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# A systematic review of the genus *Parapsectra* Reiss (Diptera: Chironomidae: Tanytarsini) with description of a new species from Poland

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## Abstract

Adult males of the genus *Parapsectra* Reiss are diagnosed, illustrated in detail and keyed. *Parapsectra bumasta* **sp. n.**, collected from Pomerania (N Poland) is described and compared with two similar species: *P. chionophila* (Edwards) and *P. nana* (Meigen). Systematic relationships between the species included in *Parapsectra* and close genera are discussed. Data on biology of *Parapsectra* from new European sites are provided.

**Key words:** Diptera, Chironomidae, *Parapsectra*, taxonomy, new species, biology

## Introduction

*Parapsectra* Reiss, 1969 is a poorly known genus of the chironomid tribe Tanytarsini. It is distributed throughout the Holarctic (Epler 2003, Sæther & Spies 2004, Makarchenko *et al*. 2005), but so far only six species have been described [*P. chionophila* (Edwards), *P. mendli* Reiss, *P. nana* (Meigen), *P. styriaca* (Reiss), *P. uliginosa* Reiss, *P. wagneri* Siebert]. *Parapsectra* was separated based on morphological characters of pupae provided with pairs of oval or transversely elongated fields of short spines (shagreen) on abdominal tergites (Reiss 1969b). However, early developmental stages of most *Parapsectra* species remain unknown. Moreover, it is difficult to find genus-level taxonomic characters of adult *Parapsectra* males, which could unequivocally distinguish the genus from *Micropsectra* Kieffer and *Krenopsectra* Reiss (Cranston *et al*. 1989, Stur & Ekrem 2008). Thus, inclusion of species into the genus *Parapsectra* is possible only based on morphology of both pupae and adult males, or when the characters of adult male are evidently similar to those of the type species. Consequently, our review includes a description of a new species which demonstrates unique features of its hypopygium as well as a set of characters indicating its close relationship with *Parapsectra nana*.

Morphological characteristics, evolutionary trends and phyletic relations between *Parapsectra* and similar genera, which are proposed to be collectively termed ‘the *Micropsectra* series’, were discussed by Säwedal (1982). The hypotheses pointed out by him are, partly, in agreement with our data and indicate particularly close relationships between *Parapsectra* and the species currently included into the *Micropsectra attenuata* group but also to the genus *Paratanytarsus* Thienemann *et* Bause.

## Materials and methods

Specimens, collected with a sweep net and the Malaise trap, were dissected and slide-mounted in a mixture of phenol and Canada balsam using the method of Wirth & Marston (1968). To preserve the natural shape and configuration and to prevent flattening of the structures studied, all parts of the specimen were placed under 3 x 3 mm, or smaller cover slips. Illustrations, descriptions and measurements are based on slide-mounted individuals (except for the body colouration, taken from specimens preserved in alcohol). The wing was

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measured from the arculus to the tip; lengths of leg segments were rounded off to the nearest 5 μm, lengths of palpomeres 2–5 and antennal and leg ratios (AR, LR) were measured to 0.01. The morphological terminology and abbreviations follow Sæther (1980) and Giłka (2009). Illustrations were prepared using the technique described by Giłka (2008). The type series of *Parapsectra uliginosa* and *P. wagneri* are housed in the Zoologische Staatssammlung München, Germany (ZSM); the remaining specimens studied are deposited in the Department of Invertebrate Zoology, University of Gdańsk, Poland (DIZUG). Legators: Patrycja Dominiak (PD), Elżbieta Sontag (ES), Ryszard Szadziewski (RSz) (all of DIZUG), Dawid Graczyk (DG, Gdynia, Poland); Jukka Salmela (JS, University of Jyväskylä, Finland), and the present authors (WG, NJ).

## Systematics

### *Parapsectra* Reiss, 1969

Reiss 1969b: 192. Type species: *Chironomus nanus* Meigen, 1818.

**Diagnostic description**. Wing length 1.25–2.05 mm (arculus–tip) to 2.40 mm (base–tip), exceptionally 0.55–0.82 mm (*P. uliginosa*, brachyptery). Eyes bare, reniform. Antenna with 13 flagellomeres, exceptionally with only 6 or 7 flagellomeres (*P. uliginosa*, Fig. 25); AR = 0.29–0.90; frontal tubercles minute or absent. Wing covered with macrotrichia on almost entire area (excl. *P. wagneri*), number of macrotrichia below An, length of RM, distance between RM and FCu and shape of anal lobe species-specific (Figs 1–7). Tibial combs of mid and hind leg fused or slightly separated, if widely separated - number of teeth reduced; each comb often bears single, slightly longer, spur-like tooth. Anal tergite bands of V-type, lateral teeth usually absent (excl. *P. mendli* and *P. styriaca*), 2–7 median setae present. Anal point with rounded, transversally cut or slightly concave apex, exceptionally apex acute (*P. mendli*); crests slender or slightly widened in posterior section (*P. wagneri*). Superior volsella triangular with anteromedian margin straight or convex, or with slender apical prolongation and anteromedian margin concave (*P. mendli*), and/or sinuous (*P. styriaca*); tubercle at base of superior volsella bearing *Micropsectra*-seta *sensu* Säwedal (1982) usually tall and cylindrical, exceptionally short and conical (*P. mendli*). Digitus never extending beyond superior volsella or absent (*P. styriaca*). Inferior volsella species-specific (Figs 32–41). Median volsella usually with spoon-shaped or with falciform lamellae (*P. uliginosa*, *P. wagneri*). See also taxonomic remarks.

### *Parapsectra bumasta* sp. n.
(Figures 1, 8–11, 32, 33)

**Type material**. POLAND. Holotype: adult male, slide mounted in Canada balsam; Chmielonko at Lake Raduńskie Dolne (54º19'N 18º06'E), 3 May 2009, sweep net, NJ. Paratype: 1 male; collection data identical to those of the holotype. Types in DIZUG.

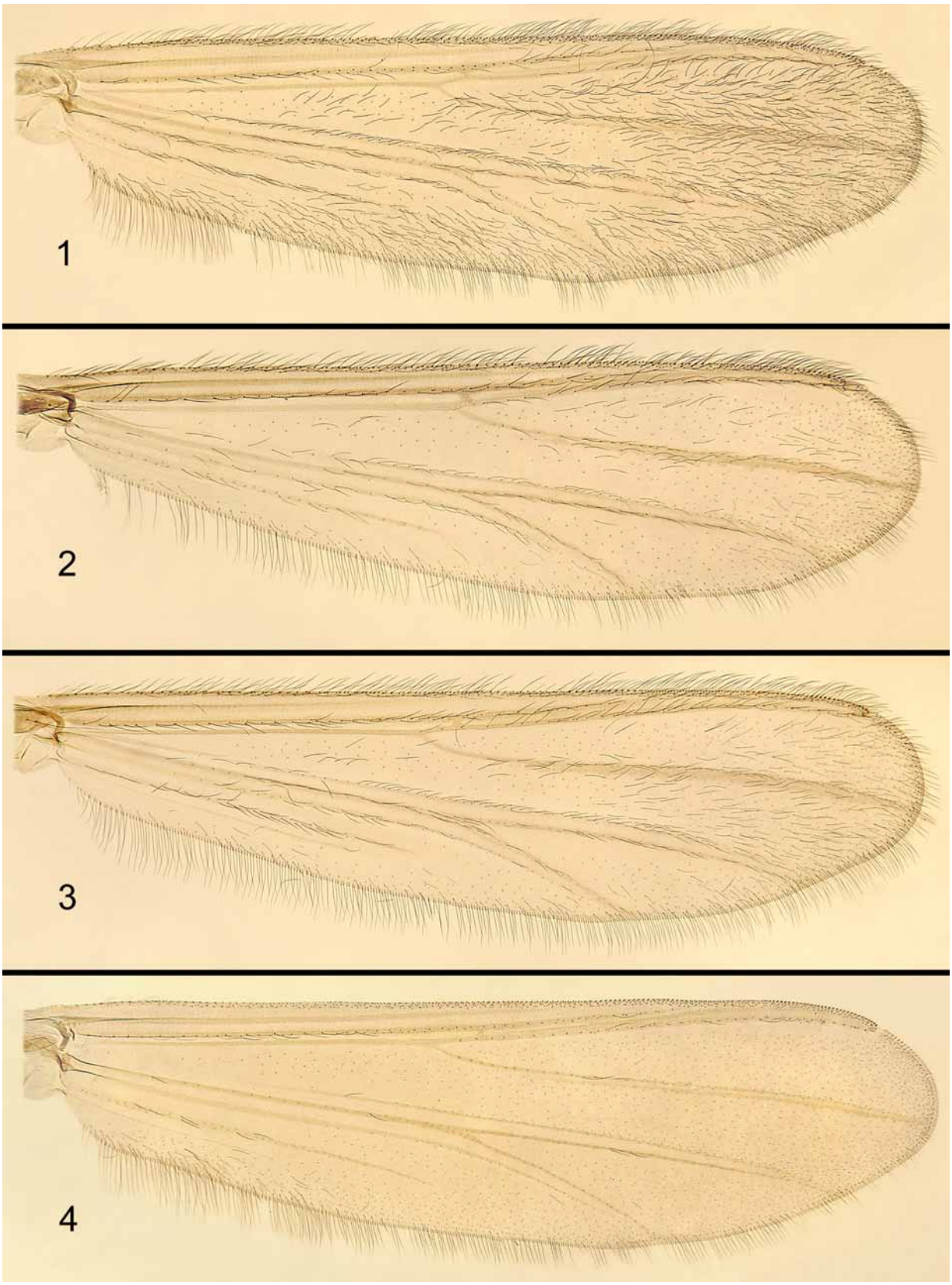
**Derivation of the name.** The specific name, derived from Latin - large swelling grapes, refers to the shape of the median volsella. The name is a noun in apposition.

**Diagnosis.** Adult male. Median volsella bearing c. 30 large, spoon-shaped lamellae arranged in regular rows. Inferior volsella bent at base, with distinct transversal protrusion.

