Global view of *Parametriocnemus* (Diptera, Chironomidae), including species key to the adult males

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Abstract

A modified and updated diagnosis of *Parametriocnemus* adult males is provided by examining 13 morphological characters to separate the genus from the other 32 genera of Orthocladiinae worldwide with macrotrichia on the wing membrane. Consequently, seven species assigned to *Parametriocnemus* are transferred to other genera. *Parametriocnemus tenuiapicalis* is recognized as a new species based on a description including drawings of a species from Turkey addressed as *Parametriocnemus* sp. in a publication by Caspers and Reiss 1989.

A provisional identification key to the males of the 31 species of *Parametriocnemus* of the world is presented, assisted by a table containing data for 19 characters of each species. The shape of the hypopygium inferior volsella was found to be the most important character to distinguish species.

Introduction

The knowledge of the taxonomy, geographical distribution and ecology of the genus *Parametriocnemus* within the subfamily Orthocladiinae has increased substantially during the last decade, including findings in Africa (Ekrem et al. 2017, Benka et al. 2023, Baranov et al. 2024), Asia (Mohammadi et al. 2020, Wang et al. 2020, Cranston and Tang 2024), Europe (Rossaro and Marziali 2024, Stasiukynas et al. 2024, Widmann et al. 2025), North America (Namayandeh et al. 2018, Hubler et al. 2024, Armitage et al. 2025), Oceania (Cranston 2019, Chessman et al. 2022) and South America (Matthews-Bird et al. 2015, Villamarin et al. 2021, Prat Fornells et al. 2024).

Parametriocnemus was raised to genus level by Brundin (1956) from the subgenus of *Metriocnemus* (Goetghebuer 1932). The support for genus level was a combination of morphological characters of the males, pupae and larvae separating *Parametriocnemus* particularly from the similar *Paraphaenocladius.* Brundin's definition of *Parametriocnemus* was based almost exclusively on species present in Europe. Scaling up the geographical extension to cover the Holarctic region (Northern Asia, North America, Europe and Africa north of Sahara) changed the definition of what is *Parametriocnemus* to a small extent for males (Pinder 1978, Cranston et al. 1989, Sasa and Kikuchi 1995, Sæther et al. 2000), but developed a more detailed and precise definition for pupae (Coffman et al. 1986, Langton and Visser 2003) and larvae (Cranston et al. 1983, Arnett 2000, Andersen et al. 2013). Knowledge of all life stages still suggests that *Paraphaenocladius* is the closest relative of *Parametriocnemus*.

Ashe and O'Connor (2012) listed 35 valid species of *Parametriocnemus* worldwide while Catalogue of Life (Bánki et al. 2023) listed 36 species derived from Systema Dipterorum (Evenhuis and Pape 2024) including findings of two new species in China (Li et al. 2013). The study by Widmann et al. (2025) added two more species to the list.

DNA barcoding results have been crucial for the improved knowledge of insect taxonomy (Meiklejohn et al. 2109, Cheng et al. 2023, Salis et al. 2024) and provided the basis for the possibilities to describe a new species of *Parametriocnemus* (Widmann et al. 2025).

The present study reviews taxonomic papers with

Parametriocnemus species descriptions. Some of the species may require generic reassignment. We also provide a provisional worldwide key to males of the genus.

Material and methods

Ashe and O'Connor (2012) and Li et al. (2013) list most of the taxonomical literature needed for studying the species of *Parametriocnemus* worldwide. Additional relevant information was gathered from the Chironomidae literature database (Aagaard et al. 2025) and from a complementary systematic online search conducted in 2025. In addition, we reviewed papers on other Orthocladiinae genera with wings membrane containing macrotrichia to find out if they might include species better placed into *Parametriocnemus* and to distinguish the genus more accurately from other genera.

Table 1 contains a list with explanations for 26 characters measured or assessed to identify species of *Parametriocnemus* worldwide. Terminology follows Sæther (1980), but for wing length which is measured from the joint point with thorax instead of from the tip of the arculus. Wing length when measured from arculus is approximately 10% shorter. In addition to the ratios AR, VR_{Cu}, LR and HR in Sæther (1980) we used ratios addressing characters of the hypopygium and the distance between the eyes.

All 25 illustrations are drawn by hand. Image editing was performed using Artweaver Free (Version 7 or 8; Boris Eyrich Software, available at https://www.artweaver.de/en). Apart from illustrations based on the first author's (Brodin) private collection or specimens of the Swedish Museum of Natural History, all illustrations are significantly modified versions based on details in illustrations or photos in scientific literature or web sites such as the BOLD database (Ratnasingham et al. 2024).

Fig. 1 is based on a specimen in the first author's private collection. Fig. 2 is based on a paratype specimen stored in the Swedish Museum of Natural History. Fig. 3 is based on a photo in Widmann et al. (2025). Figs 4 and 5 are based on four specimens stored in the Swedish Museum of Natural History.

Fig. 6 is based on a drawing in Sasa et al. (1998) compared with a photo in The National Museum of Nature and Science Tokyo (2024). Fig. 7 is based on drawings in Sasa and Okazawa (1992) and Sasa and Kikuchi (1995). Fig. 8 is based on drawings of paratype without virga in Sublette (1967) and specimen with virga in Cranston et al. (1989) compared with a photo in Namayandeh and Beresford (2018).

Fig. 9 is based on a drawing in Caspers and Reiss (1989). Fig. 10 is based on a drawing in Kownacki and Zosidze 1973) compared with one photo in BOLD by S. Wiedenbrug, specimen ID FBCHI886-16 within BIN BOLD:AAI2687, named *P. stylatus* by S. Wiedenbrug but changed to *P. adzharicus* in Widmann et al. (2025). Fig. 11 is based on one specimen in the first author's collection and one specimen stored in the Swedish Museum of Natural History compared with drawings in Sublette (1967), Sæther (1975), Cranston et al. (1989) and a photo in BOLD by S. Dahle, specimen ID CHRFI198-10 within BIN BOLD:AAP6586, species identification by E. Stur. Fig. 12 is based on one specimen stored in the Swedish Museum of Natural History and a drawing by Brundin (1956), compared with drawings in Sasa and Okazawa (1992), Sasa and Kikuchi (1995), Langton and Pinder (2007), and three photos in BOLD, one by A. Mærk Aspaas, specimen ID MIDGE009-06, and two by S. Dahle, specimen ID ATNA221-09 and MIDGE216-06, all within BIN BOLD:AAB4494, all species identifications by E. Stur.

Fig. 13 is based on a drawing in Chaudhuri et al. (1989). Fig. 14 is based on a drawing in Freeman (1954) and one in Freeman (1956). Fig. 15 is based on a drawing in Sasa and Okazawa (1992) and one in Sasa and Kikuchi (1995) compared with a photo in the National Museum of Nature and Science Tokyo (2024). Fig. 16 is based on a drawing in Kieffer (1917) and one in Freeman (1961). Fig. 17 is based on two specimens stored in the Swedish Museum of Natural History compared with drawings in Sublette (1967), Sæther (1975), Cranston et al. (1989) and photos in BOLD, one by E. Bostrøm, specimen ID MIDGE013-06, and two by S. Dahle, specimen ID ATNA221-09 and MIDGE216-06, all within BIN BOLD:AAB4494, all species identifications by E. Stur. Fig. 18 is based on drawings in Freeman (1953), Freeman (1956) and Lehmann (1979) compared with a photo in Baranov et al. (2024) and one in BOLD by V.Q. Baranov, specimen ID NAMOE029-22 within BIN BOLD:ADY1682, species identified by V.Q. Baranov. Fig. 19 is based on a drawing in Gowin and Thienemann (1942) and one in Langton and Pinder (2007) compared with two photos in BOLD by A. Mærk Aspaas, specimen ID CHRFI637-11, and S. Dahle, specimen ID ATNA503-10, both within BIN BOLD:AAL7338, both species identifications by E. Stur. Fig. 20 is based on a drawing in Widmann et al. (2025) and four additional photos by C. Widmann. Fig. 21 is based on a drawing in Sasa and Suzuki (2000b) and a photo in the National Museum of Nature and Science Tokyo (2024). Fig. 22 is based on a drawing in Sasa and Okazawa (1992) and one in Sasa and Kikuchi (1995).

