

The Fennoscandian species of *Parakiefferiella* Thienemann (Diptera, Chironomidae, Orthocladiinae)

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The genus *Parakiefferiella* includes the following Fennoscandian species which are all described in detail (male or male and pupa): *P. bathophila* (Kieffer) (male, pupa), *P. bilobata* sp.n. (male), *P. coronata* (Edwards) (male, pupa), *P. fennica* sp. n. (male, pupa), *P. finnmarkica* sp. n. (male), *P. gynocera* (Edwards) (male, pupa), *P. minuta* sp. n. (male), *P. nigra* Brundin (male, pupa), *P. scandica* Brundin (male, pupa), and *P. smolandica* (Brundin) (male, pupa). A key to the males and pupae is presented and the taxonomy and ecology of the species is briefly discussed. The other European species of the genus, *P. dentifera* Wülker and *P. gracillima* (Kieffer), as well as published unidentified exuviae and unpublished males are discussed.

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1. Introduction

According to Limnofauna Europaea (Fittkau & Reiss 1978) the genus *Parakiefferiella* Thienemann consists of six hitherto known European species. All were considered by Brundin (1956). Wülker (1957) published an important paper containing several descriptions and redescrptions of the *Parakiefferiella* group. In addition, unknown exuviae have been described (Brundin 1956, Wülker 1957 and Reiss 1968). Saether (1983) has discussed the phylogeny of the *Parakiefferiella* group.

During the last few years I have sorted out samples collected in different parts of Finland (particularly in the north) and northern Norway and Sweden. Much new information has been accumulated: among others, the species of *Parakiefferiella* are very abundant in Lapland, containing one common species to be described as *P. fennica* sp. n. The detection of three additional undescribed species may suggest that further new finds can be made.

The aim of the present paper is to describe the four new species, to redescribe the males of the other Fennoscandian species, to describe the known exuviae and to present a synoptic key to males and exuviae. Further, the tax-

onomy and ecology of the species will be discussed in brief.

2. Material, methods and terminology

Most of the material studied has been collected by P. Virtanen and B. Lindeberg, and by myself in 1981–1985, from different parts of Finland and some localities in Finnmark, northern Norway and the Abisko area, Swedish Lapland. The adults have been taken from swarms and by sweeping among vegetation and pupal exuviae from the surface of lakes with a plankton net, and the material preserved in about 70% ethanol. Specimens for drawings were cleared in KOH, but others used for descriptions were mounted in Euparal directly from absolute alcohol.

The terminology and measurements of males and pupae mainly follow Saether (1980). For wing venation and certain hypopygial structures the terminology of Fittkau (1962), Roback (1971) and Pinder (1978) is used. I prefer to use the term basal median lobe as used by Söponis (1977). This is obviously the same as the superior volsella of Saether (1980). My gonocoxite lobes are the basal lobes of Söponis, but here I follow Pinder (1978).

Abbreviations suggested for spinule groups of abdominal tergites of pupal exuviae are AG, MG and PG (anterior, medial and posterior group). AG means the oralmost spinule group of tergites which can be distinctly separated, but which especially in tergites 3–5 is often connected with MG. MG means the spinule group between AG and PG, the posterior margin of which lies slightly caudad to the level of D₅-setae. PG is a group of strong spinules approximately in 2–6 rows near the posterior margin of the tergite, often narrowly separated

from MG (cf. Fig. 7.3.). The length of the anal lobe extension is measured from the base of the last anal macroseta to the tip of the extension. The breadth is measured at the point of the last macroseta.

3. Genus *Parakiefferiella* Thienemann

Typus generis: *Parakiefferiella coronata* (Edwards)

Male

Some additional characters can be given to expand the generic diagnosis of Brundin (1956) and Saether (1969): Antennal flagellum 13, in *P. gynocera* 5-segmented. Second free palp segment with 0–2 weak sensilla clavata, in *P. minuta* with a group of long sensilla clavata. Dorsocentrals 3–8. Prealars 1–5. Vein R with 0–6, R_{4+5} with 0–5 macrotrichia. Virga well developed, long. Transverse sternapodeme nearly straight to very concave. Basal median lobe often very distinct, rounded to angular. Anal point with 1–15 bristles on each side. Hypopygium normal or slightly broadened.

Pupal exuviae

Small exuviae with slightly brownish colour. Certain abdominal segments sometimes darkened. Thoracic horn small and ovoid (longish in *P. dentifera*), with or without weak spinules on surface, or absent. Frontal warts often well developed. Pair of frontal setae without cephalic tubercle. 2 postorbitals. Ventral seta lacking. 2–3 median and 1–2 lateral antepronotals present, one LAps very long. 4 dorsocentrals, 3 precorneals and 0–1 small metanotal seta present. Wing sheaths without pearls or nose. Tergite 1 mostly without spinules (spinules present in *P. coronata*). Tergites 2–4 with very weak to strong spinules in anterior, medial and posterior groups (AG, MG and PG, cf. Fig. 7.3). Tergites 5 and 6 without PG, in tergite 6 AG and MG usually divided into two groups. AG of tergite 7 present, MG only rarely. Tergite 8 with AG of very small spinules. Sternites 2–8 with very fine spinules mainly in oral part of sternite, stronger spinules only on *P. coronata*. Abdominal segment 1 with 5 dorsal, 4 ventral setae and 2 lateral hairs; segments 2–7 with 5 dorsal, 4 ventral setae and 4 lateral hairs; segment 8 with 2 dorsal, 1 ventral setae and 4 lateral hairs. Anal lobe without fringe, with three anal macrosetae and well developed anal lobe extensions of different length.

Remarks

The only taxonomically important character in the cephalothorax seems to be the thoracic horn. However, some care must be exercised in using this character: on a microscope slide the horn is easily pressed and loses its original size and shape. Sometimes the spinules, although present, are very poorly visible or not at all.

The number of cephalothoracic setae is almost the same in all the species treated, and because of their minute size and strong

curvature the length is nearly impossible as a criterion for use in practical taxonomy. For these reasons the lengths and numbers are not given in the present descriptions.

The most useful characters are found in the tergal spinulae patterns. However, variation and poor mounting may render this character difficult. For these reasons, the U-shaped plain area on tergites 3–5, for instance, typical to *P. fennica*, *P. gynocera*, *P. nigra* and *P. smolandica*, may become difficult to interpret.

Useful differences can also be found in the sternal shagreenation, although this character is very difficult to use and needs very successful mounts. Fig. 10 has been drawn from single representatives only, so the limits of variation are not shown in this connexion.

Parakiefferiella bathophila (Kieffer, 1912)

Imago:

Dactylocladius bathophilus Kieffer 1912: 88.

Smittia (*Epoicocladius*) *cheethami* Edwards 1929: 359, fig. 7k and plate XVIII, fig. 10.

Smittia (*Epoicocladius*) *cheethami* Edw., Goetghebuer 1932: 119, fig. 215.

Eukiefferiella (*Parakiefferiella*) *bathophila* (K.), Goetghebuer 1940–50: 123.

Epoicocladius cheethami Edw., Brundin 1947: fig. 68.

Hydrobaenus (*Smittia* (*Epoicocladius*)) *cheethami* Edw., Coe 1950: 165, figs. 184j and 189k. ♂ in key.

Parakiefferiella bathophila (K.), Brundin 1956: 152. ♂ in key.

Parakiefferiella bathophila (K.), Pinder 1978: 92, figs. 45c and 133c. ♂ in key.

Pupa:

Dactylocladius bathophilus K., Potthast 1914: 275–276, fig. 36.

Parakiefferiella bathophila (K.), Thienemann 1944: 574, fig. 34. In key.

Parakiefferiella bathophila (K.), Brundin 1956: 152. In key.

Parakiefferiella bathophila (K.), Wülker 1957: 411–412, fig. 1c.

Parakiefferiella bathophila (K.), Langton 1984: 122, fig. 40c.

Larva:

Dactylocladius bathophilus K., Potthast 1914: 274–275, figs. 32–35.

Parakiefferiella bathophila (K.), Thienemann 1944: 647, fig. 194. In key.

Orthocladius bathophilus (K.), Chernovskii 1949: 203, fig. 127. In key.

Parakiefferiella bathophila (K.), Cranston et al. 1983: figs. 9.52 A, D–F.

Material used for description

15 males; 1 ♂ from Ka, Vehkalahti, Pajjärvi (672:51), 5.6.1983, J. Tuiskunen leg.; 2 ♂ ♂ from Ta, Kangasala,

Table 1. Description of males of *Parakiefferiella bathophila* (Kieffer), *P. coronata* (Edwards), *P. gynocera* (Edwards), *P. nigra* Brundin, *P. scandica* Brundin and *P. smolandica* (Brundin).

	<i>P. bathophila</i> n=15	<i>P. coronata</i> n=11	<i>P. gynocera</i> n=10	<i>P. nigra</i> n=12	<i>P. scandica</i> n=18	<i>P. smolandica</i> n=10
Total length (mm)	1.9–2.5	1.5–1.7	1.5–1.8	2.4–2.9	2.0–2.6	2.0–2.4
Scutal stripes	separated	fused	separated	separated	separated	separated
Temporals	3–5	1–3	3–5	5–7	4–7	3–4
Clypeals	3–5	6–9	3–6	4–6	4–7	4–6
Length of palp (μm)						
segment 2	32–40	21–30	25–36	30–40	30–40	32–40
— " — 3	50–64	32–40	40–52	48–60	45–60	48–60
— " — 4	55–72	50–60	44–52	60–72	52–68	55–75
— " — 5	80–110	80–100	60–72	84–115	70–95	64–95
Antennal flagellum	13-segmented	indistinctly 13-segmented	5-segmented	13-segmented	13-segmented	13-segmented
Tip of antenna	club-shaped	blunt-pointed, with pubescence	smoothly rounded	club-shaped	club-shaped	club-shaped
Sensilla chaetica in segments	2, 3 and 13	2, 3 and 13	1, 2, 3 and 5	2, 3 and 13	2, 3 and 13	2, 3 and 13
AR	0.54–0.94	0.36–0.48	0.53–0.71	0.84–0.98	0.55–0.73	0.54–0.75
Anteprenotal lobes	joined medially	separated medially	joined medially	joined medially	joined medially	joined medially
Anteprenotals	0–1	0	1–3	0–1	0, rarely 1	0–2
Dorsocentrals	5–8	4–6	4–5	3–7	4–7	4–6
Prealars	2–4	1–2	2–5	3–4	1–4	2–3
Scutellars	2–4	2	2–4	4–6	2	2
Mesonotum with	hair tuft	tubercle + hair tuft	hair tuft	hair tuft	hair tuft	hair tuft
Wing granulation visible at	×200	×200	×200	×200	×200	×200
Extended part of costa (μm)	45–72	76–100	70–95	45–75	45–80	32–70
Costa ending	slightly distad the tip of Cu ₁	proximal of the tip of Cu ₁	above the tip of Cu ₁	slightly distad the tip of Cu ₁	above the tip of Cu ₁	slightly proximal the tip of Cu ₁
No. of macrotrichia in R	0–1	0	3–6	0	0	0
in R ₄₊₅	0	0	2–5	0, rarely 1	0	0
No. of setae in brachiolium	1–2	1	1	1	1	1–2
R ₂₊₃	clearly separated	fused to R ₄₊₅	clearly separated	clearly separated	clearly separated	clearly separated
Cu ₂	strongly curved	nearly straight	strongly curved	strongly curved	strongly curved	strongly curved
Anal vein ending	strongly distad FCu	below FCu	below FCu	strongly distad FCu	slightly distad FCu	strongly distad FCu
Anal lobe of wing	fairly large	reduced	weakly developed	fairly large	weakly developed	fairly large
Wing length (μm)	1.3–1.7	1.0–1.2	1.4–1.5	1.7–2.0	1.3–1.7	1.4–1.6
LR P ₁	0.51–0.55	0.42–0.46	0.47–0.51	0.50–0.55	0.51–0.53	0.50–0.54
LR P ₂	0.43–0.45	0.44–0.48	0.41–0.44	0.45–0.48	0.42–0.47	0.43–0.46
LR P ₃	0.47–0.51	0.45–0.51	0.43–0.46	0.50–0.52	0.49–0.52	0.50–0.53
Tibial spurs (μm)						
front	36–45	25–32	25–30	35–40	32–38	34–40
mid	12–20	14–18	14–18	14–20	14–18	15–20
hind	12–16, 32–44	10–12, 25–30	12–16, 28–35	12–14, 32–40	12–14, 32–40	12–15, 34–42
Hind tibial comb, no. of setae	9–15	9–11	11–13	9–11	11–14	11–13
Pulvilli	small but distinct	absent	distinct	distinct	small but distinct	absent
Virga, length (μm)	35–44	42–48	40–45	52–68	42–56	48–56
Transverse stern- apodeme shape	slightly convex	slightly convex	very convex	slightly convex	slightly convex	slightly convex
length (μm)	68–84	40–60	65–75	75–85	68–85	68–76
Basal median lobe, shape	angular	rounded	reduced	rounded, narrow	rounded, broad	angular
Anal point	pointed, bare, without keel	hemispherical, without keel	round apex, with keel	hemispherical, without keel	round apex, without keel	pointed, with keel
No. of setae on tergite 9	1–4	2–3	10–15	2–5	1–4	2–4
Hypopygium	Fig. 5.1	Fig. 5.2	Fig. 5.3	Fig. 5.4	Fig. 6.2	Fig. 6.1

Ponsa, Längelmävesi (683:35), 27.6.1981 and 5.7.1982, J. Tuiskunen leg.; 3 ♂♂ from Sa, Punkaharju, Puruvesi (684:62), 31.5.1961, 2.6.1973 and 6.–7.6.1978, B. Lindeberg leg.; 1 ♂ from Kb, Kontiolahti, Höytiäinen (698:63), 29.8.1982, J. Tuiskunen leg.; 1 ♂ from Li, Inari, Inarijärvi, Viimassaari (765:52), 21.6.1971, P. Virtanen leg.; 1 ♂ from Inarijärvi, Kasariselkä (765:52), 4.7.1971, P. Virtanen leg.; 4 ♂♂ from Inarijärvi, Saunari (767:53), 30.6. and 1.7.1971, P. Virtanen leg.; 1 ♂ from Inari, Peltojoki (768:49), 13.7.1982, J. Tuiskunen leg.; 1 ♂ from Le, Enontekiö, Ala-Kilpisjärvi (766:25), 25.8.1983, J. Tuiskunen leg.

