Opusc. Zool. Budapest, 2013, 44(1): 23–46

Synopsis of the *Oxyethira flavicornis* species group with new Japanese *Oxyethira* species (Trichoptera, Hydroptilidae)

J. OLÁH[1] and T. ITO[2]

Prof. János Oláh, Tarján u. 28, H-4032 Debrecen, Hungary. E-mail: profolah@gmail.com
Dr. Tomiko Ito, Hokkaido Aquatic Biology, Hakuyo-cho, 3-3-5, Eniwa, Hokkaido 061-1434, Japan. E-mail: tobikera@siren.ocn.ne.jp

Abstract. A brief synopsis of the *Oxyethira flavicornis* species group is produced by the examination of type materials. Diagrammatic drawings with similar style were prepared for all the known and for the new species. Short description of genus *Oxyethira*, subgenus *Oxyethira*, species group of *Oxyethira flavicornis* are presented together with the description of five species clusters: *O. datra* new species cluster, *O. ecornuta* new species cluster, *O. flavicornis* new species cluster, *O. hiroshima* new species cluster, *O. tiunovae* new species cluster. Five new species are described from the *O. flavicornis* species group: *O chitosea* sp. n., *O. hena* sp. n., *O. hiroshima* sp. n., *O. kakida* sp. n., *O. mekunna* sp. n. One new species is described from the *Oxyethira grisea* species group: *Oxyethira ozea* sp. n. and two new species from the *Oxyethira ramosa* species group: *Oxyethira miea* sp. n., *Oxyethira okinawa* sp. n.

Keywords. Caddisflies, *Oxyethira*, new species, Japan.

INTRODUCTION

The micro-caddisfly genus *Oxyethira* is among the largest genera in the family Hydroptilidae and has a worldwide distribution. The *Oxyethira flavicornis* species group has been erected by Marshall (1979). She has established this group by broad genital morphological character range, based on the absence of a median ventral lobe on the fused gonopods and on the presence of broad, widely separated paraproct. This broadly defined diagnosis covered several species from three species groups redefined later: *O. falcata*, *O. flavicornis* and *O. ramosa*. Kelley (1984, 1985) modified this broad concept and restricted the group characters to flattened paramere that is split into two strands. As a result two species remained in *O. flavicornis* species group defined narrowly: *O. ecornuta* Morton, 1893 and *O. flavicornis* (Pictet, 1834). Later, four new species have been discovered having flattened and split paramere and added to the species group: *O. datra* Oláh, 1989 from Vietnam, *O. josifovi* Kumanski, 1990 from Korea, *O. sichuanensis* Yang & Kelley, 1997 from China and *O. tiunovae* Arefina & Armitage, 2003 from Russia (Far-East).

Malicky & Chantaramongol (2007) examined an *Oxyethira* specimen with flat and split paramere from Hokkaido and compared it with the published drawings of *O. datra* and *O. josifovi*. They have synonymised *O. josifovi* as a junior synonym of *O. datra* and thus identified the Hokkaido specimen as *O. datra*. Malicky sent his drawings of the Hokkaido specimen to the first author (J.O.). Examination without special care on paramere revealed no differences. Nozaki has collected specimens from Honshu and sent them to the first author to compare with *O. datra*. The second author (T.I.) borrowed Malicky's specimen and took several genitalia photos in 2008–2009. Actually the lack of understanding on the taxonomic position of this Hokkaido specimen initiated this research. We have completed a brief revision of the entire species group. Reexamining the drawings and genitalia photos as well as comparing it with more specimens and with all the related taxa, we have found it as a new species *O. kakida* sp. nov.

urn:lsid:zoobank.org:pub:C32D7E94-BD4D-4F9E-9B9C-78261A33E1D0
HU ISSN 2063-1588 (online), HU ISSN 0237-5419 (print)

Recently emerging new perspectives open more sophisticated approaches to discover diverse fine structures in searching stable traits to distinguish specific state of populations without molecular studies. Phylogenetic species concept and the sexual selection theory were applied effectively in the taxonomy of the obscured *Chaetopteryx rugulosa* species group (Oláh *et al.* 2012). The phallic organ and particularly one of its formerly neglected substructure, the subapical lateral lobes of the aedeagus as well as the anal tube of the females proved to be very diverse and stable traits to separate and distinguish among closely related species. In the present study on *Oxyethira flavicornis* species group we have found another phallic structure, the paramere as a promising diverse and stable character to distinguish among closely related species. In this study we have re-examined all the known and the newly described species and demonstrate that parameres are differing sufficiently among species. Key question remained however how to examine, visualise in three dimensions and how to draw these very complex and plane sensitive structures.

MATERIAL AND METHODS

This paper is based upon the *Oxyethira* material collected by Japanese scientists from various localities from Hokkaido to Ryukyu Islands and set aside during the last 37 years. In order to observe morphological details on the total body as well as to prevent the loss of the dissected small structures the entire animal was macerated in a small glass beaker of 25 cm^3 with nearly boiling 10% KOH solution for 5–15 minutes. The setal wart pattern of the head and thorax in all the anatomical planes are rarely described and figured in species descriptions, or are performed only on intact animals, without maceration of tissue. In many intact species the wart and groove patterns are poorly visible and frequently indiscernible, especially if the warts have the same colour as the cranial sclerites, or if the setae on the warts are not detached and the warts are densely covered by intact setae. Clearing the entire body thus gave us useful information on the setal wart pattern for the examined specimens. When sufficient material was available the head and thorax (except wings) were macerated together with the abdomen. The duration of the treatment is adjusted individually to the effectiveness of clearing process which depends on the species or even on the nutritive state of tissues or on the physiological condition of the specimens. The digested animals were subsequently transferred to distilled water and the macerated tissue was removed mechanically by fine tipped forceps and needles. The cleared animal was transferred to 80% ethyl alcohol, and to glycerine for examination under microscope. Different sized pins modified to supporting ring bottom were used to hold and stabilise the animal or the genitalia in lateral, dorsal and ventral position for drawing.

Improved visualization

Examination of fine genital structures is not easy in Hydroptilidae. On so small an object as hydroptilids it may be very difficult to visualise and understand genital substructures and functions with absolute certainty. The phallic organ and its very complex parameres are not consistent, in most of the published figures showing inconsistencies. Positive identification is most possible only with teasing out of the entire phallic organ, not only the phallic tip. In practice teasing the entire phallic organ either anterad or posterad may injure or distort those parts of the parameres which are directed in opposite of teasing. Especially when teasing the phallic organ anterad, the complex arm of the paramere is usually detached and hooked in its original position. Following the natural movement of the phallic organ as it functions by teasing out the aedeagus and paramere together posterad results free structure without significant injuries. It is advisable to examine several specimens with properly withdrawn phallic organ to understand in details the structure and function of an unknown paramere. The in situ paramere position is highly dependent on the pre or postcopulatory state of the animals. Moreover only a little plane change creates significant alteration how we see the very complex structure of paramere under microscope.

Intact genitalia of these tiny hairy creatures are usually concealed by dense pilosity. In our present state of understanding genital appendages or peri-phallic organs of the hydroptilids cannot be identified with high degree of certainty. Without cleaning in KOH, and without denuding it properly, that is mechanically removing setae at least from pregenital segment VIII as well as removing internal content properly it is rarely possible to identify correctly specimens to species level. The setae mask the otherwise visible free genital structures projecting out of the cover of segment IX. In the case of *Oxyethira*, *Catoxyethira* and several Leucotrichiini the enlarged and enforced segment VIII frequently produces a second layer covering the entire segment IX together with its substructures projecting out free. The setal cover usually hides essential parts of the basal articulating sections of the genital structural elements, especially those of the paraprocts, gonopods and basal plate of the gonopods which are already under cover of segment IX. After macerating the remaining setae should be removed. Perfectly denuded genitalia without setae but with intact alveoli, represents what is required for the observation of fine structures of the periphallic elements, their articulations and interactions. Particularly taxonomically important is the articulation between paraprocts, gonopods and the basal plate of the gonopods.

A high quality stereomicroscope under highest resolution is required to be able to observe important three-dimensional structures, instead of using the higher magnification of compound microscope. Stereomicroscope uses 2 separate optical paths to provide different viewing angles to the left and right eyes. It therefore produces a three-dimensional visualization of the genital structures with great working distance and sufficient depth of field. However, higher resolution induces smaller depth of field and working distance. The stereomicroscope should not be confused with a compound microscope equipped with double eyepieces. In a compound microscope, both eyes see the same image, and the binocular eyepieces simply provide greater viewing comfort. However, the higher magnification potential of the compound microscope may help to detect and understand difficult parts of the genitalia. The shape, connections, interactions and articulations of the small and frequently weakly pigmented structures require experience. Permanent movement and maceration with fine tipped pins of the properly cleared and denuded genitalia under the stereomicroscope, as well as under inverted compound microscope with large working depth, help us to detect the otherwise indiscernible structures of various articulations.

Diagrammatic and habitus drawings

For Trichoptera, illustrations of the genitalia are the most important component in species descriptions. It is especially important to prepare drawings that are clearly understood and complete for visualization of the hydroptilids. These tiny animals dispose difficulties in visual detection and understanding the function of their genitalia. This is reflected by a lack of standard and by the highly varying quality of illustrations of genitalia in species descriptions. There are two basic types of genital drawings in scientific illustration with several intermediate solutions: diagrammatic and habitus drawings.

Diagrammatic, structural line or contour line drawings are symbols of ideas visualized by imagery instead of by linguistic or algebraic means. Diagrammatic drawings explain the genital structure by outlining its parts and their relationships by using lines. A single line creating an outline of an object can show the length, height, width and even details of what is being studied. The word contour refers to an outline of the genital substructures. Traditionally, it presents only their exterior edges. A plain contour is one line that is connected with no shading, emphasizing the shell of the object. Of course line drawing does not capture all of the information of the genitalia, instead it usually only captures either the interior or the exterior contours. Diagrammatic drawings are reasoning by means of simple visual representations and are about the understanding of concepts and ideas: how the researcher understands the structure and function of a

species. The idea or concept is visualized with the use of clear-cut drafting, plan, sketch, line-drawing, or outline-drawing. Diagrammatic drawings are designed to demonstrate or explain how genital structure works or to clarify the relationship between the parts of the entire genitalia. The Occam's razor of lex parsimoniae, the principle of parsimony is behind the diagrammatic type of drawings.

Habitus drawings are similar to photos. They could be more precise and exact. They are more descriptive, more detailed, more artistic. However they are less about simple visualization of functional ideas and concepts: how a researcher's understanding helps in simple presentation. Simple structural and functional imagery is frequently masked by detailed surface sculptures or by various setal densities. Connections, interactions and articulations between the periphallic organs is usually not indicated. Habitus drawings are usually preferred by scientists having more artistic ability and practice to elaborate shading by stipple, parallel lines of various spacing.

Preparation of drawings

The plane of view is never perfect and we made no special procedures of grid, matrix or reflection to produce absolute mirror symmetry when illustrating the hydroptilids. Instead, the genital structures were drawn exactly as seen in the microscope. On the drawings, setae were represented only by their alveoli, and their density is only symbolic. If essential, the setae length or setae shape are presented by drawing single or few setae only. The genital structure was traced by pencil on white paper using a drawing tube mounted on a WILD M3Z microscope at 260–416x magnification. Drawings were usually prepared in lateral, dorsal and ventral view. The lateral view is the most complete, comprising the pregenital segments VII-VIII, genital segment IX, postgenital segment X, and the entire set of periphallic organs: cerci, paraprocts, gonopods and the basal palate of the gonopods. The final illustrations were prepared by enlarging the original pencil drawings and re-drawn on transparent paper by Black India Ink.

In our diagrammatic drawings we use different linetypes with various thickness applying standard metric lines of 0.18, 0.35 and 0.70 mm (Rotring, Isograph). Thickness of contour lines represents the visibility of structures depending highly on their sclerotization. To suggest that something is less sclerotized, membranous or weakly visible we apply thinner lines as well as thicker lines for heavily sclerotized structures. Dotted lines are used to contour structure under cover of other structures and to outline segments VII and VIII. The special structural modifications developed on segments VII and VIII, like dentate patches, special processes or spiny outgrowths are emphasized by drawing with continuous lines. Dotted segment VIII with continuous drawn lines of its special structures were frequently slightly or entirely shifted in order not to overlap with segment IX and its periphallic organs. When straight, curved or crooked lines meet or intersect, they form corners and angles, in order to symbolise at least minimal signs of three-dimensional space we apply microcarving for these meeting points, that is usually not applied in diagrammatic drawings.

