

A review of the genus *Acanthocnema* Becker, 1894 (Diptera: Scathophagidae) of Russia

Обзор видов рода *Acanthocnema* Becker, 1894 (Diptera: Scathophagidae) фауны России

A.L. Ozerov¹, M.G. Krivosheina²
А.Л. Озеров¹, М.Г. Кривошеина²

¹Zoological Museum, Moscow Lomonosov State University, Bol'shaya Nikitskaya 2, Moscow 125009, Russia. E-mail: ozerov2455@rambler.ru

¹Зоологический музей, Московский государственный университет им. М.В. Ломоносова, Большая Никитская ул., 2, Москва 125009, Россия.

²A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky prospect, 33, 119071 Moscow, Russia. E-mail: dipteramarina@rambler.ru

²Институт проблем экологии и эволюции им. А.Н. Северцова РАН, Ленинский проспект, 33, Москва 119071, Россия.

KEYWORDS: Diptera, Scathophagidae, *Acanthocnema*, new species, Russia.

КЛЮЧЕВЫЕ СЛОВА: Diptera, Scathophagidae, *Acanthocnema*, новый вид, Россия.

ABSTRACT. Flies of the genus *Acanthocnema* Becker, 1894 of Russia, which includes 4 species, are reviewed. Generic and species descriptions and key for determination of species are given, and data on distributions are summarized. Two species, *Acanthocnema altaica* sp.n. and *Acanthocnema proboscidea* sp.n., both from Altai, are described as new to science. *Acanthocnema latipennis* Becker, 1894 is registered in Russia for the first time.

How to cite this article: Ozerov A.L., Krivosheina M.G. 2018. A review of the genus *Acanthocnema* Becker, 1894 (Diptera: Scathophagidae) of Russia // Russian Entomol. J. Vol.27. No.1. P.93–100. doi: 10.15298/rusentj.27.1.13

РЕЗЮМЕ. Дан обзор двукрылых рода *Acanthocnema* Becker, 1894 фауны России, включающий 4 вида. Приведены диагноз рода, описания видов и ключ для определения видов рода *Acanthocnema* России, а также суммированы данные по распространению видов рода на территории России. Описаны два новых для науки вида, *Acanthocnema altaica* sp.n. и *Acanthocnema proboscidea* sp.n., оба с территории Алтая. *Acanthocnema latipennis* Becker, 1894 впервые отмечен на территории России.

Introduction

Acanthocnema Becker, 1894 is one of the small genera within the family Scathophagidae, which until the present time has comprised 10 species distributed in the Holarctic Region (3 Holarctic and 7 Palearctic) [Vockeroth, 1965; Suwa, 1986; Ozerov, 2014; Ozerov, Krivosheina, 2014]. One species only, *A. vikhrevi* Oze-

rov et Krivosheina, 2014, is registered in Russia [Ozerov, Krivosheina, 2014].

The adult flies are found on rocks wet with the spray of swift mountainous streams (Suwa, 1986; pers. observ. by A. Ozerov; Dr. Vikhrev, per. com., 2017). Females oviposit eggs on eggs of aquatic flies (Chironomidae and Dixidae) and egg-masses of Trichoptera [Hinton, 1981; Nelson, 1992; pers. observ. by A. Ozerov]. Larvae of *Acanthocnema* feed on these eggs.

