	424-472, 451	236-252, 244	212-228, 221	136-152, 142
	ta <sub>5</sub>	LR	BV	SV	BR	
p <sub>1</sub>	104-112 (3)	2.31-2.46 (3)	1.62-1.67 (3)	1.19-1.29 (3)	–	
p <sub>2</sub>	36-40, 39	0.55-0.63, 0.60	3.82-4.62, 4.14	3.72-4.24, 3.90	4.6-4.7 (2)	
p <sub>3</sub>	56-64, 58	0.76-0.81, 0.79	2.53-2.60, 2.57	2.76-2.91, 2.80	7.5 (1)	

Hypopygium (Figs 3I-L). Anal tergite bands V-shaped, separate. Tergite IX with 1-3, 2 dorsal setae between anal tergite bands, and 6-8, 7 further lateral to caudal setae. Anal point 56-66, 61 long; 16-24, 20 wide at base; 4-6, 5 wide at apex; crests well developed, V-shaped. Phallapodeme 68-78, 72 long; transverse sternapodeme 26-30, 29 long. Gonocoxite 86-96, 93 long; gonostylus 74-86, 80 long. Superior volsella (Fig. 3K) 24-30, 27 long, with pronounced, hook-like posterior extension; inferior volsella 48-54, 52 long; median volsella (Fig. 3L) 22-28, 24 long, markedly curved, with subulate setae fused into a narrow apical and a sub-apical plate with 1-2 apical points. HR 1.07-1.27, 1.16; HV 2.63-3.24, 2.88.

**Etymology.** From Latin 'falcipediis' = bow-legged, referring to the shape of the gonostylus.

**Distribution.** Known only from northern Thailand.

***Rheotanytarsus reissi* Lehmann**

(Lehmann 1970: figs 26-30)

*Rheotanytarsus reissi* Lehmann, 1970: 368.

**Material examined** (all leg. J. Moubayed, in coll. JM). THAILAND: 1♂, 1 Pex, 17.VII.1987. LEBANON: 2♂♂, Awwali River, St. A13, 13.III.1981; 1♂, Awwali River, St. 27 (2), 13.VI.1981.

**Diagnosis.** Close to the preceding species, but differs in having a strongly developed digitus, non-spatulate anal point, and an abruptly tapering gonostylus with parallel-sided apical portion.

*R. reissi* is described in sufficient detail in Lehmann (1970). The species is known from Germany and Spain, and was recorded from Thailand by Moubayed (1988). From the latter material we have studied one male and one pupal exuvia, but are unable to confirm this record due to the condition of the slide.

**The *trivittatus* group**

The pupae have thoracic horn without median bend; tergites II-V or II-VI with circular anterior spine patches and with intraspecific variation in both *R. additus* (Johannsen) and *R. trivittatus* (Johannsen); T II with posterior shagreen arranged in two groups; segment VIII with caudolateral comb of 3-6 curved, thorn-like spurs (the Australian *R. barrengarryensis* Cranston with single spur only); and anal lobe with taeniate or hair-like dorsal seta.

The adult males have posterior margin of tergite IX straight or, in the group in its strictest sense, with shoulders or projections to each side of the anal point; median volsella not reaching apex of inferior volsella, with setae fused into apical plate(s); median volsella in the group sensu stricto not reaching beyond apex of superior volsella, in the group in its wider sense extending beyond superior volsella; gonostylus not abruptly tapered (tapered and with parallel-sided apical portion in one new Neotropical species).

***Rheotanytarsus tobaseptidecimus* Kikuchi & Sasa**

(Kikuchi & Sasa 1990: fig. 23)

*Rheotanytarsus tobaseptidecimus* Kikuchi & Sasa, 1990: 317.

**Diagnosis.** Separated from other members of the genus by the combination of tergite IX with straight posterior margin; antennal ratio relatively high (0.6-0.7); anal point broad and non-spatulate; anal tergite bands V-shaped and medially joined, but weak; superior volsella round; and gonostylus abruptly tapered but without parallel-sided apical portion. In the original description, the median volsella is stated to be without a plate, but this needs to be reexamined as the plates often are not easily observed.

The species is described in sufficient details by Kikuchi & Sasa (1990). It is known only from Lake Toba, Sumatra, Indonesia.

***Rheotanytarsus additus* (Johannsen)**

(Figs 4 A-C, 5 A-F)

*Tanytarsus additus* Johannsen, 1932: 548; Zavrel 1934: 150.

*Rheotanytarsus additus* (Johannsen); Thienemann in Zavrel 1934: 152, 154.

**Material examined.** INDONESIA (all leg. A. Thienemann): Lectotype ♂, here designated (Rg, B.M. 1937-703; at BMNH), S. Sumatra, Lake Ranau, water surface, 26.I.1929; paralectotypes: 2♂♂, 3♀♀, as lectotype (BMNH). Other: 3♂♂, 1♀ (133, B.M. 1937-703), Java, 1928-29 (BMNH); 1♂, 2 Pex, as lectotype (ZSM).

**Note.** The lectotype designation is carried out in order to define *R. additus* (Johannsen) against the very similar *R. ceratophylli* (Dejour). Specimens from Java at BMNH and from the type sample at ZSM are not paralectotypes, because they are not part of the material listed by Johannsen (1932).

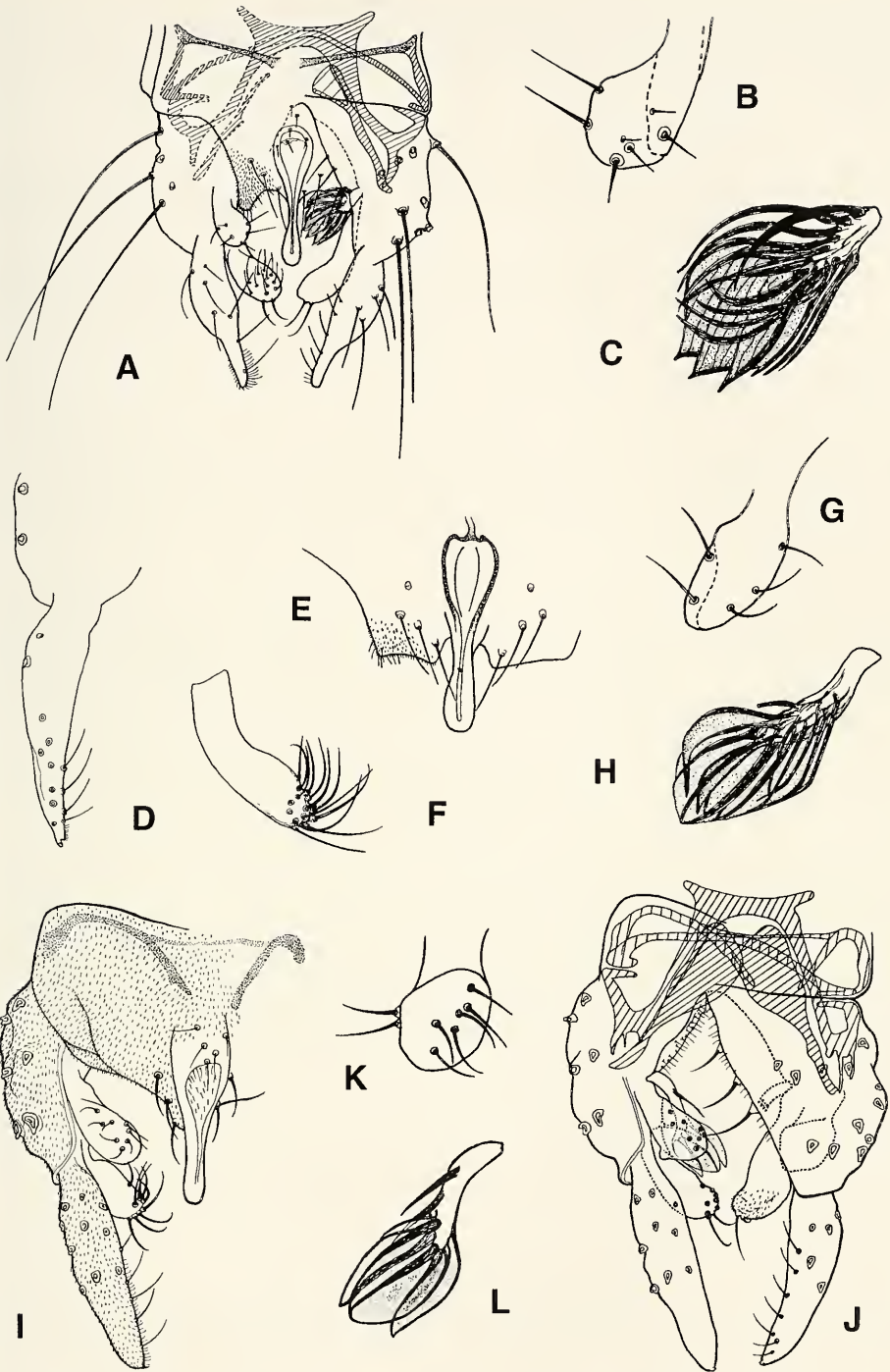


Fig. 4. Male genitalia of *Rheotanytarsus additus*, spec. nov. (A-C); *R. trivittatus* (Johannsen) (D-H); *R. beccus*, spec. nov. (I-L). A. Hypopygium; left: dorsal, right: ventral. D. Gonostylus. E. Anal point and caudal margin of tergite IX. F. Inferior volsella. I. Hypopygium, dorsal aspect. J. Hypopygium, tergite IX removed; left: dorsal, right: ventral. B,G,K. Superior volsella. C,H,L. Median volsella.

