

## A revision of the *Simocephalus (latirostris)* species group (Crustacea: Anomopoda: Daphniidae)

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### Abstract

The group of 3 species: *Simocephalus latirostris*, *S. lusaticus* and a new species, *S. mesorostris*, is given the rank of a subgenus. Descriptions and a key for the identification of these species are given. The unknown male of *S. latirostris* is described. The comparison of the lectotype of *S. latirostris* with material from different regions shows that this species is not pantropical as previously supposed. It occurs only in South and Central America. *S. mesorostris* n. sp., living in Australia, the Malay Archipelago, South-East Asia and Africa, was previously confused with *S. latirostris*.

### Introduction

Freshwater Daphniidae of the genus *Simocephalus* Schödler 1858 are common in littoral aquatic vegetation all over the world. These 'untailed water fleas' have been known from the middle of the 18th century (Schaeffer, 1755), but their taxonomy remains rather unsettled, with 59 specific and subspecific names proposed. On the one hand, the morphological variability of *Simocephalus* is poorly known. This makes the taxonomic status of certain forms doubtful, since they may not represent taxa, but mere morphological varieties. On the other hand, the descriptions of numerous species are inadequate. Furthermore, some species which are supposed to be wide-spread, cosmopolitan, pantropical *etc.* are really groups of closely related species, with restricted distributions. Frey (1982, 1987) proved the same for some other Anomopoda.

The males of numerous *Simocephalus* species are unknown. Such important characters as the structure of trunk limbs, headpores and the reticulation of the ephippium, are not described in most species, such that the range of diagnostic character is restricted. Some species were erroneously described and the variability

of most of them is unknown. Obviously, a world-wide revision of *Simocephalus* is necessary.

Recently, a list of described species, subspecies and varieties including synonyms was published, and a division of the genus into 4 groups proposed (Orlova-Bienkowskaja 1993a). The *Simocephalus latirostris* group, regarded as a subgenus here, is morphologically clear-cut, comprising *S. latirostris*, *S. lusaticus* and one new species.

The original description of *S. latirostris* was rather complete for that time (Stingelin, 1906), but does not contain information about trunk limb structure and certain other diagnostic characters. Subsequent authors (Brandorff *et al.*, 1982; Collado *et al.*, 1984; Zoppi de Roa & Vasquez, 1991) added practically nothing to the knowledge of its morphology. Thus, there is no adequate description of the parthenogenetic female. The male and the ephippial female are also undescribed. The variability of this species has not been studied.

A number of authors have recorded *S. latirostris* outside the American continent: in South-East Asia, the Malay Archipelago, Australia, and Africa (Fig. 1). But all figures and descriptions presented in these works (Fryer, 1957; Dumont & Van De Velde, 1977; Rajapaksa, 1981; Kanduru, 1981; Hossain, 1982;

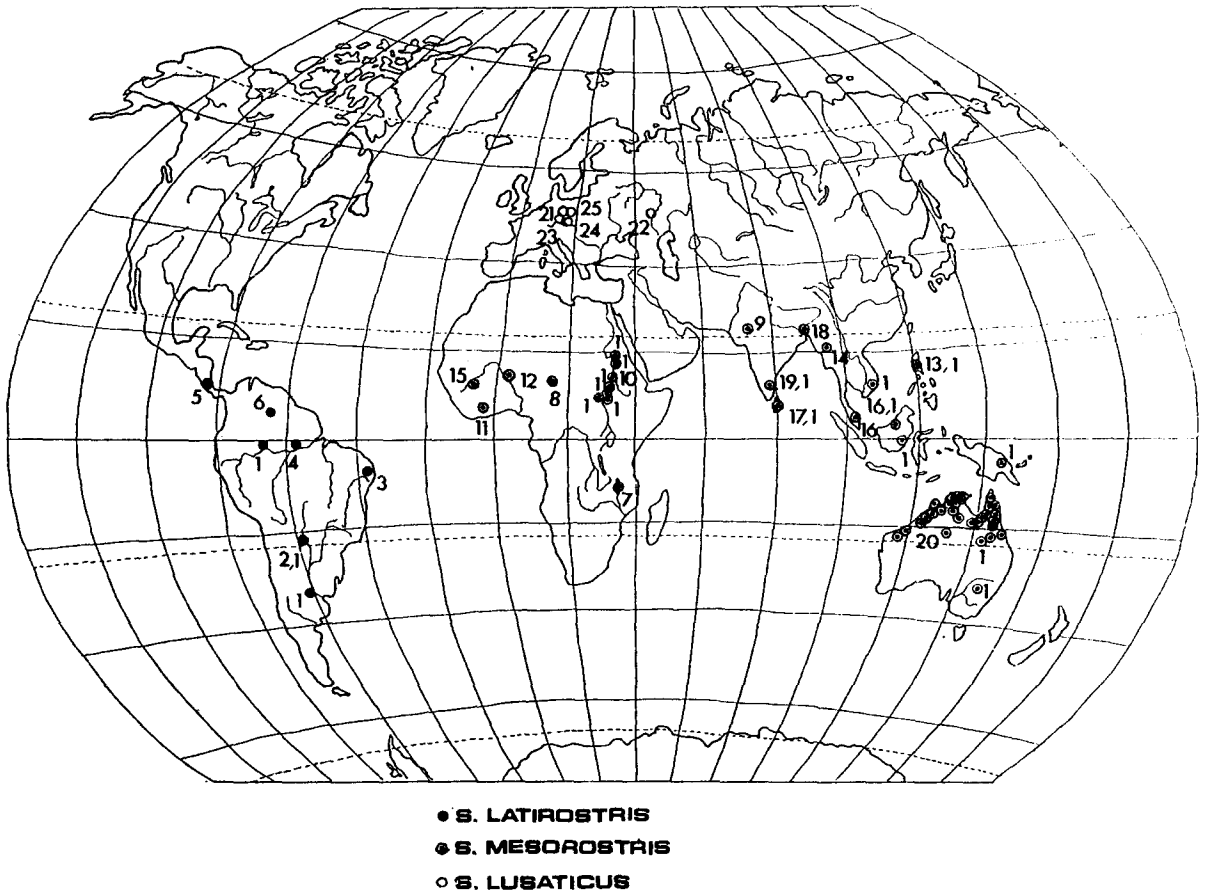


Fig. 1. Areas where the species of *Simocephalus* (*Aquipiculus*) were collected for study or reported in the literature. 1. present study; 2. Stingelin, 1906; 3. Brehm, 1937; 4. Brandorff *et al.*, 1982; 5. Collado *et al.*, 1984; 6. Zoppi de Roa & Vasquez, 1991; 7. Freyer, 1957; 8. Rey & Saint-Jean, 1969; 9. Biswas, 1971; 10. Monakov, 1971; Dumont, 1986; 11. Lamoot (non publ., cit. after Dumont & Van De Velde, 1977); 12. Dumont & Van De Velde, 1977; 13. Mamaril & Fernando, 1978; 14. Bricker *et al.*, 1978; 15. Dumont *et al.*, 1981; 16. Idris & Fernando, 1981; 17. Rajapaksa, 1981; Rajapaksa & Fernando, 1982; 18. Hossain, 1982; 19. Michael & Sharma, 1988; 20. Timms, 1988; 21. Herr, 1917; 22. Behning, 1923, 1925; 23. Šrámek-Hušek, 1943; 24. Ferienc & Zmoray, 1943; 25. Kaminski, 1975.