Nomenclature applied

The terminology applied to grooves, setal warts and genital structures follows that of by Oláh & Johanson (2007, 2008). The following terminologies were used to qualify the dimensions and extensions of genital structural elements: (1) *short* or *long* for length dimension on the longitudinal direction of coronal plane along the anteroposterior axis; (2) *low* or *high* (traditionally *shallow* or *deep* especially for excisions) for height dimension on the vertical direction of the sagittal plane along the dorsoventral axis and (3) *narrow* or *wide* (broad) on the lateral direction of the transversal plane along the mediolateral or left-right axis.

In hydroptilids all the basic periphallic structures, together with genital segment IX and postgenital segment X of the genital groundplan are present. Cerci are seldom observed in Hydroptilidae. Segment X frequently obscure and difficult to visualize. Usually located apicad of segment IX

and dorsad of phallic organ, frequently fused with segment IX. Less sclerotized, sometimes membranous, especially on cleared specimens difficult to discern its exact shape and boundaries. At higher magnification its surface microsculpture seldom glabrous, frequently coriaceous covered with microtrichia or tomentose, sometimes granulate, foveolate, punctulated often canaliculated, striated longitudinally or transversally, rugulose and narrow folded. The periphallic structures of paraproct, gonopods and basal plate of gonopods are frequently vestigial or strongly modified and were commonly present under various names in literature. The terminology systems by various authors are listed below.

Paraproct. Ventral part of segment X in *Oxyethira* spp. (Ross 1944), according to Kelley (1984) surprising for segment X to be present ventrad of phallus. Process above claspers at *Stactobiella palmata* (Ross 1944). Apophyses supérieure (Vaillant 1951). Semiannular sclerite with two spine-like asymmetric processes (Nielsen 1957). Appendices supérieure (Schmid 1959, 1983). Ventral plate of segment X when fused (Marshall 1979). Parameres at *Orthotrichia* (Wells 1979). Aedeagal sheath at *Paroxyethira* (Kelley 1989). Pair of spines arising basoventrally on segment X at *Hellyethira davidi* (Wells 2005). Subgenital appendages (Marshall 1979). Intermediate appendages (Marshall 1979). Lateral penis-sheets (Marshall 1979). Parameres when paired (Marshall 1979). Subgenital plate (Marshall 1979). Lower penis cover (Marshall 1979).

Gonopods. Inferior appendages (McLachlan 1874–1880). Claspers (Ross 1938). Apophyses inférieure (Vaillant 1951). Appendices inférieure (Schmid 1959, 1983).

Basal plate of gonopods. Bracteole (Ross 1948). Subgenital plate at *Orthotrichia cristata* (Flint 1968). Bilobed process (Marshall 1979). Dorsal process of the inferior appendages (Wells 1979, Malicky & Chantaramongkol 2007).

Depositories and abbreviations. Clemson University Arthropod Collection (CUAC). Institute of Biology and Soil Science, Russian Academy of Sciences, Vladivostok, (IBSS RAS). Natural History Museum and Institute of CHIBA, Japan (CMB-ZI). Nanjing Agricultural University (NAU). Oláh Private Collection (OPC), under national protection by the Hungarian Natural History Museum. Ito Private Collection (IPC)

TAXONOMY

Genus *Oxyethira* Eaton, 1873

Diagnosis. Segment IX completely retracted within segment VIII, venter IX pointed or rounded anteriorly, not truncate or excised mesally, caudal end of venter IX indistinct, fused with gonopods. Based upon a selection of 15 plesiomorphic and apomorphic character states (Oláh & Johanson 2011), the genus *Oxyethira* is defined in the tribe Hydroptilini as having (1) 3 ocelli present. (2) Tentorium vestigial. It means that anterior tentorial pits present with the basal third of anterior tentorial arms and the posterior two third of this arms disappeared; tentorial bridge forming a closed loop together with the posterior tentorial arms. (3) Length of first and second segments of maxillary palp shorter than wide. (4) Number of antennal segments 24–47. (5) Terminal antennal segment with blunt apex. (6) Clothing antennal setae whorled fimbriate. (7) Scapus unmodified. (8) Mesoscutellum subtriangular with convex anterior margin. (9) Mesoscutellum without transversal suture. (10) Metascutellum convexly subtriangular. (11) Spur count 034. (12) Abdominal segments unmodified. (13) Dorsolateral lobes on segment IX present. (14) Segment IX semicylindrical. (15) Segment X indistinct. (16) Cerci absent. (17) Paraproct highly modified. (18) Harpagones absent.

Subgenus *Oxyethira* Eaton, 1873

Diagnosis. The subgenus *Oxyethira* is the largest subgenus within genus *Oxyethira* and is distributed in the Holarctic and Oriental regions. Segment VIII with long ventral and short dorsal excision, pleuron often with blunt lateral processes and spines. Dorsum IX often with anterolateral lobes and/or posterolateral rounded processes. Gonopods fused basad. Spiralling paramere present.

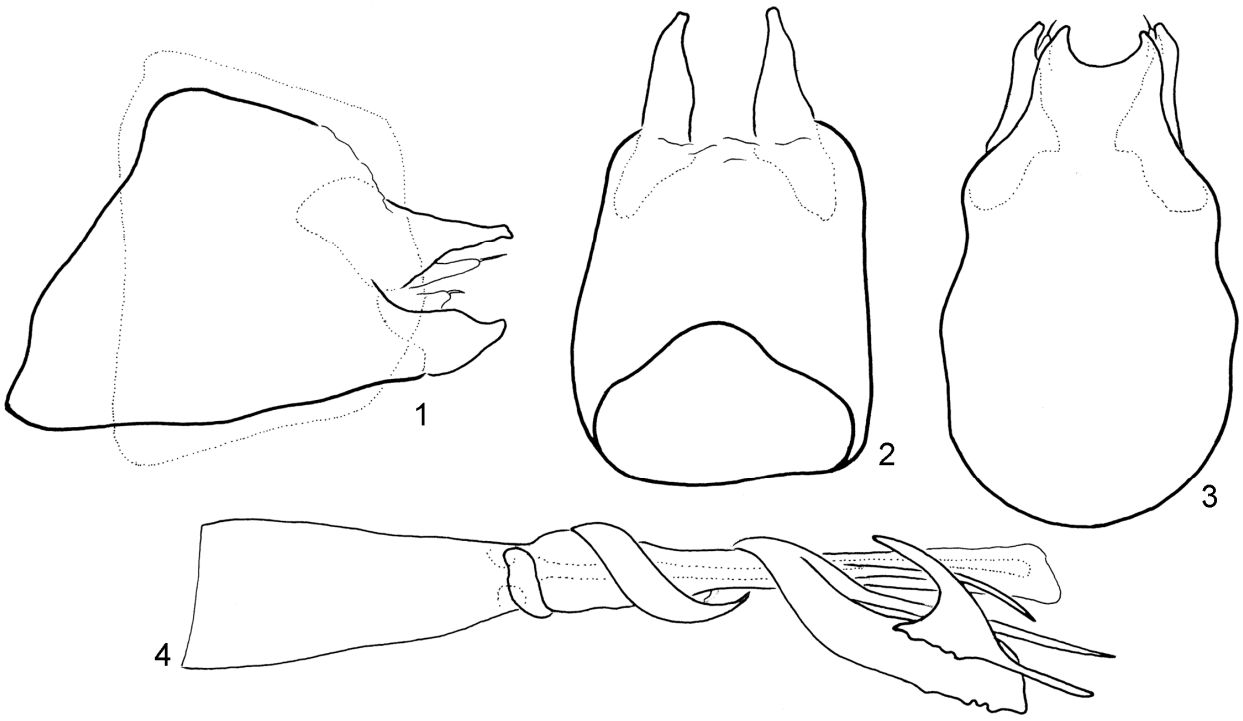
Oxyethira flavicornis species group Kelley, 1984

Diagnosis. The *flavicornis* group of the subgenus *Oxyethira* has evolved a paramere forming flattened band, that is split into two strands. One strand is usually filiform, the other strand is more robust and complex. Dorsum IX without anterolateral and posterolateral processes. Aedeagus lacking distal processes. Distributed in the Palearctic and Oriental regions, species mentioned, but not documented from Alaska and USA (Kelley 1985).

The formation of the parameres is the most reliable character to separate closely related species. The complex strand or arm of the split paramere is very diverse and species specific. This is a direct indication of the intense processes of the sexual selection (Oláh *et al.* 2012). In this species group we have separated five new species clusters: *O. datra, O. ecornuta, O. flavicornis, O. hiroshima, O. tiunovae*.

Oxyethira datra new species cluster

Diagnosis. This species cluster is distinguished by the following combination of characters: simple apical margin of segment VIII without produced lobes or processes; simple pair of paraprocts straight in lateral view with capitate or malleolate apex; deep mesal excision on the fused gonopod; very complex paramere with anterad turning spine. Four species belong to this group: *O. datra* Oláh, 1989; *O. josifovi* Kumanski, 1990; *O. kakida* sp. nov.; *O. sichuanensis* Yang & Kelley, 1997.



Figures 1–4. *Oxyethira datra* Oláh, 1989, male holotype. 1 = genitalia in left lateral view, 2 = genitalia in dorsal view, 3 = genitalia in ventral view, 4 = phallic organ in left lateral view.

Oxyethira datra Oláh, 1989

(Figures 1–4)

Oxyethira datra Oláh, 1989: 287–288, male, Vietnam.

Material examined. Holotype. Vietnam, Cuc Phuong, 400 m, 17.X.1986, light, leg. J. Oláh (1 male, OPC). Holotype is in a rather disintegrated condition. Right forewing and hindwing are mounted in dry preparation under glass cover; rest is in alcohol: body without right wings and abdomen is in separate glass vial; abdomen without phallic organ is in separate glass vial. Dissected phallic organ was lost during redrawing procedure!

Remarks. The Holotype was redrawn. The slightly capitate, malleolate and truncate apex of paraproct is similar to *Oxyethira josifovi*, gonopod less deeply excised in ventral view and the paramere is easily distinguishable by its triple coiling or spiralling and by the fine structure of the complex strand.

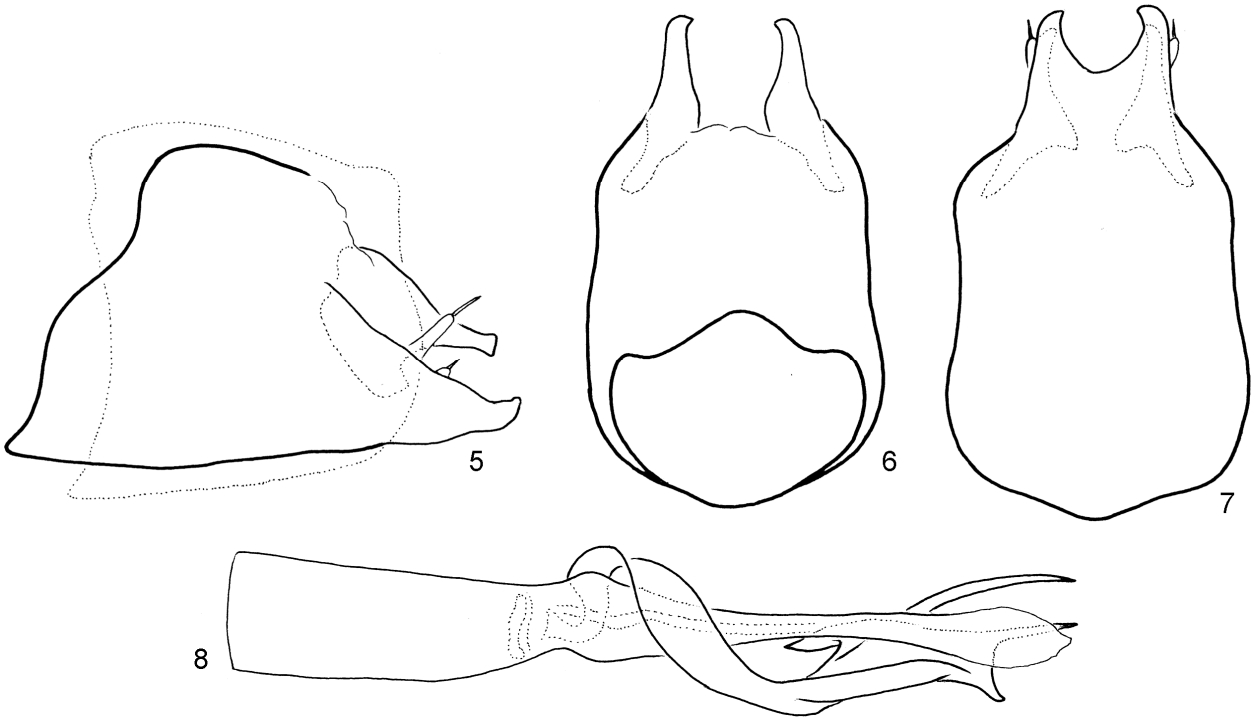
Oxyethira josifovi Kumanski, 1990

(Figures 5–8)

Oxyethira josifovi Kumanski, 1990: 57–59, male, female, Korea.