**Diagnosis.** Differs from all other known members of the genus except the Afrotropical *R. ceratophylli* (Dejoux) by having pronounced triangular projections to each side of the anal point. From *R. ceratophylli* it differs in having these projections longer, and by having an abruptly tapering gonostylus.

## Description

**Adult male** (n=6-7 except when otherwise stated).

Total length 1.99-2.62, 2.21 mm. Wing length 1.08-1.38, 1.19 mm. Total length / wing length 1.84-2.04, 1.91. Wing length / length of profemur 2.09-2.29, 2.19. Thorax, legs and abdomen pale yellow, slightly darker vittae feebly indicated.

Head. AR 0.63-0.72, 0.69 (4); Fm13 261-323, 303 (4) long. Temporal setae 7-9, 8 (5); including 2-4, 3 inner verticals; 3-4, 4 outer verticals and 1-3, 2 postorbitals. Clypeus with 16-20, 18 (5) setae. Tentorium 90-113, 99 (4) long; 19-28, 23 (4) wide. Palpomere lengths 26-34, 30; 34-45, 39; 71-86, 77; 83-101, 90; 113-154, 134 (n=4-5); Pm3 with 2 lanceolate sensilla clavata about 15 long.

Thorax. Acrostichals 14-18, 16; dorsocentrals 10-12, 11 (5); scutellars 2-4, 3.

Wing. VR 1.38-1.58, 1.46. Sc, RM and M bare, R with 9-16, 12 setae; R<sub>1</sub> 13-20, 15; R<sub>4+5</sub> 27-38, 31; M<sub>1+2</sub> 25-32, 30; M<sub>3+4</sub> 8-21, 15; Cu 0-2, 1; Cu<sub>1</sub> 6-11, 9; PCu 18-36, 27; An 7-18, 13. Cell m with 0-1, 0 setae; r<sub>4+5</sub> 51-105, 77; m<sub>1+2</sub> 43-98, 61; m<sub>3+4</sub> 5-17, 10; cu and an combined 0-8, 3 setae, 0-1, 0 of them on reduced anal lobe.

Legs. Spur of front tibia 15-26, 22 long; spurs of mid ti 23-30, 27 long including 11-15, 14 of comb; hind ti spurs 26-34, 27 long; including 11-19, 18 of comb. Width at apex of front ti 34-40, 37; of mid ti 30-36, 32; of hind ti 34-41, 37. Sensilla chaetica 4-7, 5 at apical 0.13-0.25, 0.21. Lengths and proportions of legs (n=4 for front tarsi):

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>
p <sub>1</sub>	482-600, 546	293-340, 313	562-662, 613	293-350, 324	222-269, 245	151-189, 173
p <sub>2</sub>	520-614, 559	383-472, 428	232-214, 250	118-137, 125	66-95, 84	47-66, 56
p <sub>3</sub>	558-690, 614	529-682, 590	331-406, 356	184-236, 209	165-213, 180	95-123, 105
	ta <sub>5</sub>	LR	BV	SV	BR	
p <sub>1</sub>	66-85, 76	1.82-2.06, 1.92	1.76-1.88, 1.82	1.36-1.48, 1.42	3.6-5.6, 4.2	
p <sub>2</sub>	38-47, 40	0.57-0.60, 0.59	3.97-4.60, 4.35	3.82-4.00, 3.90	3.0-5.8, 4.5	
p <sub>3</sub>	52-66, 60	0.62-0.65, 0.63	2.64-2.80, 2.72	3.13-3.29, 3.23	5.2-7.6, 6.1	

Hypopygium (Figs 4A-C). Basal transverse anal tergite band apparently interrupted. Tergite IX with triangular projections to each side of anal point; 5 dorsal setae between or anterior of anal point crests, and about 12-16, 14 caudal setae, including about 4 weak setae at apex of each lateral projection. Anal point 54-70, 56 long; crests well developed, separate to near apex. Phallapodeme 53-92, 68 (6) long; transverse sternapodeme 41-56, 46 (5) long. Gonocoxite 86-90, 87 long; gonostylus 75-104, 81 long. Superior volsella (Fig. 4B) 30-49, 35 long, ovoid; inferior volsella 53-68, 61 long; median volsella (Fig. 4C) 34-41, 35 long, with distal setae apparently fused into single plate with several terminal points. HR 1.06-1.20, 1.15; HV 2.66-3.31, 2.86.

**Female** (n=3-4 except when otherwise stated).

Total length 1.42-1.98, 1.79 mm. Wing length 0.95-1.32, 1.17 mm. Total length / wing length 1.50-1.56, 1.53. Wing length / length of profemur 2.33-2.50, 2.37. Coloration as in male.

Head. AR 0.30-0.38, 0.36; flagellomere lengths 56-75, 65; 41-49, 44; 45-53, 49; 34-47, 43; 45-79, 66. Temporal setae 7 (1), including 3 inner verticals, 2 outer verticals and 2 postorbitals. Clypeus with 18 (1) setae. Tentorium and stipes not measurable. Palpomere lengths 23-34, 30-38, 64-68, 83-84, 139-156.

Thorax. Acrostichals 16-18, 17; dorsocentrals 14; scutellars 2-4, 3.

Wing. VR 1.36-1.51, 1.42. Sc and M bare, R with 12-19, 15 setae; R<sub>1</sub> 16-18, 17; R<sub>4+5</sub> 38-48; RM 1-2; M<sub>1+2</sub> 28-32; M<sub>3+4</sub> 25-27 (2); Cu 12-18; Cu<sub>1</sub> 14-17; PCu 30-43; An 22 (1). Cell m with 0-28 setae, r<sub>4+5</sub> about 100-175 (2), m<sub>1+2</sub> about 100-220, m<sub>3+4</sub> about 75-80 (2), cu and an combined about 75-80 (2), about 14-15 (2) of them on reduced anal lobe.

Legs. Spur of front tibia 19-23, 21 long; spurs of mid ti 30-36, 34 long; including 13-15, 14 of comb; hind ti spurs 26-34, 30 long; including 13-17, 15 of comb. Width at apex of front ti 34-38, 36; of mid ti 30-36, 34; of hind ti 34-39, 37. Sensilla chaetica 11-13, 12 at apical 0.38-0.52, 0.46. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>
p <sub>1</sub>	406-529, 491	227-321, 293	444-619, 559	208-312, 273	161-232, 202	123-161, 147
p <sub>2</sub>	529-576	321-454, 406	170-250, 221	85-118, 103	66-80, 72	38-57, 47
p <sub>3</sub>	576-662	425-624, 548	246-340	137-189	123-170	76-95
	ta <sub>5</sub>	LR	BV	SV	BR	
p <sub>1</sub>	57-80, 69	1.88-1.96, 1.91	1.82-2.06, 1.94	1.37-1.43, 1.40	2.2-3.3, 2.9	
p <sub>2</sub>	33-43, 39	0.53-0.56, 0.54	4.30-4.70	4.04-4.29	3.6 (1)	
p <sub>3</sub>	38-57	0.57-0.60	2.91-3.16 (2)	3.36-3.62 (2)	3.8-6.0	

Genitalia. Tergite IX with about 16-20 setae. Gonocoxite apparently without setae. Cercus 56-68, 64 long. Seminal capsule 60-71 long, 45-49 wide. Notum 56-113 long.

**Pupa** (n=3-4 except when otherwise stated).

Total length 3.08-4.24, 3.61 mm. Exuviae pale with outer edges of cephalothorax and abdomen slightly darker.