Dumont, 1983a; Michael & Sharma, 1988) do not correspond with *S. latirostris* in most characters. The cause of this discrepancy is discussed below. *S. lusaticus* is the rarest European species of *Simocephalus*. Its close morphological relation with *S. latirostris* has never been recognised.

### Material and methods

About 300 specimens of *Simocephalus* from 18 localities have been studied. This material was kindly donated by Prof. N. N. Smirnov and Dr N. M. Korovchinsky.

The source of the material are their own collections and those of Prof. C. H. Fernando, Prof. H. Dumont, Dr L. De Meester, Dr A. V. Monakov and Dr T. A. Britaev. In addition, the type of *S. latirostris* deposited in the Museum of Natural History in Olten (Switzerland) was studied.

Original figures were made with a 'Ra-6' camera lucida. Micrographs were made with a JEOL JSM-50A scanning electron microscope. The key and diagnoses are based on adult specimens.

The following abbreviations are used: MPA – material preserved in alcohol, CBS – Canadian balsam slides, PVAS – polyvinyl alcohol slides, PSEM –

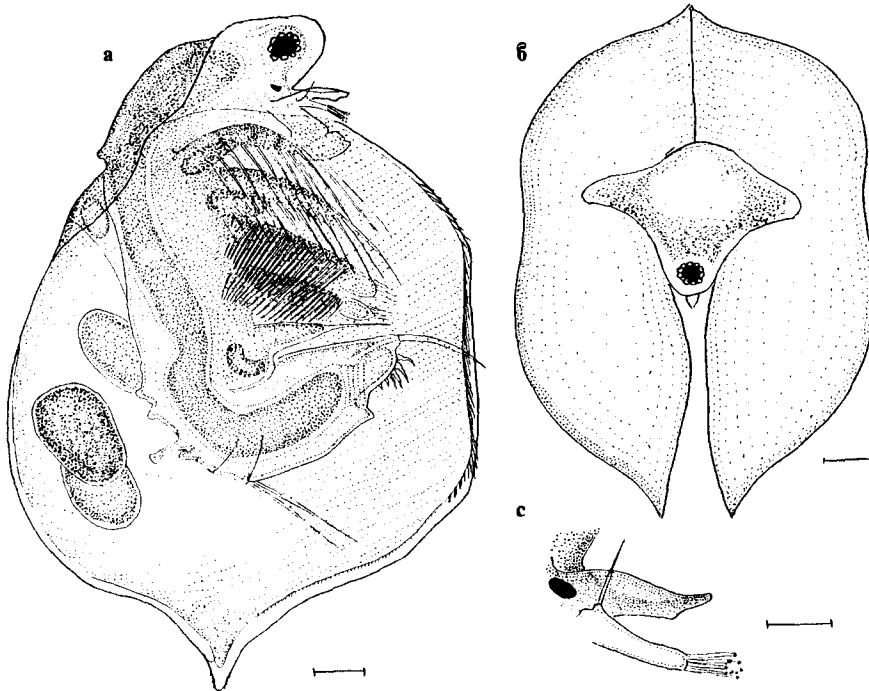


Fig. 2. *S. latirostris*, ♀ ad. (Argentina, Santa Fe). a. lateral view; b. anterior view; c. rostrum and antennule. Scales: 0.1 mm (a, b), 0.05 mm (c).

preparation for the scanning electron microscopy, AC – author's collection, NMO – Naturmuseum Olten (Museum of Natural History in Olten, Switzerland), BMNH – British Museum (Natural History), London, England, ♀ – parthenogenetic female, ♀e – ephippial female, ♂ – male, ad. – adult, juv. – juvenile, P<sub>1</sub>–P<sub>5</sub> – the 1st–5th trunk limb, en. – endite.

*Simocephalus (Aquipiculus)* subgen. n.

*Derivatio nominis:*

The subgenus is name *Aquipiculus* or 'small water woodpecker' because all its representatives have a long rostrum resembling a beak.

*Type species:*

*Simocephalus latirostris* Stingelin, 1906.

*Diagnosis:*

Measurements. ♀♀ 1–2 mm, ♂♂ 0.6–0.9 mm.

Both sexes. Frons rounded, without denticles (Fig. 2a). Head plate depressed or flattened in middle (Figs 2a, 3a, c). Three main connected head-

pores, transversely orientated, and usually 2 minute lateral headpores seen only with scanning electron microscope. Insertion of antennules at base of rostrum (Figs 2c, 3b). Antennule longer than in other species, with neither ridges nor denticles on inner side. Aesthetes shorter than base of antennule. Rostrum longer than in other species. Central part of valves reticulated, with lines running dorsoventrally, sometimes intersecting. Inner rim of ventral valves edge with embayment in middle, its posterior part with fine setules. Postabdominal claws lacking a differentiated basal pecten of enlarged setules. Inner and outer pectens of fine setules located to side of claw. Anal bay of postabdomen wide, straightened in middle, with proximal part (2/3) without anal teeth.

Female (Figs 2, 3c, 4, 5, 6f–i). Valves produced into a more or less sharp point posteriorly. Dorsal edge of valves with deep embayment near posterior protuberance. Valves with dorsal keel (Fig. 2b). Posterior corner of ephippium with protuberance (Figs 3c, 5a). Ephippium reticulated with small humps (Figs 5a–c). Ocellus short or slightly elongated, but always shorter than in *S. vetulus* (O. F. Müller, 1775) (Fig. 2c). Gen-

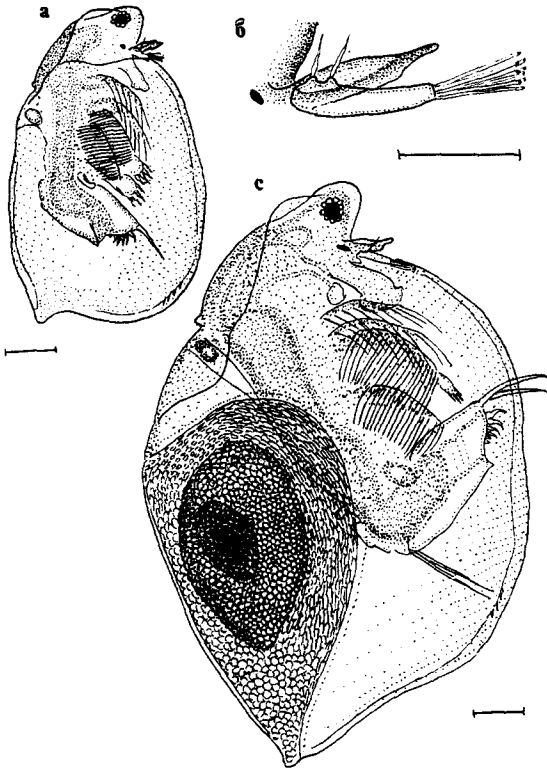


Fig. 3. *S. latirostris* (Argentina, Santa Fe). a. ♂, lateral view; b. rostrum and antennule of ♂; c. ♀e, lateral view. Scales: 0.1 mm (a, c), 0.05 mm (b).

eral structure of trunk limbs as in other *Simocephalus* species (see Orlova-Bienkowskaja, 1993b) (Figs 4a–e). Setae of 2nd and 3rd prominences of  $P_2$  en. as long as 0.6–0.7 and 1.4–1.6 basal segment of plumose seta of 1st prominence, respectively (Fig. 4e). Postabdomen with 5–10 anal teeth on each side (Fig. 6f). Anal corner forming a sharp angle.