14 pupal exuviae; 12 from Inarijärvi, 9.7., 11.7., 24.7. and 31.7.1971, P. Virtanen leg.; 2 from Enontekiö, Kilpisjärvi, 19.7.1969, B. Lindeberg leg.

Description of male, see Table 1 and Fig. 5.1.

Remarks

According to Brundin (1949, 1956) *P. bathophila* is closely related to *P. nigra*. Wülker (1957) found the typical hairs of the gonocoxite lobes of *P. nigra* the only good character for separating these species. However, some additional characters can be given (*P. nigra* in brackets): basal median lobe well developed, with an angle (basal median lobe weakly developed, rounded); anal point triangular, pointed apically (anal point rounded apically); scutellars 2, rarely 4 (scutellars 4–6); wing length 1.3–1.7 (1.7–2.0) mm. *P. bathophila* seems to be very variable in such characters as size, antennal ratio and colour (cf. also Wülker 1957), but typical characters of the hypopygium remain unchanged in different populations.

On the basis of imaginal morphology *P. bathophila* falls near *P. smolandica* and *P. fennica*. Both species have angular basal median lobe and gonocoxite lobes of *P. bathophila* type. They are, however, easily distinguished using characters given in the key.

Description of pupa (n=14)

Total length 2.5–3.1 mm. Colour: Cephalothorax and abdomen uniformly slightly brownish.

Cephalothorax: Thoracic horn (Fig. 9.1) rather large (length 80–130 µm), ovoid, with several small spinules arranged in regular transverse rings. Sometimes spinules very poorly visible or apparently lacking.

Abdomen: Spinulae pattern of tergites 2–6 as in Fig. 7.1. Tergite 1 without spinules. Tergite 2: Spinulae pattern variable, sometimes rather sparse as in figure, sometimes much resembling those of tergites 3 and 4. Spinules of AG and MG of equal strength, longest spinules 6–7 µm. AG either not, or poorly, separated from MG. PG with strong spinules (10–12 µm) in about 2–6 rows, hardly separated from MG. Tergite 3: AG very wide, with stronger spinules (10–12 µm) in medial part, weaker (6–7 µm) laterally. MG with wide connection to AG so that two spinuleless areas remain medially. Sometimes two additional smaller areas between anterior parts of larger areas as in tergite 4 in Fig. 7.1. PG with strong spinules (11–13 µm) in about 2–5 rows, either not, or poorly, separated from medial group. Tergite 4: Much like tergite 3, but MG and PG more clearly separated. Spinules of MG longer, 9–11 µm. Tergite 5: As tergite 4, but PG absent. Tergite 6: Spinules of AG rather long (7–9 µm) but very weak, in two separate groups. Medial part of tergite almost bare. AG sometimes with

weak connection to MG, which consists of two separate patches of strong spinules (10–13 µm). Tergite 7: AG consisting of very weak, hardly visible spinules in two separate, ovoid groups. Tergite 8: As tergite 7, but spinules somewhat more numerous. Spinulae pattern of sternites as in Fig. 10.1, all spinules very weak and hardly visible. Chaetotaxy of tergites and sternites as in *P. fennica* sp. n. (cf. page 183). Lateral hairs in segments 7 and 8, sometimes also in 6, more or less lamellate. Well developed pedes spurii B present in segments 2 and 3. Pedes spurii A present on sternites 4–7. Anal lobe resembling much that of *P. scandica* (Fig. 8.5), but teeth of anal lobe extensions somewhat less numerous. Anal macroseta normal.

Remarks

The following combination of characters will separate this exuviae from others: Thoracic horn well developed, ovoid, with several spinules often in more or less regular rings. AG and MG of tergite 2 with lateral connections. AG of tergites 3–5 very broad, without U-shaped, bare area medially. Lateral and medial connections between AG and MG of tergites 3–5 very strong. MG of tergite 7 absent. Lateral hairs more or less lamellate in segments 6–8. Pedes spurii B well developed. Anal lobe extensions about as long as broad.

The very well developed, wide spinulae pattern of the tergites, large and spinulated thoracic horn, large pedes spurii B, and lamellate lateral hairs in the three last abdominal segments suggest that this exuviae is one of the most plesiomorphic in the genus *Parakiefferiella*. It resembles somewhat the American species *P. torulata* (Saether 1969, fig. 77A) with very wide and tight shagreenation on tergites 2–5, being, however, readily recognizable by the thoracic horn (lacking in *P. torulata*). Because of the wide intraspecific variation, especially in tergite 2, *P. bathophila* can sometimes be confused with *P. scandica*, but is separable by the large thoracic horn and the lack of spinules in MG of tergite 7.

According to Wülker (1957) the exuviae of *P. bathophila* and *P. nigra* are very similar, without distinct differences. This idea is probably based on Brundin's (1949) misidentification of the exuviae of *P. nigra* (cf. also p. 187). The exuviae of *P. nigra* are, however, much weaker spinulated, longer, without pedes spurii B and with differences in the thoracic horn and anal lobe extensions.

Ecology and distribution

P. bathophila is the most widely distributed *Parakiefferiella*, having wide ecological amplitude. According to Brundin (1949) the larvae mainly inhabit the littoral zone of standing waters, living as well on organogenic as on stony or sandy bottoms with or without vegetation. Secondly the species can also occur in springs and rivers (Humphries & Frost 1937, Reiss 1968, Pinder 1974, Lindegaard et al. 1975). Hiilivirta (unpubl.) reared single specimens from moss taken from one of the rapids on the polluted River Keravanjoki, southern Finland.

The larvae seem to be very euryoikous, enduring many kind of conditions. In the eutrophicated Lake Mälaren, central Sweden, *P. bathophila* was one of the most abundant species down to 30 m, except in the most polluted areas (Wiederholm 1974a). In Lake Vättern it occurred commonly at depths of 20–40 m (Wiederholm 1974b). Grimås (1961) examined an impounded Lake

Blåsjön in northern Jämtland and found *P. bathophila* to be a very dominant species in the uppermost 4 m. Raddum & Saether (1981) found the species inhabiting a very acid (pH 4.82) lake in southern Norway.

According to Limnofauna Europaea (Fittkau & Reiss 1978) *P. bathophila* has been reported from 15 of the 27 geographical regions, from all parts of Europe. Recently it has also been found in Southern Indian Lake, Canada (Rosenberg et al. 1980, 1984).

In Finland *P. bathophila* is a very typical species of larger oligotrophic and oligohumic lakes up to the alpine region, but does not avoid smaller eutrophicated lakes and ponds. In brackish water this species appears to be absent, however.

In southern Finland imagines hatch from the middle of May to the end of September; in northern Finland hatching seems to begin a week or two after the breaking up of the ice. The species is bivoltine in Central Europe (Humphries 1938, Reiss 1968) and probably also in southern Finland.

Parakiefferiella bilobata sp. n.

Holotype: Male; Finland, Ok, Vaala, Säräisniemi (714:49), 16.6.1908, Vuorentaus leg. Mounted in Euparal on microscope slide, deposited in the Zoological Museum of the University of Helsinki.

Paratypes: 11 males; 10 with same data as holotype, 1 male from Norway, Polmakelva, 11.8.1985, J. Tuiskunen leg. Mounted in Euparal and deposited as the holotype.

Description of male ($n=12$)

Total length 2.3–2.7 mm. Colour: Ground colour of thorax yellowish green. Scutal stripes separated. Abdomen greenish brown. Legs and palps brown, halteres pale brown. Wings very slightly brownish.

Head: Inner and outer verticals absent, postorbitals 3–6. Clypeals 5–12 in upper half. Eyes naked, without dorsal projection. Sometimes very minute frontal tubercles present. Palps normally developed, lengths of the four free segments (in μm): 25–40, 55–65, 55–66, 84–96. Antennal flagellum 13-segmented, ultimate segment club-shaped, with several pale and curved sensillar setae subapically. Sensillar setae present also in segments 2 and 3. AR 0.81–0.99.

Thorax: Dorsocentrals 5–8 arising from paler spots. Acrostichals absent. Scutellars 4–6 in a row. Prealars 2–4. Antepronotum normally developed, without setae or with one seta. Mesonotal tubercle absent or very low and indistinct, with a hair tuft. Medial scar about 1/4 of length of median line of scutum.

Wing (Fig. 1.3): Membrane devoid of setae, with granulation visible at $\times 200$. Veins bare except R with 0–1 setae. Brachiolum with 1 seta. Squama without fringe. Costa only slightly produced beyond tip of R_{2+3} (extended part 45–65 μm), ending above the midpoint between tips of Cu_1 and M . R_{2+3} ending slightly distad of the midpoint between the tips of R_1 and R_{4+5} . Cu_2 strongly curved. Anal vein ending slightly distal to FCu. Anal lobe rather well developed. Wing length 1.7–1.9 mm.

Legs: LR(P_1) 0.50–0.53, P_2 0.43–0.47, P_3 0.47–0.50. Front tibial spur 38–44 μm long, mid-tibial spurs both 12–20 μm , hind tibial spurs 36–40 and 10–12 μm . Hind tibial comb with 12–14 setae. Distinct pulvilli present.

Hypopygium (Fig. 1.1): Anal point short and broad,

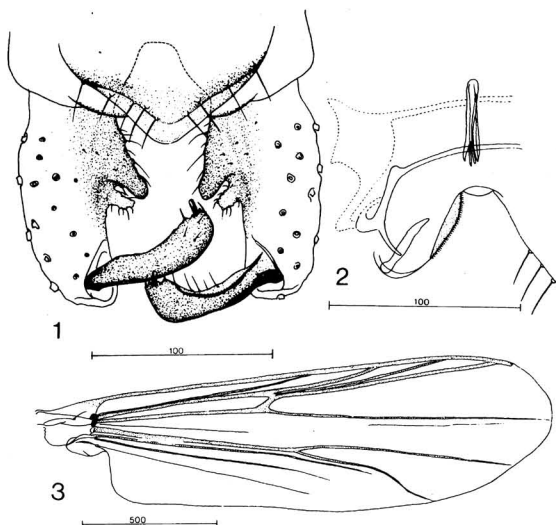


Fig. 1. *Parakiefferiella bilobata* sp. n. Male: Hypopygium (1); internal structures of hypopygium (2); wing (3). Scale in μm .

rounded apically and transparent especially distally, bearing 3–6 dorsolateral setae on each side. Apodemes of hypopygium as in Fig. 1.2. Virga 48–56 μm long. Transverse sternapodeme 75–88 μm long, slightly convex. Basal median lobe rather weakly developed, narrow and rounded. Gonocoxites with two separate lobes: anterior lobe fingerlike, well chitinized and distally almost bare, posterior lobe small, tubercle-like, weakly sclerotised and hairy in "armpit" of larger lobe. Styles of normal *Parakiefferiella* type, bending distally and somewhat broadening in apical part.

Remarks

The bipartite gonocoxite lobe distinguishes *P. bilobata* sp. n. from all other species of this genus. Other unique characteristics are hard to find: this species is a typical *Parakiefferiella*. On the basis of male morphology the systematic position may be near *P. nigra* or *P. scandica*. The upper, fingerlike lobe is almost identical with that of *P. scandica*, and to a certain degree also with that of *P. nigra*. The smaller, tubercle-like lobe has a slight analogy with *P. nigra*, in which the lobe has been compensated by 2–4 strong hairs arising from strong bases. The close relationship with *P. nigra* suggests also the similarity of anal points, basal median lobe (strongly reduced in *P. nigra*, somewhat better developed in *P. bilobata*), and presence of distinct pulvilli. The last-named characteristic is not in accordance with Brundin's (1956) generic description, but, as noticed by Saether (1969), this is no rarity in the genus. In *Parakiefferiella*, the presence or absence of pulvilli seems to be connected with the size of the species: absent from the smallest species *P. minuta*, *P. finnmarkica* and *P. coronata*; very small in medium-sized *P. bathophila*, *P. scandica* (and probably *P. fennica*); and well developed in *P. nigra* and *P. bilobata*, which are the largest *Parakiefferiella* species.

The exuviae of *P. bilobata* is unknown. Of the unnamed exuvial forms described by Brundin (1956), Wülker (1957) and Reiss (1968) only Thienemann's *P. sp. c* (Brundin 1956) from Torneträsk could eventually belong to *P. bilobata* (see p. 192).

Ecology and distribution

The larvae probably prefer oligotrophic, oligohumic lakes like most other species of this genus. Since the material taken in the beginning of the century, *P. bilobata* has been found only twice: Finland, Le, Muonio, Pallasjärvi (755:38), L. Paasivirta leg., and northern Norway, Polmakelva.

Parakiefferiella coronata (Edwards, 1929)

Imago:

Spaniotoma (*Eukiefferiella*) *coronata* Edwards, 1929: 354, fig. 8c.

Eukiefferiella coronata Edw., Pagast 1931: 204.

Eukiefferiella coronata Edw., Goetghebuer 1932: 101.

Eukiefferiella (*Parakiefferiella*) *coronata* Edw., Goetghebuer 1940–50: 123, fig. 74.