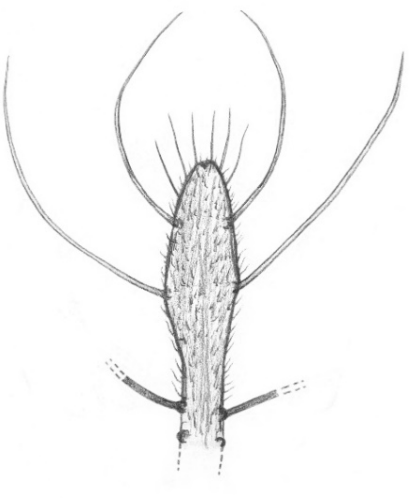
Fig. 23 is based on a drawing in Caspers and Reiss (1989). Fig. 24 is based on drawings in Johannsen (1934), Sublette (1967) and Cranston et al. (1989) compared with a photo in Namayandeh and Beresford (2018). Fig. 25 is based on a specimen in the first author's private collection and one specimen stored in the Swedish Museum of Natural History compared with drawings in Johannsen (1905), Sublette (1967), Sæther (1975), Cranston et al. (1989) and a photo in BOLD by S. Dahle, specimen ID CHRFI198-10 within BIN BOLD:AAP6586, and species identification by E. Stur.

Table 1. Characters of male *Parametriocnemus* for species identification. L = length, W = width, L/W = length divided by width.

Character	Description
B1. Body: L mm.	Length from beginning of thorax (antepronotum) to end of gonocoxite. Total L in Sæther 1980.
H1. Head: Antenna AR.	Length of last segment divided with length of the previous segments but not including pedicel and scape.
H2. Head: Apical or nearly apical single seta.	1 = not present (Fig. 1), 2 = present (Fig. 2).
H3. Head: Antenna long apical sensilla chaetica (sen. cha.).	Numbers (Fig. 1).
H4. Head: Eye dorsal distance W versus pedicel W.	Distance between dorsal eye extension divided by width of pedicel. Ratio > 1.7 = short dorsal eye extension, 1.7-1.3 = medium, < 1.3 = long (Fig. 3).
T1. Thorax: Acrostichal (acr.) setae.	Numbers.
W1. Wing: L mm.	Length from base of squama to apex of wing.
W2. Wing: Squama setae.	Numbers (Fig. 4).
W3. Wing: Membrane macrotrichia cover (hair cover).	0 = no macrotrichia, 1 = from distal third and onwards (Fig. 4), 2 = distal half from RM and onwards, 3 = proximal to RM and onwards.
W4. Wing: Vein R_{4+5} end versus vein M_{3+4} end.	1 = strongly proximal (closer to Cu_1 end), 2 = slightly proximal, 3 = about opposite (Fig. 4), 4 = slightly distal, 5 = strongly distal (closer to M_{1+2} end).
W5. Wing VR_{Cu}: Vein $Cu_,$ versus vein M (placement of FCu versus placement of RM).	Length of Cu from arculus to division FCu (M_{3+4} and Cu_1) divided by length of M from arculus to division RM. 0.8-0.9 = FCu slightly proximal of RM, 0.9-1.1 = about opposite, 1.1-1.2 = moderately distal (Fig. 4), 1.2-1.3 = strongly distal, >1.3 = very strongly distal.
W6. Wing: Cu_1 form distally.	1 = straight, 2 = simply curved, 3 = s-curved (sinuate) (Fig. 4).
L1. Legs: Foreleg ratio LRI.	Length of first tarsomere divided by length of tibia.
A1. Abdomen: Tergite IX apical lobes at each side of anal point.	0 = no lobes, 1 = weak, 2 = strong (Fig. 5).
A2. Abdomen: Virga branches.	Numbers (Figs 6-8). 0 = virga not evident.
G1. Genitalia: Anal point (AnP) form distally.	1 = narrowing (Figs 9-10), 2 = parallel sided (Fig. 11), 3 = expanded (Figs 5, 12).
G2. Genitalia: Anal point end versus inferior volsella (IVo) end.	1 = anal point end not reaching inferior volsella end, 2 = about reaching (Fig. 5), 3 = reaching beyond.
G3. Genitalia: Anal point L versus gonostylus (Gs) L.	Length of anal point to apex divided by length of gonostylus (Fig. 5).
G4. Genitalia HR: Gonocoxite (Gc) L versus gonostylus L.	Length of gonocoxite divided by length of gonostylus.

Character	Description
G5. Genitalia: Inferior volsella (IVo) lower part expansion.	1 = lower part not expanded beyond distal margin of upper part (Figs 13, 15, 18-22), 2 = lower part expanded beyond distal margin of upper part (Figs 5, 14, 17).
G6. Genitalia: Inferior volsella L/W.	Length of inferior volsella divided by its width (Fig. 5).
G7. Genitalia: Inferior volsella apical section angle and form.	Referring to upper part. 120-160°, = rounded semicircular (Figs 13-14), 80-130° rounded, squarish to broadly conical (Figs 5, 15-17, 20), 40-80° = narrowly conical (Figs 18-19), 10-40° = digitiform (Figs 21-22).
G8. Genitalia: Inferior volsella distal inner angle.	Angle in degrees ° of inferior volsella distally towards gonocoxite (Fig. 5).
G9. Genitalia: Gonostylus inner lobe (crista dorsalis).	1 = absent or short and low in distal fourth of gonostylus (Figs 5, 23), 2 = in distal fourth of gonostylus short and strongly protruding (Fig. 24), 3 = from mid of gonostylus longish and gradually expanding to near apex (Fig. 25), 4 = from mid of gonostylus longish and very protruding distally.
G10. Genitalia: Gonostylus end versus inferior volsella end.	1 = gonostylus if turned proximally not reaching inferior volsella, 2 = just reaching (Fig. 5), 3 = reaching distinctly beyond.

1



2

Figures 1-2. Antenna apex of 1. *Parametriocnemus lundbeckii* and 2. *Tavastia yggdrasilia* males.

3

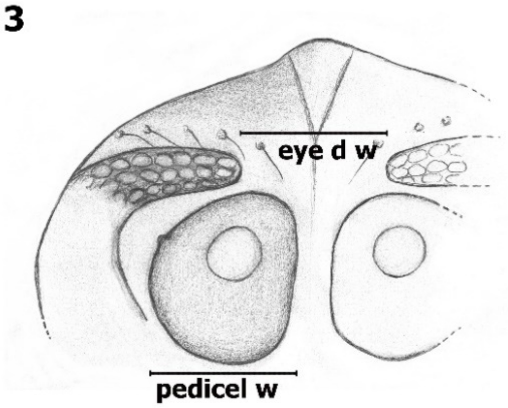


Figure 3. Head front view of *Parametriocnemus lausannensis* male. d = dorsal, w = width.