Material examined. Holotype. Korea, 25 km E of Vonsan, 1–3 km from the sea, near Casan village, stream and small torrents of the plain, 6.X.1978, leg. K. kumanski. According to Y. Vidinova and S. Beshkov (Zoological Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria) all the holotypes in the Kumanski's collection in the Zoological Institute, Sofia is well preserved, however the holotype of *Oxyethira josifovi*, the single specimen of this species is lost, probably during a loaning procedure.

Remarks. Paraproct is similar to *Oxyethira datra*, gonopod more deeply excised and the paramere is easily distinguishable by its single coiling or spiralling and by the fine structure of the complex strand.



Figures 5–8. *Oxyethira josifovi* Kumanski, 1990, male holotype (adapted from original illustration). 5= genitalia in left lateral view, 6 = genitalia in dorsal view, 7 = genitalia in ventral view, 8 = phallic organ in left lateral view.

Oxyethira kakida **sp. nov.**

(Figures 9–12)

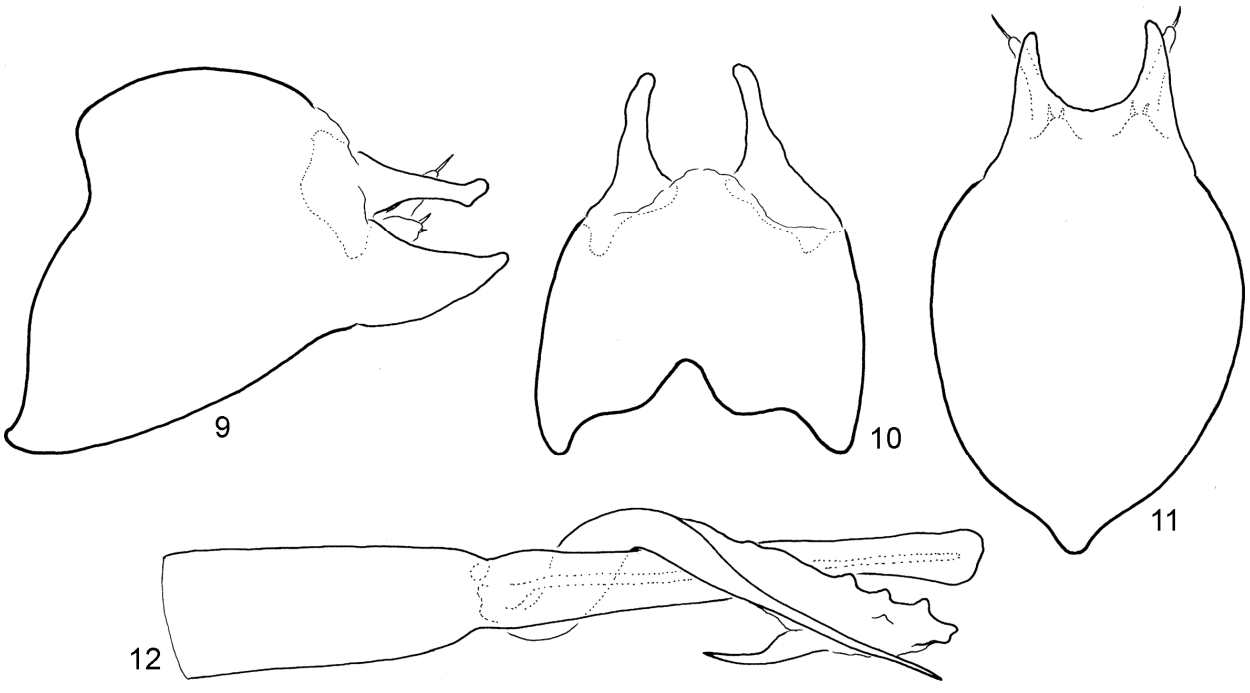
Oxyethira josifovi Nozaki & Tanida, 2007: 246, Honshu (Shizuoka). Misidentification.
Oxyethira datra Malicky & Chantaramongkol, 2007: 1030, Hokkaido (Chitose). Misidentification.

Diagnosis. This new species belongs to *O. datra* species cluster and has periphallic organs of paraproct, gonopods and basal plate of gonopods similar to *O. sichuanensis* Yang & Kelley, 1997 described from China (Sichuan), but differs by having antennal segment 41, not 47; excision on gonopod rounded, not triangular; the complex strand of the paramere with blunt apex, not spine-like; the anterad directed spine on this strand more axial, not right-angled.

Material examined. Holotype. *Japan*, Honshu, Shizuoka, Shimizu-cho, Kakida-gawa, N35°06' 11", E138°54'10", 13 m, 11–15.V.2002, Malaise trap, leg T. Nozaki (1 male, CMB-ZI 146972).

Paratypes. Data same as of holotype (4 males, 5 associated females; CMB-ZI 146973–146981). Honshu, Tokyo, Fussa-shi, Fussa, Nagata-bashi, N 33°44'46", E 139°18'39", 3.VIII.2011, leg. T. Nozaki & T. Kagaya (1 male, 1 female; CMB-ZI 146982-146983). Honshu, Yamagata, Kaneyama-machi, Kanayama-gawa, 11.X.1999, leg. A. Ohkawa (5 males, 5 females; OPC). Hokkaido, Ishikari, Chitose-shi, Bibi, Lake Chitose-ko, 8. VII.2001, light trap, leg. T. Ito & A. Ohkawa (1 male; OPC).

Other specimens. Honshu, Yamagata, Kaneyama-machi, Kanayama-gawa, Araya-bashi, 14. X.1999, leg. A. Ohkawa (3 males, 5 females; IPC). Hokkaido, Ishikari, Chitose-shi, Bibi, Bibigawa River, Bibi-bashi, light trap, 24.IX. 1999, leg T. Ito (3 males; IPC). Hokkaido, Kushiro-shi, Akan-cho, Ibeshibetsu-gawa, middle area, 13.IX.1999, light trap, leg. T. Ito (2 males, 3 females; IPC). Hokkaido, Kushiro-shi, Akan-cho, Akan-kohan, Ibeshibetsu, 27.VII.2012, light trap, leg. T. Ito (1 male, 1 female; IPC). Hokkaido, Shibetsu-cho, Ichani-gawa, Chishine-bashi, light, 21.VII.1996, leg. T. Ito & A. Ohkawa (2 males, 1 female; IPC). Hokkaido, Obihiro-shi, Izumi-cho, Tobetsu-gawa, Izumi-bashi, 11.VI.1997, leg. A. Ohkawa (1 male; IPC). Hokkaido, Shibecha-cho, Kayanuma, Shirarutoroetoro-gawa, Tomi-bashi, 4.IX.2008, leg. T. Ito (1 male; IPC).



Figures 9–12. *Oxyethira kakida* sp. nov. male holotype. 9 = genitalia in left lateral view, 10 = genitalia in dorsal view, 11 = genitalia in ventral view,12 = phallic organ in left lateral view.

Description. Male (in alcohol). Light brown. Forewing length 2.3 mm. 3 ocelli present. Antennal segments 37–42; terminal segment blunt; clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short ventromesal process. Segment VIII annular; less excised dorsoapicad and more ventroapicad.

Male genitalia. Segment IX completely enclosed within VIII; ventrum longer than dorsum, ovoid in ventral view with small triangle anteromesad. Segment X reduced to short membranous lobe. Pair of paraproct almost straight in lateral view with capiate malleolate apex. Gonopods fused basad to the ventrum IX deeply and roundly excised and produced into lateral narrow lobes. Basal plate of gonopods forming long bilobed process and short setose lobes. Phallic organ with paramere encircling shaft once and split into a filiform and into a more complex arm; the complex arm serrated and armed with an anterad directed, almost axial spine.

Etymology. The name *kakida* is a noon in apposition, coined from the name of the holotype locality.

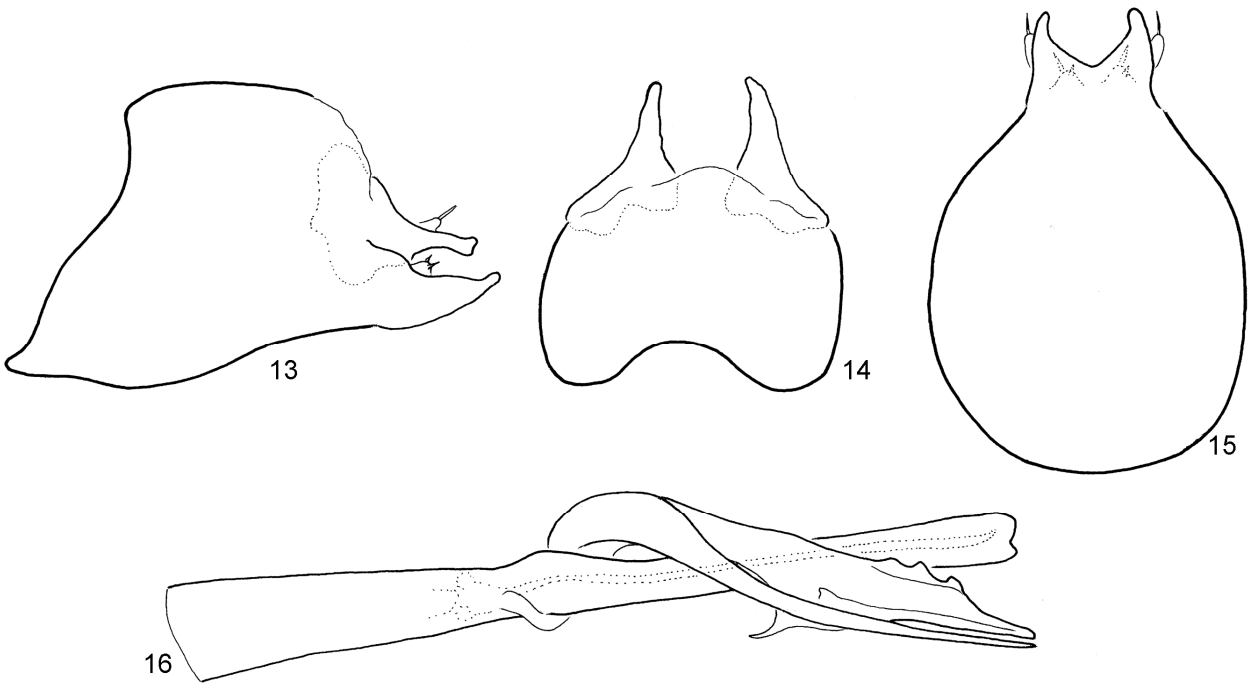
Oxyethira sichuanensis Yang & Kelley, 1997

(Figures 13–16)

Oxyethira sichuanensis Yang, Kelley & Morse, 1997: 92–95, male, China (Sichuan).

Material examined. Paratype. *China*, Sichuan Province, Nanpingxian, Jiouzhaigou, Shuzhengqunhai, 2250 m, 26.VI.1990, leg. J. C. Morse (deposited in CUAC).

Remarks. In lateral view we have found the dorsal margin of the complex strand of the paramere serrated, not simple as it is indicated on the holotype drawings. Moreover there is a longitudinal ridge running along and ending in a tooth on the middle of the strand.