Hydrobaenus (*Eukiefferiella*) *coronata* Edw., Coe 1950: 161, fig. 190c. ♂ in key.

Parakiefferiella coronata (Edw.), Brundin 1956: 152, fig. 110. ♂ in key.

Parakiefferiella coronata (Edw.), Pinder 1978: 92, figs. 45D and 133D. ♂ in key.

Pupa:

Eukiefferiella coronata Edw., Pagast 1931: 204–206, fig. 1.

Parakiefferiella sp. b, Thienemann 1936: 197, figs. 5 and 7.

Spaniotoma (*Eukiefferiella*) *coronata* Edw., Johannsen 1937: 62. In key.

Parakiefferiella coronata (Edw.), Thienemann 1944: 574. In key.

Parakiefferiella coronata (Edw.), Brundin 1956: 153. In key.

Parakiefferiella coronata (Edw.), Wülker 1957: 414–415, fig. 1c.

Parakiefferiella coronata (Edw.), Pankratova 1970: 292, figs. 185: 1 and 2.

Parakiefferiella coronata (Edw.), Langton 1984: 122, fig. 40d. In key.

Larva:

Eukiefferiella coronata Edw., Pagast 1931: 204–206.

Parakiefferiella coronata (Edw.), Thienemann 1944: 647. In key.

Parakiefferiella coronata (Edw.), Pankratova 1970: 202.

Parakiefferiella coronata (Edw.), Cranston 1982: 110. In key.

Material used in description

11 males; 1 ♂ from U, Vantaa, Kuusijärvi (668:38), 30.5.1975, B. Lindeberg leg.; 2 ♂ ♂ from Ta, Kangasala, Ponsa, Längelmävesi (683:35), 19.6. and 12.7.1981, J. Tuiskunen leg.; 2 ♂ ♂ from Punkaharju, Puruvesi (684:62), 16.7.1960, B. Lindeberg leg.; 1 ♂ from Li, Inari, Inarijärvi, Jäniskarinsaaret (766:52), 6.7.1971, P. Virtanen leg.; 1 ♂ from Inarijärvi, Viimasaari (765:52), 22.7.1971, P. Virtanen leg.; 1 ♂ from Inarijärvi, Palkissaari (765:53),

7.7.1971, P. Virtanen leg.; 2 ♂ ♂ from Inari, Rautaperäjärvi (770:55), 15.7.1971, P. Virtanen leg.; 1 ♂ from Le, Enontekiö, Saanaajärvi (767:25), 6.7.1963, B. Lindeberg leg.

6 pupal exuviae; 3 from Lk, Sodankylä, Posolampi (754:52), 19.6., 9.7. and 17.7.1961, M. Hirvenoja leg.; 2 from Le, Enontekiö, small ponds at Saanaajärvi (767:25), 15.7.1969, B. Lindeberg leg.; 1 from Enontekiö, Harrijärvi (767:24), 14.7.1969, B. Lindeberg leg.

Description of male, see Table 1 and Fig. 5.2.

Remarks

Although *P. coronata* is the type species of the genus, the male and pupal morphology differs in many details from the rest of the *Parakiefferiella* species. Male *P. coronata* is the only species to be easily recognized by the black thorax. The ground colour of the other species is always more or less pale (scutal stripes separated), although variation seems to be wide. The absence of vein R_{2+3} suggests close relationship with *P. minuta* sp. n. Other unique characters are the often indistinctly 13-segmented, blunt-pointed antennal flagellum with apical pubescence, scarcely bent Cu_2 , weakly developed antepnotum, well developed mesonotal tubercle with hair tuft, and very low LR of front leg.

The hypopygium is not far from that of *P. minuta* with a similar, weakly developed anal point and rectangular gonocoxite lobes. The basal median lobe of *P. coronata*, however, belongs to the rounded type, whereas that of *P. minuta* is distinctly angular (see also remarks on *P. minuta*).

Description of pupa ($n=6$)

Total length 1.9–2.1 mm. Colour: Thorax slightly brownish. In some specimens abdominal segments somewhat darkened laterally, but usually uniformly faintly brownish.

Cephalothorax: Thoracic horn as in Fig. 9.5, small (length 45–55 μ m), ovoid, without spinules on surface.

Abdomen: Spinulae pattern of tergites 1–7 as in Fig. 7.2. Tergite 1: MG consisting of weak lateral (6–8 μ m) and very weak medial (2–3 μ m) spinules in 1–3 rows. AG and PG absent. Tergite 2: Spinules of AG about as strong as in tergite 1, with several connections to MG. MG and PG not separated, with strong but short (6–8 μ m) spinules, especially in the mid-tergite. Tergite 3: AG well developed, with strong spinules (8–9 μ m) medially and weak (4–6 μ m) laterally. MG and PG inseparable, with strong spinules (11–13 μ m) medially, weaker (6–8 μ m) laterally. MG with lateral connections to AG. Tergite 4: As tergite 3. Tergite 5: As tergite 4, but PG absent. Tergite 6: AG with very strong and long (13–15 μ m) spinules in a patch medially, and very weak spinules (2–4 μ m) laterally (dots in Fig. 7.2). MG consisting of two patches of strong spinules (12–14 μ m), without or with weak connections to AG. Tergite 7: AG consisting of some stronger spinules (7–8 μ m) medially and several very weak spinules (2–4 μ m) laterally. Tergite 8: AG with very weak spinules (2–4 μ m) in 3–5 rows. Spinulae pattern of sternites as in Fig. 10.2. Sternites 2–4 with patches of very strong and long (17–20 μ m) spinules (Fig. 10.7). Other sternites bare. Chaetotaxy of sternites and tergites as in *P. fennica* sp. n. (cf. p. 183). Pedes spurii B normally developed, present in segments 2 and 3. Pedes spurii A

present on sternites 4–6. Anal lobe (Figs. 8.1 and 8.2) with long and narrow extensions (L : B = 30–40 : 10–14 μ m). Anal macrosetae normal.

Remarks

The exuviae of *P. coronata* is separable on the basis of the following combination of characters: Thoracic horn small, without spinules. MG of tergite 1 present. AG and MG of tergite 2 with several connections. AG of tergites 3–6 with strong spinules medially. AG of tergite 7 well developed, with some stronger spinules medially. Sternites 2–4 with medial groups of strong spinules. Pedes spurii B normal. Pedes spurii A present only on sternites 4–6. Anal lobe extensions much longer than broad.

The exuviae is very distinct from others of the genus *Parakiefferiella*, especially in having strong spinulae patches in the centre of segments 2–4. On the other hand, the other sternites are quite bare, whereas those of other species possess groups of very fine spinules. The tergal shagreenation is also conspicuous, mainly because of the well developed medial spinule groups in AG of tergites 3–6, and the presence of some strong spinules in AG of tergite 7. The absence of pedes spurii A on sternite 7 is also peculiar to this species.

The systematical position of *P. coronata* is somewhat problematic. Both the male and pupal exuviae possess characters that suggest a more distant relationship from the other *Parakiefferiella* species. There could be grounds for a subgeneric division of the genus. Saether & McLean (1972) discussed larval differences between "*P. coronata*" and "*P. nigra*". According to these authors the genus is clearly heterogenous, "*P. nigra*" and "*P. coronata*" deserving two new genera.

The rather close relationship between *P. coronata* and *P. minuta* seems obvious but remains without confirmation, since immatures of *P. minuta* have not been found.

Ecology and distribution

This species is, after *P. bathophila*, the second commonest *Parakiefferiella* recorded from 10 out of the 27 geographical regions of Limnofauna Europaea (Fittkau & Reiss 1978). Distribution in more detail in Wülker (1957) and Laville (1972). The species is probably known also from Canada (Saether & McLean 1972). The larvae inhabit oligotrophic lakes and ponds, even swamp pools, living among litoral vegetation (Pagast 1931, Brundin 1949, Laville 1972). To a lesser extent larvae can occur also in lotic habitats (Berczik 1967, Laville & Lavandier 1977).

In Finland the species is common all over the country. The maximum occurrence seems to be in oligotrophic, oligohumic lakes, but the habitat requirements of *P. coronata* are not very strict.

Parakiefferiella fennica sp. n.

Holotype: Male; Finland, Li, Inari, Pasasloppolo (761:50), 2.9.1981, J. Tuiskunen leg. Mounted in Euparal on microscope slide, deposited in the Zoological Museum of the University of Helsinki.

Paratypes: 15 males and 1 pupal exuvia. 2 ♂♂ from Sa, Punkasalmi, Puruvesi, Koivusaari (685:62), 21.6.1963, B. Lindeberg leg.; 1 ♂ from Sa, Punkasalmi, Akonniemi, Korte (684:62), 5.6.1973, B. Lindeberg leg.; 2 ♂♂ from Li, Inari, Inarijärvi, Lintusaaret (765:52), 7.7. and 21.7.1971, P. Virtanen leg.; 2 ♂♂ from Li, Inari, Inarijärvi, Akulahti (766:52), 6.7.1971, P. Virtanen leg.; 1 ♂ + pupal exuvia from Li, Inari, Tsuolijärvi (770:56), 17.7.1971, P. Virtanen leg.; 1 ♂ from Li, Inari, Inarijärvi, Kasariselkä (765:52), 4.7.1971, P. Virtanen leg.; 1 ♂ from Le, Enontekiö, Sarvisoaivi (762:29), 30.8.1972, B. Lindeberg leg.; 2 ♂♂ from Le, Enontekiö, Ala-Kilpisjärvi (766:25), 25.8.1983, J. Tuiskunen leg.; 3 ♂♂ from Sweden, Abisko, Torneträsk, 11.8.1973, B. Lindeberg leg. Mounted in Euparal, deposited as the holotype.

Description of male (n=16)

Total length 2.2–2.7 mm. Colour: Ground colour of thorax greenish brown, scutal stripes brown and separated, sometimes not very clearly. Abdomen greenish to brownish. Legs pale brown. Wings colourless.

Head: Outer verticals and postorbitalis inseparable, 3–6 in a row, inner verticals absent. Clypeus with 4–6 setae in one, irregular row. Sometimes very minute frontal tubercles present. Eyes without dorsal projection, naked. Palps normally developed, lengths of the four free segments: 1. 32–48 μ m, 2. 48–68 μ m, 3. 60–70 μ m, 4. 72–92 μ m. Segment 3 with 1 (rarely 2) weak sensilla clavata apically. Antennal flagellum 13-segmented, ultimate club-shaped, with several curved sensillar setae subapically (Fig. 2.1). Sensillar setae present also in segments 2 and 3, sometimes in 1. AR 0.48–0.60.

Thorax (Fig. 2.2): Antepronotum normally developed, with 0–3 weak antepronotals laterally. Acrostichals absent. Dorsocentrals 4–10 arising from pale spots. Prelars 1–4, scutellars 2. Mesonotum with a distinct tuft of hairs.

Wing (Fig. 2.3): Membrane without macrotrichia. Granulation very fine, difficult to see at magnifications less than $\times 400$. Veins naked except R with 0–1 setae. Brachiolium with 1 seta. Squamal fringe absent. Costa slightly produced, extended part 70–90 μ m long, ending above or somewhat proximal to tip of Cu₂. R₂₊₃, sometimes nearly fused with R₄₊₅ but mostly well separated. Cu₂ clearly curved. Anal vein ending distal to level of Fcu. Anal lobe rather well developed. Wing length 1.55–1.90 mm.

Legs: LR (P₁) 0.50–0.58, P₂ 0.46–0.50, P₃ 0.45–0.49. Front tibial spur 34–38 μ m, middle tibial spurs 14–16 μ m, hind tibial spurs 34–40 μ m and 12–14 μ m long. Hind tibial comb with 12–13 setae. Pulvilli absent or very minute and poorly visible.

Hypopygium (Fig. 2.4): Anal point rather short, more or less membranous laterally, rounded distally, with 3–6 setae on each side, with a longitudinal ridge in the middle. Some variation occurs in the strength of the ridge. Apodemes of hypopygium as in Fig. 2.5. Virga 45–55 μ m long. Transverse sternapodeme 75–90 μ m long, slightly convex. Basal median lobe well developed, tongue-like, with short but rather strong setae apically. Gonocoxite lobes very large, with transverse ridges dorsally. Frontal margin of elevation with chitinization, which, however, may sometimes be lacking or poorly visible. Caudal margin of gonocoxite lobe joins gonocoxite at an obtuse angle. Gonocoxites with distinct swelling laterally (especially clear in specimens from Lapland). Styles of normal *Parakiefferiella* type, smoothly curved and without crista dorsalis.