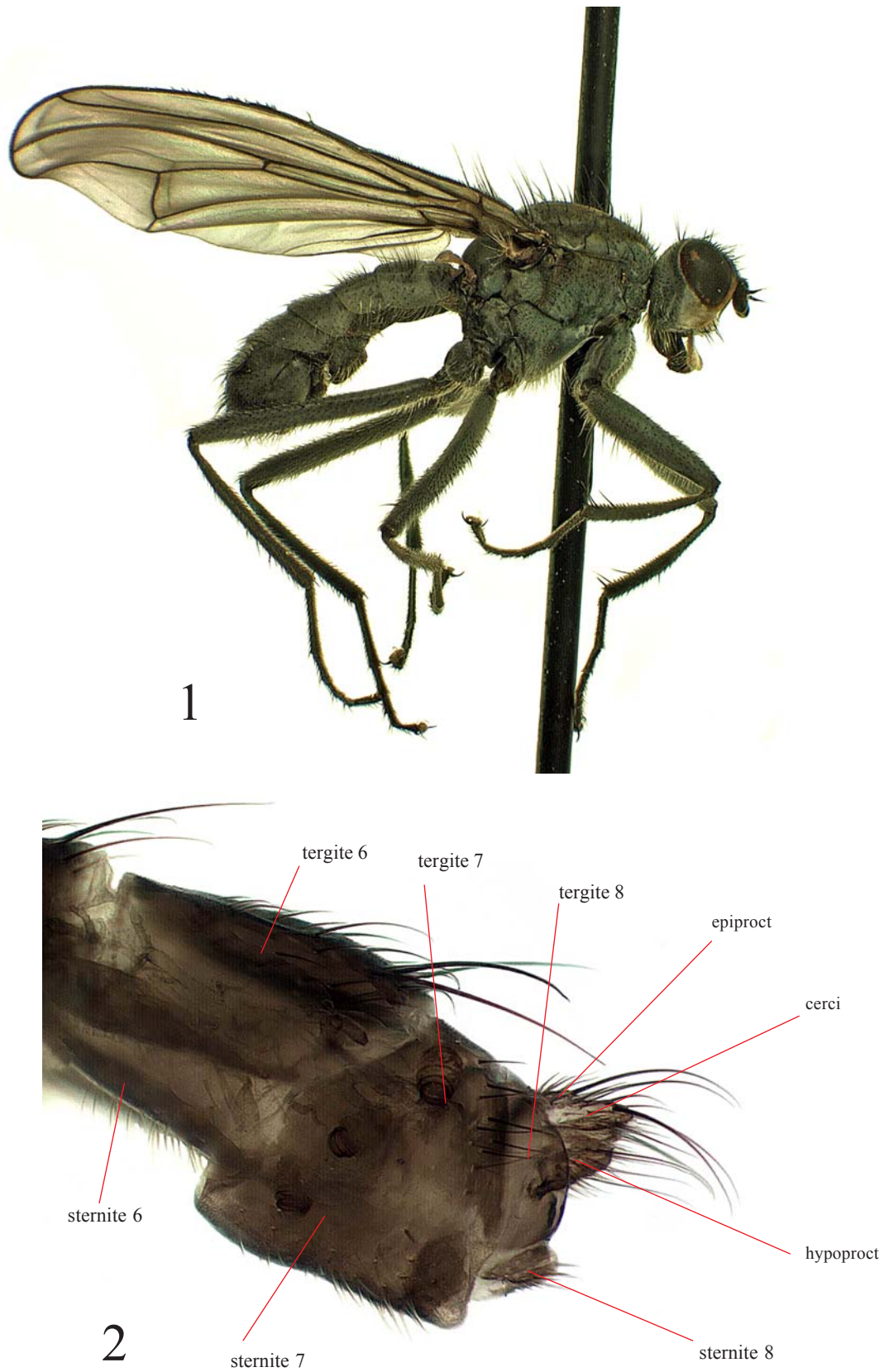
Material and methods

The specimens examined for this study are deposited in the Zoological Museum, Moscow State University, Russia (ZMUM).