**Description.** Adult male (measurements in Tables 1 and 8).

Colouration. Antennal pedicel, postnotum and sternum brown; scutal stripes orange to brown; head capsule, scutellum, haltere, ground colour of thorax and abdomen including hypopygium green; antennal flagellum and legs olive-brown; wing with greenish undertone, with C, M, and radial veins only slightly darker. Head. Antenna with 13 well-separated flagellomeres. Frontal tubercles absent. Third palpomere shorter than fourth. Wing. Sc, M, $R_{2+3}$, proximal 1/5 of $R_{4+5}$, very short proximal section of $M_{1+2}$ and 1/3 proximal part of Cu bare, remaining veins with dense macrotrichia. FCu very slightly distal of RM. RM relatively long. Membrane covered with dense macrotrichia in almost entire area; macrotrichia below An

particularly numerous. Anal lobe of wing relatively well developed (Fig. 1). Legs. Spur of fore tibia straight, c. 10–12 μm long. Combs of mid and hind tibiae slightly separated, each tibia with 25–30 teeth c. 12 μm long (mid leg) and 32–35 teeth c. 16 μm long (hind leg).




**FIGURES 1–4.** Wing of male. 1: *Parapsectra bumasta* **sp. n.**, 2: *P. chionophila*, 3: *P. mendli*, 4: *P. nana*.

**TABLE 1**. Length (μm) of leg segments of male *Parapsectra bumasta* **sp. n.**

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 845–895 | 625–675 | 880 | 470 | 340 | 250 | 90 |
| $p_2$ | 800–880 | 700–765 | 360–390 | 215–230 | 155–170 | 110–120 | 90–95 |
| $p_3$ | 955–1030 | 880–955 | 565–615 | 360–390 | 280–300 | 170–175 | 105–110 |

Hypopygium. Gonostylus narrowed and bent at base, regularly tapering to slender tip (Figs 8, 9). Anal tergite with relatively short, broadly separated bands of V-type; lateral teeth absent; anal point broad at base, short and apically rounded, bearing long and thin crests; microtrichia-free area surrounding base of anal point small (Fig. 8). Superior volsella triangular, with pointed apex and anteromedian margin slightly convex bearing setal protuberances; digitus well developed, reaching beyond half length of superior volsella; *Micropsectra*-seta placed on tall tubercle (Figs 8, 10). Median volsella grape-like, with straight and relatively long stem, bearing c. 30 large spoon-shaped lamellae placed in 3 regular rows posteromedially (Fig. 11). Inferior volsella short, strongly bent at base, with distinct transversal protrusion and widely rounded apex (Figs 8, 32, 33).

Adult female, pupa and larva: unknown.

**Discussion.** Because of the peculiar structure of the median volsella and the short, strongly bent inferior volsella with distinct transversal protrusion (Figs 8, 11, 32, 33), *Parapsectra bumasta* cannot be mistaken for any other species of the genus or the tribe. The species morphologically most similar to *P. bumasta*, having the long gonostylus, the very short and apically rounded anal point as well as the short inferior volsella are *P. nana* and *P. chionophila*. The shape, venation and chaetotaxy of wing in males of *P. bumasta* and *P. nana* are also similar (Figs 1 and 4).

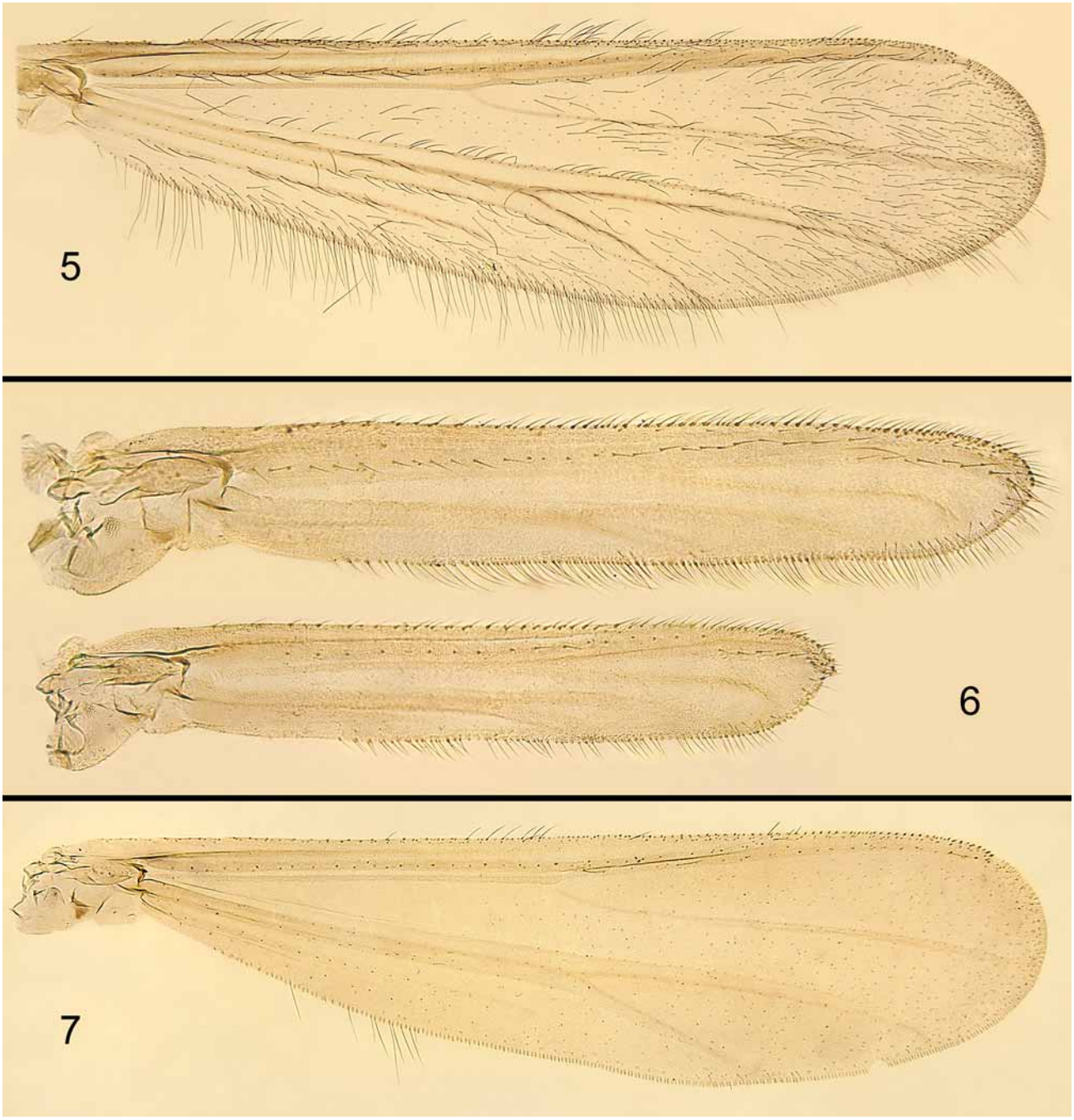
Adult males of *P. bumasta* were collected from a small forest spring pool (limnocrene, c. 0.5 ha) in the closest vicinity of Lake Raduńskie Dolne. Seasonal variability in the species' distribution is not known in detail. *P. bumasta* was sampled in early May, but was absent in April and late May as well as in July and August at the same site which was visited twice a month. Thus, it might be evidence of a single generation per year, although the results could have been affected by the non-typical dry weather conditions as a consequence of which, at the time of collection, the lake's water level has been lowered by c. 30 cm and most of the limnocrene area has been desiccated.

***Parapsectra chionophila* (Edwards, 1933)**
(Figures 2, 12–14, 34, 35)

**Material examined.** FINLAND. Sarmitunturi near Vanhapää (Inari distr.), c. 13 km west of the Russian border, 3 June–27 August 2004, Malaise trap, 6 males, JS. NORWAY. Kvitblik near Fauske, 7 July 2006, sweep net, 1 male, WG.