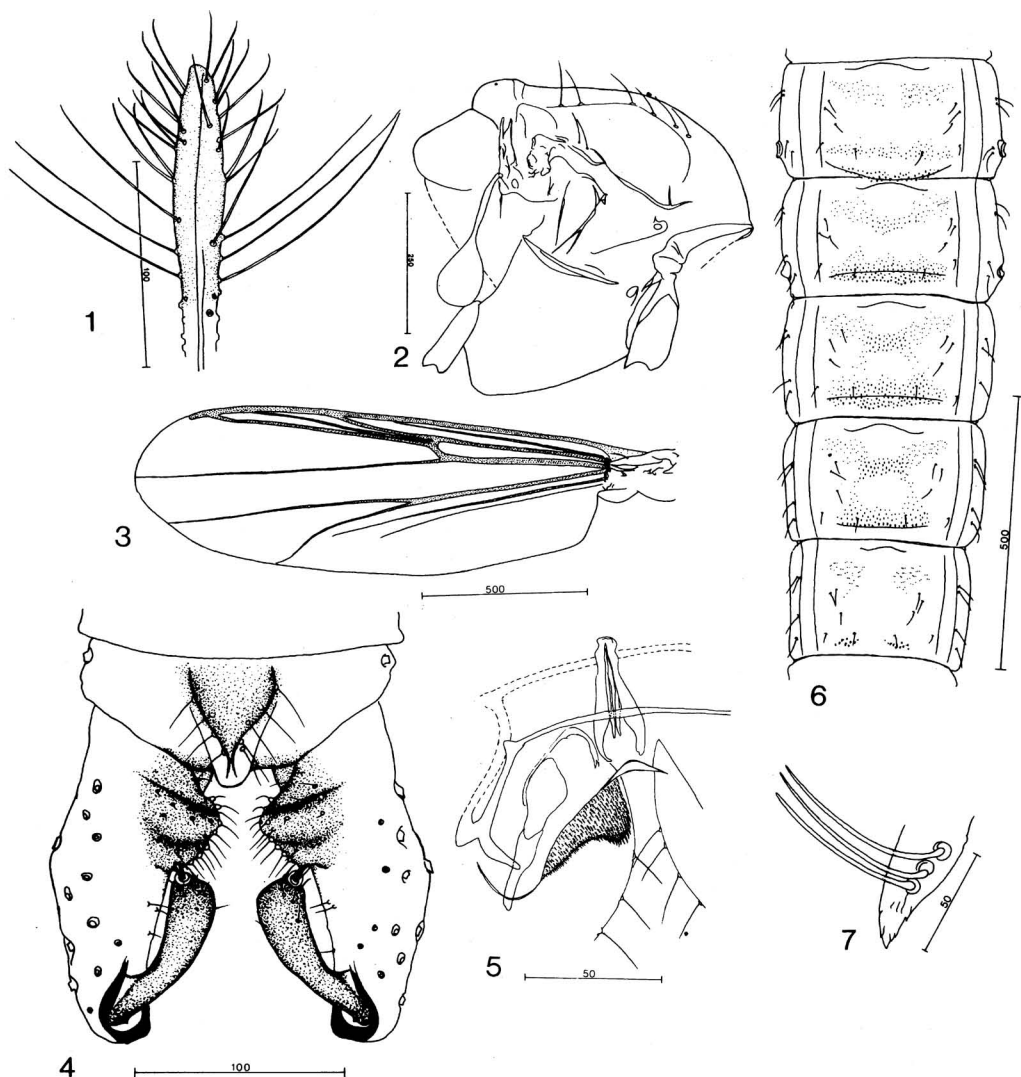


Fig. 2. *Parakiefferiella fennica* sp. n. Male: Tip of antenna (1); thorax (2); wing (3); hypopygium (4); internal structures of hypopygium (5). Pupa: Pupal exuviae, tergites 2-6 (6); anal lobe extension (7). Scale in μm .

Remarks

According to Brundin's (1956) key *P. fennica* sp. n. will key to *P. bathophila* except for the greater wing length. However, these species are readily separable on the basis of hypopygial characters: The anal point of *P. bathophila* is always sharp-pointed, triangular, and without a longitudinal ridge medially, whereas the ridge of *P. fennica* is usually very well developed. Gonocoxite lobes of *P. bathophila* are characterized by the caudal margin being about perpendicular to the gonocoxite. In *P. fennica* this angle is clearly obtuse (cf. Figs 2.4 and 5.1).

Both the imaginal and pupal morphology of *P. fennica* suggest the closest relationship with *P. smolandica*. Males

of these species have angular basal median lobes, well developed gonocoxite lobes with transverse dorsal elevations, and anal points of the same shape. Identification will, however, succeed easily by using characters given in the key.

P. fennica shows a certain tendency towards enlargement of the hypopygium, appearing as a swelling of the lateral parts of the gonocoxites. The enlargement has especially been observed in specimens from arctic conditions (e.g. lakes Torneträsk and Kilpisjärvi), making this species readily separable from other *Parakiefferiella* spp. even in stereomicroscopic sorting. The hypopygium enlargement was less conspicuous in specimens collected from Lake Puruvesi, southeastern Finland.

Description of pupa ($n=11$)

Total length 2.0–2.9 mm. Colour: Whole exuviae uniformly faintly brownish.

Cephalothorax: Thoracic horn lacking.

Abdomen: Spinulae pattern of tergites 2–6 as in Fig. 2.6. Tergite 1 without spinules. Tergite 2: AG with very fine spinules (longest spinules 3–4 μm) approximately in 3–6 rows, can be divided into two parts medially. MG with stronger but very short (2–3 μm) spinules in about 2–5 rows, well separated from AG. PG with strong spinules (8–10 μm) in about 2–4 rows, separated from MG. Tergite 3: AG with very weak spinules (3–4 μm) laterally and stronger spinules (6–8 μm) medially. U-shaped, spinuleless area remains medially to AG. MG with stronger but short (4–6 μm) spinules in 3–7 rows, without connection to AG. PG with strong spinules (9–11 μm), often only poorly separated from MG. Tergite 4: As tergite 3, but AG with mostly distinct connection to MG so that the bare area is in the centre of the tergite. Medial spinules of AG 10–12 μm long. Tergite 5: As tergite 4, but PG absent. Tergite 6: AG with very fine spinules (4–6 μm) in two separate groups anteriolaterally. MG with two separate patches of strong spinules (11–13 μm). Tergite 7: AG with two separate spinule groups, spinules extremely weak and poorly visible. MG and PG absent. Tergite 8: As tergite 7, but spinules somewhat more numerous. Spinulae pattern of sternites as in Fig. 10.3, all spinules extremely weak. Number of setae and hairs of abdominal segments 1–8:

dorsal	5	5	5	5	5	5	5	2
lateral	2	4	4	4	4	4	4	4
ventral	4	4	4	4	4	4	4	1

Well developed pedes spurii B present on segments 2 and 3. Pedes spurii A present on sternites 4–7. Anal lobe of normal *Parakiefferiella* type, with few to several teeth on outer and inner margins of elongations. Elongations often distinctly longer than broad (22–32 : 12–22 μm) (Fig. 2.7). Anal macrosetae 40–90 μm long, extending considerably beyond tips of anal lobe elongations.

Remarks

The exuviae of *P. fennica* is separable on the basis of the following character combination: Thoracic horn lacking. AG and MG of tergite 2 always clearly separated. AG of tergites 3–5 with U-shaped, spinuleless area medially. AG and MG of tergites 4–5 with lateral connections. MG of tergite 7 absent. Pedes spurii B well developed. Anal lobe elongations rather well developed, generally distinctly longer than broad.

According to Brundin's (1956) key this exuviae will key to *P. sp. c* Thienemann, 1941, particularly because of the lack of thoracic horn. The presence of very strong MG in tergites 2–7, strong and long lateral hairs, weak anal macroseta and strongly produced anal lobe extensions with several teeth on the surface and margins (Brundin 1956, figs. 116–117) separate this pupal type from *P. fennica* and all other *Parakiefferiella* pupae known to me.

The abdominal spinulae pattern of the pupal exuviae of *P. fennica* is very similar to that of *P. smolandica* (cf. Figs. 2.6 and 7.6). These species are, however, readily separated by the large thoracic horn of *P. smolandica*. Again, the anal lobe extensions of *P. smolandica* seem to be shorter ($L : B = 14-20 : 15-20 \mu\text{m}$, in *P. fennica* 22–32 : 12–22 μm).

Ecology and distribution

P. fennica seems to favour large oligotrophic, oligohumic lakes, probably being more widespread and abundant in Lapland than in southern Finland, where it has been collected only at Lake Puruvesi. In lakes Inarijärvi and Kilpisjärvi the species is quite common, emergence commencing in July and continuing till mid-September.

Imagines have also been collected at Lake Torneträsk, Swedish Lapland (11.8.1973, B. Lindeberg leg.).

Parakiefferiella finnmarkica sp. n.

Holotype: Male; Norway, Finnmark, Karasjok, Jerggul, at the river Jergguljokka, 12.8.1985, J. Tuiskunen leg. Mounted in Euparal on microscope slide, deposited in the Zoological Museum of the University of Helsinki.

Description of male ($n=1$)

Total length 1.8 mm. Colour: Ground colour of thorax yellowish green, scutal stripes well separated, brown. Abdomen greenish, halteres pale, wings transparent, legs pale brown.

Head: Postorbitals 1–2, inner and outer verticals absent. Clypeals 4 in a row. Eyes naked, without dorsal projection. Palps rather short, lengths of last four segments (in μm): 28, 45, ~40, 72. Segment 3 with 1 sensilla clavata apically. Antennal flagellum 13-segmented, ultimate segment club-shaped, with several pale, apically curved sensillar setae. Sensilla chaetica present on segments 2, 3 and 13. AR 0.47.

Thorax (Fig. 3.2): Acrostichals absent. Dorsocentrals 3, not arising from pale spots. Prealars 2, scutellars 2. Antepnotum normally developed, both lobes joining medially. Antepnotals absent. Mesonotum with very low tubercle under a well developed hair tuft.

Wing (Fig. 3.1): Membrane without macrotrichia, with very fine granulation (visible at a magnification of $\times 400$). Veins and squama naked. Brachiolium with 1–2 setae. Costa somewhat produced (extended part 40 μm), ending above or slightly proximal to tip Cu_1 . R_{2+3} poorly separated, proximal part of it fused with R_{4+5} , and only apical 1/3 separated, ending near the tip of R_{4+5} . Cu_2 rather strongly incurved. An ending about below FCu . Anal lobe slightly developed. Wing length 1.2 mm.

Legs: LR (P_1) 0.52, P_2 0.44, P_3 0.48. Front tibial spur 30 μm , mid tibial spurs both 12–14 μm , hind tibial spurs 12 and 29 μm . Hind tibial comb with 12 setae. Pulvilli absent.

Hypopygium (Fig. 3.3): Anal point more or less triangular, about as long as broad basally, pointed apically and with macrotrichia on surface (only margins bare), and with 2 dorsolateral setae on each side. Virga 38 μm long. Transverse sternapodeme slightly convex, 60 μm long. Basal median lobe well developed, broad and rounded. Gonocoxite lobes normally developed, caudal margin joining the gonocoxite at approximately right angles. Lobes also with transverse ridge dorsally. Styles strongly curved, without crista dorsalis.

Remarks

On the basis of external hypopygial features this species is very similar to *P. smolandica* (cf. Figs. 3.3 and 6.1).

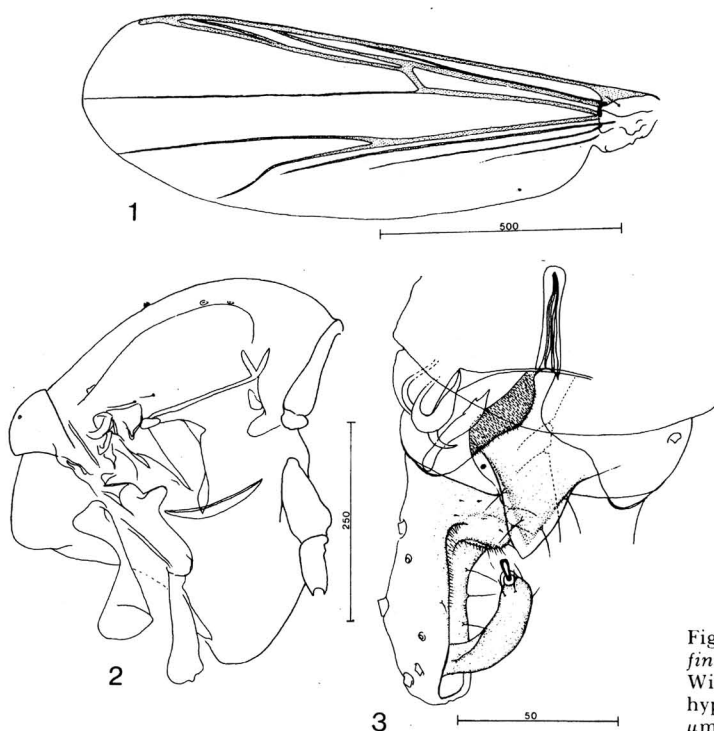


Fig. 3. *Parakiefferiella finnmarkica* sp. n. Male: Wing (1); thorax (2); hypopygium (3). Scale in μm .

However, the basal median lobe, being angular in *P. smolandica* but rounded in *P. finnmarkica*, allows easy separation of these species. Also the gonocoxite lobe of *P. smolandica* appears to be often distinctly sharper pointed apically. Other distinctive features are (*P. smolandica* in brackets): poorly separated vein R_{2+3} (R_{2+3} well separated), wing length only 1.2 mm (1.4–1.6 mm), AR 0.47 (0.54–0.75).

Although I did not find more than one male, I do not hesitate to describe it as a new species, since it is readily separable from its closest relative, *P. smolandica*. This recently collected species is from northern Norway (see above).

Parakiefferiella gynocera (Edwards, 1937)

Smittia (*Epoicocladus*) *gynocera* Edwards 1937: 145 (male + female)

Smittia (*Krenosmittia*) *gynocera* Edw., Goetghebuer 1940–50: 79–80 (male + female)

Epoicocladus gynocera Edw., Wülker 1957: 424–426, fig. 14 (male + female).

Material used in description

10 males; 7 ♂♂ from Ta, Kangasala, Ponsa, Längelmävesi (683:35), 14.5.1983, J. Tuiskunen leg.; 3 ♂♂ from Li, Inari, Inarijärvi, Lintusaaret (765:52), 28.6.1971, P. Virtanen leg.

30 pupal exuviae; all from Sa, Punkaharju, Puruvesi (684:62), 2.5.1960, B. Lindeberg leg.

Description of male, see Table 1 and Fig. 5.3.