Cephalothorax. Frontal apotome (Fig. 5A) wrinkled. Frontal setae apparently absent. Median anteprenotals (MAPs) 68-146, 113 long; LAs 10-110, 58 long; all taeniate. Precorneals taeniate, close together; anterior Pc 58-126 long; median Pc 110-150, 127 long; posterior Pc 140-160, 151 long. Dorsocentrals Dc<sub>1</sub> 12-120 long, Dc<sub>2</sub> 20-70 long, Dc<sub>3</sub> 30-90 long, Dc<sub>4</sub> 18-102 long; Dc<sub>1</sub> 2-6 in front of Dc<sub>2</sub>, Dc<sub>2</sub> 110-216 in front of Dc<sub>3</sub>, Dc<sub>3</sub> 2-6 in front of Dc<sub>4</sub>. Thoracic horn (Fig. 5B) 376-616, 500 long; 24-56, 40 wide; with fine spinules over about distal half. Nose of wing sheath (Fig. 5C) 12-38 long.

Abdomen (Fig. 5D). Tergite I bare. Spines on T II-V(VI) arranged in circular patches. Median shagreen essentially absent, weak and sparse shagreen present caudolaterally on T IV-V(VI). Number of spines on T II-V(VI): 60-200, 50-70, 50-60, 50, 35 (1). T II (Fig. 5E) with additional pair of posterior patches of very fine spinules; hook row occupying approximately 1/3 of segment width, containing about 70-90 hooklets. Anal comb (Fig. 5F) with about 4-10 curved spurs. Lateral setae/taeniae on segments II-VIII not countable; lengths of L<sub>3</sub> and L<sub>4</sub> on VIII 102-222 (2), 110-220 (2). Anal lobe with 1 long, taeniate dorsolateral seta; 32-51, 46 taeniae in fringe; longest taeniae 346-440 long.

**Distribution.** Known only from Java and Sumatra in Indonesia.

### *Rheotanytarsus trivittatus* (Johannsen)

(Figs 4 D-H, 5 G-L)

*Tanytarsus trivittatus* Johannsen, 1932: 546; Zavrel 1934: 151.

*Rheotanytarsus trivittatus* (Johannsen); Thienemann in Zavrel 1934: 152, 154; Cranston 1997: 724.

*Rheotanytarsus johnstoni* Glover, 1973: 422; Cranston 1991: 124 (part, pupa); Cranston 1996: 181.

**Material examined.** Syntypes: 2♂♂ on three slides, 3♀♀ (R26, B.M. 1937-703), INDONESIA: S. Sumatra, Lake Ranau, at light, 28.I.1928, leg. A. Thienemann. Other: 1 Pex, outlet of lake Ranau, sample R1c, 20.I.1929 (ZSM).

**Diagnosis.** *R. trivittatus* (Johannsen), as well as *R. additus* (Johannsen) and the Afrotropical *R. ceratophylli* (Dejoux), has triangular projections to each side of the anal point. However, in *R. trivittatus* these are less pronounced, and the species also has more numerous setae on the wing membrane than *R. additus* and *R. ceratophylli*, the median volsella is much longer, and the antennal ratio lower.

### Description

**Adult male** (n=1-2).

Total length 2.13 mm. Wing length 1.21-1.23 mm. Total length / wing length 1.75. Wing length / length of profemur 1.88-1.95. Thorax, legs and abdomen yellow, with darker yellow to brownish vittae and brown metanotum.

Head. AR 0.36-0.44; Fm13 165-214 long. Temporal setae 8-9, including 2 inner verticals, 3 outer verticals and 3-4 postorbitals. Clypeus with about 15 setae. Tentorium 113 long, 23 wide. Palpomere lengths 38, 38, 94, 90, 161.

Thorax. Acrostichals 18-20, dorsocentrals 14-16, scutellars 4-6.

Wing. VR 1.39-1.41. Sc, RM and M bare, R with 16-23 setae, R<sub>1</sub> 14-16, R<sub>4+5</sub> 43-46, M<sub>1+2</sub> 45-54, M<sub>3+4</sub> 27-33, Cu 18-19, Cu<sub>1</sub> 17-20, PCu 45, An 23-28. Cell m with 10-25 setae, r<sub>4+5</sub> and m<sub>1+2</sub> each more than 200, m<sub>3+4</sub> about 100-130, cu and an combined about 180-190, about 45 of them on reduced anal lobe.

Legs. Spur of front tibia 23 long, spurs of mid ti 30 long including 15 of comb, of hind ti 38 long including 15-19 of comb. Width at apex of front ti 36-38, of mid ti 30, of hind ti 38-41. Sensilla chaetica 9 at apical 0.28-0.40. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	624-632	302-340	–	–	–	–	–	–	–	–	–
p <sub>2</sub>	643-662	435-468	255-260	132-142	95-109	61	38	0.56-0.59	3.97	4.22-4.35	4.8-5.0
p <sub>3</sub>	633-709	539-576	387	255	123	66	–	0.67	–	3.32	–

Hypopygium (Figs 4D-H). Tergite IX with triangular projections to each side of anal point (Fig. 4E); with 0 dorsal and about 20 caudal setae, including about 6 weak setae at apex of each lateral projection. Anal point (Fig. 4E) 28-38 long, crests well developed, separate to near apex. Phallapodeme and transverse sternapodeme not measurable. Gonocoxite 98 long, gonostylus (Fig. 4D) 90-98 long. Superior volsella (Fig. 4G) 41-45 long, elongate ovoid; inferior volsella (Fig. 4F) 71-75 long; median volsella (Fig. 4H) 71 long, with distal setae fused into plates with terminal points. HR 1.08, HV 2.36.

#### Female (n=1-3).

Total length 1.55-1.66 mm. Wing length 1.19-1.33 mm. Total length / wing length 1.30-1.38. Wing length / length of profemur 1.88-1.96. Coloration as in male.

Head. AR 0.28-0.29; flagellomere lengths 79-86, 49-54, 60, 45-51, 68. Temporal setae 9-10, including 2 inner verticals, 4 outer verticals and 3-4 postorbitals. Clypeus with 16-22 setae. Tentorium and stipes not measurable. Palpomere lengths 30-34, 38-41, 101-116, 101-109, 191-195.

Thorax. Acrostichals 22-28, dorsocentrals 20-22, scutellars 6-8.

Wing. VR 1.44-1.49. Sc and M bare, R with 20-28 setae, R<sub>1</sub> 26-34, R<sub>4+5</sub> 54-58, RM 1-2, M<sub>1+2</sub> 60-67, M<sub>3+4</sub> 34-37, Cu 16-17, Cu<sub>1</sub> 21-22, PCu 49-60, An 22-28. Cell m with 34-40 setae, r<sub>4+5</sub> about 200, m<sub>1+2</sub> about 200, m<sub>3+4</sub> about 200, cu and an combined about 50.

Legs. Spur of front tibia 25-26 long, spurs of mid ti 34-41 long including 19-21 of comb, hind ti spurs 38-41 long including 19-21 of comb. Width at apex of front ti 38-41, of mid ti 38, of hind ti 39-45. Sensilla chaetica 11-12 at apical 0.32-0.36. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	633-680	312-369	318	364	274	208	85	1.95	1.90	1.46	3.9
p <sub>2</sub>	628-690	473-501	255-284	132-151	85-104	57-71	38-43	0.54-0.57	4.05-4.23	4.20-4.45	3.0-5.6
p <sub>3</sub>	680-737	586-627	359-387	208-217	170-194	104	66	0.61-0.65	2.92-3.06	3.38-3.58	3.3-4.7

Genitalia. Tergite IX with about 20-25 setae. Gonocoxite apparently without setae. Cercus 68-83 long. Seminal capsule 43-56 long, 41-47 wide. Notum 98-113 long.

#### Pupa (n=1-2).

Total length 2.90-2.94 mm. Exuviae pale with outer edges of cephalothorax dark.

Cephalothorax. Frontal apotome (Fig. 5G) granulose dorsally. Frontal setae absent. Median antepnotals (MAps) 130-150 long, LAps 44-50 long, all taeniate. Precorneals taeniate and close together; anterior Pc 20-46 long, median Pc 110-120 long, posterior Pc 124 long. Anterior dorsocentrals Dc<sub>1</sub> 14-20 long, Dc<sub>2</sub> 10-40 long, Dc<sub>3</sub> and Dc<sub>4</sub> not measurable; Dc<sub>1</sub> 4 in front of Dc<sub>2</sub>. Thoracic horn (Fig. 5H) 380-392 long, 36-40 wide, with fine spinules in distal 1/3. Nose of wing sheath (Fig. 5I) 18-28 long.

Abdomen (Fig. 5J). Tergite I bare. Spines on T II-V(VI) arranged in circular patches. Median shagreen essentially absent, weak and sparse shagreen present caudolaterally on T IV-V. Number of spines on T II-V: 60, 60-65, 50-60, 50-55. T II (Fig. 5K) with additional pair of posterior patches of very fine spinules; hook row occupying approximately 1/3 of segment width, containing about 60-70 hooklets. Anal comb of three curved spurs (Fig. 5L), 14-16, 20-22, 24-30 long. Lateral setae on segments II-VIII as 2, 2, 2, 3, 3, 3; on segments II-IV all hair-like, V with 2 hair-like and 1 taeniate, VI-VIII all taeniate; lengths of L<sub>3</sub> and L<sub>4</sub> on VIII 90 and 190. Anal lobe with one taeniate dorsolateral seta; 20 taeniae in fringe, longest taeniae 400-420 long.