**Diagnostic description.** Adult male (measurements in Tables 2 and 8).

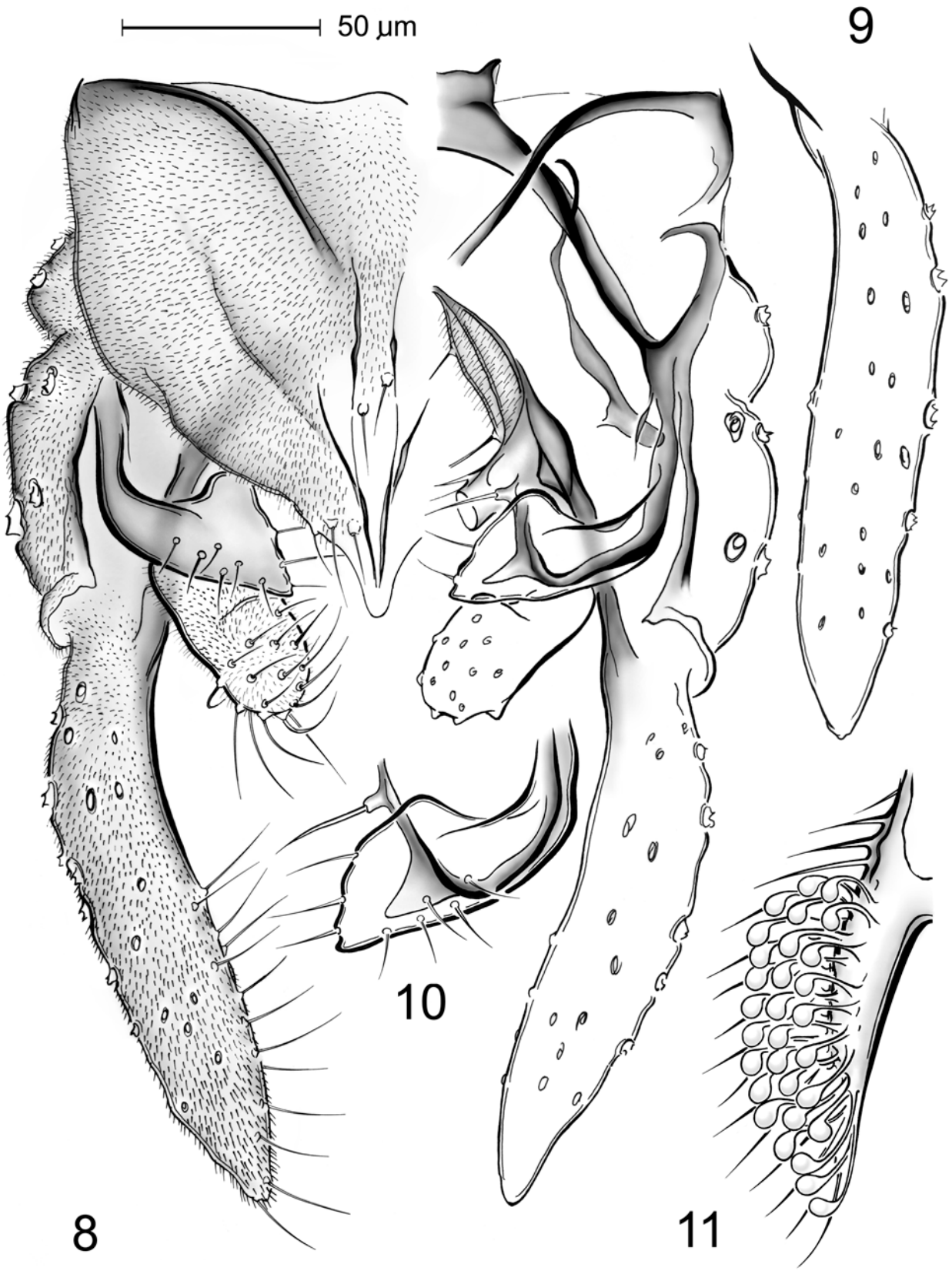
Colouration. Generally dark. Antennal pedicel, scutal stripes, postnotum, sternum and legs dark brown to fuscous; antennal flagellum, head capsule, scutellum, haltere, ground colour of thorax and abdomen including hypopygium olive-brown to dark brown; wing with brownish undertone, with C, M and radial veins distinctly darker, brown. Head. Antenna with 13 well separated flagellomeres. Frontal tubercles rarely present, formed as tiny swellings. Third palpomere longer than fourth. Wing. Sc, M, $R_{2+3}$, very short proximal section of $M_{1+2}$ and 1/3 proximal part of Cu bare, remaining veins with macrotrichia. FCu under RM. RM very short. Membrane below An with sparse macrotrichia. Anal lobe of wing strongly reduced (Fig. 2). Legs. Spur of fore tibia straight, 4–15 μm long, often reduced or absent. Combs of mid and hind tibiae slightly separated or fused, each tibia with 30–32 teeth 10–15 μm long (mid leg) and 30–35 teeth 14–16 μm long (hind leg).




**FIGURES 5–7.** Wing of male. 5: *Parapsectra styriaca*, 6: *P. uliginosa* (paratypes, variation), 7: *P. wagneri* (holotype).

**TABLE 2**. Length (μm) of leg segments of male *Parapsectra chionophila*.

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 730–770 (755) | 545–595 (580) | 675–690 (685) | 360–370 (365) | 280–290 (285) | 185–195 (190) | 90–100 (95) |
| $p_2$ | 700–750 (720) | 640–670 (650) | 285–330 (310) | 175–200 (190) | 140–150 (145) | 90–105 (100) | 75–90 (80) |
| $p_3$ | 840–920 (870) | 765–825 (790) | 480–520 (505) | 300–340 (325) | 235–255 (245) | 125–145 (140) | 90–100 (95) |




**FIGURES 8–11.** *Parapsectra bumasta* **sp. n.**, male. 8: hypopygium, 9: gonostylus (variation), 10: superior volsella and digitus (variation), 11: median volsella (magnified x 2 in comparison with hypopygium).


**FIGURES 12–14.** *Parapsectra chionophila*, male. 12: hypopygium, 13: superior volsella and digitus (variation), 14: median volsella (magnified x 3 in comparison with hypopygium).

Hypopygium. Gonostylus long, widest in half length, subapically narrowed, tapering to blunt tip. Anal tergite with long separated bands of V-type; lateral teeth absent; anal point broad at base, very short and apically rounded, bearing thin crests; microtrichia-free area surrounding base of anal point small (Fig. 12). Superior volsella variable in shape, usually with convex and broadly rounded anteromedian margin and apex; digitus stout but short, reaching half length of superior volsella, apically rounded, variable in shape; *Micropsectra*-seta placed on tall cylindrical tubercle (Figs 12, 13). Median volsella short, with stumpy stem bearing c. 20 small spoon-shaped lamellae placed in 2–3 irregular rows apically (Fig. 14). Inferior volsella short but stout, slightly bent at base, with distinctly swollen head-like distal half (Figs 12, 34, 35).

Adult female: Edwards (1933); pupa and larva: unknown.

**Discussion.** The adult male of *Parapsectra chionophila* can be separated from other species of the genus by its superior volsella with convex and usually broadly rounded anteromedian margin and/or apex (Figs 12, 13), the stumpy stem of the median volsella (Fig. 14), the inferior volsella with swollen head-like distal part (Figs 12, 34, 35), and by the very short wing vein RM (Fig. 2). Although the colouration varies greatly in most of the Tanytarsini, the dark brown/fuscous body of the adult male of *P. chionophila* seems to be a stable diagnostic feature. Due to the characters discussed (see above and taxonomic remarks), *P. chionophila* resembles *P. bumasta* and *P. nana*.

*P. chionophila* has been so far recorded from Britain (Edwards 1933), Germany (Reiss 1971), and Finland (Paasivirta 2009). This poorly known species is presumed to be a cold-adapted stenothermic inhabitant of springs, brooks, moorland pools and peat bogs. The specimens examined in this study were collected at sites located above 67°N, from spring brooks and small lakes, together with *P. nana* (Finland), and from a temporary peat pool, together with *P. styriaca* (Norway).

### *Parapsectra mendli* Reiss, 1983

(Figures 3, 15–18, 36, 37)

**Material examined.** POLAND. Czarna Tama at Lake Spierewnik near Tuchola, sweep net, at limnocrene, 20 April 2008, 3 males, 28 April 2009, 39 males, 21 July 2009, 5 males, WG. Wysocki Młyn near Tuchola, sweep net, at helocrene, 28 April 2009, 7 males, WG.

**Diagnostic description.** Adult male (measurements in Tables 3 and 8).

Colouration. Antennal pedicel, scutal stripes, postnotum and sternum dark brown to fuscous; antennal flagellum, head capsule, scutellum, haltere, legs, ground colour of thorax and abdomen including hypopygium olive to dark brown; wing with brownish undertone, with C, M and radial veins darker, brownish. Head. Antenna with 13 well-separated flagellomeres. Frontal tubercles present, sometimes very short and visible as tiny swellings. Third palpomere usually longer than fourth. Wing. Sc, M, $R_{2+3}$, short proximal section of $M_{1+2}$ and 1/4 proximal part of Cu bare, remaining veins with macrotrichia. FCu slightly distal of RM. RM relatively long. Membrane below An with sparse macrotrichia. Anal lobe of wing reduced (Fig. 3). Legs. Spur of fore tibia straight or slightly bent, 12–25 μm long. Combs of mid and hind tibiae usually slightly separated, if widely separated - number of teeth reduced; each tibia with 20–35 teeth 12–20 μm long (mid leg) and 25–45 teeth 16–25 μm long (hind leg); sometimes each comb bears single, somewhat longer spur-like tooth. For lengths of leg segments see Table 3 and Reiss (1983; presumably mean values given).

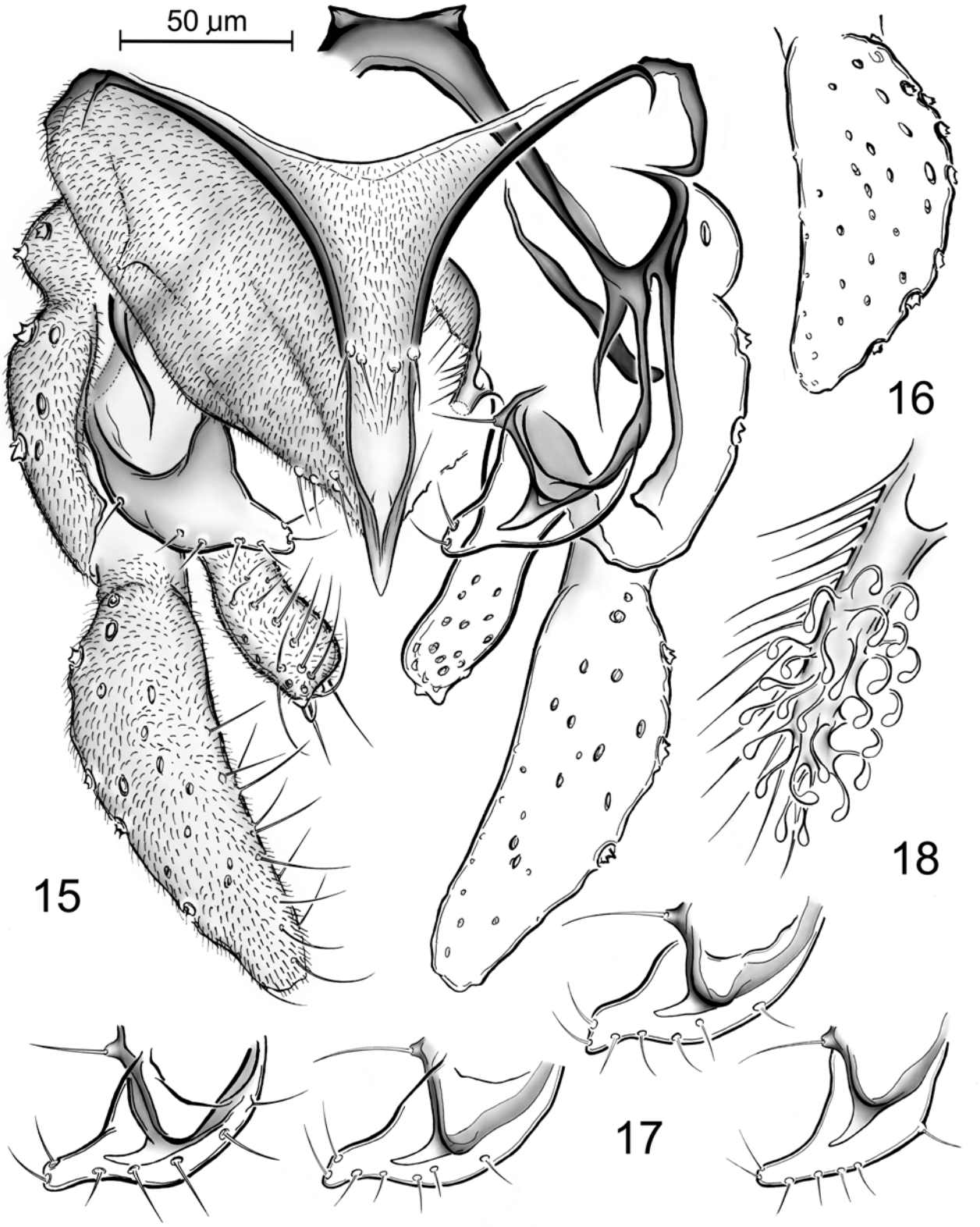
**TABLE 3**. Length (μm) of leg segments of male *Parapsectra mendli*.