Male (Figs 3a, b, 6a–e). Spermiduct opening in middle of anal bay or at base of anal corner (Fig. 6e). Postabdomen with 5–7 anal teeth. Valves produced posteriorly into a rounded prominence (Fig. 3a). ♂ differs from ♀ as in other *Simocephalus* species with the following: abdominal outgrowths absent; dorsal edge of valves almost straight, because of absence of brood pouch; antennules bearing both an aesthete and a seta (Fig. 3b); 4th prominence of  $P_1$  en. with 4 setae, hook and hump covered with denticles (Figs 6a, b); 2nd, 3rd, 4th prominences of  $P_2$  en. with identical setae, slightly longer than basal joint of plumose seta

of 1st prominence, with hooks at tips (Fig. 6c); 3rd seta of  $P_5$  located on large protuberance (Fig. 6d).

**Remarks:**

The 3 species considered in this paper differ from all other representatives of the genus in many characters: the shape of the head plate, rostrum, anal corner, anal bay and ephippium, the proportions of the antennules, the small number of anal teeth, the structure of  $P_4$  en. etc. A differential diagnosis of the subgenus is given in Table 1.

*Simocephalus latirostris* Stingelin, 1906

*S. latirostris*:

Stingelin, 1906: 187; Brandorff *et al.*, 1982: 92.

**Material:**

Lectotype: Paraguay, Riacho Negro; 3. 1894. leg. Carl Ternetz. ♀ ad., CBS in poor condition, deposited in NMO, N III/24. (Paralectotype: ♀ juv., mentioned in the original description is probably lost.)

**Other specimens:**

Argentina: Santa Fe; 23.5.1981: MPA: 12 ♀♀ ad., more than 50 ♀♀ juv., 21 ♀♀e, CBS: 9 ♀♀ ad., 8 ♀♀e, 8 ♂♂, PSEM: 2 ♀♀e; deposited in BMNH (CBS: 1 ♀, 1 ♀e, 1 ♂), NMO (CBS: 1 ♀, 1 ♀e) and AC (all other specimens).

Brazil: Rio Negro, Anavilanas Margen; 14.9.1979: MPA: 1 ♀ ad. (AC).

**Diagnosis:**

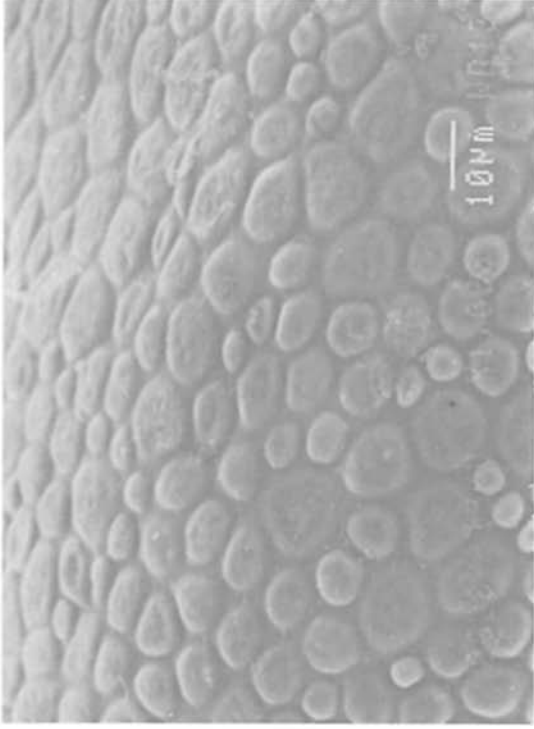
Measurements. ♀♀ 0.99–1.84 mm, ♂♂ 0.62–0.85 mm.

Both sexes. (Figs 2–6). Rostrum very long (Figs 2c, 3b), rostrum length 6.4–9.1% of body length in ♀♀, 5.4–7.7% in ♂♂. Lateral margins of rostrum elevated above central part. Antennule long, in correspondance with the long rostrum; about as long as rostrum. Head plate deeply depressed in the middle.

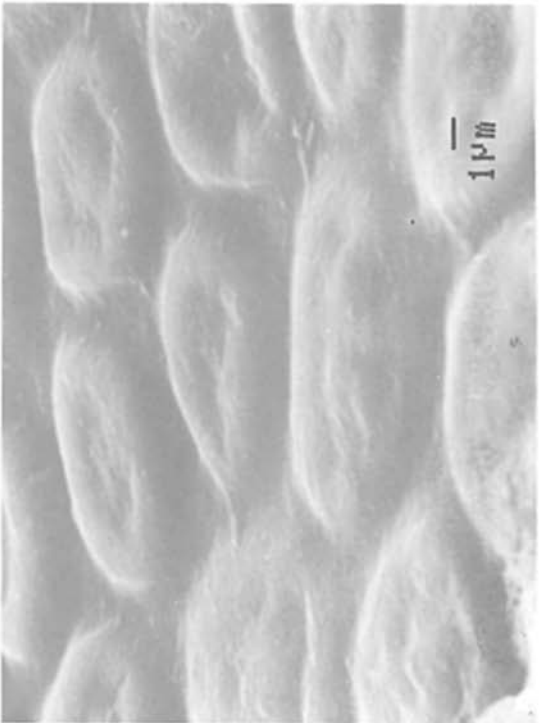
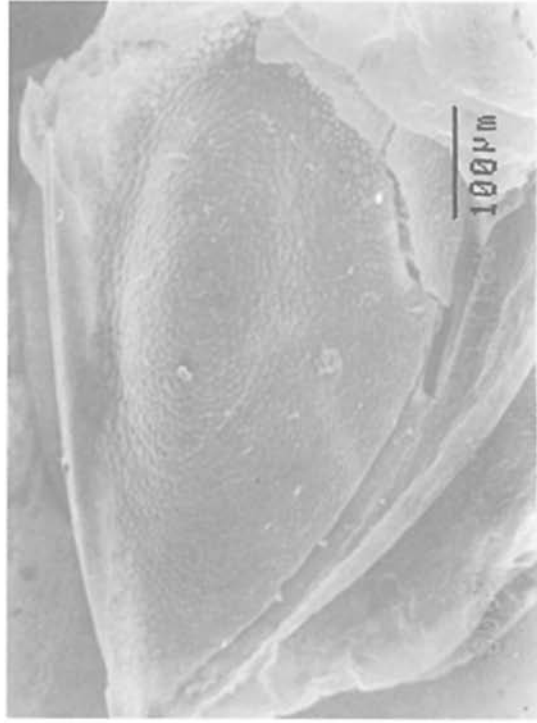
Female. Height 65–74% of length in ♀♀ (Fig. 2a). Ephippium length 47–67% of body length. Aesthetes shorter than 1/2 of length of antennule (Fig. 2c). Posterior prominence of valves in ♀ pointed. Denticles of valves small, located only on posterior prominence. No lateral prominences on valves (Fig. 2b). Postabdomen with 5–9 (usually 7) anal teeth on each side (Fig. 6f). Anal teeth gradually decreasing in size proximally, 5th tooth more than half the length of 4th.