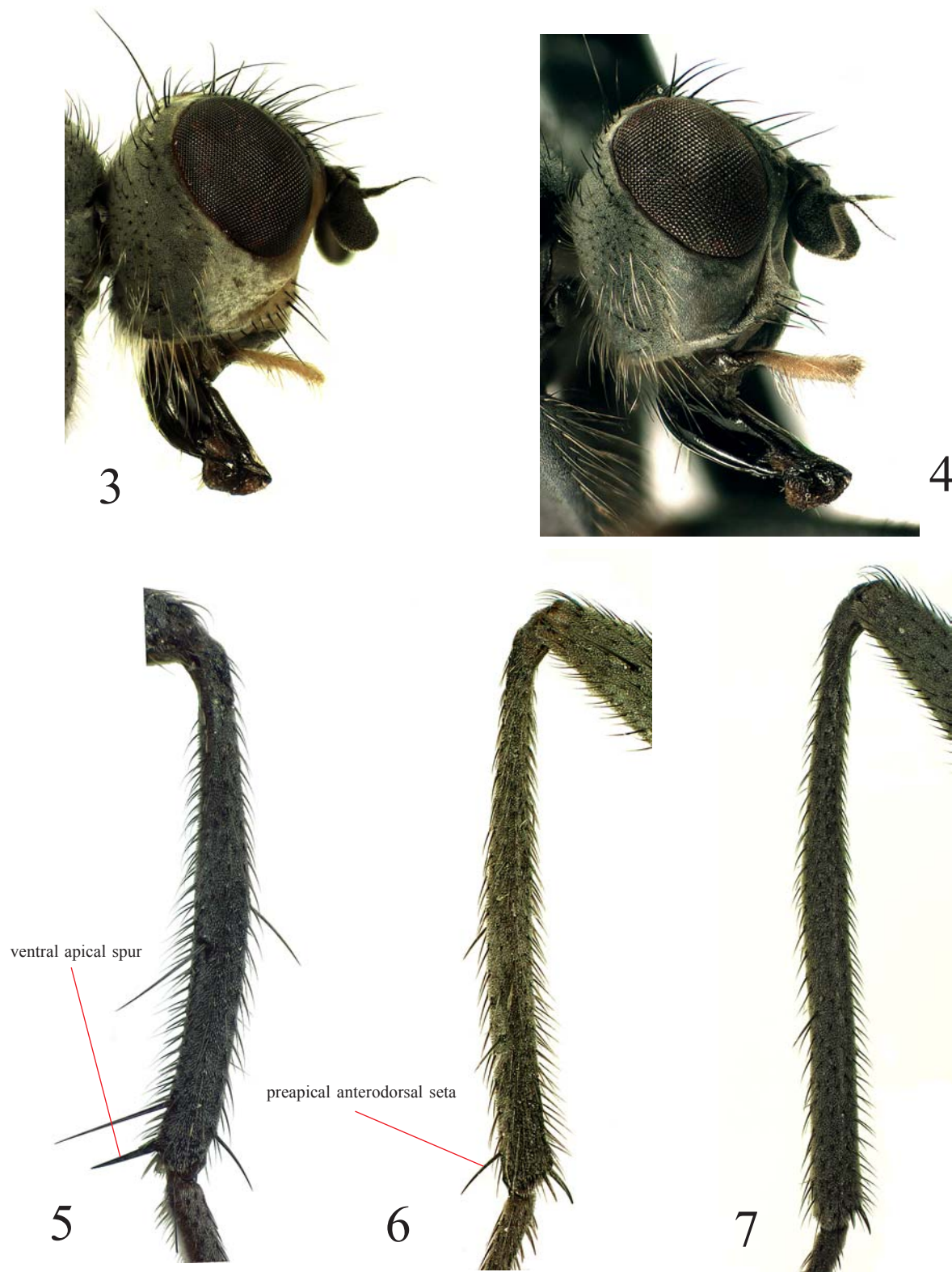
The majority of original Russian geographical names are given in transliteration; names of some large geographical regions (e.g. Altai (=Altai Krai + Altai Republic)) follow program Google Earth. Geographical coordinates are given in the Decimal Degrees format.

The terminology used in the generic descriptions, species diagnoses, description of the new species, and keys follows McAlpine [1981], Cumming et al. [2009], except that “postpedicel” is used for antennal flagellomere 1 (third antennal segment) [Stuckenberg, 1999].

Dissected male genitalia were examined with a Nikon SMZ645 zoom stereomicroscope and then photographed using an eTREK DCM900 digital camera attached in place of an eyepiece of monocular microscope. Resulting batches of images were processed with CombineZP software [Hadley, 2007], editing of stacked images was performed in Adobe Photoshop.



Figs. 1, 2. *Acanthocnema altaica*, sp.n., holotype ♂, habitus (1) and *Acanthocnema vikhrevi* Ozerov et Krivosheina, ovipositor (2).
 Рис. 1, 2. *Acanthocnema altaica*, sp.n., голотип ♂, общий вид (1) и *Acanthocnema vikhrevi* Ozerov et Krivosheina, яйцеклад (2).



Figs. 3–7. *Acanthocnema altaica*, sp.n., ♂ paratype (3, 7), *Acanthocnema proboscidea* sp.n., ♂ holotype (4) and *Acanthocnema vikhrevi* Ozerov et Krivosheina, ♂ (5, 6): 3, 4 — head, lateral view; 5 — fore tibia, posterior view; 6, 7 — mid tibia, anterior view. 5 — after Ozerov & Krivosheina, 2014, Fig. 1.

Рис. 3–7. *Acanthocnema altaica*, sp.n., ♂ паратип (3, 7), *Acanthocnema proboscidea* sp.n., ♂ голотип (4) и *Acanthocnema vikhrevi* Ozerov et Krivosheina, ♂ (5, 6): 3, 4 — голова, сбоку; 5 — голеня передней ноги, сзади; 6, 7 — голеня средней ноги, спереди. 5 — по Ozerov & Krivosheina, 2014, Fig. 1.

Taxonomic part

Acanthocnema Becker, 1894

Acanthocnema Becker, 1894: 136. Gender: feminine. Type-species: *Cordylura nigrimana* Zetterstedt, 1846, by original designation. [*Acanthocnema* Becker, 1894 is a junior homonym of *Acanthocnema* A. Costa, 1859 (Hymenoptera), but the former name was conserved as valid by ICZN [1954: 91]].