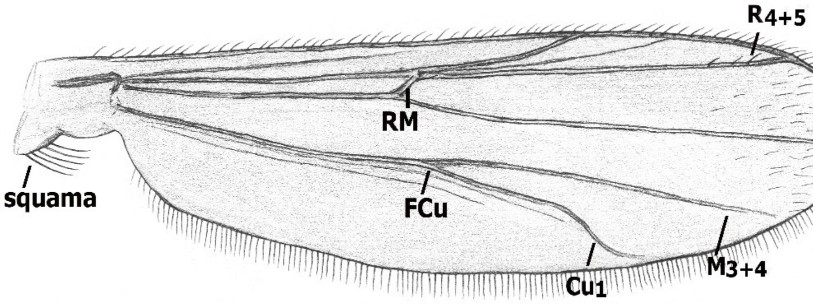
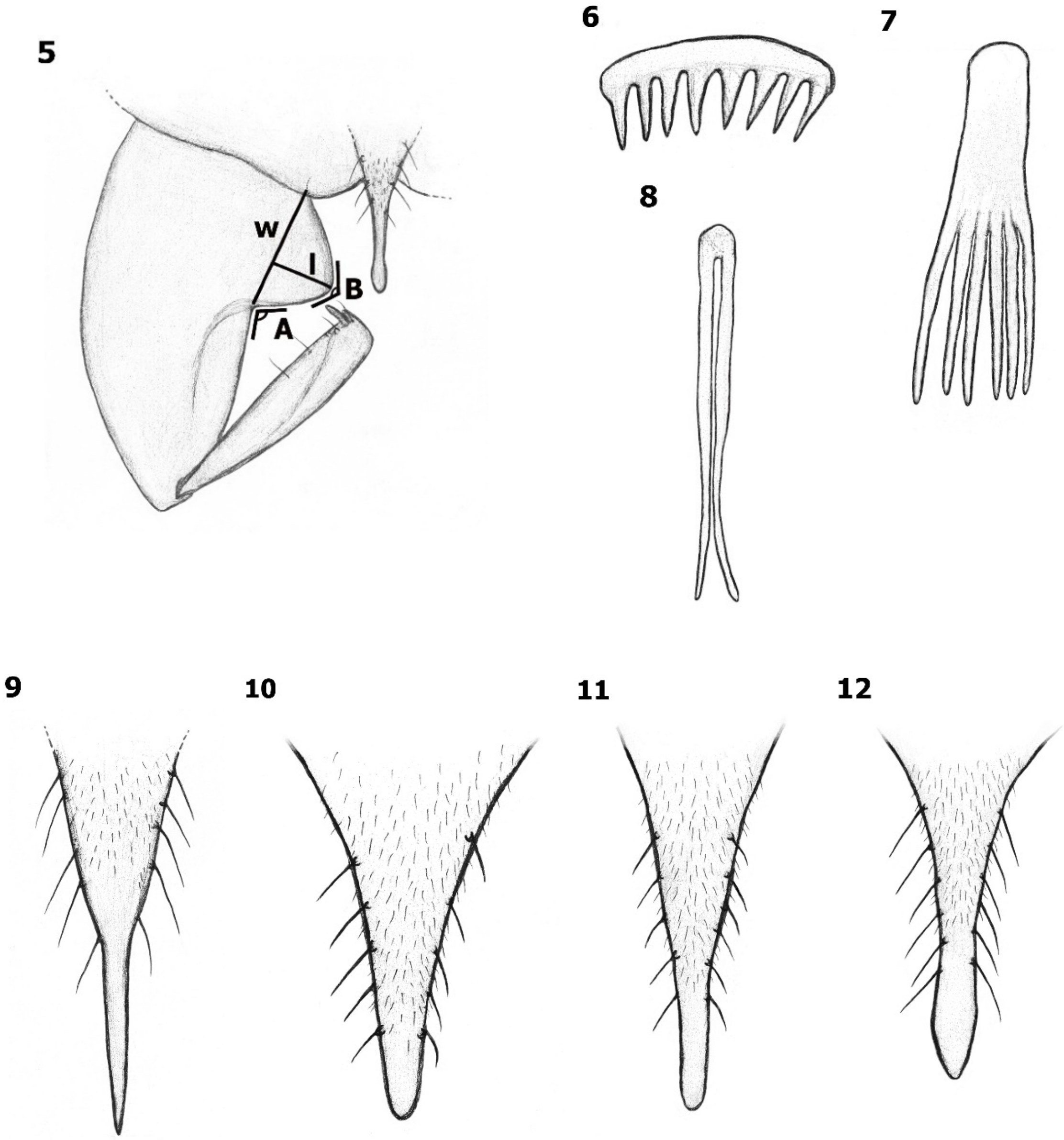
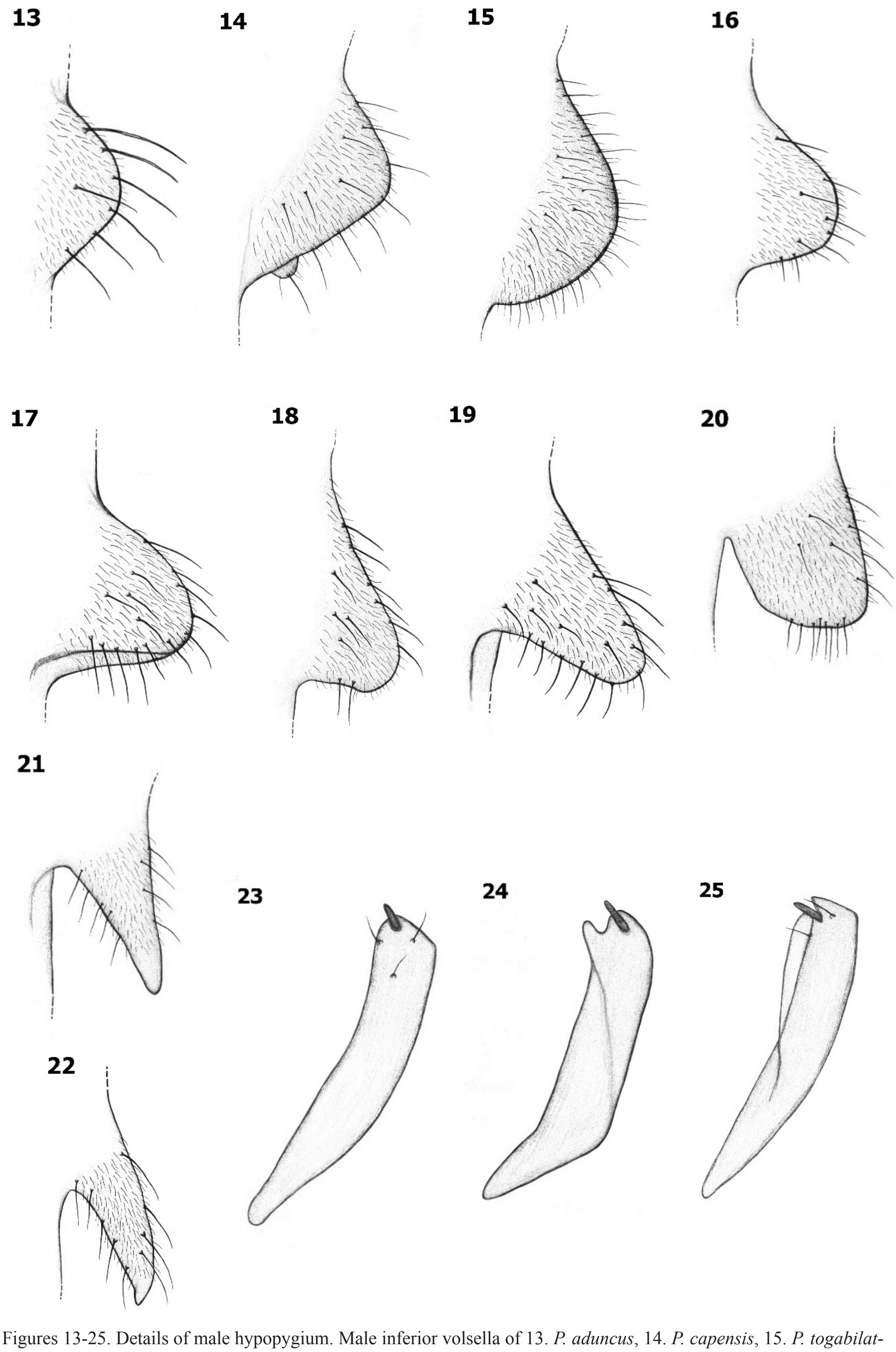


Figure 4. Wing of *Parametriocnemus graminicola* male.



Figures 5-12. Details of male hypopygium. Hypopygium of 5. *Parametriocnemus stylatus* male. Inferior volsella, A = distal inner angle, B = apical angle, l = length, w = width. Male virga of 6. *Parametriocnemus seiryukeleus*, 7. *P. togadigitalis* and 8. *P. hamatus*. Male anal point of 9. *Parametriocnemus tenuiapicalis*, 10. *P. adzharicus*, 11. *P. lundbeckii* and 12. *P. stylatus*.



Figures 13-25. Details of male hypopygium. Male inferior volsella of 13. *P. aduncus*, 14. *P. capensis*, 15. *P. togabilateralis*, 16. *P. ornaticornis*, 17. *P. stylatus*, 18. *P. scotti*, 19. *P. boreoalpinus*, 20. *P. lausannensis*, 21. *P. yakyheius* and 22. *P. togadigitalis*. Male gonostylus of 23. *P. tenuiapicalis*, 24. *P. hamatus* and 25. *P. lundbeckii*.