Fig. 4. Extremities of *S. latirostris* ♀ (Argentina, Santa Fe). a-e. trunk limbs: a. P<sub>5</sub>; b. P<sub>4</sub>; c. P<sub>3</sub>; d. P<sub>1</sub>; e. P<sub>2</sub>; f. maxillule. Scales 0.1 mm.



d



a

c

Fig. 5 Details of *S. latirostris* (Argentina, Santa Fe). a, ephippium; b, c surface of ephippium; d, setules of inner rim of posterior part of ventral edge of valves.

Table 1. Differential diagnosis of *Simocephalus* (*Aquipiculus*) 1. *S. vetulus* group; 2. *S. exspinosus* group; 3. *S. serrulatus* group; 4. *Simocephalus* (*Aquipiculus*).

Characters	1	2	3	4
Postabdominal claw (in both sexes):				
Outer and inner sides with fine setules	+			+
Outer side with pecten of elongated setules at base and fine setules proximally; inner side with fine setules		+		
Outer side with fine setules at base and with pecten of elongated setules proximally; inner side with elongated setules			+	
Frons in both sexes rounded, without denticles	+	+		+
Frons in both sexes pointed, with denticles			+	
Frons in both sexes pointed, without denticles		+		
Head plate in both sexes without embayment	+	+	+	
Head plate in both sexes with embayment in middle				+
Antennules in both sexes without ridges and denticles	+	+		+
Antennules in both sexes with ridges and denticles			+	
Insertion of antennules in both sexes at base of rostrum	+	+		+
Insertion of antennules in both sexes at tip of rostrum			+	
Aesthetes in both sexes longer than length of antennule	+	+	+	
Aesthetes in both sexes shorter than length of antennule				+
Rostrum and antennules in both sexes short	+	+	+	
Rostrum and antennules in both sexes long				+
Anal bay in both sexes rounded in middle	+	+	+	
Anal bay in both sexes straightened in middle				+
More than 10 anal teeth in female	+	+	+	
5–10 anal teeth in female				+
Setae of 2nd and 3rd prominence of P <sub>2</sub> en. in female as long as 0.6–0.7 and 1.4–1.6 basal segment of plumose seta of 1st prominence respectively				+
about 0.3 and 0.2 respectively	+			
about 0.7 and 1.1 respectively		+		
about 0.3 and 0.9 respectively			+	
Anal corner in female forming a sharp angle				+
Anal corner in female forming a sharp or obtuse angle	+	+	+	
Distal corner of ephippium with prominence				+
Distal corner of ephippium without prominence	+	+	+	
Spermaduct opening on top of anal corner	+			
Spermaduct opening at base of anal corner or in anal bay		+	+	+
Anal corner in male pointed	+			
Anal corner in male rounded		+	+	+

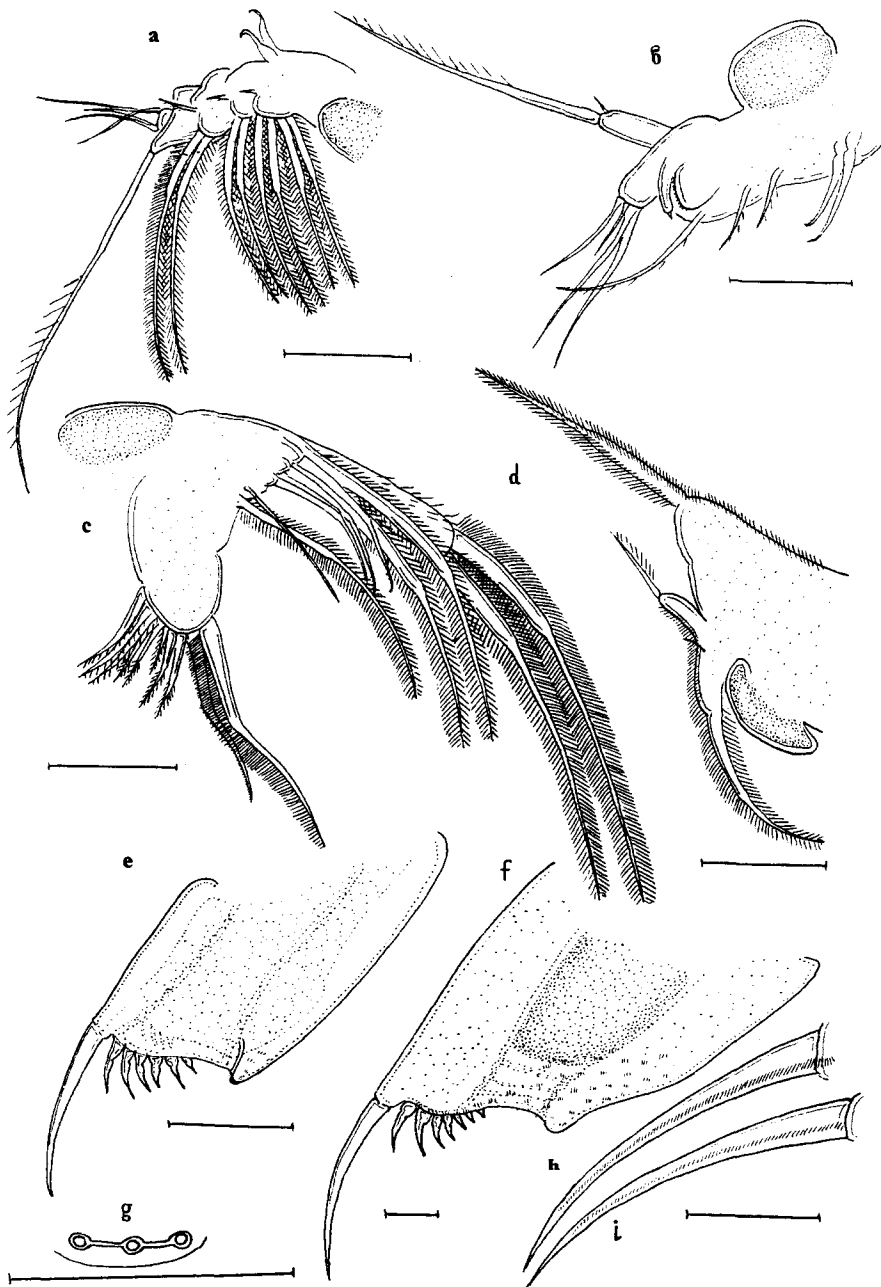


Fig. 6. Details of *S. latirostris* (Argentina, Santa Fe). a-d trunk limbs of ♂: a. P<sub>1</sub>, lateral view; b. P<sub>1</sub>, frontal view; c. P<sub>2</sub>; d. P<sub>5</sub>; e. postabdomen of ♂; f. postabdomen of ♀; g. 3 main headpores; h, i. postabdominal claw: outer and inner view respectively. Scales: 0.05 mm.

Male. Spermiduct opening at base of anal corner (Fig. 6e).