Clinoceroides Hendel, 1917: 36. Gender: masculine. Type-species: *Cordylura glaucescens* Loew, 1864, by original designation.

The genus *Acanthocnema* is characterised by the combination of next characters: arista short pubescent on basal part or almost completely, except apex; palpus elongate, distinctly spatulate, without strong apical/subapical seta; proepisternum covered with hairs at middle part; anepisternum covered with setulae along dorsal margin and in posterior part only, without setulae posterior to anterior spiracle; katepisternum with one strong seta in posterodorsal corner; anepimeron bare; postmetacoxal bridge absent; fore femur ventrally without short black spines; fore tibia with ventral apical spur (Fig. 5), with or without rows of short spinules ventrally; scutellum with a pair of strong apical and a pair of strong basal setae; male sternite 5 bilobate posteriorly (Figs 10, 13, 14, 17); ovipositor short and compact, proctiger shifted dorsally (Fig. 2); segment 7 consisting of fused tergite and sternite, dorsal part of tergite 7 sometimes membranous; tergite 8 represented by single semicircular sclerite or divided medially into 2 sclerites; sternite 8 divided medially into 2 small sclerites.

A unique character for the genus is the presence of ventral apical spur on fore tibia (Fig. 5).

Acanthocnema altaica Ozerov et Krivosheina, **sp.n.** Figs 1, 3, 7, 11–13.

MATERIAL. Holotype ♂, **Russia:** Altai Republic, Ust-Sema env. (51.6°N 85.8°E), 21–26.VI.2016, N. Vikhrev (ZMUM). Paratypes: data as for holotype (11 ♂♂, 5 ♀♀, ZMUM).

DESCRIPTION. Male, female. Body blackish in ground colour and densely grey dusted. Length of body 5.4–6.1 mm. Length of wing 5.2–6.7 mm.

Head (Fig. 3). Frontal vitta black completely in female, with anterior margin reddish in male, matt; fronto-orbital plate black, grey dusted, covered with black hairs. Orbitals 3, frontals 2–3, 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae absent or at least not differ from setulae on ocellar triangle; 2 vibrissae. Gena yellow, with silver reflection, broad, depth below lowest eye-margin almost equal to length of postpedicel. Face pale yellow in male and blackish in female. Parafacial yellow. Postcranium black, grey dusted. Palpus pale yellow in male and dark yellow or blackish in female. Proboscis short and wide (Fig. 3). Antenna black; postpedicel rounded apically, 2 times as long as broad. Arista pubescent on basal quarter and bare apically.

Scutum densely grey dusted, with a patch of brown markings around dorsocentral and supra-alar areas.

Acrostichals as hairs in two rows, dorsocentrals 2+(3–4), intra-alars 1+2, supra-alars 1+1, 1–2 postpronotals (if 2 then the medial weak), 2 notopleurals, 2 postalars. Pleura densely grey dusted. Proepisternum with yellow hairs and 1 pale seta near ventral margin. Proepimeron with 1 seta ventral to spiracle. Anepisternum with rare hairs in posterior half and 1–2 long setae near posterior margin. Katepisternum with yellow hairs and one long seta in posterodorsal corner. Anepimeron bare. Scutellum grey dusted, with a pair of strong apical and a pair of strong basal setae; lateral margins and dorsal surface apically with black hairs and setulae.

Legs black, densely grey dusted. Fore femur with 2 posterior setae basally in male and 4–6 posterior setae in female. Fore tibia with ventral apical spur, 1 anterodorsal at middle and 2 posteroventral setae, with rows of short spinules ventrally. Mid femur with a row of anterior/anterodorsal setae, with 1 posterodorsal apical and 1–2 posterior apical setae. Mid tibia with 1 anterodorsal and 1 posterodorsal setae at middle and following apical setae: 1 ventral, 1 anteroventral and 1 posteroventral. Hind femur with a row of anterodorsal setae, 1 pale ventral seta basally. Hind tibia with 2–3 anterodorsal, 1–2 posterodorsal and 1 anteroventral apical setae.

Wing conspicuously blackish tinged; veins black. Calypteres and halter brownish.

Abdomen black, densely grey dusted. Male sternite 4 wider, about 2 times as wide as long (Fig. 13). Male sternite 5 with broad lobes (Fig. 13). Epandrium, cerci and surstyli as in Figs 11, 12; surstylus broad basally and slender apically in lateral view (Fig. 12).