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 800–1005 (910) | 550–735 (655) | 810–990 (890) | 410–500 (465) | 310–390 (350) | 220–280 (255) | 120–155 (140) |
| $p_2$ | 755–965 (870) | 655–795 (735) | 360–455 (410) | 215–270 (245) | 155–205 (185) | 105–145 (130) | 80–110 (100) |
| $p_3$ | 925–1175 (1070) | 825–1065 (965) | 515–685 (610) | 330–410 (380) | 245–310 (285) | 155–200 (180) | 95–125 (115) |

Hypopygium. Gonostylus stout, widest in half length, tapering to rounded apex, variable in shape (Figs 15, 16). Anal tergite with long, separated bands of V-type; lateral teeth present; anal point slender, acute, bearing short crests; entire area surrounding base of anal point covered with microtrichia (Fig. 15). Superior volsella with slender apical prolongation and anteromedian margin concave, bearing dorsal setae placed in row, with proximal seta somewhat distant; digitus well-developed, apically pointed, reaching at least half length of superior volsella; *Micropsectra*-seta placed on short conical tubercle (Figs 15, 17). Median volsella

with relatively long, slightly bent and laterally directed stem bearing c. 20 strongly curved spoon-shaped lamellae arranged irregularly (Fig. 18). Inferior volsella long, reaching half length of gonostylus, straight or slightly bent and directed medially, with slight transversal protrusion and rounded apex (Fig. 15, 36, 37).

Adult female, pupa and larva: unknown.




**FIGURES 15–18.** *Parapsectra mendli*, male. 15: hypopygium, 16: gonostylus (variation), 17: superior volsella and digitus (variation), 18: median volsella (magnified x 2 in comparison with hypopygium).

**Discussion**. Characters which best separate adult male of *Parapsectra mendli* from other *Parapsectra* are the acute hypopygial anal point as well as the superior volsella with its slender apical prolongation and the concave anteromedian margin (Figs 15, 17). The tubercle placed at base of the superior volsella bearing the *Micropsectra*-seta is short and broadly conical in *P. mendli*, whereas it is prominent, usually cylindrical in other *Parapsectra*. The median volsella, bearing numerous small and strongly curved spoon-shaped lamellae, is also a unique character within the genus (Fig. 18).

Although immatures of *P. mendli* are unknown, the species is presumed to be a cold-adapted stenothermic inhabitant of springs (Reiss 1983). Adults of the species have been so far recorded at two sites, in April (Reiss 1983) and June (Ekrem *et al*. 2007). In this study, swarming males were observed at two other sites in the Eastern Pomerania (N Poland), in the closest vicinity of springs, and - in abundance - at a limnocrene. The adults were collected in April and July, but were not recorded in May and June. The specimens sampled from the same site in summer differ in having shorter wing (1.55–1.60 vs 1.75–2.05 mm in specimens collected in spring), lower AR (0.67–0.70 vs 0.72–0.79), higher LR (1.45–1.47 vs 1.33–1.36), and probably belonged to the second generation. Body measurements of the specimens examined are compatible with the original description (Reiss 1983), except for wing, which - in the original description - was presumably measured from the base, rather than from the arculus, to the tip.

***Parapsectra nana* (Meigen, 1818)**
(Figures 4, 19–21, 38)

**Material examined.** POLAND. Kożyczkowo near Chmielno, 31 May 1997, sweep net, 3 males, ES. Sudety Mts., Szklarska Poręba, 5 August 1982, sweep net, 3 males, RSz. Tatra Mts., Dolina Roztoki, 1200 m a.s.l., 6 August 1981, sweep net, 1 male, RSz. Zakopane-Oberconiówka, 900 m a.s.l., 7 August 1981, sweep net, at peat bog, 1 male, RSz. BULGARIA. Rila Mts., Skakavica near Sapareva Banja, 1580 m a.s.l., 20 July 1976, sweep net, at waterfall, 4 males, RSz. FINLAND. Sarmitunturi near Vanhapää (Inari distr.), c. 13 km west of the Russian border, 3 June–27 August 2004, Malaise trap, at spring brooks and small lakes, 3 males, JS. NORWAY. Semska (Arctic Circle), 680 m a.s.l., 6 July 2006, sweep net, at peat pools, 1 male, WG.

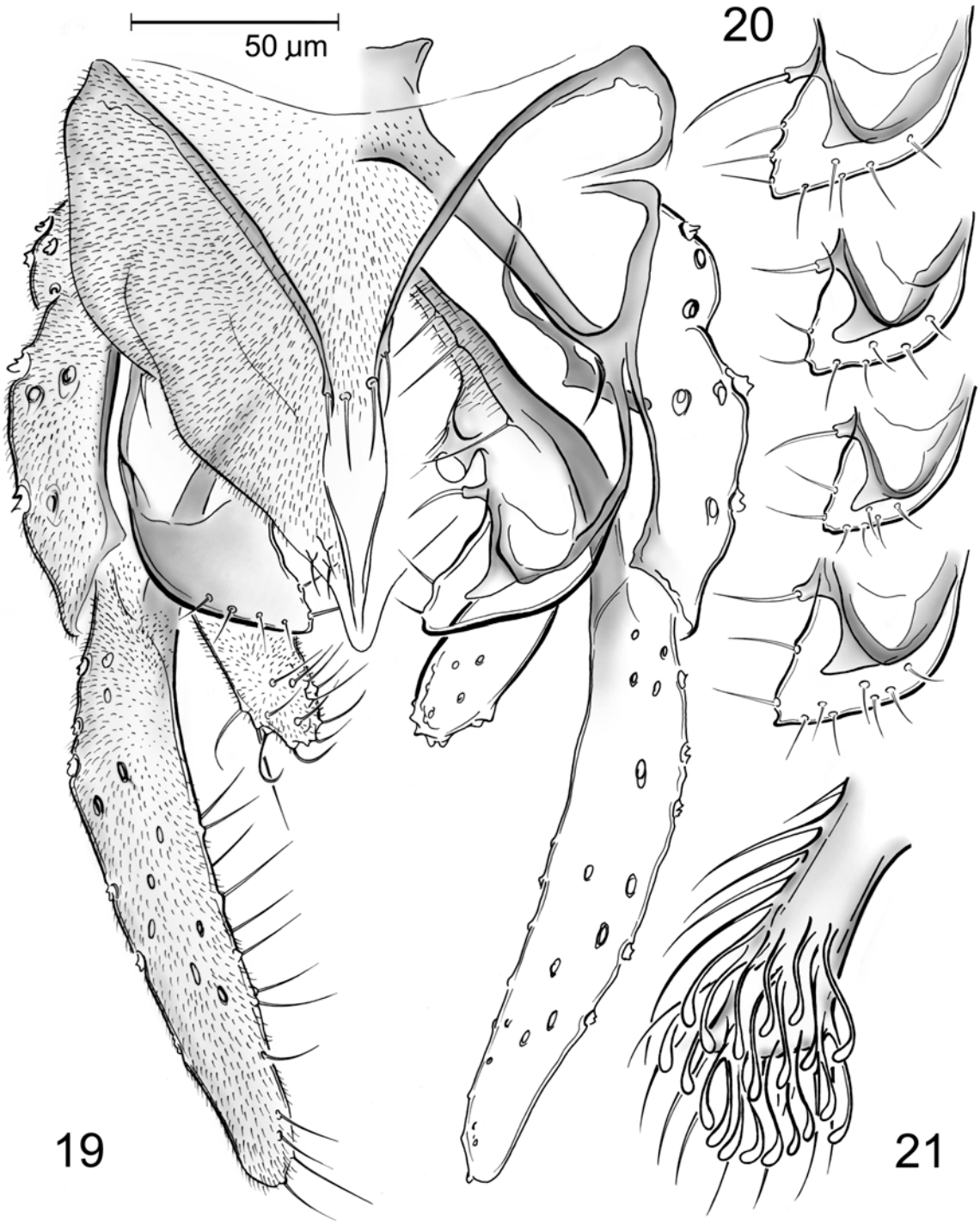
**Diagnostic description.** Adult male (measurements in Table 4 and 8).

Colouration. Antennal pedicel, postnotum and sternum brown; scutal stripes orange to brown, antennal flagellum and legs olive brown; head capsule, scutellum, haltere, ground colour of thorax and abdomen including hypopygium green to olive-green; wing with yellowish undertone, with C, M and radial veins slightly darker, brownish. Head. Antenna with 13 well separated flagellomeres. Frontal tubercles rarely present as tiny swellings. Third palpomere usually shorter than fourth. Wing. Sc, M, $R_{2+3}$, very short proximal section of $M_{1+2}$ and 1/4 proximal part of Cu bare, remaining veins with macrotrichia. FCu under RM. RM long. Membrane below An with numerous and dense macrotrichia. Anal lobe of wing relatively well developed (Fig. 4). Legs. Spur of fore tibia straight, 8–12 μm long, often reduced or absent (n = 2). Combs of mid and hind tibiae slightly separated, each tibia with 22–35 teeth 10–15 μm long (mid leg) and 30–35 teeth 12–16 μm long (hind leg); sometimes each comb bearing single, somewhat longer spur-like tooth.