Results and discussion

Definition of Parametriocnemus

Brundin (1956) defined *Parametriocnemus* as a genus separated from all other genera with similar male morphology by a combination of five characters: eyes dorsally with long parallel-sided extension, thorax acrostichals strong, wing membrane with macrotrichia, Cu_1 vein distinctly curved and vein R_{4+5} ending about opposite of vein M_{3+4}. Brundin's definition was based almost solely on species present in Europe.

Our results assign 31 species to *Parametriocnemus* worldwide. The results means that the male morphology of the genus ought to be somewhat modified and with some additions necessary to include all globally described valid species (undetermined species not considered). Information in Li et al. (2013), including two new species, also called for some morphological modification of the genus. The modifications in comparison with Brundin (1956), Cranston et al. (1989) and Sæther et al. (2000) are underlined in Table 2. Particularly notable is that only some species within the genus have eyes with long dorsal extension (Fig. 3). In many of the species the extension is comparatively short and wedge-shaped yet never absent as in some other Orthocladiinae genera with macrotrichia on the wing membrane. Important is also that some species of *Parametriocnemus* have membrane macrotrichia only in the distal third of the wing (Fig. 4).

Parametriocnemus in comparison with other genera

Adult males of 22 Orthocladiinae genera contain species with wing membrane macrotrichia. All *Parametriocnemus* species have wing membrane macrotrichia, while some of the other genera also include species without. The following text delineates how males of *Parametriocnemus* can be distinguished from males of the other 21 genera.

The gonostylus of *Parametriocnemus* is never divided into two sections near the base as in *Brillia, Elpiscladius, Eurycnemus, Euryhapsis* and *Xylotopus* (Cranston et al. 1989, Ekrem et al. 2017).

The gonostylus megaseta of *Parametriocnemus* is simple, whereas combed or pectinate in most *Compterosmittia* (Mendes et al. 2004).

The anal point of *Parametriocnemus* is always at least two times longer than wide (Figs 5, 9-12),

Table 2. Diagnostic morphological characters of *Parametriocnemus* adult males on a global scale. Emendations in comparison with previous diagnoses are underlined.

Character	Definition	Definition in Cranston et al. 1989
H1. Head: Antenna AR.	<u>0.2</u>-1.4.	0.3-1.6.
H2. Head: Apical or nearly apical single seta.	Absent (Fig. 1).	Absent.
H5. Head: Eye dorsal extension.	Short and wedge-shaped to long (Fig. 3).	Long.
T1. Thorax: Acrostichal (acr.) setae.	<u>Absent</u> to more than 20 and conspicuously long.	Very long.
W1. Wing: Length from base of squama.	1.1-2.4 mm (Fig. 4).	1.1-2.4
W2. Wing: Squama setae.	<u>1-17</u> (Fig. 4).	4-13.
W3. Wing: Membrane macrotrichia cover.	From base to <u>only at wing apex</u> (Fig. 4).	Most of wing to apical half.
W4. Wing: R_{4+5} end versus M_{3+4} end.	Slightly proximal, opposite (Fig. 4) or slightly distal.	Slightly proximal, opposite or slightly distal.
W5. Wing: Placement FCu versus RM.	Slightly, moderately (Fig. 4) to <u>strongly distal</u>.	Clearly distal.
W6. Wing: Cu_1 form distally.	Curved, usually s-curved (Fig. 4).	Distinctly curved.
L1. Leg: Foreleg LR.	0.63-1.00.	
A2. Abdomen: Virga.	Absent or with 2-<u>22</u> branches (Figs 6-8).	Absent or 2-6 spines.
G8. Genitalia: Anal point macrotrichia.	With at least 2 macrotrichia (Figs 5, 9-12).	With setae.

whereas absent or short and wider than long in *Apometriocnemus, Gymnometriocnemus*, *Pseudorthocladius* and *Tokyobrillia* (Cranston et al. 1989, Sæther and Wang 1995, Sasa and Kikuchi 1995).

Macrotrichia (lateral setae) flank the anal point of *Parametriocnemus* (Figs 5, 9-12), whereas the anal point of *Metriocnemus*, *Heterotanytarsus, Tavastia, Thienemannia* and *Parasmittia* lack macrotrichia but for basally (Cranston et al. 1989, Sæther et al. 2000, Langton and Pinder 2007). The first four mentioned genera are also distinguished by a straight or almost straight distal part of the Cu_1 wing vein, which is distinctly s-curved in most species of *Parametriocnemus* (Fig. 4). A single apical or nearly apical straight seta is present on the antenna of *Tavastia* (Fig. 2), *Thienemannia* and *Parasmittia* and several *Metriocnemus*, but not present in *Parametriocnemus* (Fig. 1).

Eyes dorsally with short to long (Fig. 3) extension and acrostichals not scalpellate are characters separating *Parametriocnemus* from *Antillocladius* which lacks dorsal eye extension but have at least some scalpellate acrostichals (Mendes and Andersen 2008, Mendes et al. 2011). Most species of *Parametriocnemus* can furthermore be distinguished from *Antillocladius* species with wing membrane macrotrichia by the placement of the wing FCu division compared to RM (opposite RM to moderately distal versus very strongly distal),

Scalpellate acrostichals are present on males of *Litocladius* (Andersen 2016) but not on males of *Parametriocnemus*. Lateral lamellae are present on the virga of *Litocladius* but not on those species which have a virga in *Parametriocnemus*.

The end of wing vein R_{4+5} in relation to the end of other wing veins separates *Parametriocnemus* from *Molleriella*, *Paraphaenocladius* and *Heterotrissocladius* (Sæther 1975, Cranston et al. 1989, Sæther and Wang 1995). Wings of *Parametriocnemus* have the end of R_{4+5} slightly proximal, opposite, or slightly distal of the end of vein M_{3+4} (Fig. 4). In *Molleriella* and *Paraphaenocladius*, R_{4+5} ends far proximal of the end of M_{3+4} (between the ends of Cu_1 and M_{3+4}). In *Heterotrissocladius*, R_{4+5} ends distinctly distal of the end of M_{3+4}. The costa vein is strongly extended beyond R_{4+5} in *Parametriocnemus* (Fig. 4), whereas not or only slightly (less than the length of vein RM) in *Heterotrissocladius*. Ecology can often also be of help to separate these four genera. Larvae of *Parametriocnemus* mostly inhabit running water, while those of *Molleriella* and *Paraphaenocladius* are mostly semiterrestrial or terrestrial, and those of *Heterotrissocladius* are mostly found in lakes and other standing water bodies. The separation of *Parametriocnemus* and *Paraphaenocladius* has been discussed, and it has been suggested that *Parametriocnemus* perhaps should be treated as a subgenus of *Paraphaenocladius* (Cranston et al. 1989). Sæther and Wang (1995) did however find distinct morphological evidence based on males, pupae and larvae to distinguish *Paraphaenocladius* from *Parametriocnemus*.

Parametriocnemus is probably a close relative of *Oropuella* which also have larvae inhabiting running water (Fasbender 2020). Males of the only two named *Oropuella* species have an antennae AR below 0.32. Only *P. capensis* (Freeman, 1954) among the *Parametriocnemu*s species has a lower AR. *P. capensis* has a very short anal point (length anal point/length gonostylus about 0.2), while very long (length anal point/length gonostylus about 0.9-1.3) in *Oropuella*. In addition, the anal point of *Parametriocnemus* is distally narrower and protruding less far beyond the end of the inferior volsella in comparison with the anal point of the two *Oropuella* species. The unusual absence of tibial spurs in *Oropuella* might be useful to distinguish the genus from *Parametriocnemus*. Several publications on *Parametriocnemus* species taxonomy do not address the issue of presence or absence of tibial spurs, but those mentioning tibial spurs or providing illustrations show their presence.

Reassigning Parametriocnemus species

Our studies of scientific papers including descriptions and illustrations, and the definition of *Parametriocnemus* above, revealed that seven species assigned to *Parametriocnemus* in Ashe and O'Connor (2012), Catalogue of Life (Bánki et al. 2023) or Systema Dipterorum (Evenhuis and Pape 2025) should be reexamined to determine their correct generic placement. The following observations have been made that result in temporary reassignments.