**Distribution.** Known from Sumatra in Indonesia and from Australia.

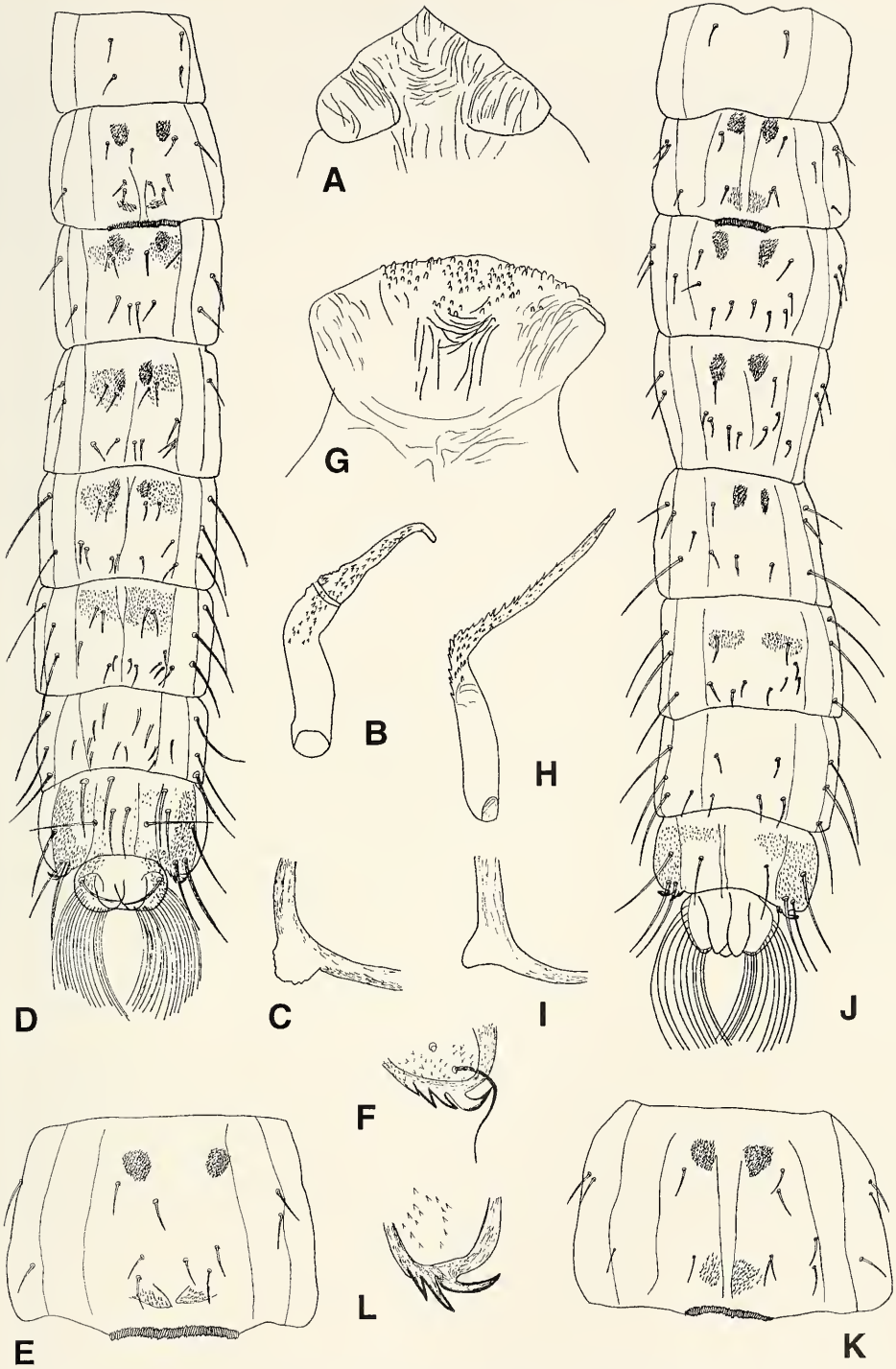


Fig. 5. Pupal structures of *Rheotanytarsus additus*, spec. nov. (A-F); *R. trivittatus* (Johannsen) (G-L). A,G. Frontal apotome. B,H. Thoracic horn. C,I. Wing sheath nose. D,J. Abdomen, dorsal. E,K. Tergite II, dorsal. F,L. Anal comb.

### The *ororus* group

The known pupae have the frontal apotome anteriorly rugulose; thoracic horn with median bend, with points in distal  $\frac{2}{3}$ - $\frac{3}{4}$ ; tergites II-V with paired anterior circular patches of spines; hook row of T II occupying less than  $\frac{1}{3}$  of segment width; anal lobe with hair-like dorsal seta.

The males have V-shaped anal tergite bands and additional, medially joined basal bands in *R. beccus*, spec. nov. and *R. pallidus*, spec. nov., and there are at least some setae between or just posterior of the bands; the anal point has proximally fused crests; the superior volsella is rounded with reduced digitus; the median volsella reaches the apex of the superior and sometimes that of the inferior volsella; and the gonostylus is not abruptly tapered.

#### *Rheotanytarsus beccus*, spec. nov.

(Figs 4I-L)

**Material examined.** Holotype: ♂ (ZMBN type No. 329; slide-mounted in Canada balsam), THAILAND: Chiang Mai Province, Doi Suthep, What Phra That Temple, 15.IV.1991, sweep net, T. Andersen.

**Diagnosis.** Distinguished from all other species except *R. pallidus* by the presence of medially joined basal tergite bands in combination with the above group characteristics. Differs from *R. pallidus* by having a dark thorax, a slightly spatulate anal point, and about 5 dorsal setae anterior of anal point crests.

#### Description

##### Adult male (n=1).

Total length 1.97 mm. Wing length 1.16 mm. Total length / wing length 1.70. Wing length / length of profemur 1.97. Thorax dark, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.40; Fm13 198 long. Temporal setae 6, including 3 inner verticals, 2 outer verticals and 1 postorbital. Clypeus with 16 setae. Tentorium 82 long, 20 wide at sieve pore, 10 wide at posterior tentorial pit. Stipes 80 long, 18 wide. Palpomere lengths 30, 30, 82, 88, 168; Pm5/Pm3 2.05.

Thorax. Acrostichals 18, dorsocentrals 8, scutellars 3.

Wing. VR 1.52. Sc, RM and M bare, R with 18 setae, R<sub>1</sub> 21, R<sub>4+5</sub> 42, M<sub>1+2</sub> 40, M<sub>3+4</sub> 24, Cu 11, Cu<sub>1</sub> 14, PCu 38, An 20 setae. Cell m with 8 setae, r<sub>4+5</sub> about 300, m<sub>1+2</sub> about 250, m<sub>3+4</sub> about 70, cu and an combined 90.

Legs. Spur of front tibia 14 long, spurs of mid ti 20 and 28 long including 12 of comb, hind ti spurs both 32 long including 14 of comb. Width at apex of front ti 36, of mid ti 32, of hind ti 38. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	588	280	—	—	—	—	—	—	—	—	—
p <sub>2</sub>	580	336	240	116	80	—	—	0.55	—	4.23	—
p <sub>3</sub>	620	508	368	208	196	120	64	0.72	2.54	3.06	—

Hypopygium (Figs 4I-L). Anal tergite bands V-shaped, linked by basal band. Tergite IX with with 6 dorsal and 8 caudal setae. Anal point 66 long, 22 wide at base, 6 wide at apex; crests well developed and proximally fused, forming an arc. Phallapodeme 68 long, transverse sternapodeme 36 long. Gonocoxite 82 long, gonostylus 72 long. Superior volsella (Fig. 4K) 24 long, oval; inferior volsella 54 long; median volsella (Fig. 4L) 36 long, not markedly curved, somewhat spatulate with subulate setae fused into a plate with few apical points. HR 1.14, HV 2.74.

**Etymology.** From Latin 'beccus' = beak, bill, referring to the tip of the tentorium.

**Distribution.** Known only from northern Thailand.



*Rheotanytarsus pallidus*, spec. nov.  
(Figs 6A-D)

**Material examined.** Holotype: ♂ (ZMBN type No. 330; slide-mounted in Canada balsam), THAILAND: Chiang Mai Province, Doi Suthep, What Phra That Temple, 15.IV.1991, sweep net, T. Andersen.

**Diagnosis.** Differs from *R. beccus*, spec. nov. in having thorax and abdomen pale, a non-spatulate anal point, and 3 dorsal setae on the anal tergite.