**TABLE 4**. Length (μm) of leg segments of male *Parapsectra nana*.

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 605–950 (800) | 435–700 (595) | 640–870 (810) | 325–455 (415) | 250–340 (315) | 170–245 (225) | 90–120 (110) |
| $p_2$ | 640–925 (760) | 560–795 (665) | 280–420 (350) | 160–250 (210) | 120–185 (160) | 75–120 (105) | 65–90 (80) |
| $P_3$ | 690–1125 (920) | 700–1015 (850) | 425–590 (540) | 250–355 (330) | 200–280 (255) | 110–170 (155) | 75–105 (95) |

Hypopygium. Gonostylus slender, nearly twice as long as gonocoxite, regularly tapering to narrow tip. Anal tergite with long separated bands of V-type; lateral teeth absent; anal point broad at base, short and apically rounded, bearing long thin crests; microtrichia-free area surrounding base of anal point small (Fig. 19). Superior volsella triangular, apically pointed, with anteromedian margin straight, bearing setal protuberances; digitus well developed, usually reaching slightly beyond half length of superior volsella, variable in shape but usually acute; *Micropsectra*-seta placed on tall cylindrical tubercle (Figs 19, 20). Median volsella moderately long, with stem bearing c. 20 small spoon-shaped lamellae placed in 2–3 irregular rows apically (Fig. 21). Inferior volsella short and straight, with very slightly swollen distal half, apically rounded (Figs 19, 38).




**FIGURES 19–21.** *Parapsectra nana*, male. 19: hypopygium, 20: superior volsella and digitus (variation), 21: median volsella (magnified x 2 in comparison with hypopygium).

Pupa: Reiss (1969b), Langton (1991); adult female and larva: unknown.

**Discussion.** Due to the set of characters discussed above, *Parapsectra nana*, *P. bumasta* and *P. chionophila* form a putative species group. The characters which best separate *P. nana* from its sibling species are the slender gonostylus, nearly twice as long as gonocoxite, and the short and straight inferior volsella (Figs 19, 38).

*P. nana* is associated with cold-water habitats. The specimens examined were collected in northern spring brooks, peat pools and small lakes, and at a waterfall and peat bogs in uplands and mountains of central and eastern Europe.

***Parapsectra styriaca* (Reiss, 1969)**
(Figures 5, 22–24, 39)

**Material examined.** POLAND. Borzestowska Huta near Chmielno, 30 July 2001, sweep net, 2 males, PD. Czarna Tama at Lake Spierewnik near Tuchola, sweep net, at helocrene, 28 April 2009, 3 males, 21 July 2009, 5 males, WG. Czysta Woda near Stężyca, 7 June 1997, sweep net, at helocrene, 1 male, WG. Chmielonko at Lake Raduńskie Dolne, sweep net, at limnocrene, 12 May 2001, 1 male, 30 July 2001, 4 males, 12 May 2002, 1 male, PD; 1–3 May 2009, 16 males, NJ; 10 August 2009, 1 male, 29 August 2009, 2 males, WG. Słupie on River Czarna Hańcza, 24 May 2006, sweep net, at peat bog, 1 male, PD. NORWAY. Kvitblik near Fauske, 7 July 2006, sweep net, at peat pool, 1 male, WG. UKRAINE. Crimea, Koreiz (Yalta distr.), 6 May 2005, sweep net, at piedmont lake, 17 males, DG.

**Diagnostic description.** Adult male (measurements in Table 5 and 8).

Colouration. Antennal pedicel, scutal stripes, postnotum and sternum brown to fuscous; antennal flagellum and legs olive-brown; head capsule, scutellum, haltere, ground colour of thorax and abdomen green to olive-green; wing with greenish undertone, with C, M, radial veins and Cu darker. Head. Antenna with 13 well separated flagellomeres. Frontal tubercles relatively long, but often reduced or absent. Third palpomere longer than fourth. Wing. Sc, M, $R_{2+3}$, short proximal section of $M_{1+2}$ and 1/4 proximal part of Cu bare, remaining veins with macrotrichia. FCu distinctly distal of RM. RM moderately long. Membrane below An with numerous macrotrichia. Anal lobe of wing strongly reduced (Fig. 5). Legs. Spur of fore tibia straight, 8–12 μm long. Combs of mid and hind tibiae usually slightly separated, if widely separated - number of teeth reduced; each tibia with 20–28 teeth 12–15 μm long (mid leg) and 25–40 teeth 12–18 μm long (hind leg); combs occasionally bearing single, somewhat longer spur-like teeth. For length of leg segments see Table 5 and Reiss (1969a; presumably mean values given).

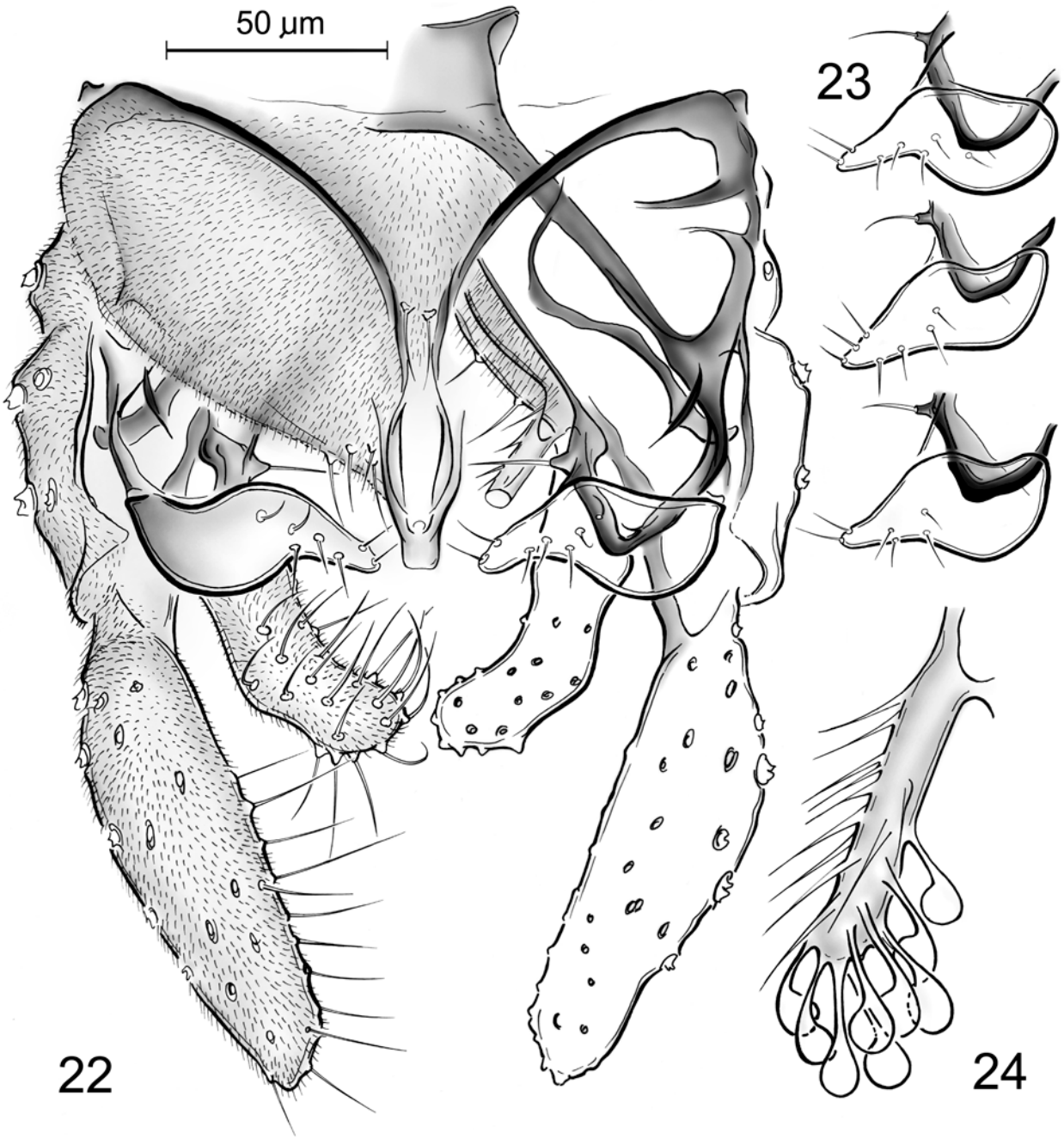
**TABLE 5**. Length (μm) of leg segments of male *Parapsectra styriaca*.

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 660–910 (815) | 450–645 (575) | 645–895 (825) | 330–465 (425) | 255–375 (340) | 200–285 (255) | 105–130 (120) |
| $p_2$ | 645–860 (780) | 530–730 (645) | 280–405 (365) | 155–220 (200) | 110–160 (145) | 80–110 (100) | 75–95 (85) |
| $p_3$ | 715–980 (885) | 655–895 (810) | 390–590 (525) | 240–350 (315) | 200–270 (250) | 115–175 (155) | 90–110 (105) |

Hypopygium. Gonostylus stout, parallel-sided or slightly broadened in half length, tapering to transversely cut apex. Anal tergite with long, separated bands of V-type; lateral teeth present; anal point stout, broad at base, with transversely cut or slightly concave apex, bearing long and wide crests; entire area surrounding base of anal point covered with microtrichia (Fig. 22). Superior volsella variable in shape, sinuous, with anteromedian margin convex, gradually tapering to pointed apex; digitus absent; *Micropsectra*-seta placed on prominent tubercle (Figs 22, 23). Median volsella with relatively long stem, bearing c. 10

sparse but large spoon-shaped lamellae placed apically (Fig. 24). Inferior volsella long, reaching gonostylus at half length, L-shaped, strongly curved and directed medially, apically rounded (Figs 22, 39).