Paraphaenocladius ogasadecimus Sasa and Suzuki, 1997 and *Heterotrissocladius shoukouzoensis* Sasa, 1989 are returned to their original genera as their wing veins and other characters do not fit the definition of *Parametriocnemus*. *Paraphaenocladius ogasadecimus* is probably a new synonym of *Paraphaenocladius exagitans* (Johannsen, 1905). It has a short wing vein R_{4+5} ending in the mid between the end of vein Cu_1 and the end of vein M_{3+4}, which is a typical feature in *Paraphaenocladius* (Cranston et al. 1989 Sæther and Wang 1995). *Heterotrissocladius shoukouzoensis* is probably a new synonym of *Heterotrissocladius marcidus*

(Walker, 1856). It has a wing vein C not produced beyond R_{4+5} which ends far distal of the end of M_{3+4}, which is typical of the wing of *Heterotrissocladius* (Sæther 1975).

Metriocnemus tusimoveweus Sasa and Suzuki, 1999 was placed in *Parametriocnemus* by Ashe and O'Connor (2012). We consider it to probably be a new synonym of *Paraphaenocladius intercedens* Brundin, 1947 as the original description including several illustrations and genitalia photos (Sasa and Suzuki 1999, National Museum of Nature and Science Tokyo 2024) agrees well with the description and illustrations of *P. intercedens* in Sæther and Wang (1995).

Three species originally assigned to *Parametriocnemus* are transferred to other genera. These species are *Compterosmittia flavellus* (Tokunaga, 1964), *Paraphaenocladius fusiger* (Kieffer, 1911) and *Pseudorthocladius kamidenticularis* (Sasa and Hirabayashi, 1993). *Compterosmittia flavellus* has a wing with a very long vein C ending near the wing apex, strongly sinuate vein Cu_1 and bare squama, all typical characters of *Compterosmittia* (Cranston et al. 1989, Mendes et al. 2004). *P. fusiger* has a short wing vein R_{4+5} ending somewhat proximal to the end of vein Cu_1, which is typical feature in *Paraphaenocladius* (Sæther et al. 2000). *P. kamidenticularis* has the wing vein R_{4+5} ending distinctly proximal of M_{3+4}, the distal third of the wing membrane with macrotrichia (Yamamoto 2004) and a short, rounded anal point with strong setae, all typical features of the *Pseudorthocladius pilosipennis* group (Sæther and Sublette 1983).

Parametriocnemus valescurensis was described as a new species by Moubayed-Breil and Langton (1999). The male pupal exuviae is very similar to that of other *Parametriocnemus* species (Langton and Visser 2003). The female genitalia have a gonapophysis VIII with a longish ventrolateral lobe like that of females of *Heterotrissocladius* but not *Parametriocnemus* (Sæther 1977). The single male of *P. valescurensis* has several characters which do not agree with other males of *Parametriocnemus*, such as the apically not expanded antenna with a strong straight seta near the antenna apex (cf. Fig. 2), well developed pulvilli, and the gonostylus strongly expanded to apex with outer triangular projection as in the *Chaetocladius dentiforceps* group (Cranston et al. 1989) but not present in any *Parametriocnemus*. The eyes and wing veins of *P. valescurensis* are not described in Moubayed-Breil and Langton (1999), probably because the only male and only female were found within their pupal exuviae. The strong straight seta near the antenna apex, low antenna AR, wing length less than 1.5 mm, longish anal point distally without setae or microtrichia, and the gonostylus form agrees with species included in *Thienemannia* (Sæther 1985, Cranston et al. 1989, Moubayed-Breil and Ashe 2016). We have not included *P. valescurensis* in the species key below because of the discrepancies between the pupal exuviae and the male. Study of the type specimen is needed to clarify the most appropriate generic placement of the male.

***Parametriocnemus tenuiapicalis*, new species**

https://zoobank.org/1CE79196-0EFC-4DC2-8B00-AC6F577F5580

Caspers and Reiss (1989) described a species of *Parametriocnemus* from south-eastern Turkey close to the Iraq border. They included a detailed illustration of the wing and hypopygium of the single male found. The species was not given a name as it was not evident if it could be distinguished from similar species such as *P. lundbeckii*, *P. scotti* and *P. stylatus*. However, the apical part of the anal point (Fig. 9) is conspicuously thin which separates it morphologically from the other three species. We name the species *Parametriocnemus tenuiapicalis* Brodin, Widmann and Marle, new species.

Material: The designated holotype is labelled and stored in Zoologische Staatssammlung München, Germany. The specimen was caught with a drift net in Turkiye, Hakkari Province, Habur Deresi valley, 37.4N 43.4E, 1 200 m a.s.l, 1985.06.29, leg. W. Schacht. No other specimens are known.

Etymology: The Latin species name refers to the thin (*tenuis*) terminal (*apicalis*) section of the anal point.

Diagnostic characters: The very thin apical section of the anal point which is about as long as the gonostylus (ratio 0.9-1.0, Figs 9, 23) combined with the low antenna AR (0.4) separates *P. tenuiapicalis* from all other described *Parametriocnemus* species. Other diagnostical differences which separates *P. tenuiapicalis* from *P. lundbeckii*. *P. scotti* and *P. stylatus* are wing membrane macrotrichia cover (not before RM versus before RM), length/width of inferior volsella (0.7-0.8 versus 0.5-0.7) and the hypopygia HR defined in Sæther (1980) (ratio between the length of the gonocoxite divided by the length of the gonostylus) (HR 2.1-2.2 versus 1.5-1.8, 1.8-2.0 and 1.6-1.9). Additional morphological information is provided in Table 4.

Distribution: Only known from the locality where the holotype was found.

Parametriocnemus species identification

The provisional key below to the males of *Parametriocnemus* of the world contains 31 species. A comprehensive integrated work studying available type material and, if possible, including all life stages of *Parametriocnemus* is needed for completeness. The provisional key and the appurtenant illustrations in Figs 1-25 are intended to guide the user to find a relevant species suggestion. This should be followed by a quality assurance process by consulting species identification literature listed in Table 3 and Table 4 with data for 19 particularly important morphological characters of each species.

The shape of the inferior volsella (Figs 5, 13-22) proved to be the most useful character for species separation of male *Parametriocnemus* in the provisional key, as often the case within other Orthocladiinae genera (Brundin 1956, Langton and Pinder 2007). The inferior volsella of *Parametriocnemus* species is very variable; from wider than long to much longer than wide, consisting of one to two distinct parts. The form of the anal point was also very useful for species separation. It should be taken into consideration that the inferior volsella and the anal point may vary rather much or even exhibit different forms within a species. This is shown by the information and illustrations of *Pseudorthocladius pseudirritus* Strenzke, 1950 in Sæther and Wang (1995) who divided the species into three morphologically different subspecies one each from Africa, Europe and North America. *Parametriocnemus boreoalpinus*, Gowin and Thienemann, 1942, *P. lundbeckii* (Johannsen, 1905) and *P. stylatus* (Spärck, 1923) are examples of species within *Parametriocnemus* which are described and illustrated rather differently in taxonomical literature (cf. Table 3). They are all widely geographically distributed with different pupal forms, at least in *P. lundbeckii*, and should possibly be divided into subspecies, hybrids, aberrant forms or maybe even complexes of sibling species.

Other hypopygium related characters such as the form of the gonostylus and virga were also very useful for species identification, and sometimes also antenna AR, antenna sensilla chaetica, wing macrotrichia cover, placement of FCu versus RM and foreleg LR.

Characters related to size, colour, and hairiness other than wing macrotrichia cover were not used to separate species in the key. Previous studies on Chironomidae (Johannsen and Townes 1952, Baranov et al. 2021, Brodin 2025) and other insects (Peat et al. 2005, Shelomi 2012, Zeuss et al. 2014) have shown that such characters can be very variable and much influenced by temperature conditions of the larval habitats.

Seven species of *Parametriocnemus* (*P. adzharicus, P. boreoalpinus P. lausannensis*, *P. lundbeckii*, *P. scotti*, *P. stylatus*, and *P. togadigitalis*) can be distinguished genetically by the COI locus aggregated in BINs (Ratnasingham et al. 2024, Widmann et al. 2025). For the other *Parametriocnemus* species, COI sequences are currently not available or have not yet been assigned to a species name.