Remarks

As stated by Edwards (1937), the hypopygium of this species much resembles that of *Epoicocladus ephemeræ* (Kieffer). On the basis of imaginal morphology *Epoicocladus* is very close to *Parakiefferiella*, and certain difficulties exist when trying to keep these genera separated. Brundin (1956) was only able to find the different position of vein R_{2+3} to distinguish these genera (in *Epoicocladus* the vein ends in or proximad, in *Parakiefferiella* distad, the midpoint between the tips of R_1 and R_{4+5}). This is, however, not a useful character, often showing strong variation within genera (e.g. *Eukiefferiella*, Lehmann 1972). Also the presence of pulvilli in *Epoicocladus* and absence in *Parakiefferiella* (Wülker 1957) has proved a less useful difference.

The pupal exuviae of *E. flavens* (Malloch) (= *E. ephemeræ*), however, differs conspicuously from all known *Parakiefferiella* exuviae by having hairy lateral margins to the abdominal segments (cf. fig. 12 in Šulc & Zavřel 1924, sub *Camptocladus ephemeræ*). As described below, the abdominal margins of *P. gynocera* pupa are of normal *Parakiefferiella* type, without such a hair coat. The tergal spinulae patterns are also typical *Parakiefferiella* characters, not like those given by Šulc & Zavřel (1924) for *E. flavens*. As already suggested by Sæwedal (1978), *P. gynocera* is a *Parakiefferiella* rather than an *Epoicocladus*.

The morphology of male *P. gynocera* has certain characters typical to substrate swimmers. Firstly, the male antennae are femalized, that is, both sexes have similar

antennae with 5 flagellar segments. Wülker (1957) suspected that the shortening of antennae might be due to mermithid parasitism, but he did not have much material available. This is, however, a consistent character of *P. gynecera* (I have seen several hundred specimens, all with such antennae). Secondly, the male hypopygium is clearly more robust than in *Parakiefferiella* species usually. The styles are unusually thick, and the gonocoxite lobes are especially well developed, the posterior margin joining to the gonocoxite in an obtuse angle. In this respect *P. gynecera* resembles *P. fennica*, the other *Parakiefferiella* with slightly enlarged hypopygium.

According to B. Lindeberg (pers. comm.) the swarming behaviour seems to depend on the weather. In calm weather, the males swarm in the air, up to a couple of metres above the ground near the shore line. When more windy, the males run actively around in the shore herbage, on twigs of shore bushes and stones etc. Mating seems to take place on the ground as well as in the air.

Wing veins of *P. gynecera* are normal except the position of R_{2+3} and presence of macrotrichia in veins R and R_{4+5} . The wings of males are broader than usually, resembling those of the females.

Description of pupa ($n=30$)

Total length 2.2–2.9 mm. Colour: Cephalothorax slightly brownish. Lateral and posterior margins of abdominal segment 1 and segments 2–5 brown. Rest of abdomen very slightly brownish.

Cephalothorax: Thoracic horn absent. Antennal sheaths of male short, 220–300 μm long. Lengths of precorneals 70–110 μm .

Abdomen: Spinulae pattern of tergites 2–7 as in Fig. 7.5. Tergite 1 without spinules. Tergite 2: AG with rather few very weak spinules (lengths of longest spinules 4–5 μm) in two separate groups. MG distinctly separated from AG, often only indistinctly from PG, with stronger but very short (3–4 μm) spinules in 1–4 rows. PG with strong spinules (8–10 μm) in 2–5 rows. Tergite 3: AG with very weak spinules (4–6 μm) laterally and stronger spinules (8–10 μm) medially in U-shaped formation. MG with stronger but short (5–6 μm) spinules in about 2–6 rows, sometimes with weak connection to AG medially. PG about as in tergite 2. Tergite 4: AG with strong spinules (9–11 μm) medially and weak spinules (4–5 μm) laterally in U-shaped formation, with 3 connections (sometimes very weak) to MG so that there are two oval bare areas medially. MG with strong spinules (9–11 μm) especially laterally. PG as in tergite 2 and 3. Tergite 5: As tergite 4, but strong spinules in MG more numerous, and PG absent. Tergite 6: AG with several very weak spinules (4–5 μm) arranged as in Fig. 7.5., with connection to MG. MG consists of two patches of strong spinules (11–13 μm), which are sometimes connected by a bridge of very weak spinules. Tergite 7: AG with several very weak spinules in two separate groups. Tergite 8: About as tergite 7. Spinulae pattern of sternites as in Fig. 10.4, all spinules very weak and short (3–5 μm). Chaetotaxy of tergites and sternites as in *P. fennica* sp. n. (cf. p. 183). Lateral hairs of three last abdominal segments rarely slightly lamellate. Pedes spurii B absent. Well developed pedes spurii A present on sternites 4–6, weak on 7. Anal lobe as in Fig. 8.3., with rather long (25–36 μm) and narrow (16–20 μm) extensions with some teeth on outer and inner margins. Anal macrosetae of normal length and strength.

Remarks

This exuvixae can be separated from others on the basis of the following combination of characters: Thoracic horn absent. Male antennal sheaths short, 220–300 μm . Abdominal segments 2–5 and margins of segment 1 darkened. AG and MG of tergite 2 well separated, AG reduced into two lateral patches of small spinules. AG of tergites 3–6 U-shaped, with medial and lateral connections to MG. Tergites 7 and 8 with well developed AG. Pedes spurii B absent. Anal lobe extensions distinctly longer than broad.

The exuviae of this typical species can be identified even by the naked eye from its colouration. The spinulae pattern of tergites, however, somewhat resembles that of *P. nigra*, as well as the absence of pedes spurii B and presence of long anal lobe extensions.

Ecology and distribution

Common and often very abundant early summer species in larger oligotrophic lakes in southern and northern Finland (e.g. Längelmävesi, Puruvesi, Inarijärvi and Kilpisjärvi), swarming soon after break up of ice. In southern Finland imagines have not been observed after the end of June.

The species is also known from Abisko (Edwards 1937).

Parakiefferiella minuta sp. n.

Holotype: Male; Finland, Ka, Vehkalahti, Paijärvi, Suuri Karjalansuo (672:51), 30.5.1983, J. Tuiskunen leg. Mounted in Euparal on microscope slide, deposited in the Zoological Museum of the University of Helsinki.

Paratype: 1 ♂ from the type locality 15.6.1985. Deposited as the holotype.

Description of male ($n=2$)

Total length 1.8 mm. Colour: Ground colour of thorax yellowish green, scutal stripes dark brown, separated. Halteres pale brown, wings brownish by transmitted light. Abdomen and legs somewhat paler than thorax.

Head: Postorbital 3–4, inner and outer verticals absent. Clypeus with 3–5 setae. Palps rather poorly developed, lengths of last four segments (in μm): 24–28, 48–50, 40–44, 45–54. Segment 2 with a group (3–4) of very large, lancet-shaped sensory setae arising from distinct pit (Fig. 4.1). Eyes naked, without dorsal projection. Antennal flagellum 13-segmented, last segment as in Fig. 4.2, pointed apically and with pale, only weakly curved sensillar setae subapically. Sensilla chaetica present also in segments 2 and 3. AR 0.41–0.45.

Thorax (Fig. 4.3): Acrostichals absent, dorsocentrals 6, arising from pale spots. Prelars 3. Scutellum with 4 setae. Antepnotum normally developed, with 2 weak antepnotals. Mesonotal tubercle and hair tuft absent.

Wing (Fig. 4.4): Membrane without macrotrichia, with granulation visible at a magnification of $\times 200$. Veins naked except R with 0–2 setae. Brachiolium with 1 seta. Squama bare. Costa very strongly produced (extended part 130–150 μm), apex ending somewhat proximal to tip of M. R_{2+3} not separable from R_{4+5} (however, in one wing R_{2+3} clearly separated, ending near the tip of R_{4+5}). Cu_2 moderately incurved. Anal vein ending below FCu. Anal lobe absent. Wing length 1.0 mm.

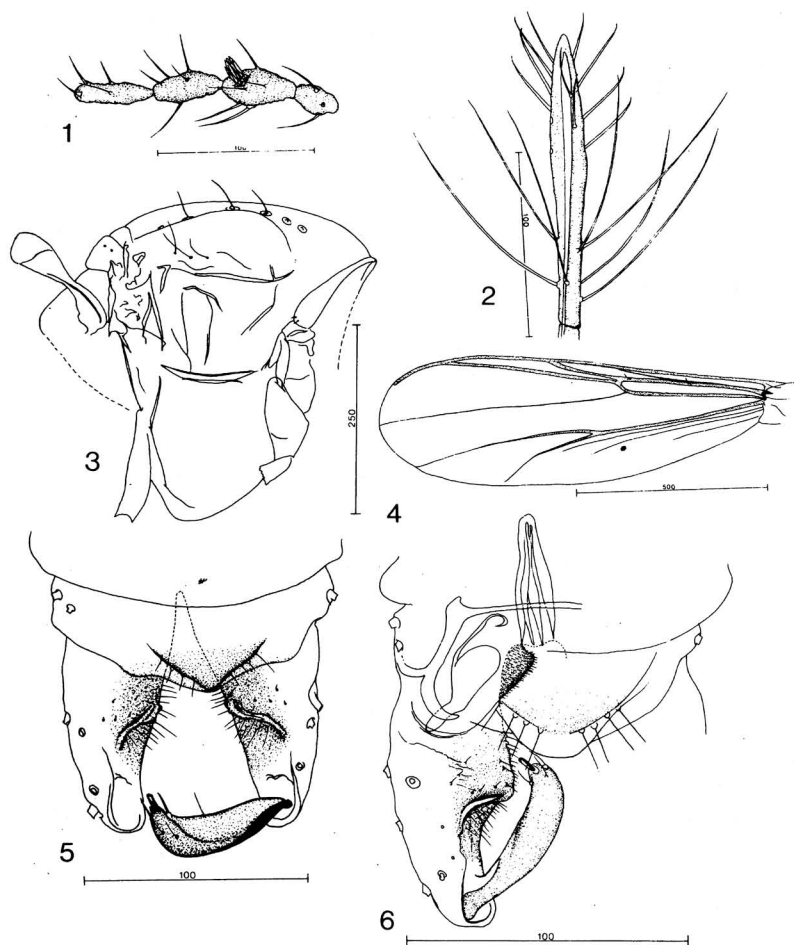


Fig. 4. *Parakiefferiella minuta* sp. n. Male: Palp (1); tip of antenna (2); thorax (3); wing (4); hypopygium of paratype (5); hypopygium of holotype (6). Scale in μm .

Legs: LR(P_1) 0.46–0.50, P_2 0.44–0.46, P_3 0.51–0.52. Legs not bearded, without sensilla chaetica. Front tibial spur 32 μm , mid tibial spurs both 11–12 μm , hind tibial spurs 14–18 μm and 38–40 μm long. Hind tibial comb with 8–9 setae. Pulvilli absent.

Hypopygium (Figs. 4.5 and 4.6): Anal point short and broad, rounded, with 4 dorsolateral setae on both sides. Virga 50 μm long. Transverse sternapodeme 55 μm long, almost straight. Basal median lobe well developed, angular. Gonocoxite lobes comparatively small (cf. especially Fig. 4.5), with distinct elevation dorsally. Styles more or less parallel-sided, distally bent, and without crista dorsalis.

Remarks

P. minuta sp. n. is very characteristic in many ways. The presence of a very well developed sensillary organ (Fig. 4.1) in the second free palp segment with long, lancet-shaped sensillar setae is, as far as I know, a character unique to the whole family. Small, club-shaped sensilla clavata (according to Saether's 1980 terminology)

arising in a cluster from a pit are commonly known in several chironomid genera (e.g. Schlee 1968, Hirvenoja 1973), but in *P. minuta* the present structure is exceptionally well developed, and the shape of the setae is quite different from the other *Parakiefferiella* species.

Other apomorphies are the absence of the vein $R_2 + 3$, the reduction of the anal lobe of the wing, absence of mesonotal cump and hair tuft, and low antennal ratio. Most of these characters are typical for small species, known also from *P. coronata*, the other very small *Parakiefferiella*. *P. coronata* may be the closest relative to *P. minuta*, although both species are very easily distinguishable using characters given in the key.

Ecology and distribution

Both males were collected by sweeping a small, artificial swamp pool in Vehkalahti, southern Finland. No lakes or rivers were in the vicinity of the locality. Contrary to other *Parakiefferiella* species *P. minuta* may inhabit pools or ditches or other biotopes in the swamp

environment.

Although copious samples have been taken in the habitat, and elsewhere in the country in comparable situations, it is interesting that no more than two specimens of *P. minuta* have been found. Cryptic behaviour of the adults may be responsible for the scanty material.

Parakiefferiella nigra Brundin

Parakiefferiella nigra Brundin, 1949: 827–828, fig. 196 (male).

Parakiefferiella nigra Br., Brundin 1956: 152 (male in key).

Parakiefferiella sp. *a*₁, Wülker 1957: 412–414, figs. 2c and 2c (pupa).

? *Parakiefferiella nigra* Br., Saether & McLean 1972: fig. 3A.

nec *Parakiefferiella nigra* Br., Wülker 1957: 411–412, fig. 1c (pupa).

nec *Parakiefferiella nigra* Br., Brundin 1956: 152 (pupa in key).

Material used in description

12 males; 1 ♂ from Ta, Kangasala, Ponsa, Längelmävesi (683:35), 22.5.1982, J. Tuiskunen leg.; 4 ♂♂ from Li, Inari, Inarijärvi, Lintusaaret (765:52), 20.6., 28.6. and 30.6.1971, P. Virtanen leg.; 2 ♂♂ from Inarijärvi, Ukon-selkä (765:51), 2.6.1971, P. Virtanen leg.; 3 ♂♂ from Inarijärvi, Kasariselkä (765:52), 24.6. and 28.6.1971, P. Virtanen leg.; 2 ♂♂ from Le, Enontekiö, Kilpisjärvi (767:25), 1.7.1969, B. Lindeberg leg.