Pupa: Reiss (1982), Langton (1991); adult female and larva: unknown.




**FIGURES 22–24.** *Parapsectra styriaca*, male. 22: hypopygium, 23: superior volsella (variation), 24: median volsella (magnified x 2 in comparison with hypopygium).

**Discussion**. Identification of both the pupa and the adult male of *Parapsectra styriaca* poses no problem (Reiss 1969a, Langton 1991). However, the generic position of the species raises some doubts as a consequence of which, the adult male was originally included in the *Micropsectra attenuata* group and only after finding of the pupa - transferred to *Parapsectra* (Reiss 1982). The presence of lateral teeth on the anal tergite, the absence of the digitus, the sinuous superior volsella, the relatively long stem of the median volsella, and the elongation and strong curvature as well as medial direction of the inferior volsella are all characters typical of the *Micropsectra attenuata* group. In addition, the adult male differs from other *Parapsectra* in having the cubital fork well distal of RM (Fig. 5).

*P. styriaca* was observed at springs, peat pools and a small piedmont lake. At several, regularly visited sites in Poland, the adult males were collected between late April and late August, and presumably represented at least two generations.

### *Parapsectra uliginosa* Reiss, 1969

(Figures 6, 25–28, 40)

**Material examined.** GERMANY. Paratypes No. 6, 7, 10, 12, 15, adult males slide-mounted, labelled: ZSM, Paratypus, design. F. Reiss; 14.v.68, *Parapsectra uliginosa* sp. n., Rotes Moor/Rhön, vorderer Teich, leg. Reiss.

**Diagnostic description.** Adult male (measurements in Tables 6 and 8).

Colouration (after Reiss 1969b). Whole body, except for wing, brown, with scutal stripes, scutellum and postnotum dark brown. Head. Antenna with 6 or 7 flagellomeres, proximal flagellomeres sometimes poorly separated (Fig. 25), AR 0.33–0.42 (when 6 flagellomeres) or 0.29–030 (7 flagellomeres). Frontal tubercles present as tiny swellings. Third palpomere longer than fourth. Wing. Strongly reduced, spatulate, usually non-symmetrical and differing in length; FCu distinctly proximal of RM; venation and chaetotaxy very specific, as shown in Figure 6. Legs. Spur of fore tibia slightly curved, 12–16 μm long, but sometimes thoroughly reduced (n = 2). Combs of mid and hind tibiae vestigial, widely separated, with at most 15 teeth, 5–15 μm long, on each tibia; combs usually bearing single, somewhat longer, dark, spur-like tooth. For length of leg segments see Table 6 and Reiss (1969b; presumably mean values given).

**TABLE 6**. Length (μm) of leg segments of male *Parapsectra uliginosa*.

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 520–645 (595) | 405–490 (455) | 360–425 (400 n = 3) | 205–240 (n = 2) | 170–205 (n = 2) | 130–155 (n = 2) | 80–95 (90) |
| $p_2$ | 500–595 (550) | 435–515 (485) | 160–200 (180 n = 4) | 95–110 (105 n = 4) | 75–90 (85 n = 4) | 50–65 (60 n = 4) | 60–75 (70 n = 4) |
| $p_3$ | 565–700 (635) | 490–595 (555) | 240–285 (265) | 130–170 (155) | 125–145 (140) | 65–80 (75) | 65–80 (75) |

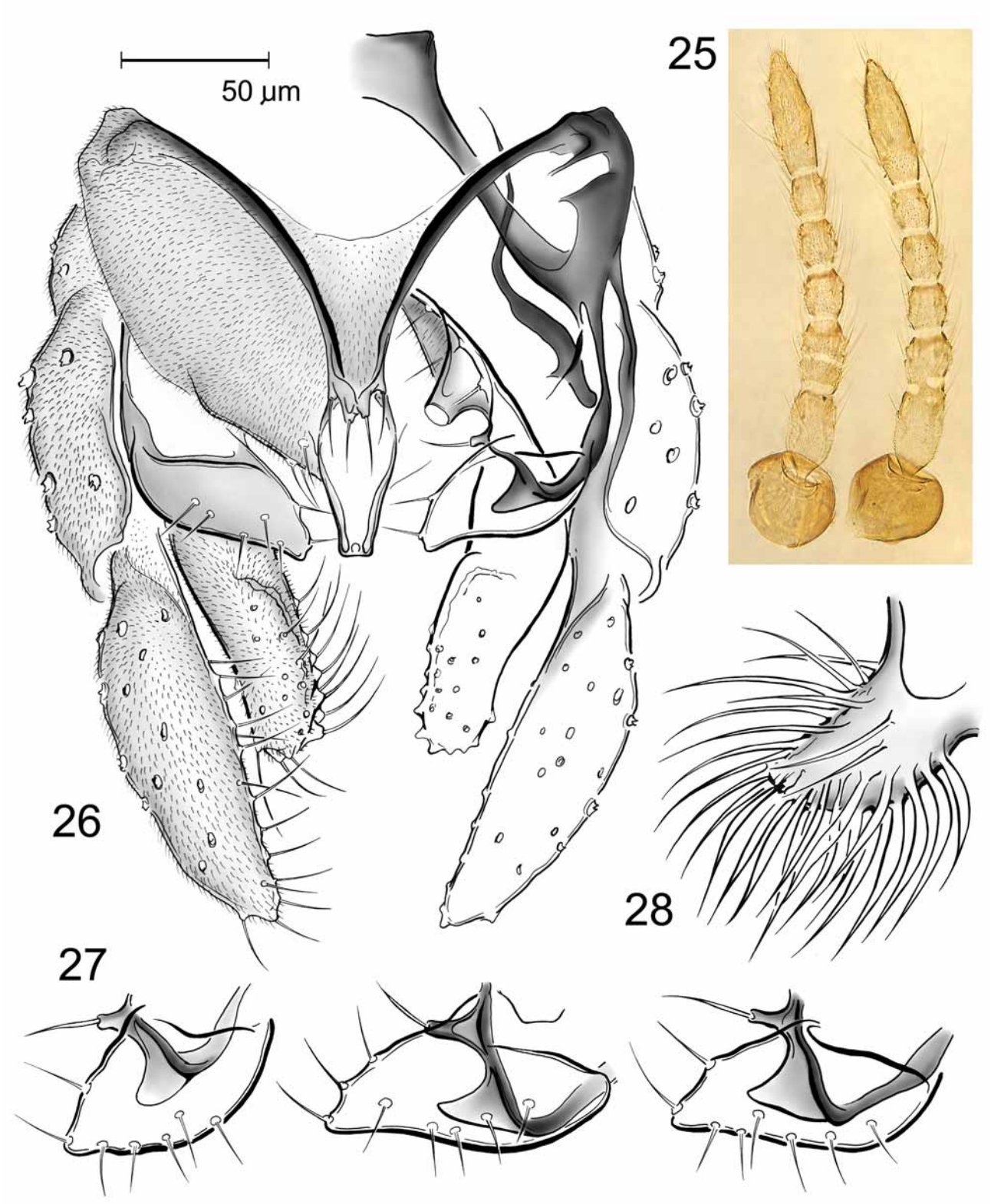
Hypopygium. Gonostylus stout, widest in half length, tapering to pointed apex. Anal tergite with long bands of V-type and elevated hump armed with stout tubercles bearing median setae; lateral teeth absent; anal point stout, broad at base, tapering to widely rounded or transversely cut trapezoid apex, bearing long crests; microtrichia-free area surrounding base of anal point small (Fig. 26). Superior volsella variable in shape, triangular or slightly elongated, with anteromedian margin convex; digitus stout but short, variable in shape, reaching half length of superior volsella; *Micropsectra*-seta placed on tall cylindrical tubercle (Figs 26, 27). Median volsella with short stem bearing c. 15 slender falciform (basally) and fusiform (apically) lamellae (Fig. 28). Inferior volsella stout and long, reaching gonostylus beyond its half length, straight or finely bent and directed laterally, with slight transverse protrusion and stout dense setae on distal half, evenly tapering to rounded apex (Figs 26, 40).

Adult female, pupa and larva: Reiss (1969b). For data on systematics and biology see Reiss (1969b), Murray & Baars (2006) and taxonomic remarks given below.