**Description**

**Adult male (n=1).**

Total length 1.78 mm. Wing length 1.18 mm. Total length / wing length 1.51. Wing length / length of profemur 1.93. Thorax and abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.44; Fm13 206 long. Temporal setae 6, including 3 inner verticals, 2 outer verticals and 1 postorbital. Clypeus with 15 setae. Tentorium 74 long, 20 wide at sieve pore, 12 wide at posterior tentorial pit. Stipes 90 long, 16 wide. Palpomere lengths 28, 30, 76, 84, 158; Pm5/Pm3 2.08.

Thorax. Acrostichals 16, dorsocentrals 9, scutellars 4.

Wing. VR 1.52. Sc and M bare, R with 15 setae, R<sub>1</sub> 20, R<sub>4+5</sub> 49, RM 1, M<sub>1+2</sub> 53, M<sub>3+4</sub> 24, Cu 15, Cu<sub>1</sub> 12, PCu 38, An 23. Cell m with 8 setae, r<sub>4+5</sub> about 300, m<sub>1+2</sub> about 250, m<sub>3+4</sub> about 70, cu and an combined 90.

Legs. Spur of front tibia 16 long, spurs of mid ti 22 and 28 long including 12 of comb, hind ti spurs both 30 long including 12 of comb. Width at apex of front ti 38, of mid ti 34, of hind ti 38. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	612	288	748	372	272	236	100	2.60	1.68	1.20	–
p <sub>2</sub>	580	420	240	112	80	56	40	0.57	4.30	4.17	–
p <sub>3</sub>	620	50	372	200	188	124	40	0.57	4.30	4.17	–

Hypopygium (Figs 6A-D). Anal tergite bands V-shaped, linked by basal band. Tergite IX with 3 dorsal and 10 caudal setae. Anal point 56 long, 24 wide at base; 6 wide at apex; crests well developed, proximally fused forming an arc. Phallapodeme 60 long, transverse sternapodeme 42 long. Gonocoxite 72 long, gonostylus 64 long. Superior volsella (Fig. 6C) 28 long, relatively large and knob-like; inferior volsella 48 long; median volsella (Fig. 6D) 34 long, not markedly curved, apex with both a plate and some free, lamellate setae. HR 1.12, HV 2.78.

**Distribution.** Known only from northern Thailand.

**The *phaselus* group**

The only known pupa of this group has frontal apotome anteriorly rugulose, frontal setae present, thoracic horn with median bend and spinules in distal 2/3, tergites II-V with circular anterior spine patches, T II with posterior shagreen arranged into two groups, hook row of about 70 hooklets occupying 1/2 of segment width, and anal lobe without dorsal seta.

The males included here all have at least a few dorsal anal tergite setae; V-shaped anal tergite bands; spatulate anal point with V-shaped crests (proximally fused in *R. phaselus*, spec. nov.); superior volsella with posterior extension; median volsella usually not reaching apex of superior volsella; and gonostylus usually abruptly tapered, often with parallel-sided apical portion.

*Rheotanytarsus phaselus*, spec. nov.  
(Figs 6E-H)

**Material examined.** Holotype: ♂ (ZMBN type No. 331; slide-mounted in Canada balsam), MALAYSIA: Dahong Region, Kuantan, Pandam Waterfalls, 8-10.VIII.1993, Malaise trap, G. E. E. Söli.

**Diagnosis.** Separated from other members of the genus by long, digitiform extension of superior volsella; pale thorax, presence of well developed, V-shaped anal tergite bands and reduced basal bands; slightly spatulate, narrow anal point; and abruptly tapered gonostylus with completely parallel-sided apical portion.

## Description

### Adult male (n=1).

Total length 1.81 mm. Wing length 1.11 mm. Total length / wing length 1.63. Wing length / length of profemur 1.65. Thorax and abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.37; Fm13 184 long. Temporal setae 8, including 3 inner verticals, 3 outer verticals and 2 postorbital. Clypeus with 17 setae. Tentorium 54 long, 12 wide at sieve pore, 8 wide at posterior tentorial pit. Stipes 80 long, 12 wide. Palpomere lengths 22, 26, 62, 72, 112; Pm5/Pm3 1.81.

Thorax. Acrostichals 14, dorsocentrals 8, scutellars 3.

Wing. VR 1.63. Sc and M bare, R with 14 setae, R<sub>1</sub> 25, R<sub>4+5</sub> 58, RM 2, M<sub>1+2</sub> 58, M<sub>3+4</sub> 26, Cu 17; Cu<sub>1</sub> 14, PCu 45, An 22. Cell m with 8 setae, r<sub>4+5</sub> about 300, m<sub>1+2</sub> about 250, m<sub>3+4</sub> about 70, cu and an combined about 90.

Legs. Spur of front tibia 16 long, spurs of mid ti 20 and 22 long including 12 of comb, hind ti spurs 34 and 36 long including 14 of comb. Width at apex of front ti 36, of mid ti 28, of hind ti 34. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	672	308	–	–	–	–	–	–	–	–	–
p <sub>2</sub>	580	456	220	120	80	52	40	0.48	4.30	4.71	5.9
p <sub>3</sub>	644	508	–	–	–	–	–	–	–	–	–

Hypopygium (Figs 6E-H). Anal tergite bands well developed, separate, V-shaped; weak, medially interrupted basal bands also present. Tergite IX with 2-3 dorsal and 11 caudal setae. Anal point 46 long, 14 wide at base, 4 wide at apex; crests well developed, proximally fused forming an arc. Phallapodeme 60 long, transverse sternapodeme 34 long. Gonocoxite 70 long, gonostylus 70 long. Superior volsella (Fig. 6G) 26 long, relatively large and reniform with digitiform extension; inferior volsella 56 long; median volsella (Fig. 6H) 36 long, markedly curved, with subulate setae fused into plate with apical points. HR 1.12, HV 2.78.

**Etymology.** From Latin 'phaselus' = kidney bean, referring to the shape of the superior volsella.

**Distribution.** Known only from Malaysia.

## The *orientalis* group

Only the pupa of *R. orientalis* Moubayed is known. It has the frontal apotome anteriorly rugulose; frontal setae present; thoracic horn with median bend and spinules in distal half; tergites II-V with circular anterior spine patches; T II with posterior shagreen arranged into two groups, hook row occupying 1/3-1/2 of segment width; and 2 short dorsal setae on each anal lobe.

The adult males mostly have spatulate or occasionally parallel-sided or tapering anal point with V-shaped crests; rounded superior volsella except in *R. orientalis*; median volsella not reaching beyond apex of superior volsella; and gonostylus not abruptly tapered.

### *Rheotanytarsus koraensis*, spec. nov.

(Figs 6I-L)

**Material examined.** Holotype: ♂ (ZMBN type No. 333; slide-mounted in Canada balsam), THAILAND: Phang Nga Province, Ko Ra, 26.I.-4.II.1997, Malaise trap, L. O. Hansen / G. E. E. Søli. – Paratypes: 5♂♂, as holotypes; 1♂, Chiang Mai Province, Doi Suthep, What Phra That Temple, 15.IV.1991, sweep net, T. Andersen (ZMBN).

**Diagnosis.** Differs from other members of the genus by the group characteristics combined with a broad, parallel-sided anal point.