Figures 13–16. *Oxyethira sichuanensis* Yang & Kelley, 1997, male. 13 = genitalia in left lateral view, 14 = genitalia in dorsal view, 15 = genitalia in ventral view, 16 = phallic organ in left lateral view.

Oxyethira ecornuta new species cluster

Diagnosis. This small species cluster is distinguished by the following combination of characters: simple apical margin of segment VIII without produced lobes or processes; simple pair of robust and broad-based paraprocts; wide and shallow mesal excision on the fused gonopod; simple trifid paramere. Two species belong to this species cluster: *O. acuta* Kobayashi, 1977 and *O. ecornuta* Morton, 1893.

Oxyethira acuta Kobayashi, 1977

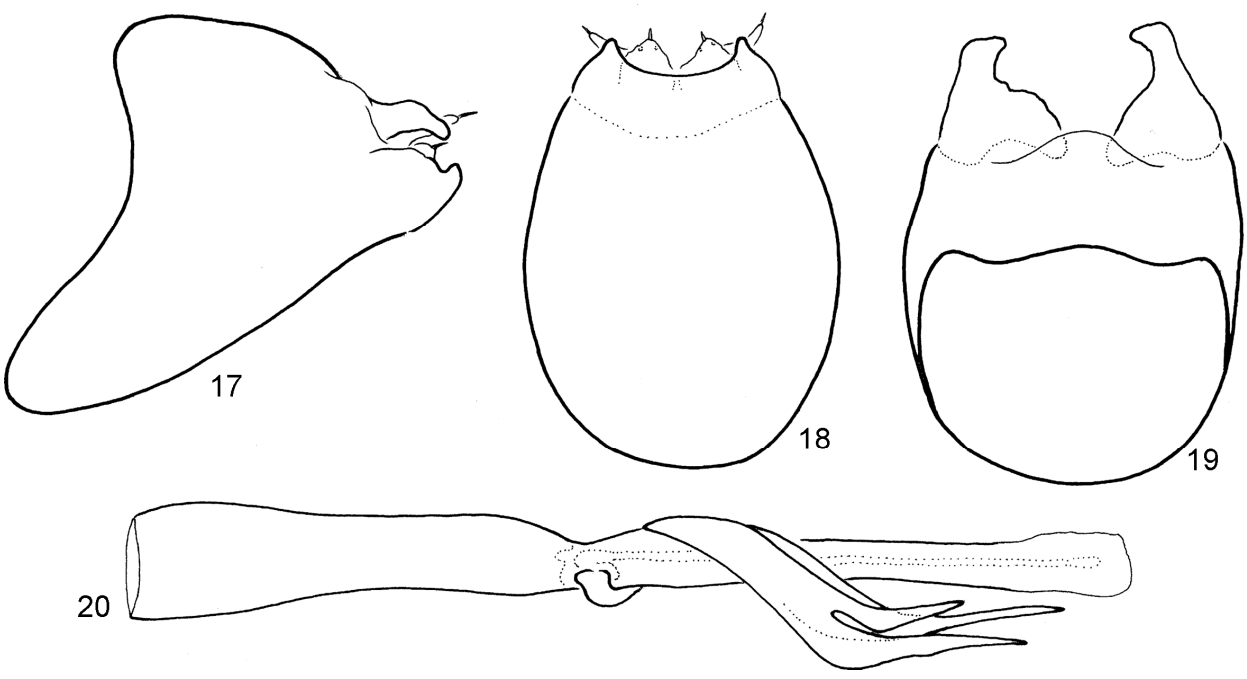
(Figures 17–20)

Oxyethira acuta Kobayashi, 1977: 6–7, pls. 5–6, male, female, Hokkaido (Iburi); Ito & Kawamula 1984: 313–317, pupa, larva, case, life cycle, Hokkaido (Iburi); Ito 2005: 442, 444, larva, case.

Material examined. Holotype. *Japan*, Lake Utonai-ko, Utonai, Tomakomai-shi, Hokkaido, 17.VIII.1976, leg T. ITO (M.5120, deposited in the form of glass slide specimen CMB-ZI).

Other specimens. Hokkaido, Iburi, Tomakamai-shi, Lake Utonai-ko, 22.VII.2004, leg. T. Ito (10 males, 5 females; OPC). Hokkaido, Iburi, Tomakamai-shi, Bibigawa River, Uenaebashi Bridge, 5.VIII.2010, leg. T. Ito (5 males, 5 females; IPC). Hokkaido, Kushiro, Kushiro-shi, Akan-cho, Lake Akan-panke-to, 14.IX.1999, sweep, leg. T. Ito (5 males, 5 females; IPC). Hokkaido, Kushiro, Shibecha-cho, Lake Shirarutoro-ko, 25.VII.2008, light, leg. T. Ito (3 males, 3 females; IPC). Hokkaido, Ishikari, Sapporo-shi, Nopporo-shinrin-koen Park, 14.VII.2004, light, leg. Y. Nagayasu & T. Ito (10 males, 10 females; IPC).

Remarks. We have examined the holotype embedded in a permanent glass slide. The preparation is in good condition, permitting clear dorsoventral view of the gonopod and paraproct. The fused gonopod and paraprocts on the holotype preparation is identical to the animals collected from the locus typicus. These specimens were used for examination and for producing detailed drawings with lateral view. The examined genital structure clearly relates this species to the *Oxyethira flavicornis* species group and to the *Oxyethira ecornuta* species cluster.



Figures 17–20. *Oxyethira acuta* Kobayashi, 1977, male. 17 = genitalia in left lateral view, 18 = genitalia in dorsal view, 19 = genitalia in ventral view, 20 = phallic organ in left lateral view.

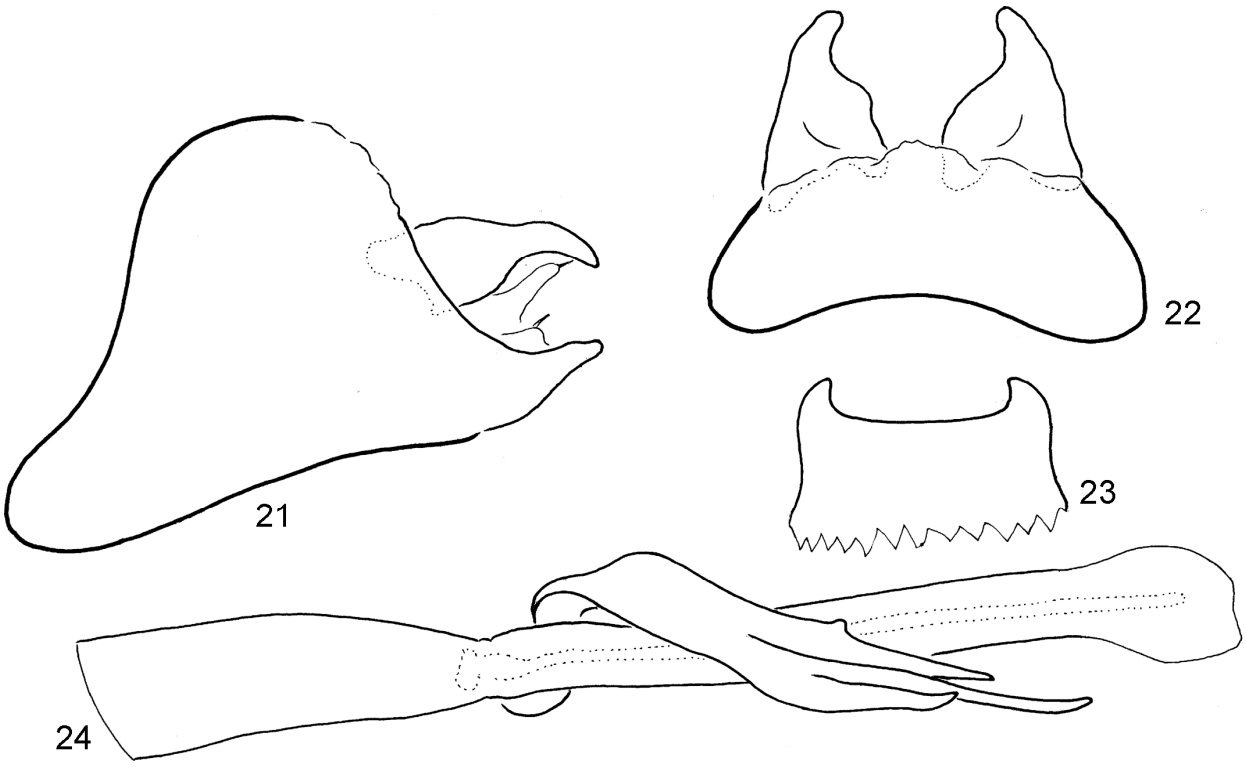
***Oxyethira ecornuta* Morton, 1893**

(Figures 21–24)

Oxyethira ecornuta Morton, 1893: 79–80, male, female, Finland. Botosaneanu & Levanidova 1988: 174–175, male, Russian Far East (South Primorye).

Material examined. Finland. We have examined the type material deposited in the Zoological Museum**,** Helsinki, Finland. There is only a single male complete specimen with abdomen remained from the three syntypes described by Morton (1893). First syntype is lost. Second syntype is a pinned animal, its abdomen is lost. Documentation. *White label*: Teisko; *White label*: J. Sahlb.; *White label*: 42; *White label, handwriting*: *Oxyethira ecornuta* n. sp.; *White label with black margin*: Mus. Zool. H:fors Spec. typ. No 6531 handwriting: *Oxyethira ecornuta* Mort; *Orange label*: Mus. Zool. Helsinki Loan No. M912; *White label with black margin*: *Oxyethira ecornuta* Morton det. R. W. Kelley 1982. Third Syntype is complete and here is designated as *Lectotype*. It is represented by 2 embedded preparations; first preparation: the intact animal without genital segments; second preparation: the genital segments in dorsoventral plane. Documentation: *White label*: Teisko; *White label*: J. Sahlb.; *White label*: 42; *White label, handwriting*: *Oxyethira ecornuta* n. sp.

New collection from Finland. Kb: Tuupovaara, Ollola, WGS84, N62.3832 °,E30.7826 °, 15.V–15. VI.2008, leg. A. Rinne (1 male; OPC). *Russia*. Far East, Primorye, Khanka Lake, 23.VII.1997, leg. T. S. Vshivkova (1 male, 1 female; OPC; 1 male, 2 females; IPC). *Sweden*. Am Herkepelejaure, Srasse Jokkmokk-Messaure Norbotten, Lappland, 7.VII.1966 leg. W. Tobias (4 males, ex Coll. W. Tobias; OPC).



Figures 21–24. *Oxyethira ecornuta* Morton, 1893, male. 21 = genitalia in left lateral view, 22 = genitalia in dorsal view, 23 = gonopods in ventral view; 24 = phallic organ in left lateral view.

Remarks. In the permanent preparation of the lectotype the cleared genital segments embedded in slightly (10°) leftlateral dorsoventral plane. The preparation is in good condition permitting clear dorsoventral view of the gonopod and paraproct. The slight, 10° torsion in view produces an unclear view of the phallic organ. It is however discernible that the paramere split into filiform and complex strands. The complex strand seems simply bifid on its apical third at least as visible in specimens collected newly in Finland and Sweden not far from the locus typicus. Drawings in lateral view were prepared from newly collected specimens. These drawings well correspond with the holotype. We have examined specimens from Russian Far East and found it identical with the holotype and with the newly collected Scandinavian specimens.

Oxyethira flavicornis new species cluster

The name-bearing species of the *Oxyethira flavicornis* species group stands alone by the following combination of characters: segment VIII with ventroapical and dorsoapical processes; simple paraprocts; small rounded mesal excision on gonopods; simple bifid paramere.

Oxyethira flavicornis (Pictet, 1934)

(Figures 25–28)

Hydroptila flavicornis Pictet, 1834: 225.

Oxyethira flavicornis (Pictet, 1834), possible senior synonym of *Oxyethira costalis* Eaton 1873 nec Curtis, 1834 (Neboiss 1963: 594–595).

Hydroptila costalis Curtis, 1834 sensu Eaton 1873, type species of the genus *Oxyethira* by original designation (Neboiss 1963: 594–595).