DISTRIBUTION. Russia: Altai.

Acanthocnema proboscidea Ozerov et Krivosheina, **sp.n.**

Figs 4, 8–10.

MATERIAL. Holotype ♂, **Russia:** Altai Republic, Ust-Sema env. (51.6°N 85.8°E), 21–26.VI.2016, N. Vikhrev (ZMUM).

DESCRIPTION. Male. Body blackish in ground colour and densely grey dusted. Length of body 4.5 mm. Length of wing 4.7 mm.

Head (Fig. 4). Frontal vitta and fronto-orbital plate black, blackish dusted; fronto-orbital plate covered with black hairs. Orbitals 3, frontals 2, 1 ocellar, 1 small inner vertical, 1 outer vertical; postocellar setae absent; 3 small vibrissae. Gena black, with silver reflection, broad, depth below lowest eye-margin almost equal to length of horizontal diameter of eye. Face and parafacial black, with silver reflection. Postcranium black, densely grey dusted. Palpus yellow. Proboscis moderately long (Fig. 4). Antenna black; postpedicel rounded apically, 2 times as long as broad. Arista short pubescent, except apex.

Scutum densely grey dusted, with a patch of brown markings around dorsocentral and supra-alar areas. Acrostichals as hairs in two rows, dorsocentrals 2+3, intra-alars 0+2, supra-alars 1+1, 2 postpronotals, 2 notopleurals, 2 postalars. Pleura densely grey dusted. Proepisternum with yellow hairs and 1 pale seta near



Figs. 8–13. *Acanthocnema proboscidea* sp.n., ♂ holotype (8–10) and *Acanthocnema altaica*, sp.n., ♂ paratype (11–13): 8, 11 — epandrium, cerci and surstyli, dorsal view; 9, 12 — same, lateral view; 10, 13 — sternites 4 (lower) and 5 (upper).

Рис. 8–13. *Acanthocnema proboscidea* sp.n., ♂ holotype (8–10) and *Acanthocnema altaica*, sp.n., ♂ paratype (11–13): 8, 11 — эпандрий, церки и сурстили, сверху; 9, 12 — то же, сбоку; 10, 13 — стерниты 4 (внизу) и 5 (вверху).

ventral margin. Proepimeron with 1 seta ventral to spiracle. Anepisternum covered with hairs in posterior half and 2 long setae near posterior margin. Katepisternum with yellow hairs and one long seta in posterodorsal corner. Anepimeron bare. Scutellum grey dusted, with a pair of strong apical and a pair of strong basal setae; lateral margins and dorsal surface apically with black hairs and setulae.

Legs black, grey dusted. Fore femur with 2–3 posterior setae basally, with a row of posterodorsal setae and 1 preapical anterodorsal seta. Fore tibia with ventral apical spur, 1 anterodorsal seta at middle and 1 posterior preapical seta in apical third, with a row of short ventral spinules in apical half. Mid femur with a row of anterior/anterodorsal setae, with 3–4 posterodorsal setae apically and 1 posterior preapical seta.

Mid tibia with 1 anterodorsal and 0–1 posterodorsal setae at middle and following apical setae: 1 posterior, 1 anterior and 1 posteroventral. Hind femur with a row of anterodorsal setae, 1 preapical dorsal seta. Hind tibia with 2–3 anterodorsal, 1 posterodorsal, 1 apical anteroventral and 1 apical anterodorsal setae.

Wing conspicuously blackish tinged; veins black. Calypteres and halter brownish.

Abdomen black, densely grey dusted. Male sternite 4 rectangular, about as wide as long (Fig. 10) Male sternite 5 with narrow lobes (Fig. 10). Epandrium, cerci and surstyli as in Figs 8, 9; surstylus blade-like in dorsal view and with curved narrowed apex in lateral view.

Female unknown.

DISTRIBUTION. Russia: Altai.

Acanthocnema latipennis Becker, 1894
Figs 14–16.

latipennis Becker, 1894: 138 (*Acanthocnema*). Type-locality: “Schlesien. Wölfelsfall bei Glatz” (Poland, near Bystrzyca Kłodzka SW).

MATERIAL. **Russia:** Crimea, Uchan-Su env. (44.49°N 34.10°E), 4–9.V.2016, N. Vikhrev (1 ♂, ZMUM).