Provisional key to adult males of *Parametriocnemus* species

1.	Virga not visible.	2
	Virga visible (Figs 6-8).	24
2.	Anal point thin and very short, length less than one fourth of gonostylus length (ratio 0.2). Antenna AR 0.2-0.3. Inferior volsella with thin lower part slightly protruding (Fig. 14). .... *P. capensis* (Freeman, 1954) [Africa]	
	Anal point longer than one third of gonostylus length (ratio 0.4-1.1). Antenna AR 0.3-1.4. Inferior volsella with lower part not visible or not protruding in most species (Figs 13, 15-16, 18-22)	3
3.	Inferior volsella low, length/width 0.3-0.4, distal angle towards gonocoxite strongly obtuse, 140-150° (Fig. 13)............................. *P. aduncus* Chaudhuri and Bhattacharyay, 1989 [Asia]	
	Inferior volsella protruding, length/width more than 0.4, distal angle towards gonocoxite less than 140° (Figs 5, 15-22).	4
4.	Antenna AR less than 0.6.	5
	Antenna AR more than 0.6.	13
5.	Wing with macrotrichia only distal of RM (cf. Fig. 4).	6
	Wing with macrotrichia before RM and to wing apex.	8

6.	Anal point about as long as gonostylus (ratio 0.9-1.0, Figs 9, 23). Inferior volsella length/width 0.7-0.8... *P. tenuiapicalis* Brodin, Widmann and Marle [Asia]	
	Anal point less than to about half as long as gonostylus (ratio 0.4-0.5). Inferior volsella length/width 0.5-0.7.	7
7.	Wing FCu slightly to moderately distal RM (vein Cu L/M L 1.11, cf. Fig. 4). Gonostylus, when turned inwards, just reaching end of inferior volsella (cf. Fig. 5). Inferior volsella rounded semicircular, length/width 0.4-0.6 (Fig. 16) .... *P. ornaticornis* (Kieffer, 1917) [Asia, Oceania]	
	Wing FCu strongly distal RM (vein Cu L/M L 1.24). Gonostylus, when turned inwards, does no reach end of inferior volsella. Inferior volsella broadly conical, length/width 0.6-0.7... *P. vittatus* Li, Lin and Wang, 2013 [Asia]	
8.	Inferior volsella distal angle towards gonocoxite sharply acute (30-40°, cf. Fig. 22). Foreleg LR 0.89-0.92 .... *P. isigageheus* (Sasa and Suzuki, 2000) [Asia]	
	Inferior volsella distal angle towards gonocoxite slightly acute to slightly obtuse (80-100°) (Figs 5, 17-18). Foreleg LR below 0.75.	9
9.	Anal point about half as long as gonostylus (ratio 0.5-0.6). Inferior volsella length/width 0.5-0.6 .... *P. triquetrius* Chaudhuri and Bhattacharyay, 1989 [Asia]	
	Anal point almost as long or as long as gonostylus (ratio 0.8-1.0). Inferior volsella length/width 0.8-1.0.	10
10.	Inferior volsella with lower part not expanded beyond distal margin of upper part. Anal point reaches about mid of gonostylus (best observed when it is turned inwards towards the anal point) .... *P. fortis* Li, Lin and Wang, 2013 [Asia]	
	Inferior volsella with lower part expanded beyond distal margin of upper part. Anal point does not reach end of gonostylus.	11
11.	Gonostylus with a very protruding triangular inner lobe (crista dorsalis). Anal point distally parallel-sided to slightly expanded (cf. Fig. 12) reaching beyond inferior volsella end .... *P. vespertinus* Saether, 1969 [N America]	
	Gonostylus without or low inner lobe (cf. Fig. 23). Anal point distal half narrowing to apex (cf. Fig. 10) not reaching end of inferior volsella.	12
12.	Wing FCu moderately distal RM (vein Cu L/M L 1.16). Antenna AR 0.4-0.6. Inferior volsella length/width 1.0-1.2 .... *P. tusimouveus* (Sasa and Suzuki, 1999) [Asia]	
	Wing FCu strongly to very strongly distal RM (vein Cu L/M L 1.31). Antenna AR 0.3-0.4. Inferior volsella length/width 0.8-1.0 .... *P. tusimoxeyeus* (Sasa and Suzuki, 1999) [Asia]	
13.	Inferior volsella distal angle towards gonocoxite acute (40-80°) (Figs 19-20).	14
	Inferior volsella distal angle towards gonocoxite right to obtuse (90-110°) (Figs 5, 15, 17).	19
14.	Wing membrane with macrotrichia only on distal third (Fig. 4).	15
	Wing membrane with macrotrichia from before mid (vein RM) to apex.	16
15.	Anal point more than half as long as gonostylus (ratio 0.6-0.8). Wing anal lobe almost absent to weak (130-150°) .... *P. boreoalpinus* Gowin and Thienemann, 1942 [Asia, Europe]	
	Anal point less than to about half as long as gonostylus (ratio 0.4-0.5). Wing anal lobe distinct (110-120°, Fig. 4) .... *P. graminicola* (Lundbeck, 1898) [Asia, Europe, N America]	
16.	Inferior volsella longer than wide (length/width 1.1-1.2) with two distinct parts, upper part completely covering lower part .... *P. biappendiculatus* Makarchenko and Makarchenko, 2006 [Asia]	
	Inferior volsella wider than long (length/width 0.5-0.9), if with two distinct parts then lower part expanded beyond distal margin of upper part.	17
17.	Inferior volsella with two parts, lower part distinctly expanded beyond distal margin of upper part. Wing FCu very strongly distal RM (vein Cu L/M L 1.48) .... *P. fordi* (Freeman, 1956) [Africa]	
	Inferior volsella with one part. Wing FCu slightly distal RM (vein Cu L/M L 1.06-1.10).	18

18. Anal point apically narrowing to apex (cf. Fig. 10). Inferior volsella conical, length/width 0.5-0.7 (Fig. 18). Antenna apically with 9-11 long, hyalin inwards curved sensilla chaetica .. .. *P. scotti* (Freeman, 1953) [Africa, Asia]

Anal point apically parallel-sided to slightly expanded (cf. Figs 11-12). Inferior volsella rectangular, length/width 0.8-0.9 (Fig. 20). Antenna apically with 5-6 long, hyalin inwards curved sensilla chaetica .... *P. lausannensis* Widmann, Marle and Brodin, 2025 [Europe]

19. Wing membrane with macrotrichia only in distal third (cf. Fig. 4). Anal point about half as long to slightly longer than gonostylus (ratio 0.5-0.6) .... *P. eoclivus* Sæther, 1969 [Europe, N America]

Wing membrane with macrotrichia in more than distal half, usually starting before vein RM. Anal point distinctly longer than half the length of gonostylus (ratio 0.7-1.0). 20

20. Gonostylus with a marked longish inner lobe (crista dorsalis) (best seen when gonostylus is turned towards inferior volsella) (Fig. 25). Inferior volsella conical to quadratic with acute to slightly obtuse apical angle (60-100°, cf. Figs 19-20). 21

Gonostylus without longish inner lobe (Fig. 5). Inferior volsella rounded with distinctly obtuse apical angle (110-160°, Figs 5, 15, 17). 22

21. Inferior volsella rather quadratic, length/width 0.5-0.7, apical angle slightly acute to slightly obtuse (80-100°). Anal point distally slightly narrowing to parallel-sided (Fig. 11) .... *P. lundbeckii* (Johannsen, 1905) [Asia, Europe, N. America]

Inferior volsella conical, length/width 0.7-0.8, apical angle distinctly acute (60-70°). Anal point distally distinctly gradually narrowing to apex (cf. Fig. 10) .... *P. brundini* Sinharay and Chaudhuri, 1979 [Asia]

22. Anal point with broad base, gradually narrowing to apex (Fig. 10). Antenna AR 0.6-0.7 .... *P. adzharicus* Kownacki and Zosidze, 1973 [Europe]

Anal point base less broad, apically parallel-sided (cf. Fig. 11) or slightly expanded (Figs 5, 12). Antenna AR 0.8-1.2. 23

23. Inferior volsella with two parts, lower part slightly expanded beyond distal margin of upper part (Figs 5, 17). Anal point reaches beyond mid to end of inferior volsella (Fig. 5) .... *P. stylatus* (Spärck, 1923) [Africa, Asia, Europe]