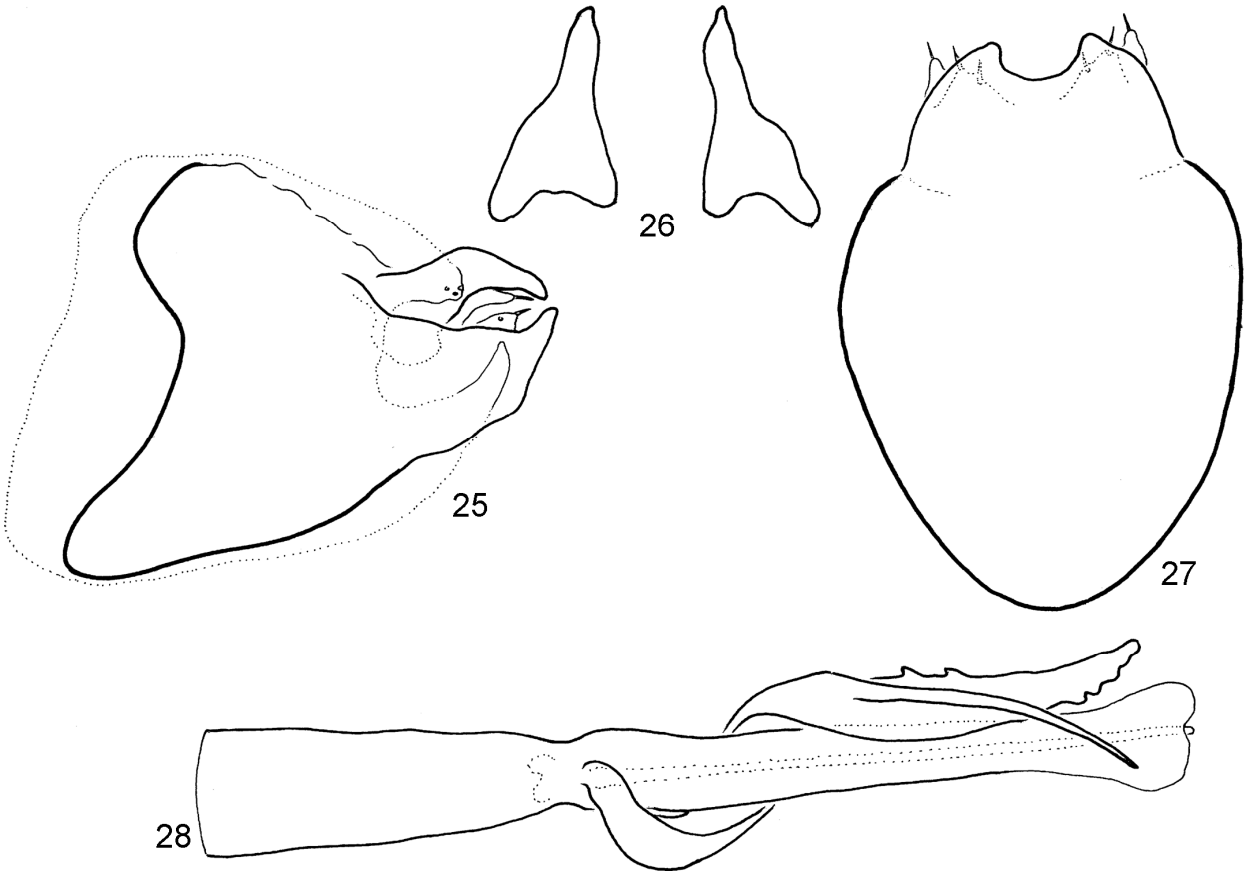
Oxyethira costalis Eaton 1873: 144–145, nec Curtis, 1834, Eaton's description and figures are not those of Curtis species *costalis*. *Oxyethira costalis* Eaton nec Curtis was renamed with some doubt by the first available synonym: *Hydroptila flavicornis* Pictet (Neboiss, 1963: 594–595).

Material examined. Austria, Lunz am See, light, leg. H. Malicky (92 males, 64 females; presented by H. Malicky, OPC). *Finland*, Ta: Valkeakoski, Saarioisjarvi, WGS84, N61.160° E24.022°, 5.VI.2012, leg. J. Salokannel (3 males, 7 females; OPC). Ta: Nokia, Pitkaniemi, WGS84, N61.4827° E23.5897°, 5.VIII.2012, leg. J. Salokannel (4 males; OPC). *Hungary*, Csobánka, 12. V.1976, leg. H. Steinmann, (1 male; OPC). Gyékényes, Lankóci erdő, 29.IV.2001, light, leg. Á. Uherkovich (10 males, 92 females; OPC). River Batár at Magosliget, 20.VII.2010, light, leg. J. Oláh (1 female; OPC). *Norway*, Finnmark, Kautokeino, Lahpoluoppal, ved innsjo, N69.20992° E23.757661° 320 m, 25.VI–9.VII.2010, Malaise trap, leg. Finnmarks Prosjektet (4 males, present by T. Andersen, Bergen Museum; OPC). *Sweden*, SÖ, Botkyrka km., Salem k:a, bank at Bornsjön, 4.VII.2003, light trap, leg. K. A. Johanson (1 male, present by K. A. Johanson; OPC). SÖ, Södertalje, Lake Uttran, at SW shore, 17.VI.2009, light trap, leg. K. A. Johanson (1 male, 3 females; present by K. A. Johanson; OPC). UP, Lövstabruk, 20-23.VIII.1992, Malaise trap, leg. Hippa & Gufstansson (1 male; 2 females; present by K. A. Johanson; OPC). UP, Nesodden, Frangerstrand, 10-11.VIII.1997, light trap, leg. S. Kobro (1 male; present by K. A. Johanson; OPC).

Remarks. Routine examination of the paramere of this widely distributed species produced excellent drawings, but without clear indication of the split bifid state of the flat paramere (Kimmins 1958). Kelley (1985) has redrawn the phallic organ with bifid paramere, however both strands look filiform. We have examined several specimens from Austria, Finland, Hungary, Norway and Sweden and have detected the split bifid paramere with filiform and complex strands. The flat and broad complex strand has two teeth on the dorsum middle and 2–3 teeth on the ventrum subapicad.

Oxyethira hiroshima new species cluster

Diagnosis. Several apomorphic and plesiomorphic characters distinguish this species cluster having the following combination of characters: development of ventroapical processes on segment VIII; presence of the produced ventroapical mesal region on the segment IX; very complex paraproct; simple bifid paramere.



Figures 25–28. *Oxyethira flavicornis* (Pictet, 1934), male. 25 = genitalia in left lateral view, 26 = paraproct in dorsal view, 27 = genitalia in ventral view, 28 = phallic organ in left lateral view.

Oxyethira hiroshima **sp. nov.**

(Figures 29–33)

Diagnosis. Having the ventroapical lateral corner of segment VIII and the ventroapical mesal region of segment IX produced, as well as very complex paraproct this new species is similar to *O. mekunna* sp. nov., but differs by the ventroapical lateral corner produced into a long stout process with spiny head, not into a short truncate process without spiny head; the ventroapical mesal region of segment IX produced into short blunt outgrowth, not into a long slender process; paraproctal complex more complicated; paramere simply split into two strands, not trifid.

Material examined. Holotype. *Japan*, Honshu, Hiroshima, Hatsukaichi-shi, Yoshiwa, Hosomi-dani, N34° 33’01”, E132°06’44”, 820 m, 11.V–7. VI.2005, Malaise trap, leg. I. Mori (1 male; CMB-ZI 146984).

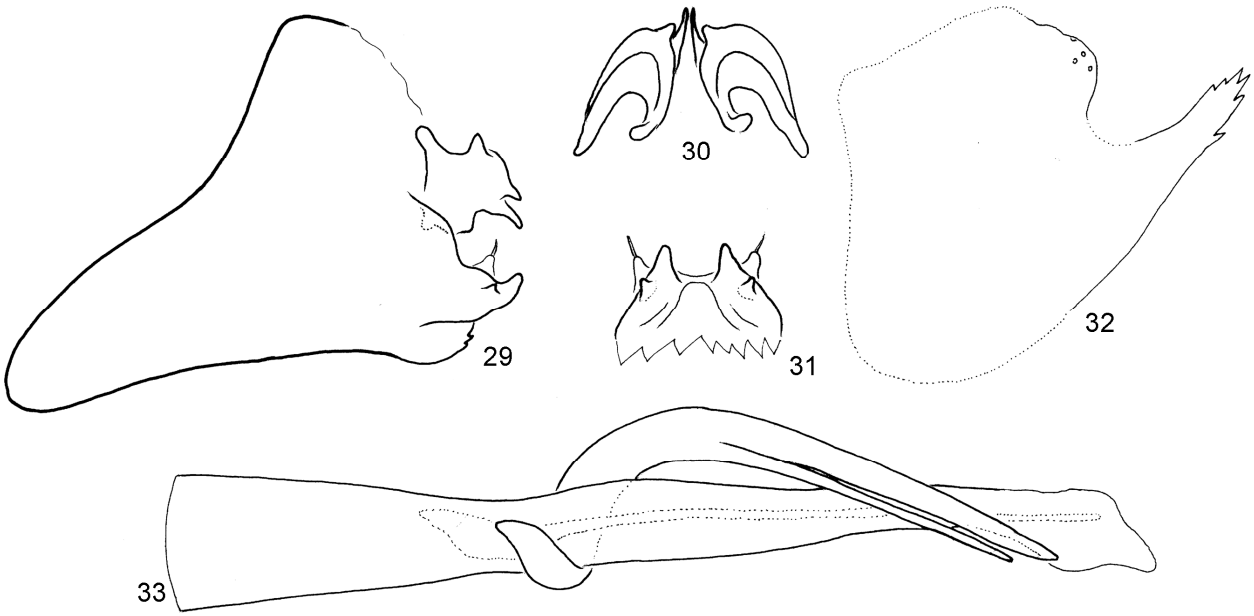
Other specimen. Honshu, Hiroshima, Hatsukaichi-shi, Yoshiwa, Hosomi-dani, N34°33’01”, E132°06’44”, 820 m, 9.X.2004-11.V.2005, Malaise trap, leg. I. Mori (1 male; IPC).

Description. Male (in alcohol). Light brown. Forewing length 3.1 mm. 3 ocelli present. Antennal segments 31; terminal segment blunt; clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short

ventromesal process. Segment VIII annular; less excised dorsoapicad and more ventroapicad; dorsoapical lobes short rounded, ventroapical lateral processes long with spiny apex.

Male genitalia. Segment IX completely enclosed within VIII; ventrum long and rounded ovoid in ventral view; dorsum short. Segment X reduced to short membranous lobe. Pair of paraproct very complex both in dorsal and lateral view, mesad almost touching. Gonopods heavily sclerotized pair of elongated triangle with short lateral tooth, fused together mesobasad as well as to ventrum IX; ventrum IX produced into a mesal hump. Basal plate of gonopods forming long bilobed process and short setose lobes. Phallic organ with paramere encircling shaft once and split into a filiform and into a more robust straight arm.

Etymology – The name *hiroshima* is a noon in apposition coined from the name of the holotype locality.



Figures 29–33. *Oxyethira hiroshima* sp. nov. male holotype. 29 = genitalia in left lateral view, 30 = paraproct complex indorsal view, 31 = gonopods in ventral view, 32 = segment VIII in lateral view, 33 = phallic organ in left lateral view.

***Oxyethira mekunna* sp. nov.**

(Figures 34–38)

Diagnosis. Having the ventroapical lateral corner of segment VIII and the ventroapical mesal region of segment IX produced, as well as a complex paraproct this new species is similar to *O. hiroshima* sp. nov., but differs by the ventroapical lateral corner of segment VIII produced into a short truncate process without spiny head, not into long stout process with spiny head; the ventroapical mesal region of segment IX produced into a long slender process not into short blunt outgrowth; paraproctal complex not so much complicated; paramere trifid, not simply split into two strands.

Material examined. Holotype. *Japan*, Hokkaido, Shiribeshi, Iwanai-cho, Mekkunai-shitsugen, marsh, N42°52’24”, E140°30’17”, 900 m, 1.VIII. 1998, leg. M. Ôhara *et al.* (1 male; CMB-ZI 146985).