ADDITIONAL MATERIAL EXAMINED: **Croatia:** spring of River Ruda, 28.IV.2006, M. Ivkovič (2 ♂♂, 1 ♀, ZMUM); **Serbia:** Crni Vrh (43.408°N 22.5751°E), 708 m, 29.VII.2015, A. Ozerov & M. Krivosheina (2 ♂♂, 2 ♀♀, ZMUM); Crni Vrh (43.407°N 22.587°E), 800 m, 1–7.V.2015, N. Vikhrev (1 ♂, 1 ♀, ZMUM).

DESCRIPTION. Male. Female. Body blackish in ground colour and densely grey dusted. Length of body 4.0–4.7 mm. Length of wing 4.2–4.9 mm.

Frontal vitta black completely or brownish apically, greyish dusted; fronto-orbital plate black, blackish dusted, covered black hairs. Orbitals 3, frontals 2, 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae absent; 2 small vibrissae. Gena black, with silver reflection, broad, depth below lowest eye-margin almost equal to length of postpedicel. Face black, with silver reflection. Parafacial dark brownish or black, greyish dusted. Postcranium black, densely grey dusted. Palpus yellow. Antenna black; postpedicel rounded apically, 2 times as long as broad. Arista pubescent on basal quarter and bare apically.

Scutum densely grey dusted, with a patch of brown markings around dorsocentral and supra-alar areas. Acrostichals as hairs in two rows, dorsocentrals 2+3, intra-alars 1+2, supra-alars 1+1, 2 postpronotals, 2 notopleurals (medial may be weak), 2 postalar. Pleura densely grey dusted. Proepisternum with yellow hairs and 1 pale seta near ventral margin. Proepimeron with 1 seta ventral to spiracle. Anepisternum covered with hairs in posterior half and 1–2 black or pale setae near posterior margin. Katepisternum with yellow hairs and one long seta in posterodorsal corner. Anepimeron bare. Scutellum grey dusted, with a pair of strong apical and a pair of strong basal setae; lateral margins and dorsal surface apically with black hairs and setulae.

Legs black, grey dusted. Fore femur with 2–3 posterior setae basally, with a row of posterodorsal setae and 1

preapical anterodorsal seta. Fore tibia with ventral apical spur, 2 anterodorsal setae in apical third, 1 anterodorsal seta at middle and 1 dorsal preapical seta, also with a row of short ventral spinules in apical half. Mid femur with rows of anterior/anterodorsal and ventral/posteroventral setae, 1–2 posterodorsal setae apically and 1 posterior preapical seta. Mid tibia with 1 anterodorsal and 0–1 posterodorsal setae at middle, 1 anterodorsal preapical seta and following apical setae: 1 posterior, 1 anteroventral and 1 posteroventral. Hind femur with a row of anterodorsal setae. Hind tibia with 1–2 anterodorsal, 1 posterodorsal, 1 preapical dorsal setae, also with 1 apical anteroventral and 1 apical anterodorsal setae.

Wing conspicuously blackish tinged; veins black. Calypteres and halter brownish.

Abdomen black, densely grey dusted. Male sternite 4 about 2 times as long as wide (Fig. 14). Male sternite 5 with broad lobes (Fig. 14). Epandrium, cerci and surstyli as in Figs 15, 16; surstylus of leaf-shaped form in lateral view (Fig. 16).

DISTRIBUTION. Russia: Crimea (**first record**). — Europe [Šifner, 2008].

Acanthocnema vikhrevi Ozerov et Krivosheina, 2014

Figs 2, 5, 6, 17–19.

vikhrevi Ozerov et Krivosheina, 2014: 204 (*Acanthocnema*). Type-locality: Yablonevyy Pass (60.59°N 151.53°E) (Russia, Magadan Oblast).

MATERIAL EXAMINED. **Russia:** Magadan Oblast, Yablonevyy Pass (60.59°N 151.53°E), 900 m, 16–18.VII.2014, N. Vikhrev (♂ holotype, 2 ♂♂ and 2 ♀♀ paratypes, ZMUM); Sokol env. (59.92°N 150.71°E), 11–19.VII.2014, N. Vikhrev (1 ♂ paratype, ZMUM).

DESCRIPTION. Male, female. Body blackish in ground colour and densely grey dusted. Length of body 6.5–7.0 mm. Length of wing 6.6–6.8 mm.

Frontal vitta black, matt; fronto-orbital plate black, grey dusted. Orbitals 3, frontals 3–4, 1 ocellar, 1 inner vertical, 1 outer vertical; postocellar setae absent or at least not differ from setulae on ocellar triangle. Face densely white or yellowish dusted. Parafacial yellowish. Gena from yellowish to black, with silver reflection, broad, depth below lowest eye-margin almost equal to length of vertical diameter of eye. Vibrissal angle yellow, with 2–3 vibrissae. Postcranium black, grey dusted. Palpus yellow in male and black in female, more broadened in male than in female. Antenna black; postpedicel rounded apically, 2 times as long as broad. Arista pubescent on basal two-thirds and bare apically.