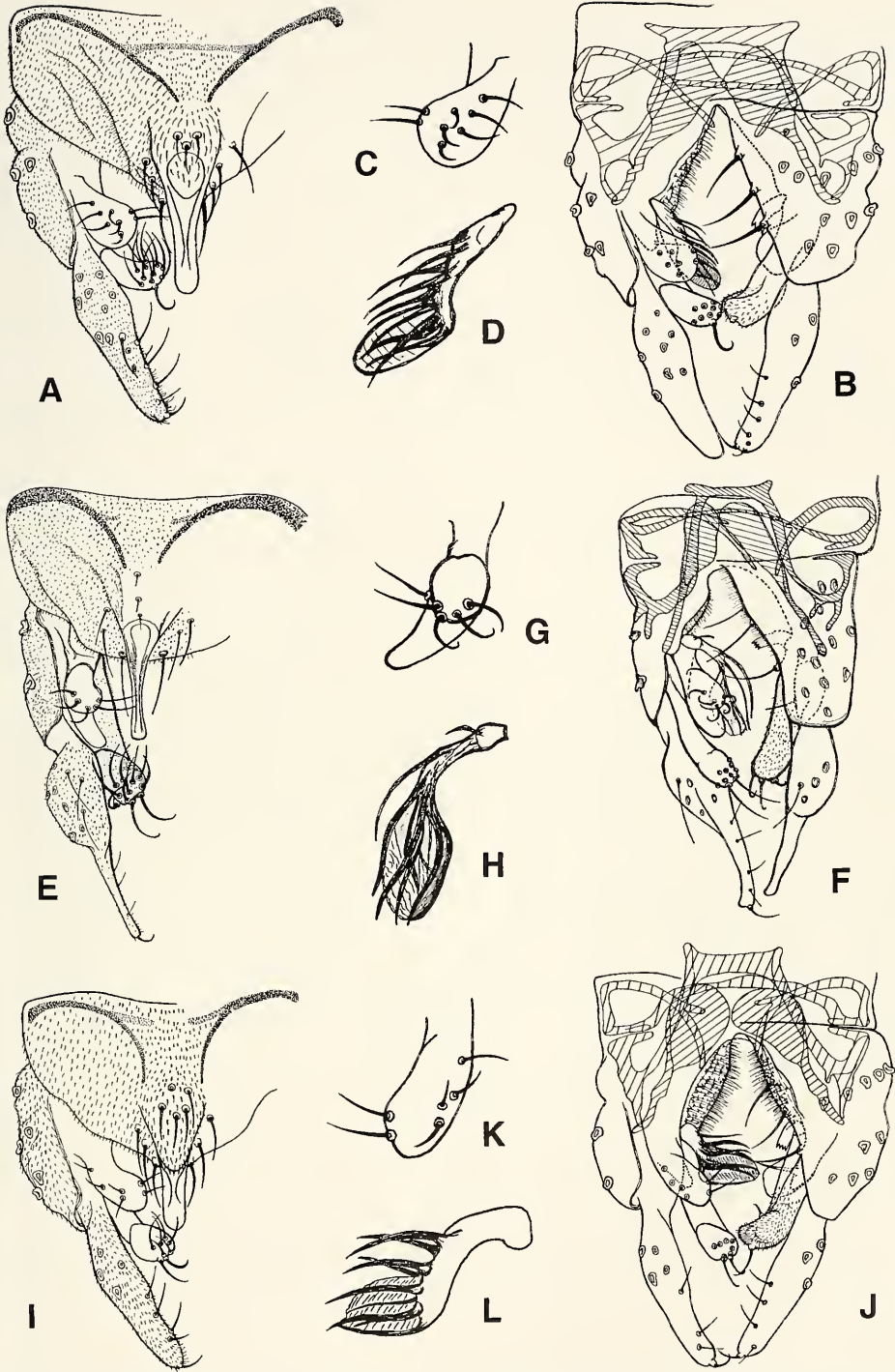


Fig. 6. Male genitalia of *Rheotanytarsus pallidus*, spec. nov. (A-D); *R. phaselus*, spec. nov. (E-H); *R. koraensis*, spec. nov. (I-L). A,E,I. Hypopygium, dorsal aspect. B,F,J. Hypopygium, tergite IX removed; left: dorsal, right: ventral. C,G,K. Superior volsella. D,H,L. Median volsella.

## Description

**Adult male** (n=6-7 except when otherwise stated).

Total length 1.29-1.69, 1.43 mm. Wing length 0.76-1.05, 0.85 mm. Total length / wing length 1.61-1.80, 1.71. Wing length / length of profemur 1.82-2.18, 1.97. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.13-0.29, 0.20; Fm13 50-130, 84 long. Temporal setae 7-8, 7; including 3-4, 3 inner verticals; 2-3, 2 outer verticals; and 2 postorbitals. Clypeus with 13-17, 15 setae. Tentorium 46-76, 60 long; 12-14, 13 wide at sieve pore; 6-10, 7 wide at posterior tentorial pit. Stipes 60-90, 69 long; 12-24, 17 wide. Palpomer lengths 16-26, 22; 14-24, 20; 40-66, 50; 58-74, 65; 100-150, 120 (4); Pm5/Pm3 2.00-2.42, 2.28 (4).

Thorax. Acrostichals 14-18, 16; dorsocentrals 7-11, 8; scutellars 3-5, 4.

Wing. VR 1.35-1.71, 1.56. Sc, RM and M bare, R with 10-14, 12 setae; R<sub>1</sub> 8-17, 13; R<sub>4+5</sub> 24-42, 32, M<sub>1+2</sub> 26-50, 35; M<sub>3+4</sub> 13-25, 17; Cu 8-14, 11; Cu<sub>1</sub> 9-14, 11; PCu 22-35, 32; An 12-20, 16. Cell m with 10 setae, r<sub>4+5</sub> about 150, m<sub>1+2</sub> about 150, m<sub>3+4</sub> about 50, cu and an combined 35.

Legs. Spur of front tibia 10-16, 13 long; spurs of mid ti 16-20, 17 and 22-24, 23 long including 10 of comb; hind ti spurs 22-30, 26 and 26-32, 29 long including 12-14, 12 of comb. Width at apex of front ti 28-34, 30; of mid ti 24-28, 26; of hind ti 28-34, 31. Lengths (n=4-6 on ta<sub>1</sub>-ta<sub>3</sub>) and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>
p <sub>1</sub>	360-528, 437	176-264, 210	408-648, 502	232-332, 261	184-248, 200	104-188, 145
p <sub>2</sub>	368-528, 426	272-388, 313	136-220, 157	64-112, 83	40-68, 51	32-48, 36
p <sub>3</sub>	400-568, 463	312-460, 365	184-292, 233	120-180, 135	120-164, 130	72-108, 81
	ta <sub>5</sub>	LR	BV	SV	BR	
p <sub>1</sub>	56-80, 72	2.22-2.77, 2.46	1.56-1.76, 1.68	1.19-1.39, 1.25	-	
p <sub>2</sub>	24-40, 31	0.47-0.53, 0.51	3.96-4.90, 4.45	4.16-5.00, 4.64	4.3-6.7, 5.3	
p <sub>3</sub>	48-60, 50	0.55-0.70, 0.64	2.56-2.80, 2.70	3.29-4.13, 3.58	3.7-7.5, 5.1	

Hypopygium (Figs 6I-L). Anal tergite bands widely separate, V-shaped; interrupted basal bands also present. Tergite IX with 3-6, 4 dorsal setae and 8-9, 8 further lateral and caudal. Anal point 36-46, 41 long; 16-20, 17 wide at base; 4-6, 5 wide at apex; crests well developed, V-shaped. Phallapodeme 50-60, 53 long; transverse sternapodeme 26-31, 29 long. Gonocoxite 64-79, 72 long; gonostylus 44-60, 52 long. Superior volsella (Fig. 6K) 24-31, 28 long, oblong with slightly pointed apex; inferior volsella 43-50, 45 long; median volsella (Fig. 6L) 29-36, 32 long, with many long sharply pointed setae; distal subulate setae fused into a large plate sometimes difficult to distinguish. HR 1.20-1.53, 1.40; HV 2.67-2.93, 2.78.

**Etymology.** Named after the town of Ko Ra, site of the type locality.

**Distribution.** Known only from Thailand.

### *Rheotanytarsus falcatus*, spec. nov. (Figs 7A-H)

**Material examined.** Holotype: ♂ (ZMBN type No. 332; slide-mounted in Canada balsam), THAILAND: Krabi Province, Tham Pheung, 19-23.I.1997, Malaise trap, L. O. Hansen / G. E. E. Søli. - Paratypes: 6♂♂ and 1♀, as holotype (ZMBN).

**Diagnosis.** Differs from *R. koraensis*, spec. nov. by the spatulate anal point and only 2-3 dorsal anal tergite setae (3-6 in *koraensis*).

## Description

**Adult male** (n=5-7 except when otherwise stated).

Total length 1.18-1.33, 1.27 mm. Wing length 0.73-0.78, 0.75 mm. Total length / wing length 1.58-1.1.79, 1.68. Wing length / length of profemur 1.86-2.11, 2.00. Thorax dark brown, abdomen pale, legs pale with apical portions of femora darker.