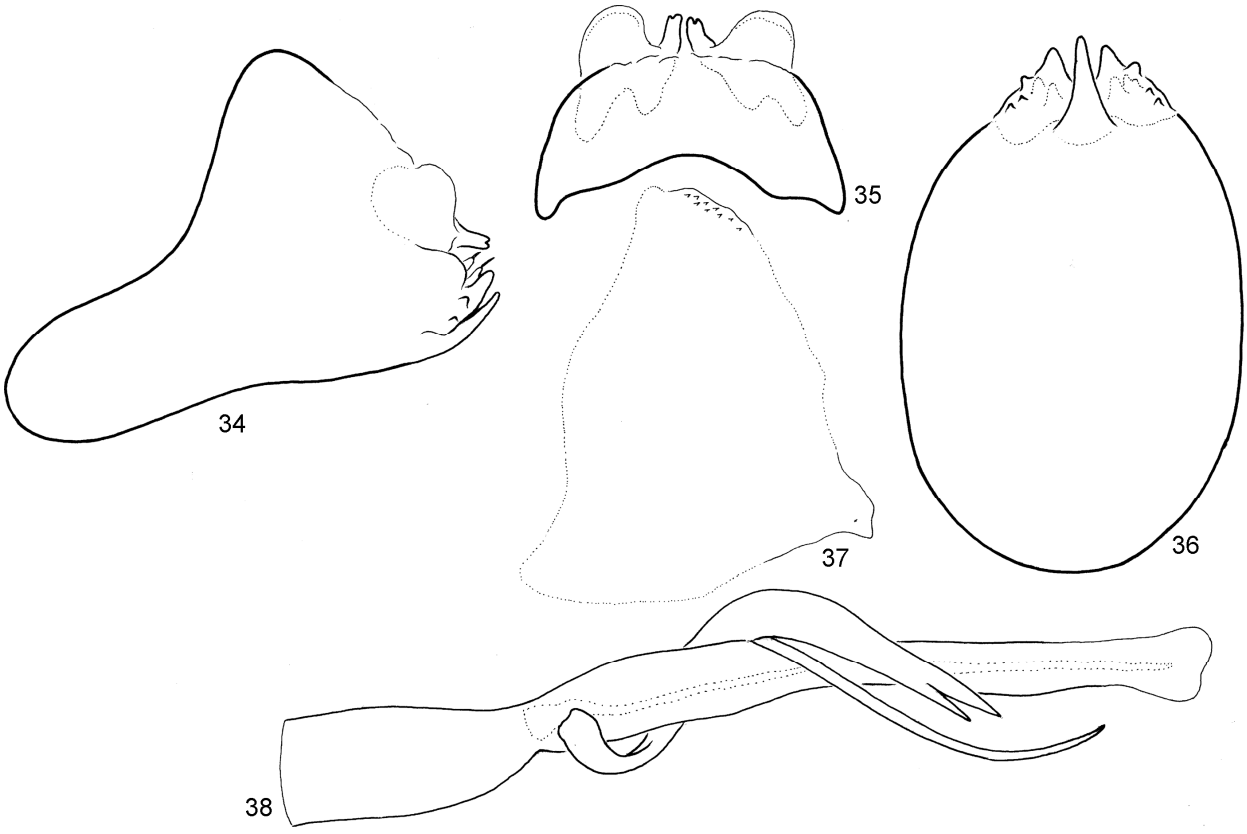
Paratypes. Locality same as of holotype (2 males, 3 females; CMB-ZI 146986-146990). Hokkaido, Shiribeshi, Iwanai-cho, Pankemekunnai-shitsugen, marsh, 13.VII.1997, leg. A. Yamamoto *et al.* (5 males, 2 females; OPC).

Other specimens. Same as of holotype (2 males, 2 females, IPC). Hokkaido, Uryu-cho, Uryu-numa, Shokambetsu, 4-6.VIII.1976, leg. T. Hattori (1 male, mounted; IPC). Hokkaido, Kami-shihoro-cho, Tokachi-mitsumata, Karafuto-daio, small stream, 13.VI.1996, leg. A. Ohkawa (2 males; IPC).

Description. Male (in alcohol). Light brown. Forewing length 2.6 mm. 3 ocelli present. Antennal segments 31; terminal segment blunt; clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short ventromesal process. Segment VIII annular; less excised dorsoapicad and more ventroapicad; dorsoapical lobes lacking, ventroapical lateral processes short obliquely truncate.

Male genitalia. Segment IX completely enclosed within VIII; ventrum long and rounded ovoid in ventral view; dorsum short. Segment X reduced to short membranous lobe. Paraproct complex with a rounded body accompanied by mesal pair of more sclerotized digitiform processes ending in shallowly bifid apex. Gonopods heavily sclerotized pair of triangle with short lateral teeth, fused together mesobasad as well as to ventrum IX; ventrum IX produced into an apicomesal long process. Basal plate of gonopods discernible as a bilobed process. Phallic organ with paramere encircling shaft once and split into a longer filiform and into a more robust straight arm, robust arm bifid.

Etymology. The epithet *mekunna* is coined from the name of the holotype locality.



Figures 34–38. *Oxyethira mekunna* sp. nov. male holotype. 34 = genitalia in left lateral view, 35 = paraproct complex in dorsal view, 36 = genitalia in ventral view, 37 = segment VIII in lateral view, 38 = phallic organ in left lateral view.

***Oxyethira tiunovae* new species cluster**

Diagnosis. This species cluster is distinguished by the following combination of characters: simple apical margin of segment VIII without produced lobes or processes; simple pair of slender paraprocts downward curving in lateral view; medium deep mesal excision on the fused gonopod; trifid paramere with right-angled turning spine. Three species belong to this group: *O. chitosea* sp. nov.; *O. hena* sp. nov.; *O. tiunovae* Arefina & Armitage, 2003.

***Oxyethira chitosea* sp. nov.**

(Figures 39–42)

Diagnosis. This new species has periphallic organs of paraproct, gonopods and basal plate of gonopods similar to *O. tiunovae* described from the Ussuri River Basin and Sakhalin, but differs by having paramere differently formed.

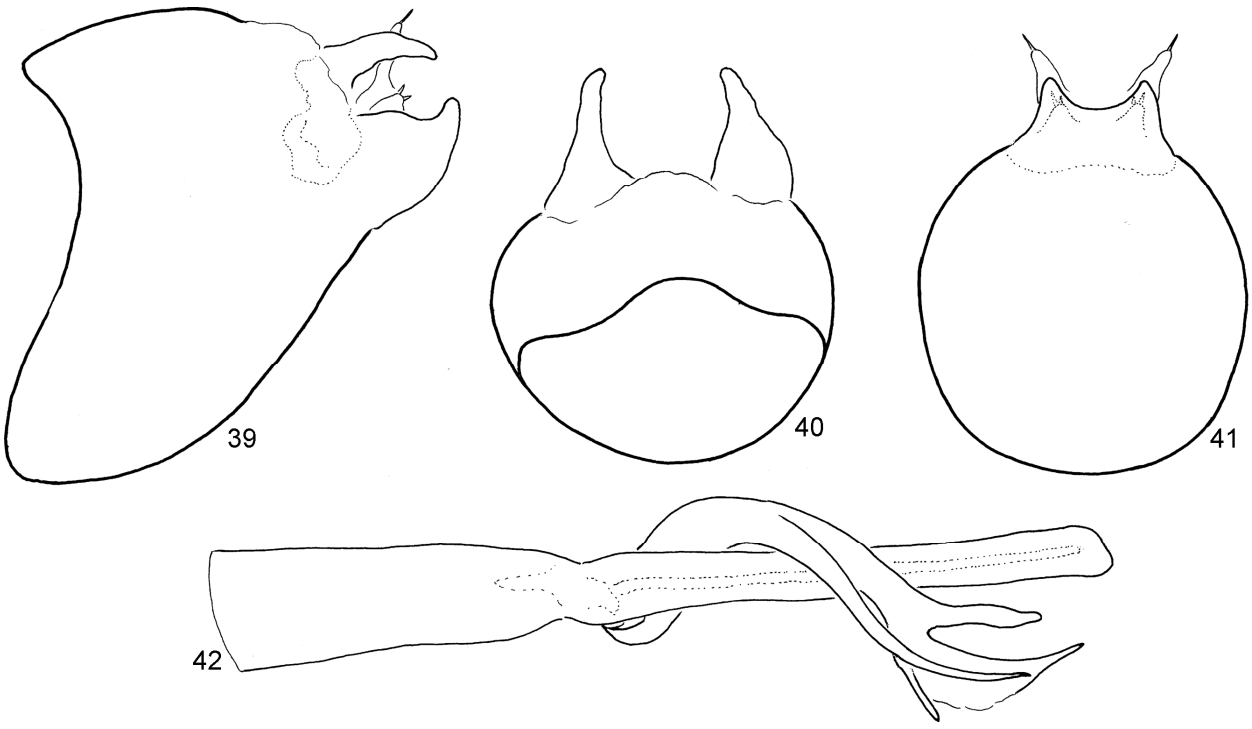
Material examined. Holotype. *Japan*, Hokkaido, Ishikari, Chitose-shi, Bibi, Lake Chitose-ko, N42°46'24", E141°43'29", 15 m, 8.VII.2001, light trap, leg. T. Ito (1 male; CMB-ZI 146991).

Paratypes. Data same as of holotype (1 male; CMB-ZI 146992; 1 male; OPC).

Other specimens. Hokkaido, Chitose-shi, Mombetsu-gawa, 240 m, 14.VII.2000, light trap, leg. T. Ito (1 male; IPC). Hokkaido, Eniwa-shi, I-chankoppe-zawa, 300 m, 10.VIII.2010, light, leg. T. Ito (1 male; IPC). Hokkaido, Kushiro-shi, Akan-cho, Ibeshibetsu-gawa, headwater, 1.VII. 1996, leg. T. Ito & A. Ohkawa (1 male, 2 females; IPC). Hokkaido, Shibecha-cho, Kayanuma, Shira-rutoroetoro-gawa, Tomi-bashi, 4.IX.2008, light trap, leg. T. Ito (1 male; IPC).

Description. Male (in alcohol). Light brown. Forewing length 2.3 mm. 3 ocelli present. Antennal segments 35; terminal segment blunt; clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short ventromesal process. Segment VIII annular; less excised dorsoapicad and more ventroapicad.

Male genitalia. Segment IX completely enclosed within VIII; ventrum longer than dorsum almost,



Figures 39–42. *Oxyethira chitosea* sp. nov. male holotype. 39 = genitalia in left lateral view, 40 = genitalia in dorsal view, 41 = genitalia in ventral view, 42 = phallic organ in left lateral view.

circular in ventral view. Segment X reduced to short membranous lobe. Pair of paraproct downward curving hook-shaped in lateral view. Gonopods fused basad to the ventrum IX and produced into lateral triangular lobes. Basal plate of gonopods forming long bilobed process and short setose lobes. Phallic organ with paramere encircling shaft once and split into a filiform and into a more complex arm; the complex arm split into three unequal branches as visible in ventral view.

Etymology. The epithet *chitosea* is coined from the name of the holotype locality.