14 exuviae; 2 from Inarijärvi, 28.6. and 9.7.1971, P. Virtanen leg.; 7 from Kilpisjärvi, 19.7.1969, B. Lindeberg leg.; 5 from Sweden, Abisko, Katterjaure, 10.8.1973, B. Lindeberg leg.

Description of male, see Table 1 and Fig. 5.4.

Remarks

The strong hairs of the "armpit" of the gonocoxite lobe distinguishes the male *P. nigra* from other species of *Parakiefferiella*. The reduced basal median lobe and the shape of the gonocoxite lobes and styles are also distinctive. Close relationship with *P. bilobata* sp. n. has been referred to above (cf. p. ??).

Description of pupa (*n* = 14)

Total length 3.0–3.5 mm. Colour: Cephalothorax and abdomen uniformly slightly brownish.

Cephalothorax: Thoracic horn (Fig. 9.3) small, ovoid, without spinules on surface. Length 50–75 µm.

Abdomen: Spinulae pattern of tergites 2–6 as in Fig. 7.3. Tergite 1 without spinules. Tergite 2: very fine spinules (3–4 µm) in AG, which can sometimes be bipartite. MG with stronger but short (5–6 µm) spinules in about 2–5 rows, clearly separated from AG and PG. PG with strong spinules (8–10 µm) in about 2–5 rows. Tergite 3: AG with very weak spinules (3–4 µm) laterally and stronger spinules (8–10 µm) medially. U-shaped, spinuleless area remains medially. MG with stronger but short (6–7 µm) spinules in about 2–5 rows, clearly

separated from AG and PG. PG with strong spinules (8–10 µm) in 2–5 rows. Tergite 4: As tergite 3, but more stronger spinules (10–13 µm) in medial part of AG. AG sometimes with weak connection to MG. Tergite 5: As tergite 4, but PG absent. Tergite 6: AG not divided medially, with very weak spinules (3–4 µm) laterally and stronger (6–8 µm) medially. AG without connection to MG. MG consisting of two patches of strong spinules (10–12 µm). Tergite 7: Extremely fine spinules present in AG, divided into two groups. Tergite 8: As tergite 7 but spinules somewhat more numerous. Spinulae pattern of sternites as in Fig. 10.5. All sternal spinules extremely fine. Chaetotaxy of tergites and sternites as in *P. fennica* sp. n. (cf. p. 183). Pedes spurii B absent or very small and indistinct. Well developed pedes spurii A present on sternites 5–7, weak on sternite 4. Anal lobe extensions rather long and narrow (length 28–40 µm, breadth 14–18 µm), curved outwards and tapering smoothly towards the tip, often with some well developed teeth on outer and inner margins (Fig. 8.4). Anal macrosetae as usual.

Remarks

The exuviae of this species is characterized by the following combination of characters: Thoracic horn rather small, without spinules on surface. AG and MG of tergite 2 well separated. AG of tergites 3–5 U-shaped, with bare area medially. Tergites 3–6 mostly without connections between AG and MG, or connections very weak. Anal lobe extensions well developed, distinctly longer than broad. Length of exuviae 3.0–3.5 mm.

Thienemann's (1936) *Parakiefferiella* sp. *a*. (pupa) has been suggested as belonging to *P. nigra* (Brundin 1949, 1956, Wülker 1957). The exuviae of *P. nigra*, however, differs distinctly from Thienemann's description. The thoracic horn of *P. sp. a* has well developed spinules in the distal part (Thienemann 1936, fig. 6), whereas that of *P. nigra* is always quite smooth. The extensions of the anal lobe of *P. sp. a* are short and broad (Thienemann 1936, fig. 8. Note: figures 5 and 8 have been transposed), but in *P. nigra* usually much longer than broad. Also the stated size of *P. sp. a* (2.8 mm) does not agree with the length of *P. nigra* (3.0–3.5 mm). Thienemann's description might refer to *P. scandica*, although positive identification is not possible without seeing the exuviae.

Wülker (1957) described a pupal exuviae from Finse, southern central Norway (*P. sp. a*₁). The following is my personal view on *P. nigra*. Only the dimensions of the thoracic horn (L:B = 42:25 µm) are somewhat lower than in the Finnish specimens (length 50–75 µm), but this may not be an important difference.

Ecology and distribution

Brundin's (1949) supposition that *P. nigra* is an arctic–subarctic species seems to be correct. The species is known from Sweden (Brundin 1949, Säwedäl 1977, 1978), Norway (Wülker 1957, sub *P. sp. a*₁) and Canada (Saether 1969, Rosenberg et al. 1984), but, as far as I know, it has not yet conclusively been found in Central Europe.

In Finland the species is spread all over the country, favouring bare, oligohumic lakes and being most abundant in such lakes as Inarijärvi and Kilpisjärvi in northernmost Finland (Tuiskunen & Lindeberg in prep.). In lakes Längelmävesi and Puruvesi in southern Finland the species has been found only as single specimens.

In Inarijärvi *P. nigra* was the first *Parakiefferiella* to be

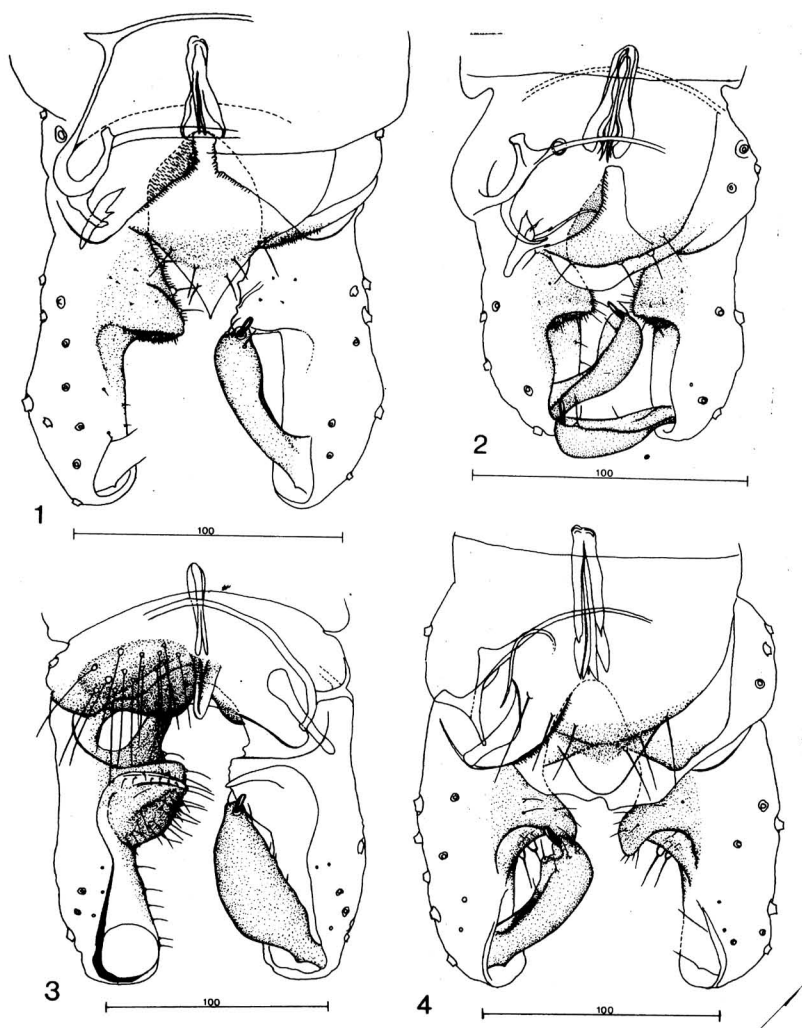


Fig. 5. *Parakiefferiella* spp. Male hypopygia: *P. bathophila* (Kieffer) (1); *P. coronata* (Edwards) (2); *P. gynocera* (Edwards) (3); *P. nigra* Brundin (4). Scale in μm .

on the wing, emerging soon after the melting of the ice (Tuiskunen & Lindeberg in prep.).

Parakiefferiella scandica Brundin, 1956

Parakiefferiella scandica Brundin, 1956: 150–152, fig. 109 (male + in key).

? *Parakiefferiella* sp. a, Thienemann 1936: 196–197, figs. 6 and 8 (pupa).

Material used in description

18 males; 1 ♂ from Ta, Kangasala, Ponsa, Längelmävesi (683:35), 6.6.1982, J. Tuiskunen leg.; 3 ♂♂

from Li, Inari, Kortejärvi (764:50), 26.6.1971, P. Virtanen leg.; 1 ♂ from Inari, Peltöjärvi (767:48), 14.7.1982, J. Tuiskunen leg.; 2 ♂♂ from Inari, Inarijärvi, Tšuoelisvuono (769:55), 17.7.1971, P. Virtanen leg.; 4 ♂♂ from Inarijärvi, Jäniskarinsaaret (766:52), 6.7.1971, P. Virtanen leg.; 2 ♂♂ from Inarijärvi, Kasariselkä (765:52), 6.7. and 5.8.1971, P. Virtanen leg.; 1 ♂ from Le, Enontekiö, Pikku Malla (767:25), 16.7.1969, B. Lindeberg leg.; 2 ♂♂ from Enontekiö, Ala-Kilpisjärvi (766:25), 25.8.1983, J. Tuiskunen leg.; 2 ♂♂ from Sweden, Abisko, Torneträsk, 11.8.1973, B. Lindeberg leg.

8 exuviae; 4 from Inari, Inarijärvi, 9.7., 24.7. and 31.7.1971, P. Virtanen leg.; 1 from Inari, Tšuoelisjärvi (770:56), 11.7.1971, P. Virtanen leg.; 1 from Enontekiö, small ponds at Saanaajärvi (767:25), 15.7.1969, B. Lindeberg leg.; 2 from Sweden, Riksgränsen, Katterjaure, 10.8.1973, B. Lindeberg leg.

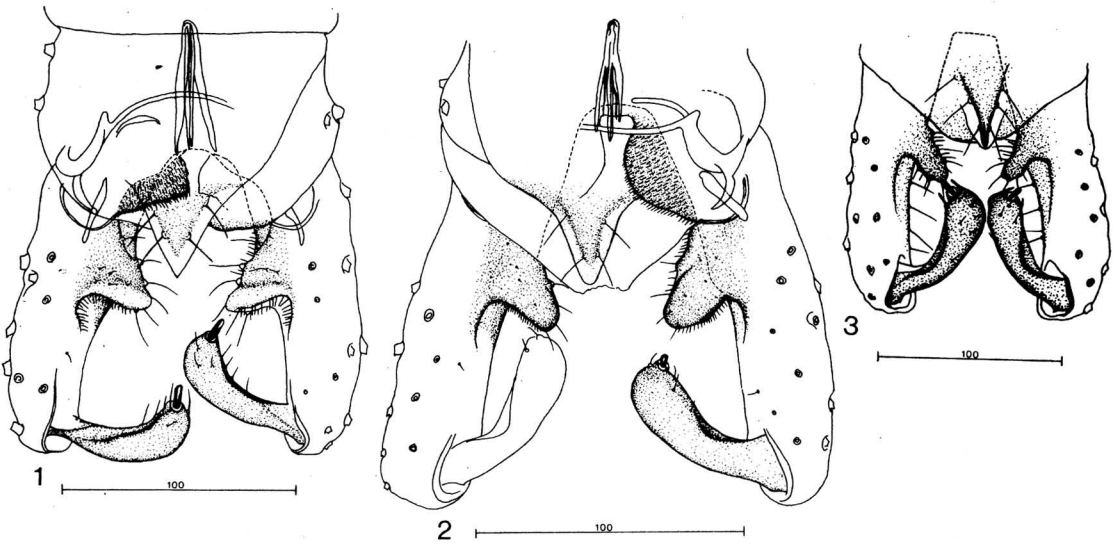


Fig. 6. *Parakiefferiella* spp. Male hypopygia: *P. smolandica* (Brundin) (1); *P. scandica* Brundin, typical form (2); *P. scandica*, aberrant form (3). Scale in μm .

Description of male, see Table 1 and Figs. 6.2 and 6.3.

Remarks

According to the male morphology *P. scandica* is somewhat intermediate between two "species groups": *P. bathophila*, *P. fennica* and *P. smolandica* on the one hand, and on the other hand *P. bilobata* and *P. nigra*. The latter two species possess rounded basal median lobes and fingerlike gonoxocite lobes of *P. scandica* type, but differ in having short, roughly hemispherical anal points. The species of the first mentioned group have more or less triangular anal points as *P. scandica*, but are easily separable by their angular basal median lobes. The basal median lobe of *P. scandica*, although rounded, is much better developed than in *P. bilobata* or *P. nigra*, in this respect resembling those of *P. bathophila*, *P. fennica* and *P. smolandica*.

Primarily *P. scandica* is recognizable by the typical basal median lobe and gonocoxite lobes. The structure of the anal point is mainly very constant, without a longitudinal keel medially. However, one specimen from Lake Peltöjärvi, northern Finland, had distinct keel of *P. fennica* type (Fig. 6.3).

Description of pupa ($n=8$)

Total length 2.4–2.7 mm. Colour: Cephalothorax and abdomen uniformly weakly brownish.

Cephalothorax: Thoracic horn small (55–65 μm long), ovoid, with some spinules in the apical part (Fig. 9.4).