Scutum densely grey dusted, with a patch of brown markings around intra-alar and supra-alar areas. Acrostichals as hairs in two rows, dorsocentrals 3+3 (first presutural weak and directed anteriorly), intra-alars (0–1)+2, supra-alars 1+1, 2 postpronotals (the medial one weak), 2 notopleurals, 2 postalar. Pleura densely grey dusted, anepisternum brown dusted in upper third. Proepisternum with yellow hairs and 1 seta near ventral margin. Proepimeron with 1 seta ventral to spiracle. Anepisternum with rare hairs in posterior half and



Figs. 14–19. *Acanthocnema latipennis* Becker (14–16) and *Acanthocnema vikhrevi* Ozerov et Krivosheina (17–19): 14, 17 — sternites 4 (lower) and 5 (upper); 15, 18 — epandrium, cerci and surstyli, dorsal view; 16, 19 — same, lateral view. 17–19 — after Ozerov & Krivosheina, 2014, Figs 2, 3, 5, 6.

Рис. 14–19. *Acanthocnema latipennis* Becker (14–16) и *Acanthocnema vikhrevi* Ozerov et Krivosheina (17–19): 14, 17 — стерниты 4 (внизу) и 5 (вверху); 15, 18 — эпандрий, церки и сурстили, сверху; 16, 19 — то же, сбоку. 17–19 — по Ozerov & Krivosheina, 2014, Figs 2, 3, 5, 6.

1–2 long setae near posterior margin. Katepisternum with yellow hairs posteriorly and one long seta in posterodorsal corner. Anepimeron bare. Scutellum grey dusted, with a pair of strong apical and a pair of strong basal setae; lateral margins and dorsal surface apically with black hairs and setulae.

Legs black, densely grey dusted. Fore femur with a row of dorsal/posterodorsal setae in both sexes; with a row of fine long hairs on ventral/anteroventral surface basally in male; with one pale and two black ventral/anteroventral setae in basal third in female. Fore tibia with ventral apical spur, 1 preapical dorsal, 1 anterodorsal at middle and 1–2 posteroventral setae, without rows of spinules ventrally. Mid femur with a row of anterior/ anterodorsal setae, with 1 posterodorsal apical and 1–2 posterior apical setae. Mid tibia with 1 anterodorsal and 1 posterior setae at middle, with 1 preapical anterodorsal seta (Fig. 6), and following apical setae: 1 anterior, 1 anteroventral and 1 posteroventral. Hind femur with a row of anterodorsal setae, 4–5 dorsal setae in apical half, 3–5 anteroventral setae in apical half, 2–3 usually pale ventral setae in basal half. Hind tibia with 2–3 anterodorsal, 2 posterodorsal, 1 preapical dorsal setae, also with 1 anterior and 1 anteroventral apical setae.

Wing conspicuously blackish tinged; veins black. Calypteres and halter brownish.

Abdomen black, densely grey dusted. Tergites 1–6 with not strong marginal setae except on middle in male, without setae in female. Male sternite 4 transverse rectangular, wider than long (Fig. 17). Male sternite 5 with straight triangular lobes (Fig. 17). Epandrium, cerci and surstyli as in Figs 18, 19.

NOTE. *A. vikhevi* is closely related to *A. sternalis* Suwa, 1986, described from Japan (Hokkaido), but easily differs from *A. sternalis* by presence of preapical anterodorsal seta on mid tibia.

DISTRIBUTION. Russia: Magadan Oblast.

KEY TO SPECIES OF *ACANTHOCNEMA* OF RUSSIA

1. Mid tibia with preapical anterodorsal seta (Fig. 6) 2
- Mid tibia without preapical anterodorsal seta (Fig. 7) .. 3
2. Larger, 6.5–7.0 mm. Male sternite 4 transverse rectangular, wider than long (Fig. 17). Male sternite 5 with straight triangular lobes (Fig. 17). Epandrium, cerci and surstyli as in Figs 18, 19 *vikhevi* Ozerov, Krivosheina
- Smaller, 4.0–4.7 mm. Male sternite 4 about 2 times as long as wide (Fig. 14). Male sternite 5 with broad lobes (Fig. 14). Epandrium, cerci and surstyli as in Figs 15, 16; surstylus of leaf-shaped form in lateral view (Fig. 16) *latipennis* Becker
3. Fore tibia with 2 posteroventral setae. Face of male yellow. Arista pubescent on basal quarter and bare apically. Proboscis short and wide (Fig. 3). Male sternite 4 wider, about 2 times as wide as long (Fig. 13). Male sternite 5 with moderate broad lobes (Figs 13). Epandrium, cerci and surstyli as in Figs 11, 12; surstylus broad basally and slender apically in lateral view (Fig. 12) *A. altaica* sp.n.