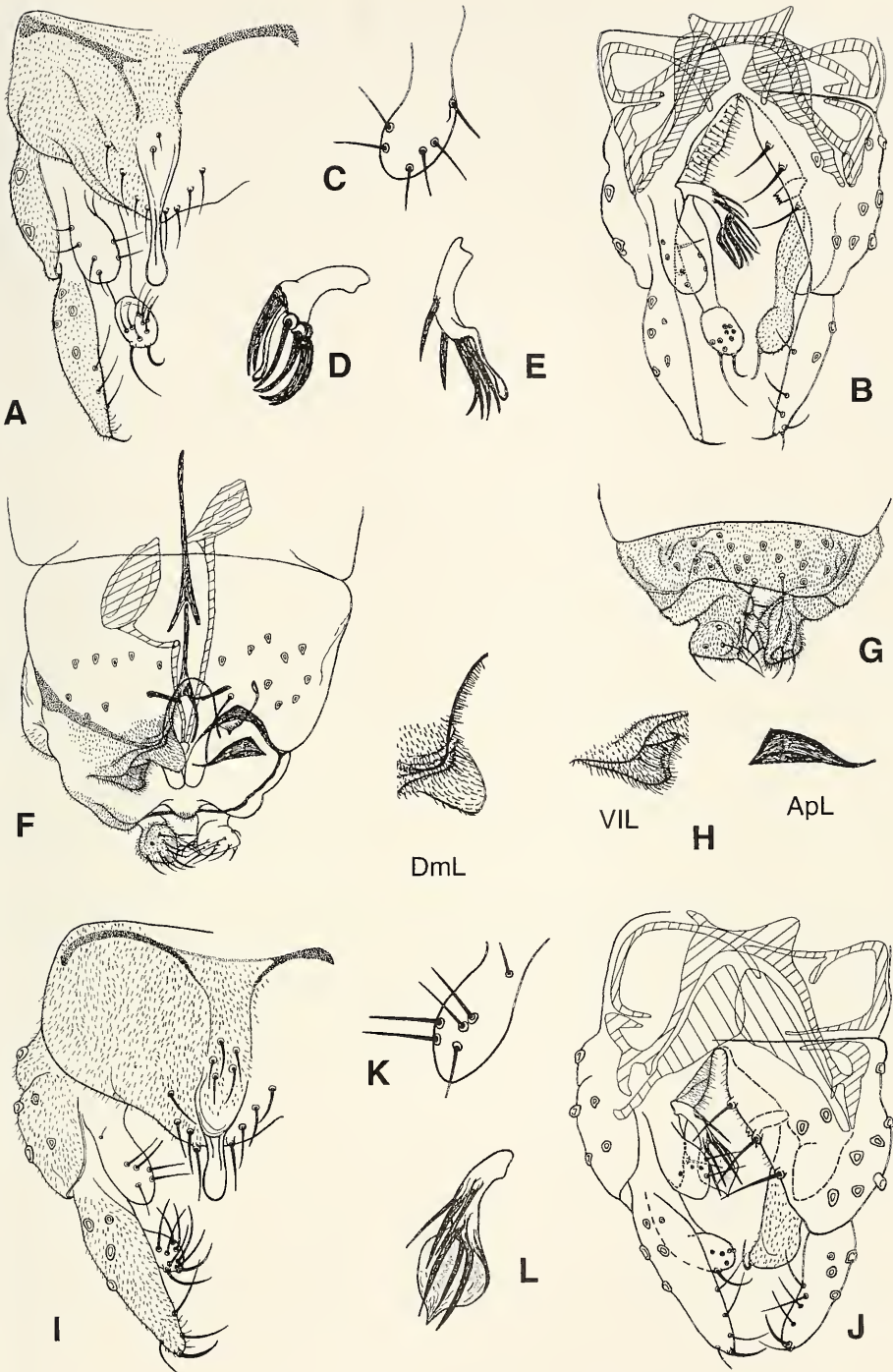


Fig. 7. Genitalia of *Rhecotanytarsus falcatus*, spec. nov.: male (A-D); female (F-H); *R. madarihatus* nom. nov.: male (I-L). A,I. Hypopygium, dorsal aspect. B,J. Hypopygium, tergite IX removed; left: dorsal, right: ventral. C,K. Superior volsella. D,E,L. Median volsella. F. Terminal segments, ventral. G. Terminal segments, dorsal aspect. H. Gonapophysis VIII (DmL, dorsomesal lobe; VIL, ventrolateral lobe; ApL, apodeme lobe).

Head. AR 0.21-0.23, 0.23; Fm13 70-92, 84 long. Temporal setae 7, including 3 inner verticals, 2 outer verticals, and 2 postorbitals. Clypeus with 13-17, 15 setae. Tentorium 48-70, 57 long; 12-14, 13 wide at sieve pore; 4-6, 5 wide at posterior tentorial pit. Stipes 64-72, 68 long; 14-24, 20 wide. Palpomere lengths 20-22, 21; 18-24, 21; 52-62, 59; 60-72, 67; 110-118, 113 (4); Pm5/Pm3 1.77-1.97, 1.89 (4).

Thorax. Acrostichals 12-20, 16; dorsocentrals 7-8, 7; scutellars 3-4, 3.

Wing. VR 1.52-1.59, 1.56. Sc and M bare, R with 8-14, 11 setae; R<sub>1</sub> 10-14, 12; R<sub>4+5</sub> 27-32, 30; RM 0-1, 1; M<sub>1+2</sub> 34-39, 36; M<sub>3+4</sub> 15-20, 17; Cu 12-14, 12; Cu<sub>1</sub> 10-11, 11; PCu 29-38, 33; An 16-22, 19. Cell m with 5 setae, r<sub>4+5</sub> about 150, m<sub>1+2</sub> about 100, m<sub>3+4</sub> about 30, cu and an combined 40.

Legs. Spur of front tibia 10-14, 12 long; spurs of mid ti 18-20, 18 and 10-14, 12 long including 10-12, 10 of comb; hind ti spurs 24 and 24-30, 26 long including 10-14, 12 of comb. Width at apex of front ti 26-32, 29; of mid ti 26-30, 27; of hind ti 30 (4). Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>
p <sub>1</sub>	368-400, 377	152-184, 171	440-488 (3)	232-264 (3)	176 (1)	–
p <sub>2</sub>	344-400, 374	256-288, 265	160-176 (3)	72-80 (3)	48-56 (3)	32-40 (3)
p <sub>3</sub>	376-448, 411	312-360, 336	232-248 (2)	120-128 (2)	88-128 (3)	56-72 (3)
	ta <sub>5</sub>	LR	BV	SV	BR	
p <sub>1</sub>	–	2.50-2.90 (3)	–	1.11-1.24 (3)	–	
p <sub>2</sub>	32 (3)	0.61-0.62 (3)	3.96-4.15 (3)	3.75-3.91 (3)	5.1-6.0 (3)	
p <sub>3</sub>	40-48 (3)	0.64-0.70 (2)	2.79-3.39 (2)	3.22-3.45 (2)	6.7 (1)	

Hypopygium (Figs 7A-E). Anal tergite bands widely separate, V-shaped; interrupted basal bands also present. Tergite IX with 2-3, 2 dorsal setae and 7-9, 8 further lateral and caudal. Anal point 38-47, 42 long; 10-14, 11 wide at base; 4-6, 4 wide at apex; crests well developed, V-shaped. Phallapodeme 50-52, 51 long; transverse sternapodeme 20-30, 23 long. Gonocoxite 62-74, 67 long; gonostylus 44-52, 47 long. Superior volsella (Fig. 7C) 27-34, 30 long, oblong; inferior volsella 50-60, 53 long; median volsella (Fig. 7D,E) 30-36, 32 long, sickle-shaped, not reaching apex of superior volsella, with subulate setae fused into narrow plate with few apical points. HR 1.38-1.45, 1.43; HV 2.48-3.02, 2.74.

**Female (n=1).**

Total length 1.38 mm. Wing length 1.01 mm. Total length / wing length 1.37. Wing length / length of profemur 1.80. Thorax pale; postnotum, preepisternum and vittae dark. Abdomen pale, legs pale with apical ¼ of femora darker.

Head. AR 0.24; flagellomere lengths 76, 52, 60, 48, 56. Temporal setae 6, including 3 inner verticals, 2 outer verticals and 1 postorbital. Clypeus with 16 setae. Tentorium 70 long, 10 wide at sieve pore, 4 wide at posterior tentorial pit. Stipes 90 long, 12 wide. Palpomere lengths 28, 28, 62, 62; Pm5 lost.

Thorax. Acrostichals 14, dorsocentrals 11, scutellars 2.

Wing. VR 1.77. Sc and M bare, R with 14 setae, R<sub>1</sub> 31, R<sub>4+5</sub> 56, RM 2, M<sub>1+2</sub> 48, M<sub>3+4</sub> 28, Cu 15, Cu<sub>1</sub> 15, PCu 31, An 21. Cell m with 4 setae, r<sub>4+5</sub> about 270, m<sub>1+2</sub> about 200, m<sub>3+4</sub> 110, cu and an combined 90.

Legs. Spur of front tibia 18 long, spurs of mid ti 24 and 26 long including 12 of comb, hind ti spurs 28 and 30 long including 12 of comb. Width at apex of front ti 34, of mid ti 34, of hind ti 34. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV	BR
p <sub>1</sub>	560	380	–	–	–	–	–	–	–	–	–
p <sub>2</sub>	488	376	200	96	64	32	32	0.53	4.36	4.32	4.4
p <sub>3</sub>	528	480	272	144	136	80	48	0.57	3.14	3.71	5.1

Genitalia (Figs 7F-H). Tergite IX with about 16-20 setae. Gonocoxite apparently without setae. Cercus 40 long. Seminal capsule 54 long, with 4 long sclerotisation, and 16 long neck. Notum 126 long.