Inferior volsella with one part (Fig. 15). Anal point reaches between base and mid of inferior volsella .... *P. togabilateralis* Sasa and Okazawa, 1992 [Asia]

24. Virga conspicuously long with 6-12 longish branches and about as long as gonostylus (ratio 0.9-1.1). 25

Virga with 2-22 branches (Figs 6-8) not more than half as long as gonostylus (ratio 0.1-0.5). 26

25. Virga with 6-8 branches. Gonostylus near distal end with 3-4 short dark spines. Inferior volsella with two distinct parts .... *P. zorinae* Makarchenko and Makarchenko, 2009 [Asia]

Virga with 11-12 branches. Gonostylus near distal end without spines. Inferior volsella with one part (Fig. 21) .... *P. yakyheius* (Sasa & Suzuki, 2000) [Asia]

26. Virga with 20-22 branches. Gonostylus conspicuously long, when turned inwards reaching base of inferior volsella .... *P. togavirgus* Sasa and Okazawa, 1992 [Asia]

Virga with less than 10 branches. Gonostylus not conspicuously long, when turned inwards not or just reaching end of inferior volsella. 27

27. Gonostylus apically with a marked sharp inner triangular tooth (crista dorsalis) about as long as megaseta (Fig. 24). Inferior volsella slender (length/width 1.9-2.2). 28

Gonostylus apically without sharp inner tooth. Inferior volsella rounded to conical (length/width 0.6-1.5). 29

28. Virga with 2 branches (Fig. 8). Inferior volsella distal angle towards gonocoxite 60-70°... *P. hamatus* (Johannsen, 1934) [N America]

Virga with 5-6 branches (Fig. 7). Inferior volsella distal angle towards gonocoxite 20-30° (Fig. 22) .... *P. togadigitalis* (Sasa and Okazawa, 1992) [Asia]

29. Virga with 8-9 very short branches (Fig. 6) not more than one tenth as long as gonostylus (ratio 0.05-0.1). Inferior volsella rounded, shorter than long (length/width 0.6-0.7) .... *P. seiryukeleus* (Sasa, Suzuki and Sakai, 1998) [Asia]

Virga with 3-5 longish branches about one third to half as long as gonostylus (ratio 0.3-0.5). Inferior volsella length/width 1.0-1.5. 30

30. Gonostylus when turned inwards reaching distinctly beyond end of inferior volsella. Inferior volsella length/width 1.3-1.5 with distal angle towards gonocoxite 40-50°.. *P. kurilensis* Makarchenko and Makarchenko, 2006 [Asia]

Gonostylus when turned inwards far from reaching end of inferior volsella. Inferior volsella length/width 1.0-1.2 with distal angle towards gonocoxite 70-80°... *P. kurolemeus* Sasa, 1996 [Asia]

Table 3. *Parametriocnemus* species of the world and literature with morphological information on males.

Species	Literature
P. aduncus	Chaudhuri et al. 1989
P. adzharicus	Kownacki and Zosidze 1973, Widmann et al. 2025
P. biappendiculatus	Makarchenko and Makarchenko 2006
P. boreoalpinus	Gowin and Thienemann 1942, Pinder 1978, Langton and Pinder 2007
P. brundini	Sinharay and Chaudhuri 1979
P. capensis	Freeman 1954, Freeman 1956
P. eoclivus	Sæther 1969
P. fordi	Freeman 1956
P. fortis	Li et al. 2013
P. graminicola	Lundbeck 1898, Sublette 1966, Sæther 1969, Oliver 1970, Cranston et al. 1989, Lindegaard 2015
P. hamatus	Johannsen 1934, Johannsen and Townes 1952, Sublette 1967, Cranston et al. 1989, Namayandeh and Beresford 2018
P. isigageheus	Sasa and Suzuki 2000a, National Museum of Nature and Science Tokyo 2024
P. kurilensis	Makarchenko and Makarchenko 2006
P. kurolemeus	Sasa 1996b, National Museum of Nature and Science Tokyo 2024
P. lausannensis	Widmann et al. 2025
P. lundbeckii	Johannsen 1905, Johannsen and Townes 1952, Sublette 1966, Sublette 1967, Sæther 1969, Sæther 1971, Sæther 1975, Sublette 1979, Cranston et al. 1989, Spies et al. 2009, Li et al. 2013, Lindegaard 2015, Namayandeh and Beresford 2018
P. ornaticornis	Kieffer 1917, Freeman 1961, Li et al. 2013
P. scotti	Freeman 1953, Freeman 1956, Lehmann 1979, Li et al. 2013, Baranov et al. 2024
P. seiryukeleus	Sasa et al. 1998, National Museum of Nature and Science Tokyo 2024
P. stylatus	Spärck 1923, Kieffer 1924, Goetghebuer 1934, Goetghebuer and Lenz 1940, Coe 1950, Brundin 1956, Gouin 1956, Kownacki and Zosidze 1973, Pinder 1978, Sasa and Kawai 1987, Sasa and Okazawa 1992, Sasa and Kikuchi 1995, Sasa 1996a, Sasa and Suzuki 1999, Langton and Pinder 2007, Li et al. 2013, Kappert 2025
P. tenuiapicalis	Caspers and Reiss 1989
P. togabilateralis	Sasa and Okazawa 1992, Sasa and Kikuchi 1995, National Museum of Nature and Science Tokyo 2024

Species	Literature
P. togadigitalis	Sasa and Okazawa 1992, Sasa and Kikuchi 1995
P. togavirgus	Sasa and Okazawa 1992, Sasa and Kikuchi 1995, National Museum of Nature and Science Tokyo 2024
P. triquetrius	Chaudhuri et al. 1989
P. tusimouveus	Sasa and Suzuki 1999, National Museum of Nature and Science Tokyo 2024
P. tusimoxeyeus	Sasa and Suzuki 1999, National Museum of Nature and Science Tokyo 2024
P. vespertinus	Sæther 1969
P. vittatus	Li et al. 2013
P. yakyheius	Sasa and Suzuki 2000b, National Museum of Nature and Science Tokyo 2024
P. zorinae	Makarchenko and Makarchenko 2009, National Museum of Nature and Science Tokyo 2024

Table 4a. Morphological characters of head, thorax and wings particularly useful for identification of males of *Parametriocnemus* species worldwide. The characters are explained in Table 1 and illustrated in Figs 1-25.

Species	H1. Antenna AR	Key 4. Antenna AR	H4. Eye dorsal ratio	T1. Thorax acr. setae	W1. Wing L, mm	W3. Wing hair cover	W5. Wing ratio L Cu/L M
P. aduncus	0.7-0.8	>0.6		21	1.4-1.6	3	1.07
P. adzharicus	0.6-0.7	>0.6			1.7-2.3	3	1.06
P. biappendiculatus	1.0-1.1	>0.6		14	2.1-2.4	3	
P. boreoalpinus	1.0	>0.6			1.7-2.1	1	1.17
P. brundini	1.0-1.1	>0.6	0.9-1.1	18	1.5-1.6	3	1.15
P. capensis	0.2-0.3	<0.6		0	1.4-1.5	3	1.32
P. eoclivus	1.1-1.2	>0.6	1.3		2.0-2.1	1	
P. fordi	0.7-1.0	>0.6		0	1.9-2.1	3	1.48
P. fortis	0.5-0.6	<0.6		3	2.1-2.2	3	1.07
P. graminicola	1.0-1.1	>0.6	1.2	10	2.0-2.2	1-2	1.15
P. hamatus	1.3	>0.6	1.4-1.5		2.1-2.4	3	1.28
P. isigageheus	0.5-0.6	<0.6	0.8-0.9	15-16	1.1-1.2	3	1.09
P. kurilensis	0.7-0.9	>0.6		12-13	1.7-2.4	3	
P. kurolemeus						2	
P. lausannensis	1.1-1.4	>0.6	0.9	13-14	1.9	3	1.06
P. lundbeckii	0.9-1.4	>0.6	1.0-1.2	4-14	1.7-2.3	3	1.18
P. ornaticornis	0.3-0.5	<0.6			1.5-1.6	3	1.11
P. scotti	0.7-1.0	>0.6	0.7-0.9	7	1.7-2.1	3	1.10
P. seiryukeleus	0.8-0.9	>0.6	1.1-1.2	18	1.6-1.7	3	1.11
P. stylatus	0.8-1.2	>0.6	1.2-1.3	12-30	1.2-2.1	3	1.05-1.10
P. tenuiapicalis	0.4	<0.6	1.2-1.3		1.6	2	1.21
P. togabilateralis	0.8-1.0	>0.6	1.3-1.4	10-18	1.6-1.8	3	1.08-1.11
P. togadigitalis	1.0-1.3	>0.6	1.2-1.3	20-22	1.7-2.2	3	1.22-1.24
P. togavirgus	0.7-0.8	>0.6	1.0-1.1	16	1.6-1.7	3	1.25
P. triquetrius	0.5-0.6	<0.6		15	1.7-1.8	3	1.14
P. tusimouveus	0.4-0.6	<0.6	1.5-1.6	14-24	1.3-1.6	3	1.31
P. tusimoxeyeus	0.3-0.4	<0.6	1.4-1.5	16	1.2-1.3	3	1.16