Abdomen: Spinulae pattern of tergites 2–7 as in Fig. 7.4. Tergite 1 without spinules. Tergite 2: AG with fine spinules (length of longest spinules 6–7 μm) in about 2–7 rows, rarely with weak connection to MG. Spinules

of MG strong but very short ($\sim 2 \mu\text{m}$), visible as dots in slide. Distinct or indistinct spinuleless strip between MG and PG. PG with strong spinules (8–9 μm) in about 2–5 rows. Tergite 3: AG with strong spinules (12–14 μm) medially, weaker laterally, in about 4–8 rows, sometimes with weak connection with MG laterally. Spinules of MG as in previous tergite, but somewhat more abundant. PG with strong spinules (9–11 μm) in 2–5 rows. Tergite 4: AG with numerous strong spinules (10–12 μm) especially medially, with good connection to MG. PG with strong spinules (10–12 μm) in about 3–5 rows, not separated from MG. Tergite 5: As tergite 4, but PG absent. Tergite 6: AG divided into two groups of very fine spinules (2–3 μm) without or with weak connection to MG. MG also bipartite, with strong spinules (10–13 μm). Tergite 7: AG consisting of extremely fine spinules in two separate groups. MG present, with about 5–15 weak spinules in two groups. Tergite 8: As tergite 7 but spinules in AG somewhat more numerous, and MG absent. Spinulae pattern of sternites as in Fig. 10.6. All spinules extremely small and poorly visible. Chaetotaxy of tergites and sternites as in *P. fennica* sp. n. (cf. p. 183). Lateral hairs of last two or three abdominal segments often more or less lamellate. Well developed pedes spurii B present on segments 2 and 3. Well developed pedes spurii A on sternites 4–7. Anal lobe as in Figs. 8.5 and 8.6, with short and basally rather broad extensions (length 20–25 μm , breadth 16–20 μm), often without but sometimes with few weak teeth on margins. Anal macrosetae of normal length.

Remarks

This species is characterized by the following combination of characters: Thoracic horn small (55–65

μm), with few weak spinules in distal part. AG and MG of tergite 2 mostly well separated. AG of tergites 3–5 broad, without distinct U-shaped bare area medially. Well developed lateral and medial connections between AG and MG of tergites 4 and 5. Tergite 6 with MG consisting of weak spinules in two groups. Pedes spurii B well developed. Anal lobe extensions about as long as broad.

The exuviae of *P. scandica* is not far from that of *P. bathophila*. The spinulae pattern of tergites 2–5 is, however, distinctly weaker, although variation in *P. bathophila* is considerably wide. Also the thoracic horn is usually smaller and with fewer spinules than in *P. bathophila*. The presence of few spinules in MG of tergite 7 separates *P. scandica* from other known Finnish species. This character is, however, known from the Nearctic species *P. torulata* (Saether 1969, fig. 77A), and Palearctic *P. dentifera*, *P. sp. d* (Wülker 1957), *P. sp. I* (Reiss 1968), and *P. sp. c* (Brundin 1956). Brundin suspected the identity of the pupal exuviae of *Parakiefferiella sp. c* (Thienemann 1941) as being *P. scandica*, but as discussed before, this exuviae belongs to some so far unknown species.

Ecology and distribution

The species mainly inhabits standing waters, but appears occasionally also in lotic habitats, as in the high mountain brook Leirungså in Norway (Brundin 1956). It was one of the most abundant chironomids emerging along the shoreline of the subarctic lake Øvre Heimdalsvatn in Norway (Aagaard 1978). The species also appears commonly in the Finse area (Saether 1968; Lindeberg, material collected in 1985).

In Finland *P. scandica*, together with *P. bathophila*, is the commonest *Parakiefferiella* in lakes Inarijärvi and Kilpisjärvi and many other arctic–subarctic lakes of the northernmost part of the country, starting its emergence approximately in late June, slightly later than *P. bathophila* (Tuiskunen & Lindeberg in prep.). It occurs over the whole of Finland, being common also in the southern lakes Längelmävesi and Puruvesi.

Among *Parakiefferiella* species *P. scandica* seems to be the species enduring the most barren conditions of strongly oligotrophic high mountain lakes.

Parakiefferiella smolandica (Brundin, 1947)

Pseudosmittia smolandica Brundin 1947: 39–40, figs. 1, 14 and 69 (male).

Material used in description

10 males; 2 ♂♂ from Ta, Lammi, Pääjärvi (677:39), 28.7.1983, J. Tuiskunen leg.; 2 ♂♂ from Sa, Punkaharju, Puruvesi (684:62), 29.5.1960 and 15.9.1970, B. Lindeberg leg.; 1 ♂ from Le, Enontekiö, Tsahkaljärvi (767:25), 1.7.1969, B. Lindeberg leg.; 2 ♂♂ from Li, Inari, Inarijärvi, Saunari (767:53), 1.7.1971, P. Virtanen leg.; 1 ♂ from Inarijärvi, Tourissaaret (765:52), 19.7.1971, P. Virtanen leg.; 2 ♂♂ from Inarijärvi, Lintusaaret (765:52), 6.7. and 8.7.1971, P. Virtanen leg.

3 pupal exuviae; 2 from Puruvesi, 7.–8.8.1960, B. Lindeberg leg.; 1 from Le, Enontekiö, Kilpisjärvi (767:25), 19.7.1969, B. Lindeberg leg.

Description of male, see Table 1 and Fig. 6.1.

Remarks

Originally this species has been described in the genus *Pseudosmittia* Goetghebuer (Brundin 1947). Later on, Brundin does not mention the species, not even in his key to the *Pseudosmittia* males of northern Europe (Brundin 1956). As stated by Brundin (1947), *P. smolandica* much resembles *Epoicocladius cheethami* Edwards (= *Parakiefferiella bathophila* (Kieffer)), but according to the system of Edwards (1929) and Goetghebuer (1940–50) the species keys to *Pseudosmittia* in respect of its short anal vein ending below FCu. In the present material such a shortened anal vein was not observed, but in all specimens the vein ends distinctly distad to FCu (as in *P. fennica* sp. n., Fig. 2.3). It thus represents a very typical member of the genus *Parakiefferiella*, as interpreted already by Lindeberg (1980). Note: the anal vein is shortened in some "atypical" *Parakiefferiella*, namely *P. coronata*, *P. gynecera* and *P. minuta*, ending below FCu.

The closest relative to *P. smolandica* is perhaps *P. fennica* sp. n., as discussed previously (p. 182). Other related species are *P. bathophila* (readily distinguishable by its anal point), and *P. finmarkica* (see remarks on p. 184).

Description of pupa ($n=3$)

Total length 2.2–2.8 mm. Colour: Slightly brownish, cephalothorax somewhat darker than abdomen.

Cephalothorax: Thoracic horn large and ovoid, with several spinules over whole surface, irregularly arranged (Fig. 9.2). Length 70–85 μm .

Abdomen: Spinulae pattern of tergites 2–6 as in Fig. 7.6. Tergite 1 without spinules. Tergite 2: AG with very weak and short (2–3 μm) spinules in about 2–4 rows. MG with stronger but very short (2–3 μm) spinules in about 1–3 rows, without connection to AG and PG. PG with very strong spinules (14–16 μm) in about 2–4 rows. Tergite 3: Spinules of AG very weak (2–4 μm) laterally and stronger (6–7 μm) medially. U-shaped, bare area remains medially. Spinules of MG as in tergite 2 in about 2–4 rows, sometimes with weak connection to AG. PG with strong spinules (8–10 μm) in 2–4 rows, separated from MG. Tergite 4: AG as in previous tergite, but stronger spinules more numerous and longer (10–12 μm). MG with strong but short (6–7 μm) spinules, laterally in connection with AG so that oval, spinuleless areas remains medially. PG with strong spinules (10–12 μm) narrowly separated from MG. Tergite 5: As tergite 4, but PG absent. Tergite 6: AG with very weak spinules (2–4 μm) in two separate lateral groups. MG consisting of two separate spinule patches with 2–17 very strong spinules (14–17 μm). Sometimes weak connection between AG and MG. Tergite 7: With extremely weak spinules in two different groups anteriolaterally. Tergite 8: As tergite 7, but spinules somewhat more numerous. Spinulae pattern of sternites as in *P. fennica* sp. n. (Fig. 10.3). All sternal spinules extremely fine. Chaetotaxy of tergites and sternites as in *P. fennica* sp. n. (cf. p. ??). Pedes spurii B well developed in segments 2 and 3. Well developed pedes spurii A in segments 4–7. Anal lobe of *P. bathophila* type, with short and broad (length 14–20 μm , breadth 15–20 μm) extensions. Anal macrosetae normal.

Remarks

This exuviae can be distinguished by means of the following combination of characters: Thoracic horn

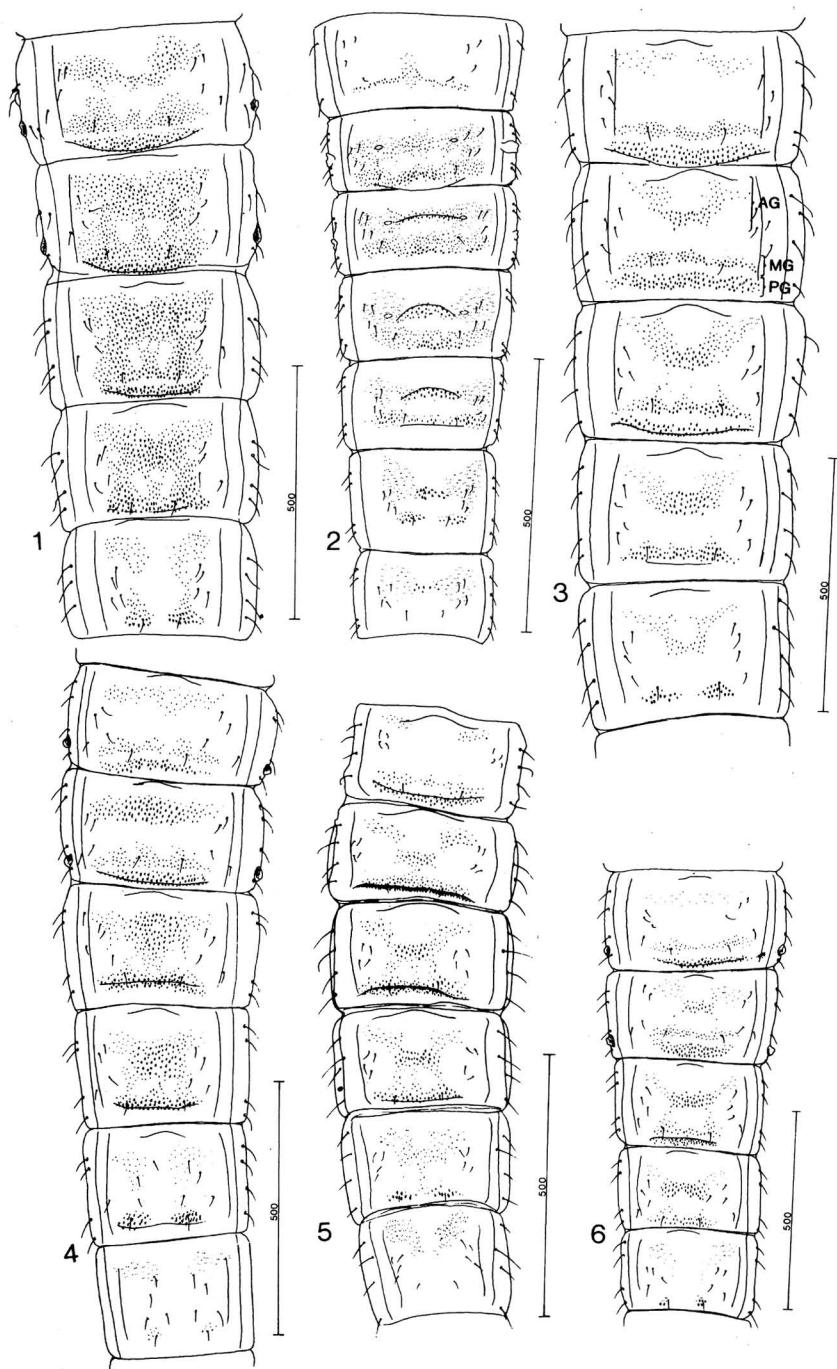


Fig. 7. *Parakiefferiella* spp. Pupal exuviae: *P. bathophila* (Kieffer), tergites 2–6 (1); *P. coronata* (Edwards), tergites 1–7 (2); *P. nigra* Brundin, tergites 2–6 (3); *P. scandica* Brundin, tergites 2–7 (4); *P. gynocera* (Edwards), tergites 2–6 (5); *P. smolandica* (Brundin), tergites 2–6 (6). Scale in μm .

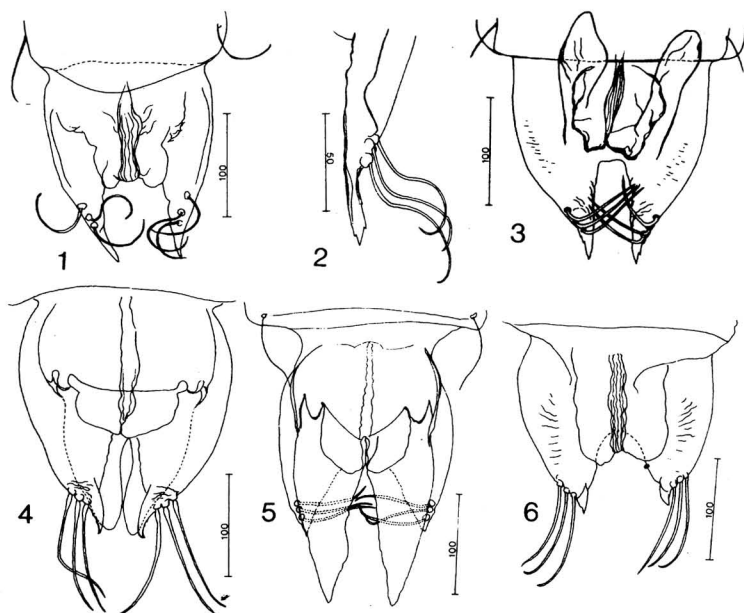


Fig. 8. *Parakiefferiella* spp. Anal lobes of pupal exuviae: *P. coronata* (Edwards) (1); anal lobe extension of *P. coronata* (2); *P. gynocera* (Edwards) (3); *P. nigra* Brundin (4); *P. scandica* Brundin male (5); *P. scandica* female (6). Scale in μm .

large, ovoid, with spinules over whole surface. AG and MG of tergite 2 well separated, AG not divided medially. Spinules of AG of tergites 3–5 in U-shaped formation. Lateral connections between AG and MG present only in tergites 4 and 5. Tergite 7 with only extremely weak spinules in AG. Pedes spurii B well developed. Anal lobe extensions as long as broad.