- Fore tibia with 1 posteroventral seta. Face of male black. Arista short pubescent, except apex. Proboscis longer and narrower (Fig. 4). Male sternite 4 rectangular, about as wide as long (Fig. 10) Male sternite 5 with narrow lobes (Fig. 10). Epandrium, cerci and surstyli as in Figs 8, 9; surstylus blade-like in dorsal view and with curved narrowed apex in lateral view *A. proboscidea* sp.n. (female unknown)

ACKNOWLEDGEMENTS. The work was conducted within the state project No AAAA-A16-116021660077-3. Morphological studies and illustrations for this work were made on equipment purchased with the support of RSF, research project No.14-50-00029.

References

- Becker T. 1894. Dipterologische Studien. I. Scatomyzidae // Berliner Entomologische Zeitschrift. Bd.39. Heft 1. P.77–196.
- Cumming J.M., Wood D.M. 2009. Adult morphology and terminology // Brown B.V., Borkent A., Cumming J.M., Wood D.M., Woodley N.E., Zumbado M. (eds.). Manual of Central American Diptera. Vol.1. Ottawa: National Research Council Press. P.9–50.
- Hadley A. 2007. CombineZM. Open source image processing software package for creating extended depth of field images. Available from: <http://www.hadleyweb.pwp.blueyonder.co.uk/> (accessed 17 January 2011)
- Hendel F. 1917. Beiträge zur Kenntnis der acalyptraten Musciden // Deutsche Entomologische Zeitschrift. Heft I. No.14. S.33–47.
- Hinton H.E. 1981. Biology of insects eggs. Pergamon Press, Oxford etc. 1: I–XXIV + 1–473, 2: I–XVIII + 475–778, 3: I–XVII + 779–1125.
- ICZN 1954. Opinion 290. Validisation, under the Plenary Powers, of the generic name “*Acanthodyla*” Costa, 1894 (Class Insecta, Order Hymenoptera) and “*Acanthocnema*” Becker, 1894 (Class Insecta, Order Diptera) // Hemming F. (ed.). Opinion and declarations rendered by the International Commission on Zoological Nomenclature. Vol. 8. International Commission of Zoological Nomenclature, London. P.91–97.
- McAlpine J.F. 1981. Morphology and terminology-adults. Pp. 9–63. In: McAlpine J.F., Peterson B.V., Shewell G.E., Teskey H.J., Vokeroth J.R., Wood D.M. (coordinators). Manual of Nearctic Diptera. Volume 2. Research Branch. Agriculture Canada. Monograph 27, Ottawa. Vi+674 pp.
- Nelson J.M. 1992. Biology and early stages of the dung-fly *Acanthocnema glaucescens* (Loew) (Dipt., Scathophagidae) // Entomologist's monthly Magazine. Vol.128. P.71–73.
- Ozerov A.L. 2014. The Primary Types of Scathophagidae (Diptera) in the Museum für Naturkunde Berlin, and Senckenberg Deutsches Entomologisches Institut, Germany // Zoosystematics and Evolution. Vol.90. No.1. P.33–43
- Ozerov A.L., Krivosheina M.G. 2014. To the fauna of dung flies (Diptera: Scathophagidae) of Russian Far East // Russian Entomological Journal. Vol.23. No.3. P.203–222.
- Šifner F. 2008. A catalogue of the Scathophagidae (Diptera) of the Palaearctic region, with notes on their taxonomy and faunistics // Acta Entomologica Musei Nationalis Pragae. Vol.48. No.1. P.111–196.
- Stuckenberg B.R. 1999. Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum // Studia Dipterologica. Vol.6. S.33–48.
- Suwa M. 1986. The genus *Acanthocnema* in Asia and Europe, with description of three new species from Japan and Nepal (Diptera: Scathophagidae) // Insecta Matsumurama. New Series. Vol.34. P.1–33.
- Vokeroth J.R. 1965. Subfamily Scathophaginae // Stone A. et al. (eds.). A catalog of the Diptera of America north of Mexico. United States Department of Agriculture. Agriculture Handbook. No.276. P.826–842.