*Variability:*

Geographical variability unknown. The variability of the diagnostic characters is described above. Head pores are located on a large or small tubercle, or this



tubercle is absent. Such tubercles occur also in other *Simocephalus* species. The frequency of occurrence and the size of the tubercles increases in autumn in populations of *S. vetulus* from Moscow region. It is not excluded that this character in *S. latirostris* is subject to seasonal variability too.

Age variability was studied in females only. All diagnostic characters are poorly expressed in juvenile ♀♀. The depression in the middle of the head plate is shallow. The number of anal teeth is small, and the youngest specimens have only 4 teeth on each side of the postabdomen. The ocellus in the youngest ♀♀ is round. The posterior prominence of the valves is less pointed, the dorsal edge of the valves is almost straight, and the brood pouch and abdominal appendages are not developed.

*Distribution:*

The tropics and subtropics of South and Central America (See Fig. 1).

*Biology:*

*S. latirostris* occurs in the littoral of rivers (Brandorff *et al.*, 1982, our data). ♂♂ and ♀♀e occur at the end of May (Argentina, Santa Fe).

*Remarks:*

Numerous records of *S. latirostris* from Australia, the Malay Archipelago, South-East Asia and Africa are available (see Introduction). Johnson (1963) supposed this species to be pantropical. However, according to the descriptions and figures, the authors have misused the name *S. latirostris* for the other species, described below.

Dumont (1983a) supposed *Simocephalus iheringi* Richard, 1897, described from Brasilia, to be a synonym of *S. latirostris*. The general body shape is rather similar in these two species, and the valves of ♀♀ are produced into a sharp point in both species. But according to the original description (Richard, 1897) and our own investigation of *S. iheringi* specimens from South America, this species has a short rostrum, a well differentiated basal pecten of enlarged setules on the postabdominal claw, a head plate without an embayment, a narrow anal bay, not straightened in the middle, and an anal corner forming a right or obtuse angle. Therefore, *S. iheringi* clearly differs from *S. latirostris* and obviously belongs to the *S. exspinosus* group.

*Simocephalus mesorostris* n. sp.

*S. latirostris*: Fryer, 1957: 225, Biswas, 1971: 115, Dumont & Van De Velde, 1977: 81, Mamaril & Fernando, 1978: 134, Kanduru, 1981: 65, Rajapaksa, 1981: 98, Hossain, 1982: 112, Dumont, 1983a: 103, Michael & Sharma, 1988: 80.

*Derivatio nominis:*

The species is named *S. mesorostris*, because its rostrum is of intermediate size: shorter than in *S. latirostris*, but longer than in other *Simocephalus* species.

*Material*

*Holotype:*

The Philippines: Luzon, Bulacan near Chemical Plant, pond, 1.1976: CBS: 1 ♀ ad. (BMNH).

*Paratypes:*

The Philippines: (same locality and data as holotype): CBS: 3 ♀ juv., MPA: 12 ♀ juv., PSEM: 1 ♀e (AC). Luzon, Univ. Lagoon near Manila, 1975: MPA: ♀ ad., ♀ juv. (AC).

Indonesia: East of Kalimantan, Tengaarong, fish pond near Samarinda, 15.7.1977: MPA: ♀ ad., ♀ juv., CBS: ♀ ad., ♀ juv. (AC).

Malaysia: Kedah, Bakih Besar near Alor Setar Pond, 31.12.1973: MPA: 2 ♀♀ ad. (AC).

New Guinea: Eastern Sepik Province 144°124'E, 4°02'S, lower River Sepik, Lake Mugiran, among vegetation (*Eichornia* sp.), 14.5.1992, leg. L. de Meester: MPA 7 ♀♀ ad., 7 ♀♀ juv. (AC).

Australia: New South Wales, Llalong Lagoon, 8.5.1966: MPA: ♀ ad., 4 ♀♀ juv. (AC). Queensland via Aramac near Lake Dunn Homestead, 17.7.1974, leg. Smirnov N. N.: PVAS: ♀ ad. (AC).

South of Viet-Nam (leg. Britaev T. A.): Nha Trang, rice field, 8.12.1985: MPA: 5 ♀♀ ad., 2 ♀♀ juv. (AC). Nha Trang, pond, littoral aquatic vegetation, 20.11.1985: ♀ juv. (AC).

Sri Lanka: Kekirawa tank, 16.12.1974: MPA: ♀ ad., 3 ♀♀ juv. (AC). Kebbitigolawa tank, 19.12.1970: MPA: 2 ♀♀ juv. (AC). Chandrika wewa, 7.7.1970: MPA: 2 ♀♀ juv. (AC). Nilunvillu Wilpattu (Villus) 10.4.1973: MPA: 2 ♀♀ ad., 6 ♀♀ juv. (AC).

India: Madurai, 5 ponds and temporary pools, leg. Dumont H.: MPA: 1 ♀ ad. (AC).

*Other specimens:*

Sudan, White Nile: (leg. Monakov A. V.) Kosti, 28.11.1963: MPA: 5 ♀♀ ad., CBS: 5 ♀♀ ad. (NMO: 1 ♀ ad., CBS; AC: all other specimens). The same locality, in vegetation (*Eichornia* sp.), 12.11.1963: ♀ ad. (AC). The same locality, in vegetation (*Nymphaea* sp.), 25.11.1963: 2 ♀♀ ad. (AC). The same locality, in vegetation, 27.11.1963: 3 ♀♀ ad. (AC). Opposite to El-Du-Eim, 14.11.1963, 19.11.1963: MPA: 4 ♀♀ ad., 8 ♀♀ juv. (AC). Near Berber, 11.12.1963: MPA: 12 ♀♀ ad., 7 ♀♀ juv. (AC). Sobat river, 2.5.1964, 26.12.1963: MPA: 16 ♀♀ ad., 17 ♀♀ juv. (AC). Right bank of Nile river, above Aliab, 26.5.1964: MPA: ♀ ad. (AC). Nile river above the mouth of El Ghazal river, 14.12.1964: MPA: 7 ♀♀ ad., 5 ♀♀ juv. (AC). Sudan, White Nile, without more detailed geographical data, in vegetation (*Phragmites* sp.), 27.1.1964: MPA: ♀ ad. (AC). The same locality, in vegetation (*Cyperus papyrus*), 28.1.1964: 2 ♀♀ ad. (AC). The same locality, without data on biotope, 10.12.1963, 26.7.1963, 11.12.1963: MPA: 20 ♀♀ ad., 11 ♀♀ juv. (AC).

*Diagnosis:*

Measurements. ♀♀ 1.22–1.94 mm.

Female. (Figs 7, 8). Height 59–75% of length. Rostrum shorter than in *S. latirostris*. Rostrum length 3.3–5.7% of body length (Fig. 7a). Lateral margins of rostrum below central part. Antennule shorter than in *S. latirostris*, in correspondence with moderate size of rostrum, its length about as that of the rostrum. Aesthetes longer than 1/2 length of antennule. Depression of head plate shallow. Posterior prominence of valves in ♀ rounded on top (Fig. 7b). Denticles of valves of moderate size, located both on posterior prominence and on dorsal edge of brood pouch. No lateral prominences of valves. Postabdomen with 5–8 (usually 6) anal teeth on each side (Fig. 8c). Four distal teeth large, the others extremely small, 5th tooth less than half as long as 4th.

Male. Unknown.