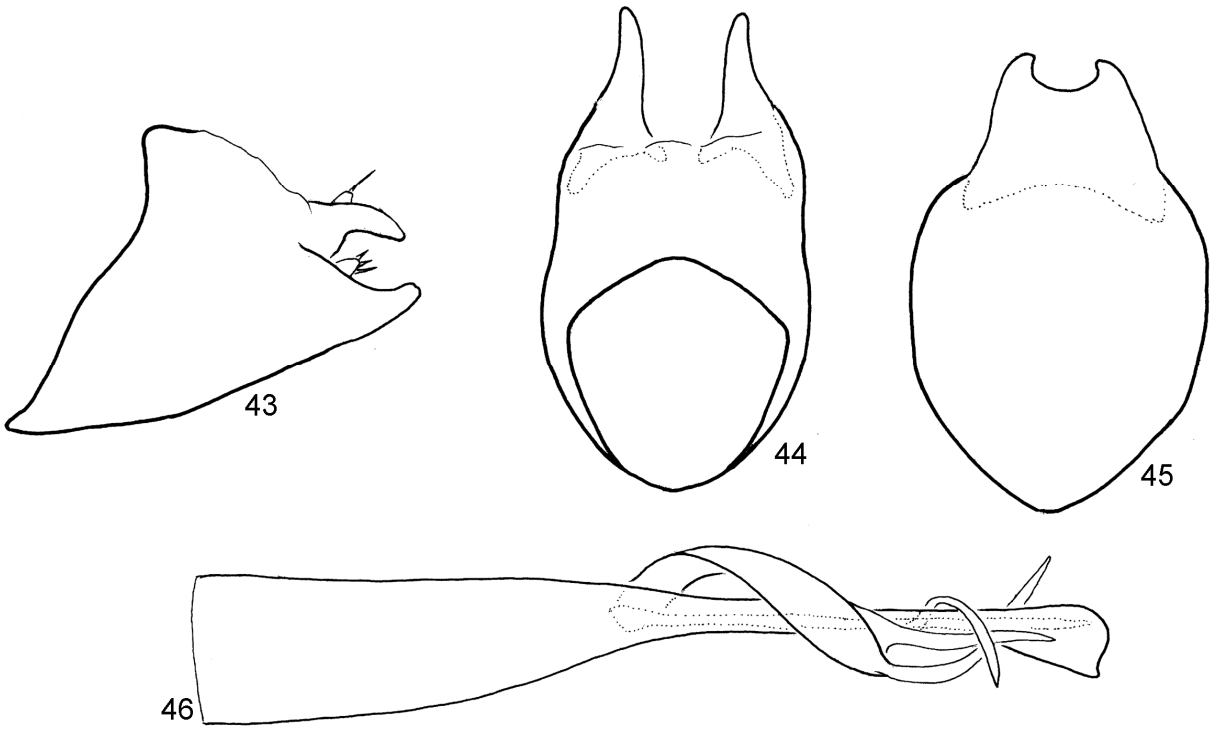
***Oxyethira hena* sp. nov.**

(Figures 43–46)

Oxyethira ecornuta Xue & Yang 1991: 20–21, male, China (Henan). Misidentification.

Diagnosis. This new species was described as *O. ecornuta* from Henan Province. After examining the details of the genital structure of the *O. ecornuta* holotype as well as the newly collected specimens from nearby the locus typicus and compared them with the drawings of the Chinese specimen from Henan we concluded that this Chinese specimen is a new species. It has simple apical margin of segment VIII without produced lobes or processes; simple pair of slender paraprocts downward curving in lateral view; medium deep mesal excision on the fused gonopod; trifid paramere with right-angled turning spine. This character combination relates it to the *O. tiunovae* new species cluster, but differs from both *O. chitosea* sp. nov. and *O. tiunovae* by the different structure of the complex strand of the paramere.

Material examined. Holotype. *China,* Henan Province, Lin county, Qi river, N36.06°, E 113.81°, 27.VIII.1988, leg. Y. Xue. (1 male; NAU).



Figures 43–46. *Oxyethira hena* sp. nov. male holotype (adapted from original illustration). 43 = genitalia in left lateral view, 44 = genitalia in dorsal view, 45 = genitalia in ventral view, 46 = phallic organ in left lateral view.

Paratype. Guangdong Prov, Bo-luo County, Luo-fu Shan, unnamed stream, 400 m on trail to Shan-bei-shui,strailhead 3.2 km W of ridge of Cha Shan, N23.31900°, E114.01157°, 290 m, 1.VI.2004, leg. J. C. Morse, X. Zhou, J. Geraci (1 male; NAU).

Etymology. The epithet *hena* is coined from the name of the holotype locality.

Oxyethira tiunovae Arefina & Armitage, 2003

(Figures 47–49)

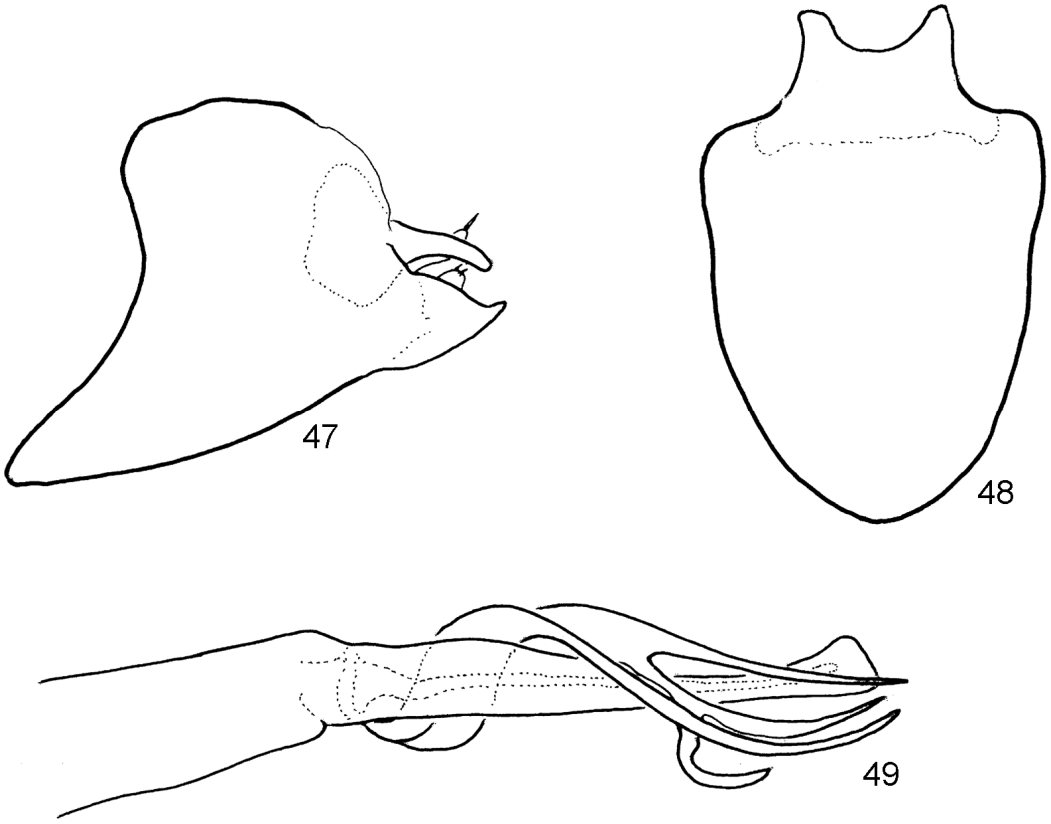
Oxyethira tiunovae Arefina & Armitage, 2003: 16–17, male, female, Russian Far East (Khabaovsk). Holotype. *Russia*, Khabarovsk Territory, Ussuri River Basin, Kiya River at Ekaterinoslavka Village, 26. VII. 1996, leg. T. I. Arefina. Paratypes. Same data as of holotype (IBSS RAS).

Material examined. New Collection from *Russia*, Jewish Autonomous Oblast, Khabarovsk Krai, Bidjan River (Amur River Basin), 15.VIII. 2004, leg. T. Tiunova (donated by Arefina & Armitage: 3 males, 3 females; OPC).

Remarks. There is a well developed curving spine on the complex strand of the paramere, that is straight at *O. chitosea* sp. nov. and differently formed at *O. hena* sp. nov.

Oxyethira grisea species group Kelley, 1984

Diagnosis. Paraproct convergent, broadly based and sharply pointed in lateral view. Aedeagus with a pair of distal sclerotized processes.



Figures 47–49. *Oxyethira tiunovae* Arefina & Armitage, 2003, male. 47 = genitalia in left lateral view; 48=genitalia in ventral view; 49=phallic organ in left lateral view.

***Oxyethira ozea* sp. nov.**

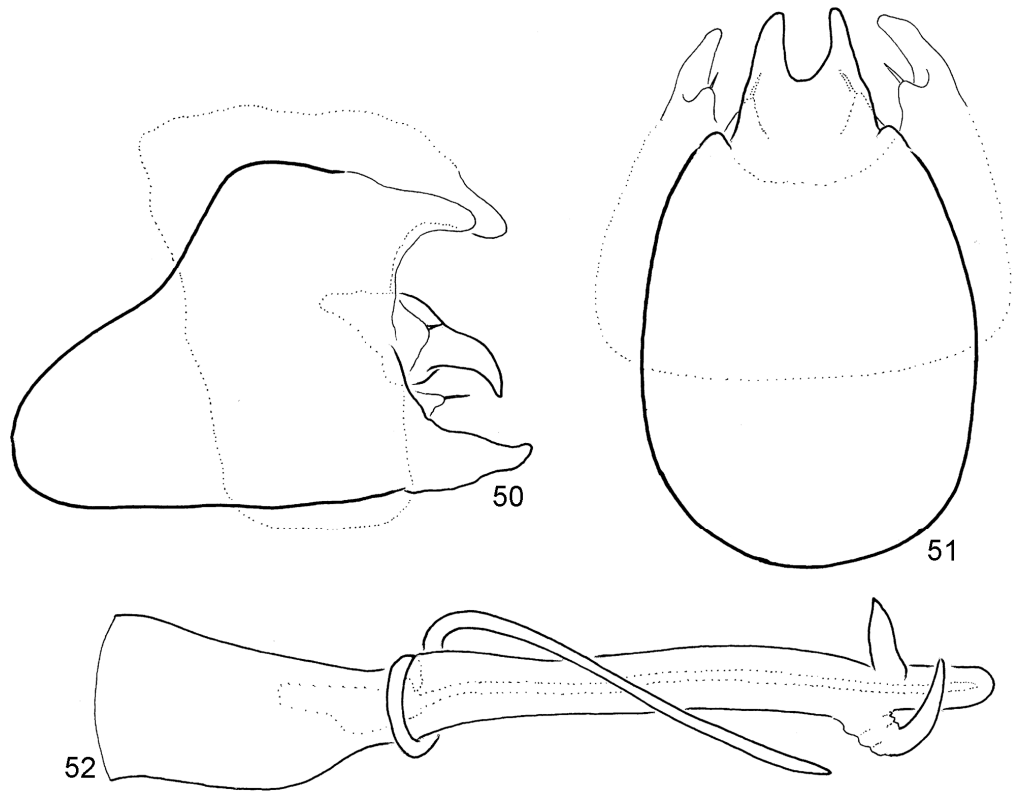
(Figures 50–52)

Diagnosis. Having two distal spines on the aedeagus this new species belongs to the *Oxyethira grisea* species group distributed in the Nearctic Region. Nybom (1983) has described *O. klingstedti* from Finland with nearest relations to species found in North America. This new Japanese species is close to *O. klingstedti*, but differs by having apical lobes on segment VIII differently formed; ventrum IX high, not low; the hook formation of paraproct in lateral view more distinct; gonopods long and tapering in ventral view; distal spine pattern on the aedeagus different.

Material examined. Holotype. Japan, Honshu, Gumma, Oze, Yamanohama, N36°55', E139° 13', 1400 m, 2.IX.1996, light, leg. T. Nozaki (1 male; CMB-ZI 146993).

Description. Male (in alcohol). Light brown. Forewing length 2.2 mm. 3 ocelli present. Antennal segments 29; terminal segment pointed conical; clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short ventromesal process. Segment VIII annular; round excised both dorsoapicad and ventroapicad; larger dorsoapical and smaller apicolateral setal lobes in lateral view.

Male genitalia. Segment IX completely enclosed within VIII; ventrum long and rounded ovoid in ventral view; dorsum short. Segment X reduced to short membranous lobe. Pair of paraproct hook-shaped in lateral view, mesad curving, almost with touching apices. Gonopods heavily sclerotized, fused together mesobasad as well as to ventrum IX; tapering bifid distally. Phallic organ with a pair of sclerotized spine-like structures apicad and paramere encircling shaft once at basal third.



Figures 50–52. *Oxyethira ozea* sp. nov. male, holotype. 50 = genitalia in left lateral view, 51 = genitalia in ventral view, 52 = phallic organ in left lateral view.

Etymology. The epiteth *ozea* is coined from the name of the holotype locality.

Oxyethira ramosa species group Kelley, 1984

Diagnosis. Segment VIII deeply excised ventrad, protruded apicad as blunt dorsolateral lobes or finger like processes and with mesal excision dorsad. Venter IX pointed and elongate anteriorly, dorsum IX reduced to a short band producing prominent anterodorsal lateral lobes. Posterodorsal lateral processes of segment IX rounded or pointed. Gonopods short, blunt.