**Etymology.** From Latin 'falcatus' = sickle-shaped, referring to the median volsella.

**Distribution.** Known only from southern Thailand.

*Rheotanytarsus madarihatusis*, nom. nov.

(Figs 71-L)

*Rheotanytarsus pellucidus* Chaudhuri & Datta in Chaudhuri et al., 1994 – preoccupied by *R. pellucidus* (Walker, 1848)

**Material examined.** (see ‘Remarks’ below). Holotype ♂ (BUEC type No. 196 according to slide label, No. 195 acc. to Chaudhuri et al. 1994), INDIA: West Bengal, Madarihatus, 25.II.1988, leg. T. Dutta acc. to slide (A. K. De acc. to Chaudhuri et al. 1994). – Other: MALAYSIA: 1♂, Dahong Region, Kuantan, Pandam Waterfalls, 8-10.VII.1993, Malaise trap, G. E. E. Soli (ZMBN).

**Diagnosis.** Distinguished from the two preceding species by having only twelve flagellomeres, and a spatulate anal point broader than in *R. falcatus*, spec. nov.

**Description**

**Adult male** (n=1-2, holotype in parentheses).

Total length 1.23 mm. Wing length 0.74 (0.99) mm. Total length / wing length 1.65. Wing length / length of profemur 1.94. Thorax pale to dark, abdomen pale, legs pale with apical portions of femora darker.

Head. AR 0.19 (0.26); Fm12 66 (108) long. Temporal setae 6, including 3 inner verticals, 2 outer verticals and 1 postorbital. Clypeus with 13 setae. Tentorium 40 long, 8 wide at sieve pore, 6 wide at posterior tentorial pit. Stipes 60 long, 18 wide. Palpomere lengths 20, 24, 42, 46, 90; Pm5/Pm3 2.14.

Thorax. Acrostichals 12, dorsocentrals 7, scutellars 2.

Wing. VR 1.49 (1.53). Sc, RM and M bare, R with 15 (14) setae, R<sub>1</sub> 16 (16), R<sub>4+5</sub> 30 (37), M<sub>1+2</sub> 38 (29), M<sub>3+4</sub> 14 (20), Cu 9 (13), Cu<sub>1</sub> 10 (11); PCu 27 (31), An 14 (16). Cell m with 4 (11) setae, r<sub>4+5</sub> about 140, m<sub>1+2</sub> about 120, m<sub>3+4</sub> about 40 (70), cu and an combined 22 (83).

Legs. Spur of front tibia 14 long, spurs of mid ti 16 and 24 long including 10 of comb, hind ti spurs 28 and 30 long including 14 of comb. Width at apex of front ti 26, of mid ti 24, of hind ti 26. Lengths and proportions of legs:

	fe	ti	ta <sub>1</sub>	ta <sub>2</sub>	ta <sub>3</sub>	ta <sub>4</sub>	ta <sub>5</sub>	LR	BV	SV
p <sub>1</sub>	384	200	80	240	200	156	76	2.40	1.58	1.21
p <sub>2</sub>	408	296	144	60	52	36	28	0.49	4.82	4.89
p <sub>3</sub>	424	340	–	–	–	–	–	–	–	–

Hypopygium (Figs 71-L). Anal tergite bands short, widely separate V-shaped; weak basal bands also present. Tergite IX with 5 dorsal and 9 caudal setae. Anal point 36 long, 12 wide at base, 4 wide at apex; crests well developed, V-shaped. Phallapodeme 44 long, transverse sternapodeme 24 long. Gonocoxite 54 long, gonostylus 48 long. Superior volsella (Fig. 7K) 16 long, somewhat oblong; inferior volsella 46 long; median volsella (Fig. 7L) 26 long, not markedly curved, with subulate setae fused into plate with few apical points. HR 1.12, HV 2.56.

**Etymology.** Named after the type locality.

**Remarks.** See ‘Remarks’ under *R. kuantanensis*, spec. nov.

The holotype is somewhat squashed. The legs are not measurable, and the median volsellae not clearly observable. The size is slightly larger than for the Malaysian specimen, and the coloration apparently lighter. However, the matching reduction to twelve flagellomeres with similar antennal ratio, the spatulate anal points, respectively similar anal tergite bands and superior volsellae lead us to regard the two specimens as conspecific.

The authors have also seen one of the two paratype slides of *R. pellucidus* Chaudhuri & Datta (date as holotype; BUEC), but that male adult belongs to an undetermined species of *Micropsectra* Kieffer.

**Distribution.** Known from India and Malaysia.

*Rheotanytarsus amamiflavus* Sasa

(Sasa 1990: fig. 11)

*Rheotanytarsus amamiflavus* Sasa, 1990: 123; Sasa & Kikuchi 1995: 133.

**Diagnosis.** Separated by the group characteristics combined with a broad, non-spatulate anal point, absence of dorsal anal tergite setae and basal tergite bands, with a dark thorax and pale legs, and a digitus extending beyond the superior volsella.

The species is described in sufficient detail by Sasa (1990) and Sasa & Kikuchi (1995). It is known from the Nansei Islands (southern Japan).

*Rheotanytarsus okisimplex* Sasa

(Sasa 1993: figs 10.6, 10.7)

*R. okisimplex* Sasa, 1993: 130; Sasa & Kikuchi 1995: 133.

**Diagnosis.** Differs from the preceding species by having a pale thorax, subcosta with setae, and a spatulate anal point.

The species is described in sufficient detail by Sasa (1993) and Sasa & Kikuchi (1995). So far it has been found only on Okinawa (southern Japan).

*Rheotanytarsus orientalis* Moubayed

(Moubayed 1989: figs 9-16)

*R. orientalis* Moubayed, 1989: 278.

**Material examined.** Holotype: ♂, THAILAND: Kwai River, Tham Rawa, 120 m a.s.l., 16.VI.1986, J. Moubayed (ZMBN). – Other (not listed in original description): 1 Pex on holotype slide, 1 pharate ♂ labeled as holotype (ZMBN).

**Diagnosis.** Differs from other members of the group by having a knob-like extension of the superior volsella. As in *R. okisimplex* Sasa, *R. amamiflavus* Sasa, and the Japanese *R. kuramasimplex* Sasa the digitus of the superior volsella extends beyond the margin. The anal point is spatulate and there are at least 4 dorsal anal tergite setae.

*R. orientalis* has been described in sufficient detail by Moubayed (1989). It is known only from Thailand.

### Zoogeography

Sæther & Kyerematen (unpublished) in order to determine the phylogeny of the genus re-examined all previously described species and using different parsimony analyses obtained 21 species groups. Ten of these groups are found in the Oriental region.

The phyletic interrelationship of the species of *Rheotanytarsus* suggests the splitting of their common ancestor into Asian, African and Neotropical lineages at the earliest very near the end of the fragmentation of the super-continent Pangaea. The Megagaic lineage shows a warm/eurythermic vicariant Gondwanan pattern with multiple sister group relationships between the South Asian subregion, the Australian and the Afrotropical regions. The East Asia – North America linkage is likely of post-Miocene origin. South Asian – West Palaeartic vicariance is found in several groups.

In the *pentapoda* group tracks between Africa and eastern South America and further to Central America are apparent as is a track between the West Palaeartic and South Asia.

The *photophilus* group includes species from South Asia, Europe and Africa. There apparently are vicariance patterns between Africa and South Asia, and between South Asia and the West Palaeartic.

The monotypic *curtistylus* group is known from West Palaeartic and South Asia.

In the *acerbus* group a Beringian connection between East Asia and North and Central America is apparent.



In the *pellucidus* group a single new African species from Ghana as well as a single new Central American species, *R. oss* Cranston from Australia and southern Thailand, *R. minusculus* Kyerematen from Thailand, and *R. tamasecundus* Sasa from Japan, most likely are all a result of peripheral isolation of the widespread *R. pellucidus* (Walker).

In the *guineensis* group the picture is rather unclear, but patterns between Australia and South Asia as well as between South Asia and Africa are indicated.

In the *trivittatus* group there appears to be a tropical Gondwanan vicariance pattern between Africa and South Asia / Australia and possibly a direct trans-Pacific dispersal between South Asia and Central America.

The *ororus* group combines 2 species from Thailand with 3 species from West and Central Africa. There thus apparently is a northern tropical Gondwanaland vicariance pattern.

The *phaselus* group combines one species from Malaysia with one West African species and three Central American species, but is a rather tenuous group.

The *orientalis* group combines 6 South Asian species with one species from non-Oriental Japan.

The Oriental members of the genus thus show several connections with Australia, the East Palaearctic (East Asia), Africa, and to some extent with the West Palaearctic.

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