*Variability:*

The rostrum in *S. mesorostris* from Africa (Fig. 8d) is longer than in specimens from Australia, the Malay Archipelago, and South-East Asia. Rostrum length is 5.2–7.3% and 3.3–5.7% of body length, respectively. The significance of the differences in mean length is more than 99%. The variability of other diagnostic characters is described in the diagnosis. Head pores located on a large tubercle in 65% of ♀♀ from Australia,

Malay Archipelago, and South-East Asia and in 22% of ♀♀ from Africa, on a small tubercle in 6% and 47%, while the tubercle is absent in 29% and 31% of ♀♀, respectively. The ocellus varies in shape from almost round to elongated, but is never as long as in *S. vetulus*. The depression of the middle part of the head plate is deep or more shallow, but never as deep as in *S. latirostris*. The rostrum is directed ventrally or slightly upturned. Age variability is similar to that of *S. latirostris*. Changes in body shape with age are shown in Fig. 8a.

*Distribution:*

The tropics of Australia, the Malay Archipelago, South-East Asia and Africa (see Fig. 1).

*Biology:*

*S. mesorostris* occurs in shallow ponds (Johnson, 1963; Mamaril & Fernando, 1978; Idris & Fernando, 1981; Michael & Sharma, 1988; our data), in rice fields (Mamaril & Fernando, 1978; Idris & Fernando, 1981; our data), in reservoirs, pools and marshes (Idris & Fernando, 1981), in the river littoral (Dumont & Van De Velde, 1977; Boonsom, 1984; our data) and in the lake littoral (Rey & Saint-Jean, 1969). This species has also been found in temporary waterbodies (Johnson, 1963; Rajapaksa, 1981) and high altitude reservoirs (>759 m a.s.l.) (Boonsom, 1984).

It lives only among vegetation, in particular, *Pistia* sp., *Echinochloa* sp., *Nymphaea lotus*, *Vossia* sp., *Utricularia* sp., *Vallisneria* sp. (Dumont & Van De Velde, 1977, Green, 1984) and *Eichornia* sp. and *Cyperus papyrus* (our data). Johnson (1963) noted that it occurs in warm, unpolluted waterbodies with low pH and low oxygen concentration. Green (1984) found it in water with conductivity about  $350 \mu\text{s cm}^{-1}$  20°C.

Co-existence of *S. mesorostris* with *S. serrulatus* has been recorded (Fryer, 1957).

The life cycle is unknown. One ♀e was found in January (in the Philippines). ♀♀ were found throughout the year, except in August and September.

*Remarks:*

We do not include the specimens from Africa in the type material because they differ from others in rostrum length. However, we consider that African *S. mesorostris* do not belong to another subspecies, because there is considerable overlap in this character (more than 25%) and there are no other differences.

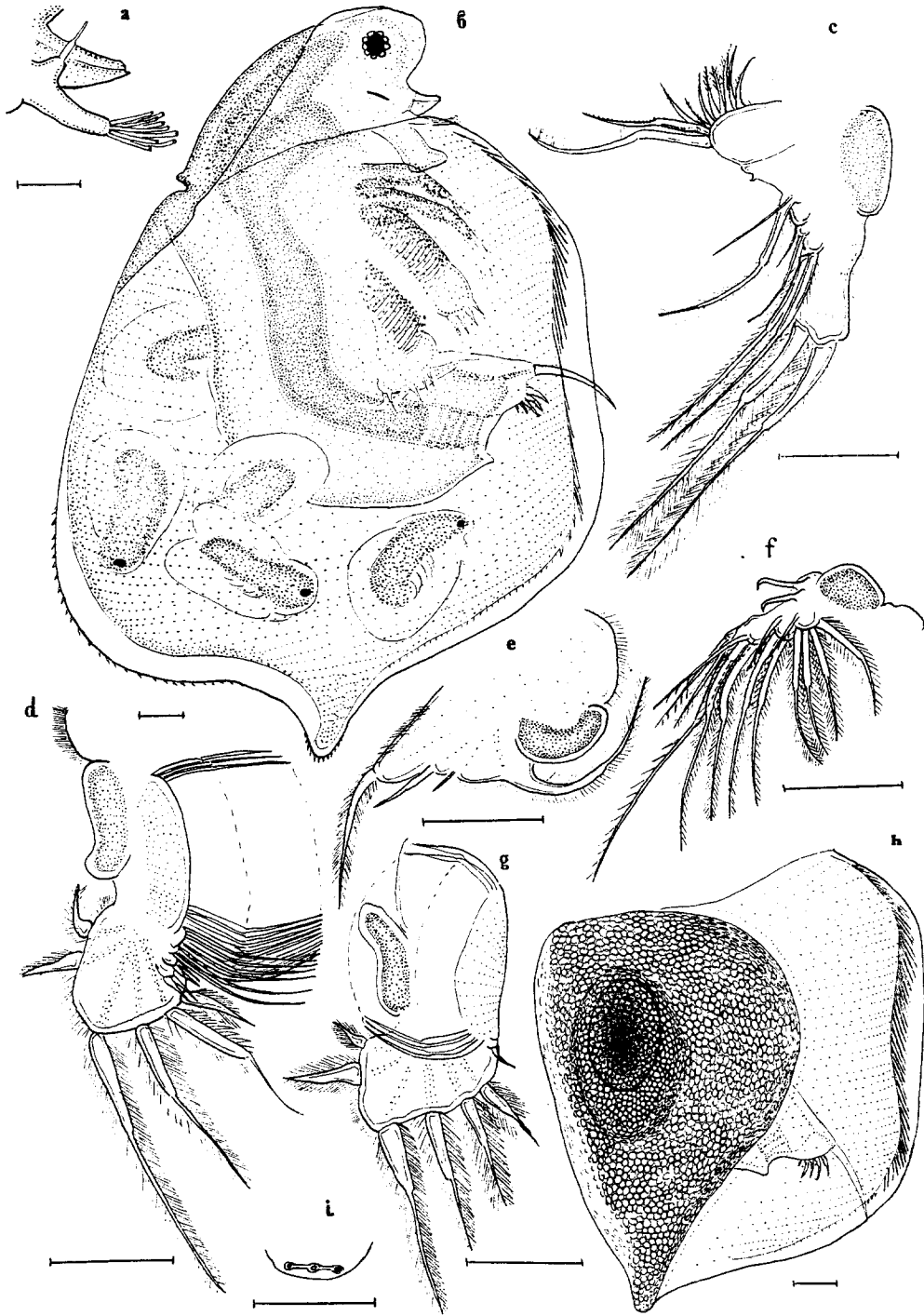


Fig. 7. *S. mesorostris* sp. n. (the Philippines, Luzon): a. rostrum and antennule of ♂; b. ♀, lateral view; c–g trunk limbs: c. P<sub>2</sub>; d. P<sub>3</sub>; e. P<sub>5</sub>; f. P<sub>1</sub>; g. P<sub>4</sub>; h. ♀, lateral view (without head); i. 3 main headpores of ♀. Scales: 0.05 mm (a, i), 0.1 mm (b–h).