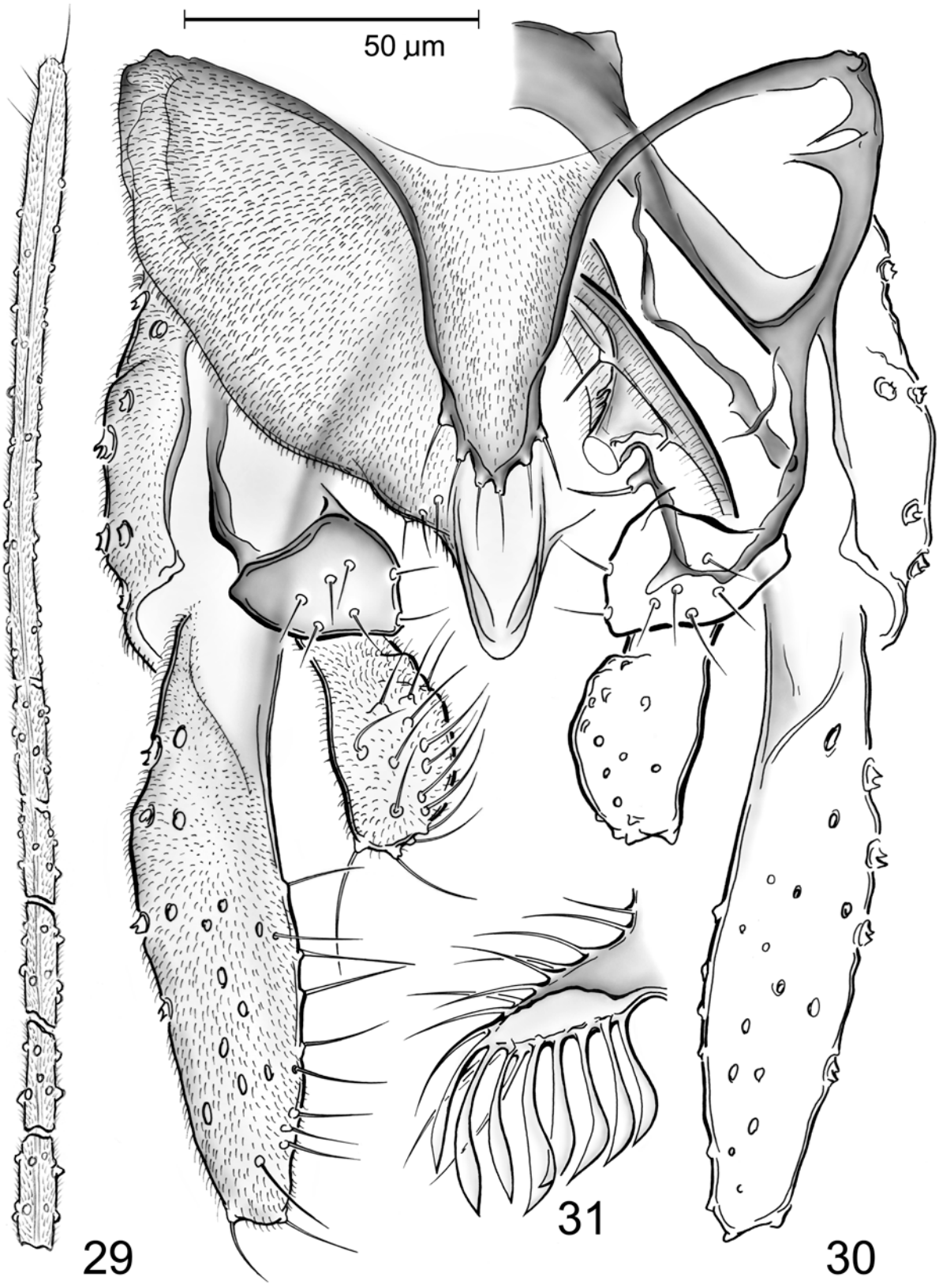
### *Parapsectra wagneri* Siebert, 1979

(Figures 7, 29–31, 41)

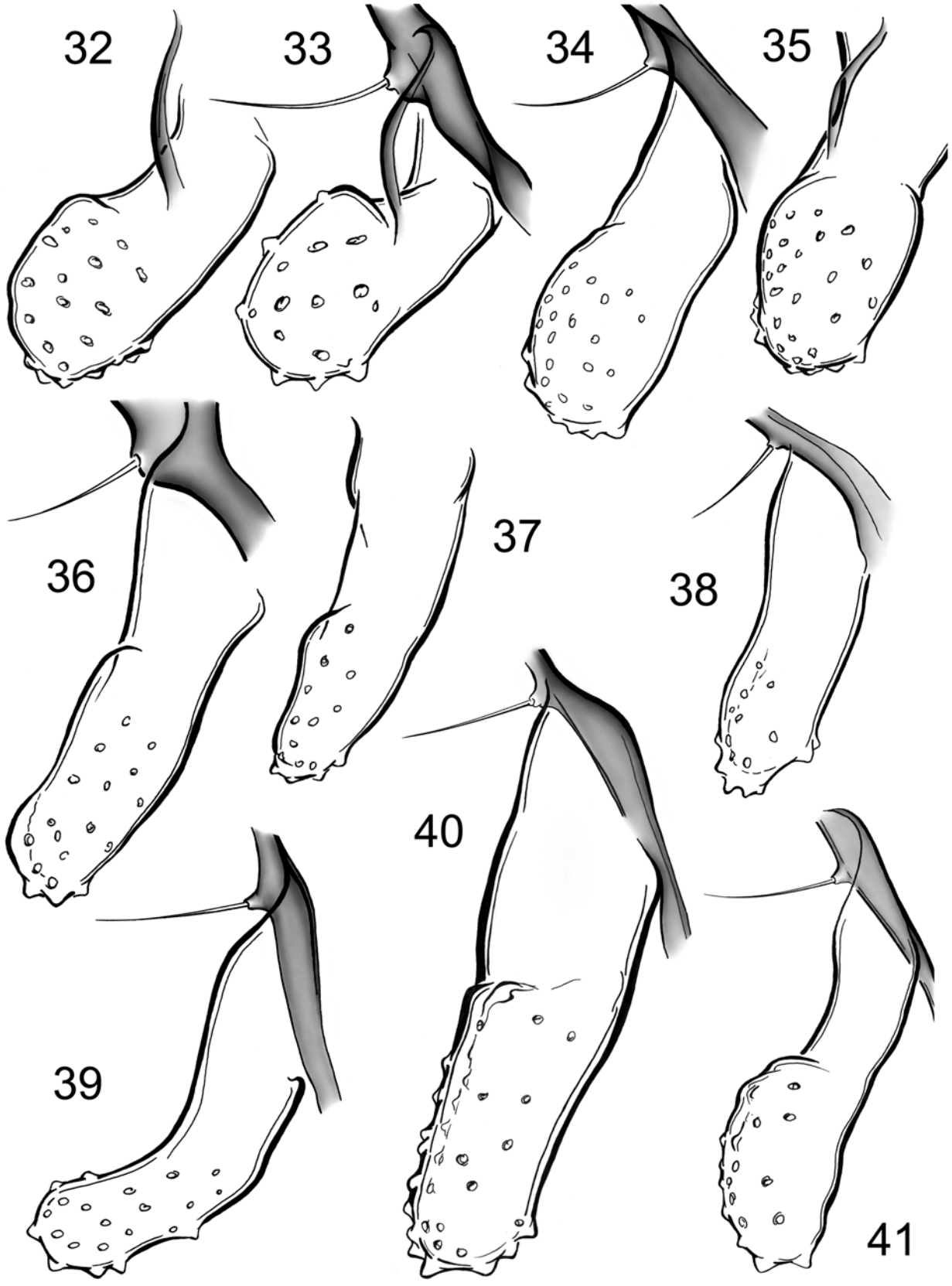
**Material examined.** GERMANY. Holotype: adult male labelled: ZSM, Holotypus, design. M. Siebert; Breitenbach Gewächshs., Schlitz/Hess., Datum 25.5.73, Art.: *Parapsectra wagneri* n. sp., Euparal, M. Siebert. Paratypus: 1 male, same data as holotype except for date: 28.5.73.




**FIGURES 25–28.** *Parapsectra uliginosa*, male. 25: antenna (variation), 26: hypopygium, 27: superior volsella and digitus (variation), 28: median volsella (magnified x 3 in comparison with hypopygium).




**FIGURES 29–31.** *Parapsectra wagneri*, male. 29: flagellomeres 8–13 of antenna (holotype), 30: hypopygium, 31: median volsella (magnified x 1.5 in comparison with hypopygium).




**FIGURES 32–41.** Hypopygial inferior volsella and inner margin of coxite. 32, 33: *Parapsectra bumasta* **sp. n.**; 34, 35: *P. chionophila*; 36, 37: *P. mendli*; 38: *P. nana*; 39: *P. styriaca*; 40: *P. uliginosa*; 41: *P. wagneri*.

**Diagnostic description.** Adult male (measurements in Table 7 and 8).

Colouration (after Siebert 1979). Yellowish brown, with scutal stripes, postnotum, sternum, haltere and proximal margins of abdominal tergites brownish. Head. Antenna with 13 flagellomeres, distal flagellomeres slightly separated (Fig. 29). Frontal tubercles absent. Third palpomere longer than fourth. Wing. Sc, M, $R_{2+3}$, proximal 1/3 of $M_{1+2}$ and proximal 1/5 of Cu bare, remaining veins with macrotrichia. FCu under RM. RM moderately long. Membrane below M mostly bare, below An covered with sparse macrotrichia. Anal lobe of wing strongly reduced (Fig. 7). Legs. Spur of fore tibia absent (?broken). Combs of mid and hind tibiae strongly reduced, usually well separated, with at most 20 teeth 10–12 μm long on each tibia; single spur-like tooth sometimes present (n = 1).

**TABLE 7**. Length (μm) of leg segments of male *Parapsectra wagneri*.

| | fe | ti | $ta_1$ | $ta_2$ | $ta_3$ | $ta_4$ | $ta_5$ |
|---|---|---|---|---|---|---|---|
| $p_1$ | 730–795 | 520–560 | - | - | - | - | - |
| $p_2$ | 685–735 | 595–625 | 270–280 | 175–185 | 120–125 | 80–90 | 65–75 |
| $p_3$ | 810–860 | 735–770 | - | - | - | - | - |

Hypopygium. Gonostylus moderately long, slightly bent at base, parallel-sided or subtly broadened in half length and tapering to blunt tip. Anal tergite with long bands of V-type and elevated hump armed with prominent tubercles bearing median setae; lateral teeth absent; anal point stout, ellipse-shaped, broad at base, smoothly tapering to rounded apex, bearing relatively wide crests; entire area surrounding base of anal point covered with microtrichia (Fig. 30). Superior volsella short, triangular, with convex anteromedian margin; digitus small but reaching at least half length of superior volsella; *Micropsectra*-seta placed on tall cylindrical tubercle (Fig. 30). Median volsella with short stem bearing c. 8–9 broad falciform (basally) and lanceolate (apically) lamellae (Fig. 31). Inferior volsella moderately long, at most reaching gonostylus at half length, straight or finely bent, with slight transverse protrusion and abruptly swollen head-like distal half (Figs 30, 41).

Adult female, pupa and larva: unknown. For data on biology see Siebert (1979); for discussion on taxonomy see below.