As discussed before, the exuviae of *P. smolandica* is close to *P. fennica* (cf. p. 182). It is also possible to confuse the exuviae with that of *P. bathophila* because of its well developed thoracic horn and similar anal lobe. These species are, however, readily separable by their tergal spinulae pattern.

Ecology and distribution

For the time being *P. smolandica* is known only from Sweden (Brundin 1947) and Finland. In Finland the species seems to favour clear oligotrophic lakes (common e.g. in lakes Puruvesi and Inarijärvi), but also occurs in mesohumic, somewhat loaded lakes. It is the only *Parakiefferiella* recorded from the brackish water of the Gulf of Finland (Bagge et al. 1980).

In Lake Inarijärvi the main emergence takes place in July (Tuiskunen & Lindeberg in prep.).

Other European *Parakiefferiella*

P. dentifera Wülker, 1957

The male is readily distinguished from other *Parakiefferiella* by the hypopygium characters (Wülker 1957, fig. 6). The pupal exuviae is characterized by a long and narrow thoracic horn (Wülker 1957, fig. 1b), well developed MG in tergite 7, and long anal lobe extensions.

Because of the inadequate description of the male (described on the basis of one ripe pupa), a more detailed

discussion of the relationships of this interesting species is impossible. According to Wülker (1957) the hypopygium, thoracic horn, spinulae pattern of tergites and anal lobe "lassen die Art aber eindeutig als 'Übergangsform' zwischen *Parakiefferiella* und *Krenosmittia* erkennen".

The only known specimen of this species has been found in Lunzer Untersee, Austria.

P. gracillima (Kieffer, 1924)

A characteristic species readily recognizable from the hypopygium (Brundin 1956, fig. 111) and very low antennal ratio (0.30). The exuviae may be best identified by the very long and relatively broad anal lobe extensions (Brundin 1956, Wülker 1957, fig. 2d). The species has not been found in Fennoscandia, but in several localities in Central Europe and the Soviet Union (Fittkau & Reiss 1978). The larvae inhabit springs (Wülker 1957).

P. sp. c Thienemann, 1941

This exuviae, described by Brundin (1956, figs. 116 and 117), is one of the most characteristic *Parakiefferiella* exuviae. It is readily separable on the basis of the following combination of characters: Thoracic horn absent. Whole abdomen strongly built, especially lateral and caudal margins of segments darkly pigmented. Lateral hairs long and strong. Well developed MG present in tergite 7, consisting of two narrowly separated spinule patches. Pedes spurii B absent. Anal lobe with long and rather broad extensions with several teeth on surface (Brundin 1956, fig. 117).

The identity of this exuviae is as yet unknown. Its moderate length (2.7 mm), however, eliminates the very small species *P. finnmargica* sp. n. and *P. minuta* sp. n. Thus, the only alternative could be *P. bilobata* or some as yet unknown species.

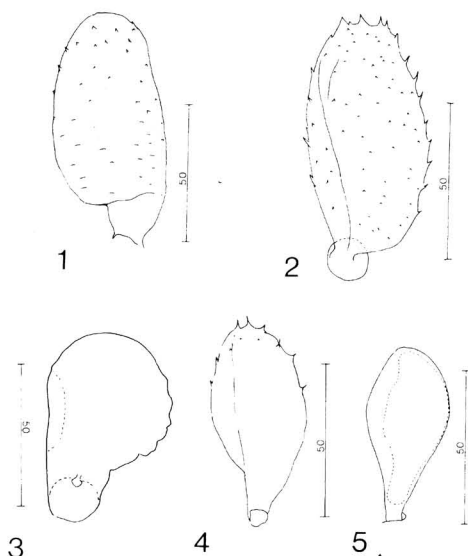


Fig. 9. *Parakiefferiella* spp. Thoracic horns of pupal exuviae: *P. bathophila* (Kieffer) (1); *P. smolandica* (Brundin) (2); *P. nigra* Brundin (3); *P. scandica* Brundin (4); *P. coronata* (Edwards) (5). Scale in μm .

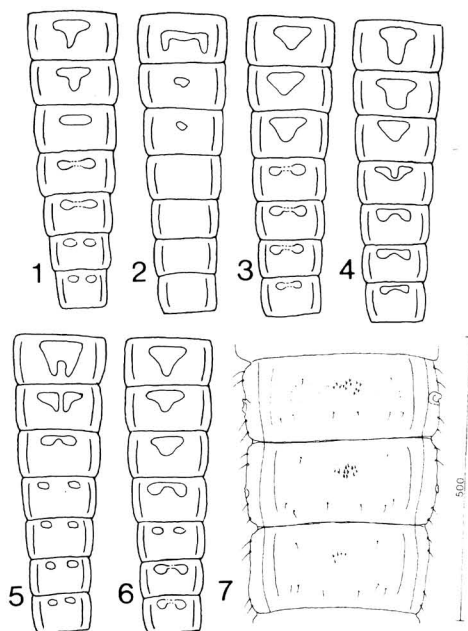


Fig. 10. *Parakiefferiella* spp. Spinulae pattern of sternites 2-8 of exuviae: *P. bathophila* (Kieffer) (1); *P. coronata* (Edwards) (2); *P. fennica* sp. n. (3); *P. gynocera* (Edwards) (4); *P. nigra* Brundin (5); *P. scandica* Brundin (6); sternites 2-4 of *P. coronata* (7). Scale in μm .

Material examined: One exuviae from Austria, Oberrothenbuch, Unterer Inn, 13.5.1982, F. Reiss leg.

P. sp. c is also known from the Torneträsk area, Swedish Lapland.

P. sp. d Wülker, 1957

Pupal exuviae characterized by a group of orally directed spinules ("...oralgerichteten hakenartigen Spitzen") in the middle of the posterior margin of tergite 2 (Wülker 1957, fig. 9). Otherwise very close to the exuviae of *P. dentifera*. Known from Spain (Wülker 1957).

P. sp. I Reiss, 1968

This very peculiar exuviae differs from other *Parakiefferiella* by the characters listed in Reiss (1968, p. 195). The increased number of lateral hairs (5 in tergites 2-7, 6 in tergite 8) and very strong tergal spinulae pattern suggest this species as representing a plesiomorphic member of the genus.

Material examined: Two exuviae from Bodensee (specimens of Reiss' description); one from Walchensee, Oberbayern, 19.8.1984, F. Reiss leg.

P. sp. II (unpubl.)

Additionally I have seen one unknown male sent me by Dr. F. Reiss, labelled as follows: Breitenbach, Gewachshs. Schlitz/Hess. 5.6.1972, M. Siebert leg. This new species may perhaps be described later.

P. sp. "Saxl"

After the completion of the manuscript I received some *Parakiefferiella* specimens from R. Saxl of Innsbruck, Austria, collected in the Tyrol from a high mountain stream Stockdalbach, where the species is one of the abundant chironomids. The male seems to be near *P. gracillima* Kieffer, but pupal exuviae and larvae differ somewhat from the description of Wülker (1957). This species must likewise be left for future discussion.

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A key to known *Parakiefferiella* males from Fennoscandia

1. Antennal flagellum 5-segmented. Transverse sternapodeme very concave. Basal median lobe reduced. Hypopygium Fig. 5.3. *P. gynocera* (Edwards)
- Antennal flagellum 13-segmented (sometimes indistinctly in *P. coronata*). Transverse sternapodeme nearly straight to slightly concave. Basal median lobe mostly well developed 2
2. Vein R_{2+3} clearly separated. Wing length 1.3 mm or more. AR over 0.48. 3
- Vein R_{2+3} fused to R_{4+5} or separated only apically. Wing length below 1.3 mm. AR less than 0.48. 8
3. Basal median lobe more or less angular (Figs. 2.5, 5.1 and 6.1). Caudal margin of gonocoxite lobes perpendicular or at obtuse angle to gonocoxite. 4
- Basal median lobe smoothly rounded (Figs. 1.2 and 6.2). Caudal margin of gonocoxite lobes form acute angle with gonocoxite (or gonocoxite lobe finger-shaped, directed caudally). 6
4. Anal point triangular, pointed apically, without longitudinal ridge medially. Hypopygium Fig. 5.1. *P. bathophila* (Kieffer)
- Anal point rounded apically (in some *P. smolandica* fairly pointed), with longitudinal ridge medially. ... 5
5. Caudal margin of gonocoxite lobe perpendicular to gonocoxite. Longitudinal ridge of anal point weak. Hypopygium not broadened medially. AR 0.55–0.75. Hypopygium Fig. 6.1. *P. smolandica* (Brundin)
- Caudal margin of gonocoxite lobe at obtuse angle to gonocoxite. Longitudinal ridge of anal point mostly well developed. Hypopygium broadened medially (sometimes only very slightly). AR 0.48–0.60. Hypopygium Fig. 2.4. *P. fennica* sp. n.
6. Gonocoxite lobe finger-shaped, simple, without strong hairs on caudal margin. Anal point distinctly longer than broad. Basal median lobe broad, distinct. Scutellars 2. AR 0.55–0.73. Wing length 1.3–1.7 mm. Hypopygium Fig. 6.2. *P. scandica* Brundin
- Gonocoxite lobe different. Anal point short and broad. Basal median lobe narrow, poorly visible. Scutellars 4–6. AR over 0.8. Wing length over 1.7 mm. 7
7. Gonocoxite lobe bipartite, with finger-shaped frontal lobe and small, tubercle-like caudal lobe. Hypopygium Fig. 1.1. *P. bilobata* sp. n.
- Gonocoxite lobe different, with 2–4 strong hairs arising from large bases. Hypopygium Fig. 5.4. *P. nigra* Brundin
8. Anal point triangular, pointed apically. Hypopygium Fig. 3.3. *P. finnmarkica* sp. n.
- Anal point hemispherical, rounded apically. 9
9. Thorax almost black. Basal median lobe rounded. Mesonotum with chump and hair tuft. Costa normally produced. Cu_2 clearly straight. Palp segment 2 without group of large sensory setae. Hypopygium Fig. 5.2. *P. coronata* (Edwards)
- Ground colour of thorax pale. Basal median lobe angular. Mesonotal chump and hair tuft absent. Costa very strongly produced. Cu_2 clearly bent. Palp segment 2 with a group of long, lanceolate sensory setae (Fig. 4.1). Hypopygium Fig. 4.6. *P. minuta* sp. n.

A key to *Parakiefferiella* exuviae known from Finland

1. Sternites 2–4 with well developed spinule groups medially (Fig. 10.7). AG of tergite 7 with stronger spinules medially. Anal lobe extensions (Fig. 8.2) long and narrow. Exuviae Fig. 7.2. *P. coronata* (Edwards)
- Sternites and AG of tergite 7 with very weak and short spinules only. Anal lobe extensions broader, often short. 2
2. Pedes spurii B well developed. Anal lobe extensions mostly about as long as broad. 3
- Pedes spurii B absent or very poorly developed. Anal lobe extensions often distinctly longer than broad. 6
3. Thoracic horn absent. Anal lobe extensions often distinctly longer than broad (Fig. 2.7). Exuviae Fig. 2.6. *P. fennica* sp. n.
- Thoracic horn present. Anal lobe extensions hardly longer than broad (Fig. 8.5). 4
4. Thoracic horn (Fig. 9.2) well developed, with several spinules over whole surface. PG of tergite 2 with a medial group of long and strong spinules. U-shaped, spinuleless area mediad the AG of tergites 3–5. AG and MG of tergites 4 and 5 with lateral connections. Exuviae Fig. 7.6. *P. smolandica* (Brundin)
- Thoracic horn well or weaker developed. PG of tergite 2 without a medial group of special strong spinules. AG of tergites 3–5 without U-shaped, spinuleless area medially. AG and MG of tergites 4 and 5 with lateral and medial connections (Figs. 7.1 and 7.4). 5
5. Spinulae pattern of tergites 2–6 very well developed, covering most of the tergite. Broad medial and lateral connections between AG and MG of tergites 3–5. MG of tergite 7 absent. Thoracic horn well developed (length 80–113 μ m), with spinules from base to tip (Fig. 9.1). Exuviae Fig. 7.1. *P. bathophila* (Kieffer)
- Spinulae pattern of tergites 2–6 weaker developed. Connections between AG and MG of tergites 3–5 weaker, lateral connections sometimes absent. MG of tergite 7 with some spinules in two groups. Thoracic horn small (55–65 μ m), with spinules only apically (Fig. 9.4). Exuviae Fig. 7.4. *P. scandica* Brundin
6. Thoracic horn absent. Antennal sheaths of male short, female-like. Abdominal segments 2–5 distinctly darker coloured than rest of exuviae. Length of exuviae 2.2–2.9 mm. Exuviae Fig. 7.5. *P. gynocera* (Edwards)
- Thoracic horn present, without spinules on surface. Antennal sheaths of male normal. Whole exuviae uniformly coloured. Length of exuviae 3.0–3.5 mm. Exuviae Fig. 7.3. *P. nigra* Brundin

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