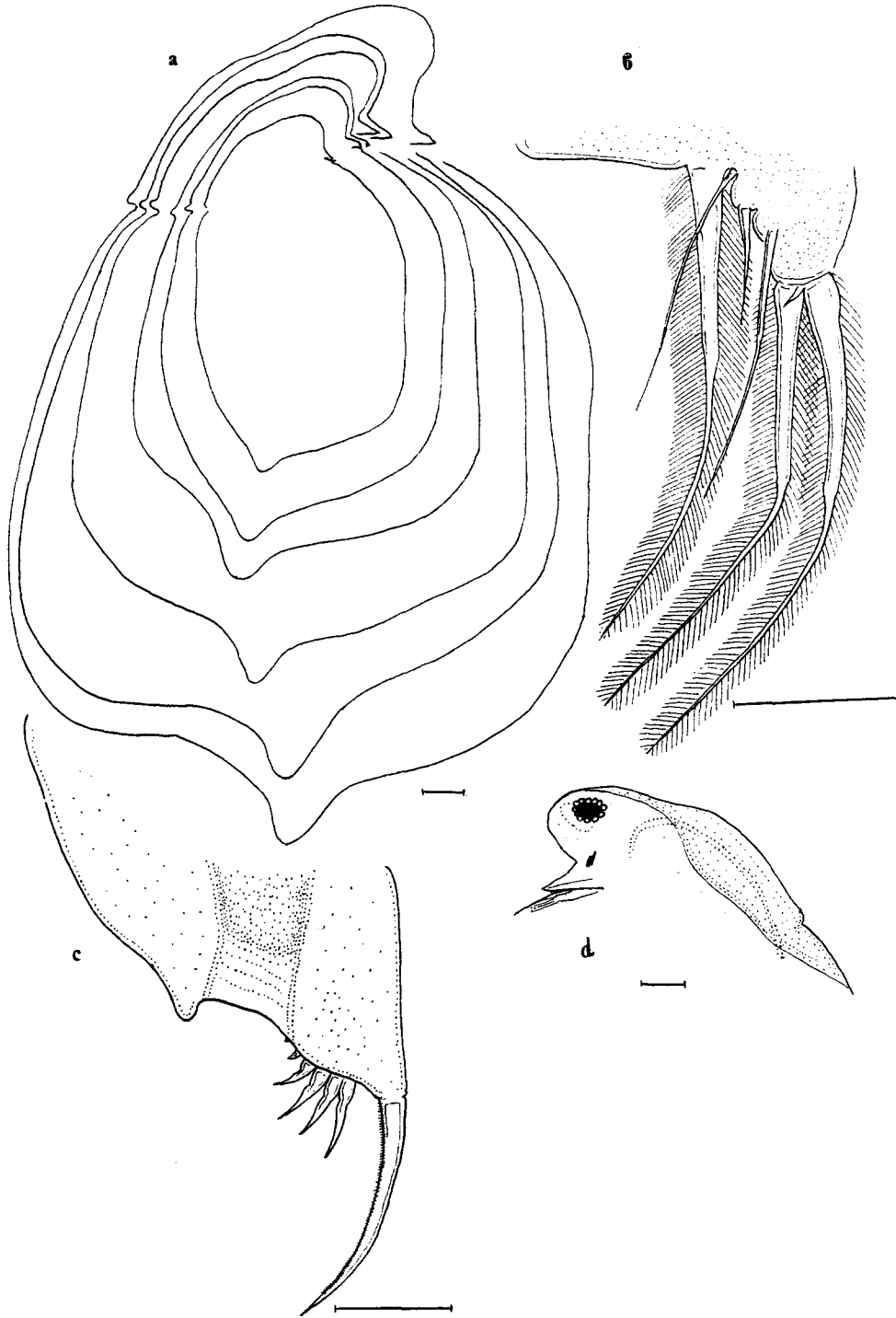


Fig. 8. *S. mesorostris* sp. n., ♀ (a, c. the Philippines, Luzon; b, d. Sudan, Costi). a. age variability of body shape; b. P<sub>2</sub> en.; c. postabdomen; d. head of African ♀ (Sudan, White Nile near Kost) (rostrum longer than in typical form). Scales: 0.05 mm (b), 0.1 mm (a, c, d).

*Simocephalus lusaticus* Herr, 1917

*S. lusaticus*: Herr, 1917: 58, Behning, 1923: 5, 1925: 526; Šrámek-Hušek *et al.*, 1962: 259, Flössner, 1972: 182, Kaminski, 1975: 89.

*S. vetulus* (partim): Ferianc & Zmoray, 1943: 19.

*Syntypes*:

East Europe, Silesia, ponds near Werda 27.7.1913 (12 specimens), 5.9.1913 (3 specimens), 'false ponds' 10.8.1913 (6 specimens). We do not know where these syntypes were deposited or whether they still exist.

*Material*:

None.

*Distribution*:

East Europe (see Fig. 1): Silesia, Czechia, Slovakia, Poland, Russia: Wolga basin. Manujlova (1964) recorded this species from the Caucasus. Obviously this is erroneous, because she refers to a book which contains no such information.

*Diagnosis*:

Measurements: ♀♀ 1.5–3 mm ♂♂ about 1 mm.

Both sexes. (Fig. 9). Rostrum shorter than in *S. latirostris*; its lateral margins below central part. Antennule shorter than in *S. latirostris*, about as long as or a little longer than the rostrum. Depression of head plate shallow.

Female. Aesthetes about half as long as antennule (Fig. 9h). Posterior prominence of valves rounded or pointed at the top (Figs 9a, e, j). Denticles of valves small, located only on posterior prominence; 2–8 pairs of lateral prominences on valves (Figs 9b, h, k). Postabdomen with 7–10 anal teeth on each side. Anal teeth gradually decreasing in size proximally.

Male (Figs 9d, i). Spermiduct opening in middle of anal bay.

*Variability*:

Unknown.

*Biology*:

*S. lusaticus* occurs in shallow, warm, stagnant reservoirs, ponds and temporary waterbodies (Herr, 1917; Behning, 1925; Flössner, 1972). ♀♀ and ♂♂ occur in July (Behning, 1925) and in September (Herr,

1917). On this basis, Flössner (1972) supposed it to be bicyclic.

*Remarks*:

According to available descriptions (Behning, 1925; Šrámek-Hušek *et al.*, 1962; Flössner, 1972; Kaminski, 1975), *S. lusaticus* has all diagnostic characters of *Simocephalus (Aquipiculus)* (see above). It differs from all other species of the genus in having lateral prominences on the valves.

Key to ♀♀ ad. of *Simocephalus (Aquipiculus)* subgen. n.

1. 2–8 pairs of lateral prominences on valves . . . . . *S. lusaticus* Herr, 1917.
- No lateral prominences . . . . . 2
2. Rostrum long, its lateral margins above central part. Posterior prominence of valves pointed on top. 5th anal tooth more than half the length of 4th. Denticles of carapace small, only on posterior protuberance of valves . . . . . *S. latirostris* Stingelin, 1906
- Rostrum shorter, its lateral margins below central part. Posterior prominence of valves rounded on top. 5th anal tooth less than half the length of 4th. Denticles of carapace of moderate size, both on posterior protuberance of valves and on dorsal edge of brood pouch . . . . . *S. mesorostris* sp. n.

*Discussion**Morphology*

Rajapaksa (1981) noted that the postabdominal claw in *S. mesorostris* (mentioned under the name *S. latirostris*) has a basal pecten of enlarged spinules. However, she figured the claw without differentiated pecten.