### Key to males of *Parapsectra*

1. Anal point acute (Fig. 15). Superior volsella with slender apical prolongation and concave anteromedian margin (Figs 15, 17) ..... *P. mendli*
-. Anal point with rounded, transversely cut or slightly concave apex (Figs 8, 12, 19, 22, 26, 30). Superior volsella without apical prolongation and/or with straight or convex anteromedian margin (Figs 10, 13, 20, 23, 27, 30). ..... 2
2. Wing with FCu well distal of RM (Fig. 5). Lateral teeth of anal tergite present (Fig. 22). Superior volsella sinuous, digitus absent (Figs 22, 23). Median volsella with sparse and large, spoon-shaped lamellae (Fig. 24). Inferior volsella long and strongly curved, L-shaped (Figs 22, 39). ..... *P. styriaca*
-. Wing with FCu very slightly distal of RM (Fig. 1), under RM (Figs 2, 4, 7) or proximal of RM (Fig. 6). Lateral teeth of anal tergite absent. Superior volsella never sinuous, digitus present. Median volsella with lamellae never as above (Figs 11, 14, 21, 28, 31). Inferior volsella never L-shaped, short when bent (Figs 32–35, 38, 40, 41). ..... 3
3. Median volsella with falciform lamellae (Figs 28, 31) ..... 4
-. Median volsella with spoon-shaped lamellae (Figs 11, 14, 21) ..... 5
4. Antenna with 6 or 7 flagellomeres (Fig. 25). Wing reduced (Fig. 6). Superior volsella elongated (Figs 26, 27). Median volsella with slender falciform and fusiform lamellae (Fig. 28). Inferior volsella reaching beyond half length of gonostylus, evenly tapering to apex (Figs 26, 40). ..... *P. uliginosa*
-. Antenna with 13 flagellomeres, with distal flagellomeres slightly separated (Fig. 29). Wing well developed (Fig. 7). Superior volsella short (Fig. 30). Median volsella with broad falciform and lanceolate lamellae (Fig. 31). Inferior volsella reaching at most half length of gonostylus, with abruptly swollen head-like distal half (Figs 30, 41) ..... ..... *P. wagneri*
5. Anal lobe of wing strongly reduced, RM very short, membrane below An with sparse macrotrichia (Fig. 2). Dark

brown to fuscous body ..... *P. chionophila*

-. Anal lobe of wing well developed, RM long, membrane below An with dense macrotrichia (Figs 1, 4). Brownish-green body ..... 6

6. Stem of median volsella with large lamellae placed posteromedially (Fig. 11). Inferior volsella bent at base, with transverse protrusion (Figs 8, 32, 33) ..... *P. bumasta* **sp. n.**

-. Stem of median volsella with small lamellae placed apically (Fig. 21). Inferior volsella short and straight, without transverse protrusion (Fig. 19, 38) ..... *P. nana*

## Taxonomic remarks

Distribution of the major diagnostic characters used in the key above is indicative of the presence of at least three lineages corresponding to three or more putative groups of species. Arguably, *Parapsectra chionophila*, *P. nana* and *P. bumasta* make up a coherent group, as evidenced by similarly structured hypopygium, particularly the slender gonostylus, the broadly triangular, very short and apically rounded anal point and the short inferior volsella. Moreover, *P. nana* and *P. bumasta* are similar in having almost identical shape, venation and chaetotaxy of the wing, similar metrics and colouration.

*Parapsectra uliginosa* and *P. wagneri* are presumably a separate group of species. The presumption is based on the structure of the median volsella, which bears falciform lamellae and of the anal tergite, showing an elevated hump armed with prominent tubercles of median setae. However, the lack of data on the structure of early developmental stages of *P. wagneri* and the strongly modified structure of some body parts of the adult male of *P. uliginosa* render interpretation of relationships between those species difficult. Reduction of wing and antenna as well as shortened legs with vestigial tibial combs, visible in *P. uliginosa* male, are an obvious result of adaptations associated with loss of the ability to fly. A similar set of characters has been observed in species representing *Thienemanniola* Kieffer (Lehmann 1973), *Tanytarsus* van der Wulp (Butler 2000) and *Cladotanytarsus* Kieffer (Giłka 2001). A tendency to reduction in the number of antennal segments in males is detectable also in *P. wagneri*. Interestingly, the hypopygial anal point bearing broadened crests in *P. wagneri* is similar to those found in males of *Paratanytarsus*, which have flake-shaped crests - the best diagnostic character for the adult male of the genus (Reiss & Säwedal 1981, Giłka 2009).

*Parapsectra styriaca*, originally placed in the genus *Micropsectra* (Reiss 1969a) and *P. mendli* are clearly different from the remaining *Parapsectra*, which has been highlighted in the key. The two species are distinct in having lateral teeth on the anal tergite, whereas the teeth are absent in the remaining species. The superior volsella possesses a slender apical prolongation in both species, which is absent in other *Parapsectra*, but distinct in the *Micropsectra attenuata* group (Reiss 1969a). Furthermore, *P. mendli* strays from other *Parapsectra* in having a slender and acute hypopygial anal point as well as a short conical tubercle bearing the *Micropsectra*-seta, the tubercle in other *Parapsectra* being cylindrical and strongly elongated. The median volsella of *P. mendli*, which bears numerous small, curved, spoon-shaped lamellae is also a character unique for *Parapsectra*, however, it is similar to those known from *Micropsectra repentina* Reiss and *M. pharetrophora* Fittkau *et* Reiss of the *attenuata group* (Fittkau & Reiss 1999, Giłka & Abramczuk 2006). The evidence presented above raise the question of the generic/species group membership of *P. mendli* and *P. styriaca*.

In view of the absence of data on early developmental stages of most species of *Parapsectra* and the difficulty to find genus-level taxonomic characters of adult males (see generic diagnosis), to change the composition and/or status of the entire genus is highly probable, however, requires further evidences.

## Acknowledgements

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**Table 8.** Comparison of metric characters of male *Parapsectra*. Length in μm, except for wing; for length of leg segments see Tables 1–7.

| Character \ species | *P. bumasta* (n = 2) | *P. chionophila* (n = 7) | *P. mendli* (n = 10) | *P. nana* (n = 10 ) | *P. styriaca* (n = 10) | *P. uliginosa* (n = 5) | *P. wagneri* (n = 2) |
|---|---|---|---|---|---|---|---|
| Wing (mm) | 1.75–1.90 | 1.55–1.65 (1.60) | 1.55–2.05 (1.85) | 1.40–2.05 (1.80) | 1.25–1.80 (1.60) | 0.55–0.80 (0.70) | 1.35–1.45 |
| AR | 0.73–0.77 | 0.64–0.68 (0.66) | 0.67–0.79 (0.74) | 0.44–0.59 (0.53) | 0.53–0.66 (0.62) | 0.29–042 (0.34) | 0.35–0.36 |
| Frontal tubercles | absent | 2–3 but rarely present (n = 1) | 2–6 always present | 2–3 but rarely present (n = 1) | 2–8 (n = 6) or absent (n = 4) | 2–4 always present | absent |
| $Pm_2$ | 48–56 | 36–40 (37) | 44–52 (48) | 36–56 (46) | 44–52 (48) | 32–36 (33) | 48–52 |
| $Pm_3$ | 111–135 $Pm_3 < Pm_4$ | 111–123 (116) $Pm_3 > Pm_4$ | 119–155 (137) $Pm_3 > Pm_4$ (n = 8) | 83–139 (113) $Pm_3 < Pm_4$ (n = 6) | 99–139 (124) $Pm_3 > Pm_4$ | 63–79 (72) $Pm_3 > Pm_4$ | 119–127 $Pm_3 > Pm_4$ |
| $Pm_4$ | 119–139 | 107–111 (110) | 111–139 (126) $Pm_4 = Pm_3$ (n = 2) | 87–147 (117) $Pm_4 \leq Pm_3$ (n = 4) | 91–131 (115) | 63–71 (67, n = 3) | 103 (n = 1) |
| $Pm_5$ | 179–206 | 155–179 (164) | 159–226 (192) | 159–225 (190) | 167–230 (202) | 75–79 (77, n = 3) | 159 (n = 1) |
| Clypeals | 19–20 | 13–19 | 14–21 | 13–20 | 9–16 | 12–16 (n = 4) | 8–9 |
| Acrostichals | 22–23 | 20–24 | 19–23 | 18–26 | 14–23 | 8–9 (n = 2) | 15–16 |
| Dorsocentrals | 10–11 | 9–13 | 8–11 | 9–17 | 7–9 | 6–8 (n = 3) | 9–12 |
| Prealars | 3–4 | 2–3 usually 2 | 1–3 usually 2 | 3–4 usually 3 | 1–4 usually 3 | 1 (n = 4) | 2 |
| Scutellars | 10 | 10–12 | 6–9 | 8–13 | 6–8 | 4–6 (n = 4) | 6–7 |
| $LR_1$ | 1.30 | 1.15–1.18 (1.16) | 1.33–1.47 (1.38) | 1.36–1.47 (1.41) | 1.30–1.47 (1.42) | 0.86–0.89 (0.88) | - |
| $LR_2$ | 0.51–.052 | 0.45–0.49 (0.48) | 0.53–0.59 (0.55) | 0.50–0.56 (0.52) | 0.52–0.59 (0.56) | 0.36–0.39 (0.37) | 0.45–0.46 |
| $LR_3$ | 0.64–0.65 | 0.62–0.66 (0.64) | 0.61–0.65 (0.63) | 0.62–0.67 (0.64) | 0.60–0.70 (0.64) | 0.46–0.49 (0.48) | - |
| SCh on $ta_1$ of $p_2$ | 1 (n = 1) | 1 (n = 3) | 1 | 1 | 1–4 usually 2 | 13–15 (n = 4) | 18–20 |
| Gonostylus | 160–165 | 140–155 | 120–140 | 120–170 (150) | 110–130 (125) | 115–140 | 110–115 |
| Median setae | 2 | 2–5 | 3–5 | 3–6 | 2–3 usually 2 | 4–7 | 5–6 |
| AP lateral setae | 3–5 (x2) | 4–7 (x2) | 4–7 usually 6 (x2) | 3–4 (x2) | 4–7 usually 5 (x2) | 3–6 (x2) | 4–6 (x2) |
| SVo dorsal setae | 5–6 | 4–5 | 5–6 usually 5 | 5–7 usually 5 | 4–5 usually 5 | 5–6 (n = 4) | 4–5 |
| SVo apical setae | 2–3 | 2–3 usually 2 | 2 | 2–3 usually 2 | 2–3 usually 2 | 2–3 (n = 4) | 2 |
| MVo stem | 50 | 30–35 | 40–50 | 30–40 | 50–60 | 25–30 | 20–25 |

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