Species	H1. Antenna AR	Key 4. Antenna AR	H4. Eye dorsal ratio	T1. Thorax acr. setae	W1. Wing L, mm	W3. Wing hair cover	W5. Wing ratio L Cu/L M
P. vespertinus	0.3	<0.6	1.2	15-18		3	
P. vittatus	0.5-0.6	<0.6		13	1.5-1.6	2	1.24
P. yakyheius	0.6-0.7	>0.6	0.9-1.1	14-15	1.5-1.7	3	1.25-1.27
P. zorinae	0.8-0.9	>0.6		18	1.5-1.7	1	

Table 4b. Morphological characters of leg, abdomen and hypopygium anal point and gonocoxite particularly useful for identification of males of *Parametriocnemus* species worldwide. The characters are explained in Table 1 and illustrated in Figs 1-25.

Species	L1. Fore-leg LR	A1. Tergite IX apical lobes	A2. Virga branches	G1. AnP form	G2. AnP reach versus IVo	G3. AnP L/Gs L	G4. Gc L/Gs L
P. aduncus	0.65	0	0	1	3	0.6-0.7	
P. adzharicus	0.71	2	0	1	1-2	0.9-1.0	1.9-2.0
P. biappendiculatus	0.70	2	0	1	1	0.5	1.6-1.7
P. boreoalpinus		0	0	1	1	0.6-0.8	1.7-2.0
P. brundini	0.77-0.82	0	0	1	2	0.9	2.0-2.2
P. capensis	0.9-1.0	1-2	0	1	1	0.2	1.6-1.7
P. eoclivus		2	0	1	1-2	0.5-0.6	2.1-2.2
P. fordi	0.9	1-2	0	1	1	0.5-0.6	1.9-2.0
P. fortis	0.70	2	0	1	3	0.8	2.1-2.2
P. graminicola	0.66-0.71	0	0	1	1	0.4-0.5	1.6-1.8
P. hamatus	0.79-0.82	1	2	1	1-2	0.5	1.7-1.8
P. isigageheus	0.89-0.92	2	0	1-2	1	0.9-1.0	1.5-1.7
P. kurilensis	0.71-0.75	1	3	1	0	0.5	1.4-1.5
P. kurolemeus		1	4-5	1	3	0.6-0.7	1.8-2.0
P. lausannensis	0.70-0.75	2	0	2-3	2-3	1.0-1.1	1.8-2.0
P. lundbeckii	0.69-0.80	1-2	0	1-2	1-2	0.8-0.9	1.5-1.8
P. ornaticornis	0.69-0.83	1	0	1	1	0.5	1.8-1.9
P. scotti	0.71-0.81	2	0	1	1	0.7-0.9	1.8-2.0
P. seiryukeleus	0.85	2	8-9	2	1-2	0.9	1.6-1.8
P. stylatus	0.72-0.76	1-2	0	2-3	1-3	0.8-1.0	1.6-1.9
P. tenuiapicalis		2	0	1	1-2	0.9-1.0	2.1-2.2
P. togabilateralis	0.77	2	0	2-3	1	0.7-0.9	1.7-1.9
P. togadigitalis	0.77-0.79	1-2	5-6	1	1	0.5-0.6	1.5-1.7
P. togavirgus		0	20-22	1	1	0.9-1.0	1.5-1.7
P. triquetrius	0.53?	0	0	1	2	0.5-0.6	1.5-1.6
P. tusimouveus	0.63-0.67	1	0	1	1	0.9-1.0	1.8-2.0
P. tusimoxeyeus	0.63	1	0	1	1	0.9-1.0	1.8-1.9
P. vespertinus	0.65-0.66	1	0	2-3	3	1.0	2.1-2.2
P. vittatus	0.81	1	0	1	1-2	0.4-0.5	1.6-1.7
P. yakyheius	0.67	1-2	11-12	1	2	0.5-0.7	2.0-2.2
P. zorinae	0.67	2	6-8	1-2	1	0.7-0.8	1.7-1.8

Table 4c. Morphological characters of hypopygium inferior volsella and gonostylus particularly useful for identification of males of *Parametriocnemus* species worldwide. The characters are explained in Table 1 and illustrated in Figs 1-25.

Species	G5. IVo parts	G6. IVo L/W	G7. IVo apical angle	G8. IVo distal angle	Key 3,8,13. IVo distal angle	G9. Gs inner lobe	G10. Gs versus IVo
P. aduncus	1	0.3-0.4	130-140	140-150	>80°	2	3
P. adzharicus	1	0.5-0.6	140-160	100-110	>80°	1	3
P. biappendiculatus	2	1.1-1.2	30-40	40-50	≤80°	1	2
P. boreoalpinus	1-2	1.0-1.2	20-30	50-80	≤80°	1-2	2
P. brundini	1	0.7-0.8	70-80	100-110	>80°	1	1-2
P. capensis	2	0.5-0.6	20-30	20-30	≤80°	2-3	3
P. eoclivus	2	0.7-0.8	40-50	90-100	>80°	1	3
P. fordi	2	0.5-0.6	120-130	50-60	≤80°	1-2	3
P. fortis	1	0.9-1.0	120-130	80-90	>80°	3	3
P. graminicola	1	0.9-1.1	40-50	50-70	≤80°	1	2-3
P. hamatus	1	2.0-2.2	30-40	60-70	≤80°	2	1
P. isigageheus	1-2	0.6-0.7	10-20	30-40	≤80°	1	3
P. kurilensis	1-2	1.3-1.5	120-130	40-50	≤80°	2-3	1-2
P. kurolemeus	2	1.0-1.2	30-40	70-80	≤80°	1	1
P. lausannensis	1	0.8-0.9	40-50	50-60	≤80°	1	2-3
P. lundbeckii	1-2	0.5-0.7	80-100	90-110	>80°	3	2-3
P. ornaticornis	1	0.4-0.6	100-120	80-100	>80°	1	2-3
P. scotti	1	0.5-0.7	80-100	70-80	≤80°	1	1-2
P. seiryukeleus	2	0.6-0.7	70-80	60-70	≤80°	1	2-3
P. stylatus	2	0.5-0.7	110-120	90-110	>80°	1-2	2-3
P. tenuiapicalis	1	0.7-0.8	110-140	80-90	>80°	1	3
P. togabilateralis	1	0.5-0.6	130-140	90-100	>80°	1	3
P. togadigitalis	1	1.9-2.1	110-130	20-30	≤80°	2	2
P. togavirgus	2	1.0-1.2	10-20	80-90	>80°	1	3
P. triquetrius	1	0.5-0.6	40-50	90-100	>80°	1	2
P. tusimouveus	2	1.0-1.2	80-90	80-90	>80°	1	2
P. tusimoxeyeus	2	0.8-1.0	30-40	80-90	>80°	2	2
P. vespertinus	2	0.9-1.0	20-30	80	≤80°	4	3
P. vittatus	1	0.6-0.7	40-50	90-100	>80°	1-2	1-2
P. yakyheius	1	1.7-1.9	50-60	40-50	≤80°	2	2
P. zorinae	2	1.1-1.2	40-50	20-30	≤80°	2	2

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