Biswas (1971) and Dumont (1983a) regarded the tubercle of the posterior part of the head as one of the chief diagnostic characters of *S. mesorostris*. Other authors did not record the presence of such a tubercle (Michael & Sharma, 1988; Hossain, 1982). According to our data, this character is subject to variability (probably seasonal) and cannot be used for the identification of *Simocephalus* species. The same is true also of the ocellus shape and the depth of the groove between the head and the body.

Some authors (Biswas, 1971; Michael & Sharma, 1988) noted that the reticulation of valves in *S. mesorostris* and *S. latirostris* is polygonal. However, according to our data, the valves are reticulated with lines running dorsoventrally, somewhat intersect-

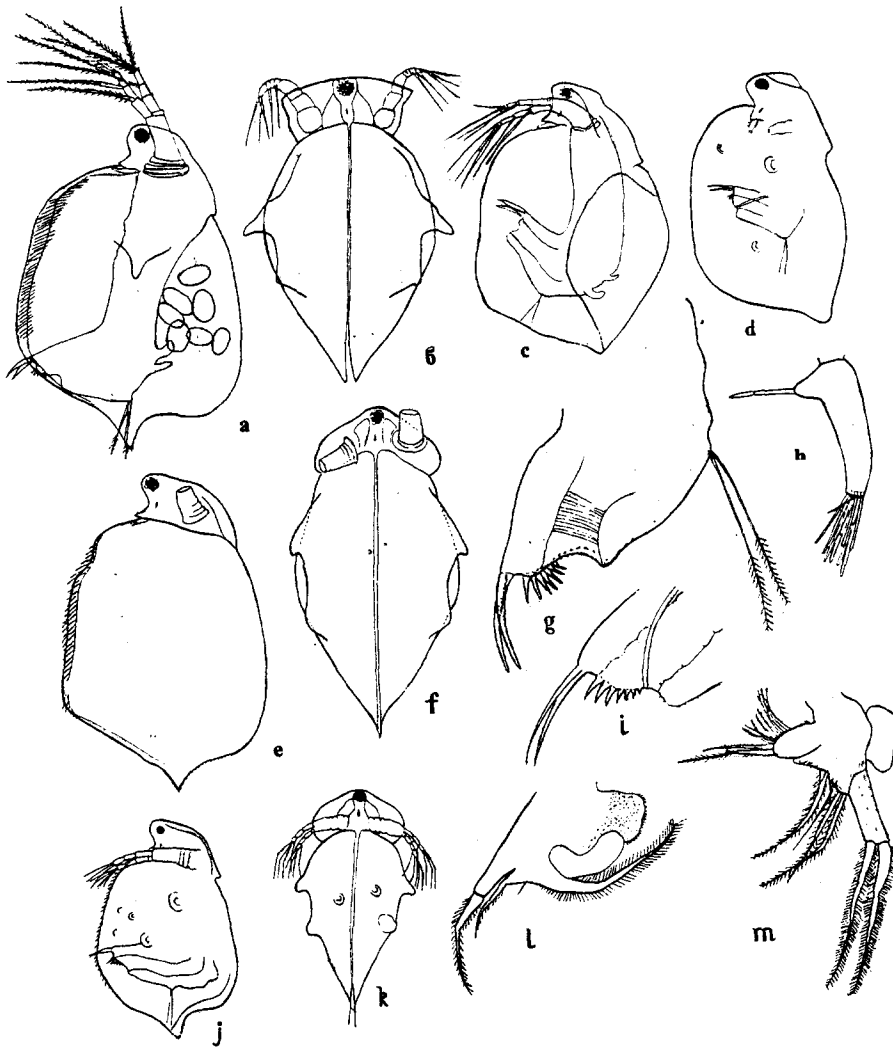


Fig. 9. *S. lusaticus*. a. ♀, lateral view; b. ♀, ventral view; c. ♀, lateral view; d. ♂, lateral view; e. ♀, lateral view; f. ♀, ventral view; g. postabdomen of ♀; h. antennule of ♀; i. postabdomen of ♂; j. ♀, lateral view; k. ♀, ventral view; l. P<sub>5</sub> of ♀; m. P<sub>2</sub> of ♀. a-c, g, h, l, m after Behning 1925 (Russia, Saratov), d, i-k after Herr 1917 (Silesia), e, f after Šrámek-Hušek *et al.*, 1962 (Czechoslovakia).

ing. Probably, the above mentioned authors studied the reticulation by transmitted light. As a result, the polygonal structure of the underlying tissue masked in the reticulation.

A number of the essential characters of *S. lusaticus* are differently described by different authors. In particular, Herr (1971) noted that *S. lusaticus* has 3-8 pairs of asymmetrically arranged lateral prominences on the valves. Other authors (Behning, 1925; Šrámek-Hušek *et al.*, 1962; Kaminski, 1975) mentioned only 2 pairs of symmetrically arranged prominences. The shape of these prominences and the posterior prominence of valves is also described and figured differently

(see Fig. 9). Probably, these differences are connected with the geographical variability of the species or even with intra-populational variability.

Behning (1925) wrote that *S. lusaticus* from the Wolga basin had denticles on the frons. We doubt the presence of such denticles, because other authors did not note them and Behning himself did not figure them.

Males in *Simocephalus* (*Aquipiculus*) are less diagnostic than in the Chydoridae. The same is true of the males of the Scapholeberinae (Dumont, 1983b).

### Chorology

*S. latirostris* is not a pantropical species as previously believed (Johnson, 1963). It occurs in South and Central America only. Another species of this group, *S. mesorostris* occurs in Australia, the Malay Archipelago, South-East Asia and Africa. These results agree with the conclusion of Frey (1982) that many widespread Anomopoda 'species' (cosmopolitan, pantropical, etc.) are actually groups of related species, each of which has a more restricted distribution.

The widespread distribution of Anomopoda genera and subgenera has been considered in the past to reflect considerable passive dispersal by wind and migrating birds, but recently Dumont (1980), Frey (1982) and Benzie (1987) have suggested that zooplankton may not spread as easily as has been thought. The distribution of *Simocephalus* (*Aquipiculus*) strongly suggests a Gondwanan or Pangean origin.

It conforms with the recent notion about the considerable evolutionary age of groups within the Daphniidae (Dumont & Verheye, 1984; Benzie, 1987) and of the genus *Simocephalus* itself. Fryer (1991) described an ephippium of Cretaceous age which is absolutely indistinguishable from the ephippium of recent *Simocephalus* species.

Obviously, *S. latirostris* is a South American endemic. It probably dispersed to Central America after the origin of the Panamanian isthmus.

The range of *S. mesorostris* consists of two large parts isolated from each other: Africa and Australia + Malay Archipelago + South-East Asia. In spite of a long period of isolation, animals from these two regions do not differ sufficiently to regard them as different subspecies.

In Africa, *S. mesorostris* occurs near lakes Malawi and Tchad and in the basins of the Nile and Niger rivers. A number of African Anomopoda have a similar distribution. Dumont & Verheye (1984) supposed that such areas were formed during the pluvial period 12,000–8,400 BP, when these water basins were connected.

The data about *S. lusaticus* are too poor for the reconstruction of the history of its distribution. Perhaps it dispersed to Europe from the East after the glacial period (Flössner, 1972).

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