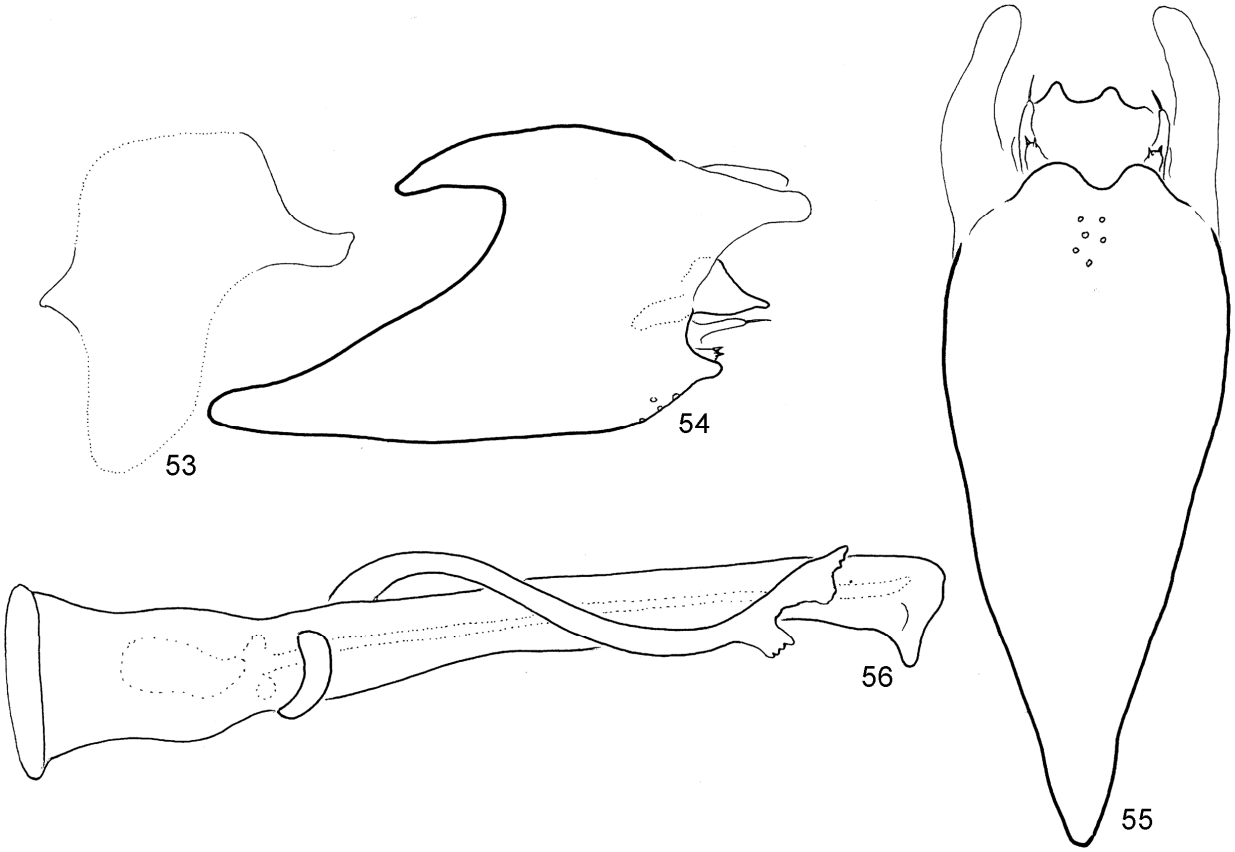
Oxyethira miea sp. nov.

(Figures 53–56)

Diagnosis. This new species belongs to the *Oxyethira ramosa* species group of Kelley (1984, 1985) and close to the *O. campanula* species, but differs by having dorsolateral processes on the posterior margin of segment VIII digitate and truncate, not narrowing pointed; anterolateral lobes on segment IX short, not long; posterodorsal lateral processes of segment IX high, not low; paramere with subapical serrated lobes.

Material examined. Holotype. *Japan*, Honshu, Mie, Taisei-cho, N36°19', E136°26', 30.V.1999, leg. H. Morita (1 male; CMB-ZI 146994).

Description. Male (in alcohol). Light brown. Forewing length 2.1 mm. 3 ocelli present. Clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short ventromesal process. Segment VIII annular; with digitate and truncate dorsolateral processes.



Figures 53–56. *Oxyethira miea* sp. nov. male, holotype. 53 = segment VIII in lateral view, 54 = genitalia in left lateral view, 55 = genitalia in ventral view, 56 = phallic organ in left lateral view.

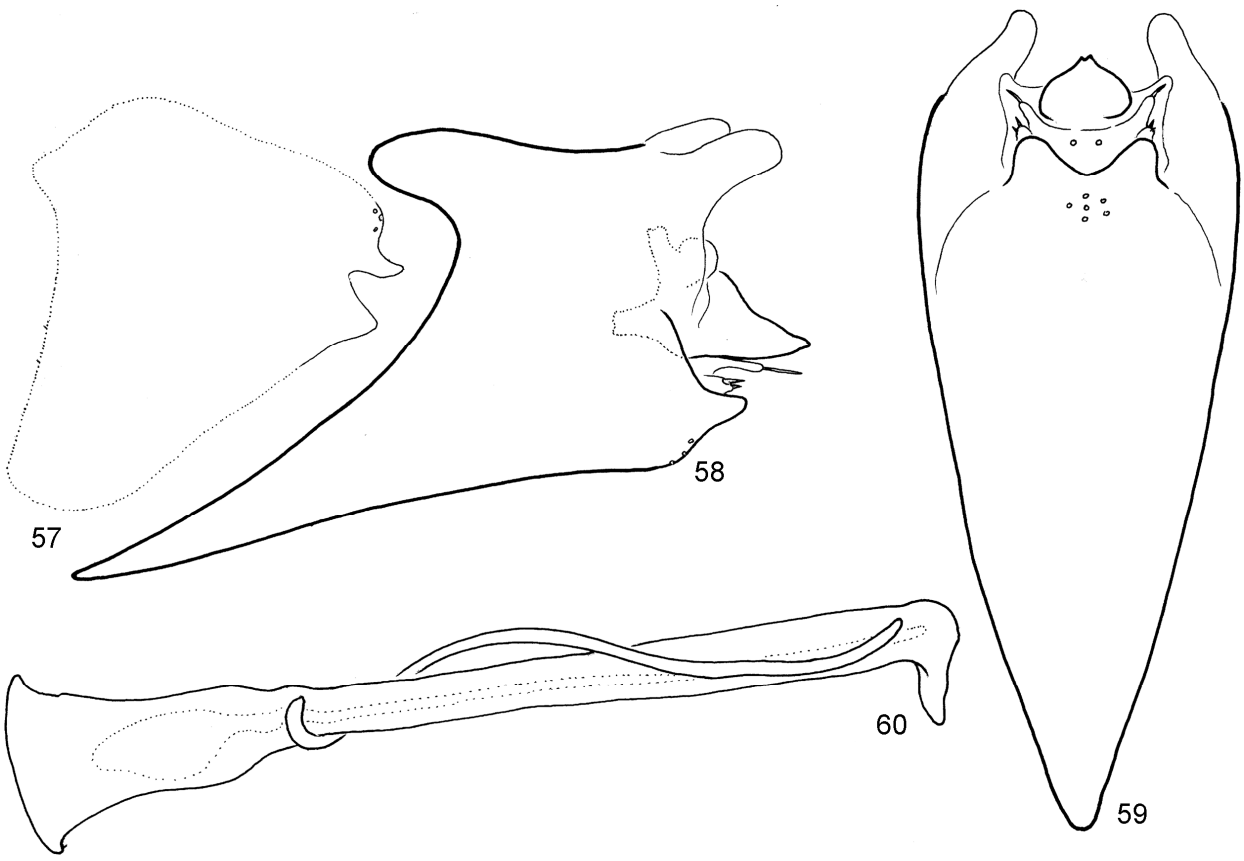
Male genitalia. Segment IX completely enclosed within VIII; ventrum long and narrowing in ventral view; dorsum short band producing short dorsolateral narrowing lobes anterad and dorsolateral, slightly mesad directed lobes posterad. Segment X reduced to short membranous lobe. Paraproct complex dominated by the median plate protruding posterad with narrowing apex in lateral view and widely excised in ventral view; its basal part indispensible. Gonopods heavily sclerotized pair of rounded widely separated lobes in ventral view. Basal plate of gonopods composed of the widely set bilobed processes dorsad and of the shorter pair of setose processes. Phallic organ with paramere encircling the aedeagus once and armed with two subapical lobes; basal lobe serrated, the head of the aedeagus producing heavily sclerotized short beak-shaped process.

Etymology. The epithet *miea* is coined from the name of the holotype locality.

***Oxyethira okinawa* sp. nov.**

(Figures 57–60)

Diagnosi. This new species belongs to the *Oxyethira ramosa* species group of Kelley (1984, 1985) and close to the *O. campanula* species, but differs by having dorsolateral processes on the posterior margin of segment VIII differently shaped and doubled, not single; anterolateral lobes on segment IX short, not long; posterodorsal lateral processes of segment IX high, not low; freely protruded mesal plate of the paraproct complex inverted heart-shaped with small excision on the dorsal tip, not widely separated bifid.



Figures 57–60. *Oxyethira okinawa* sp. nov. male, holotype. 57 = segment VIII in lateral view, 58 = genitalia in left lateral view, 59 = genitalia in ventral view, 60 = phallic organ in left lateral view.

Material examined. Holotype. *Japan*, Ryukyu Islands, Okinawa, Nago-shi, Genka-kawa, near Hogen-hashi, N 26°36', E 128°05', 22–24.XI. 2010, pan trap, leg. T. Ito (1 male; CMB-ZI 146995).

*Other specimens***.** Ryukyu Islands, Okinawa, Kunigami-son, Nishime-dake, headwater of Zatsun-gawa, 28.VII.1997, leg. R. B. Kuranishi (1 male; deposited in personal collection of R. B. Kuranishi). Ryukyu Islands, Okinawa, Kunigami-son, Yona, Yona-gawa, Nakafiji-hashi, 23.XI. 2010, pan trap, leg. T. Ito (1 male; IPC).

Description. Male (in alcohol). Light brown. Forewing length 2.2 mm. 3 ocelli present. Antennal segments broken, more than 30; terminal segment lacking; clothing antennal setae whorled fimbriate. Spur count 034. Segment VII annular with short ventromesal process. Segment VIII annular; with double dorsolateral processes.

Male genitalia. Segment IX completely enclosed within VIII; ventrum long and narrowing in ventral view; dorsum short band producing short dorsolateral lobes anterad and dorsolateral, slightly mesad directed lobes posterad. Segment X reduced to short membranous lobe. Paraproct complex composed of an inverted heart-shaped median plate freely protruded posterad in lateral view and of basal part quadratic in caudal view and bipartite in lateral view. Gonopods heavily sclerotized pair of rounded widely separated lobes in ventral view. Basal plate of gonopods composed of the widely set bilobed processes dorsad and of the shorter pair of setose processes. Phallic organ with paramere encircling shaft once; the head of the aedeagus producing heavily sclerotized long beak-shaped process.

Etymology. The epithet *okinawa* is a noon in apposition coined from the name of the holotype locality.

Acknowledgements – It was a long lasting effort to collect all the necessary types, specimens and information to summarize the synopsis and to generate new knowledge on this obscure group of Hydroptilidae. We sincerely appreciate the kind cooperation and are very grateful in supplying material, original papers and unpublished information for many colleagues: Trond Andersen (Museum of Zoology, University of Bergen, Norway), T. I. Arefina-Armitage and B. J. Armitage (Trichoptera Inc. Columbus, Ohio, USA), Kjell Arne Johanson (Swedish Museum of Natural History, Stockholm, Sweden), R. B. Kuranishi (Natural History Museum and Institute of Chiba, Japan), Larry Hulden (Zoological Museum, Finnish Museum of Natural History, Helsinki, Finland), Hisayuki Morita (Mie, Yokkaichi-shi, Japan), John C. Morse (Department of Entomology, Soils and Plant Sciences, Clemson University, Clemson, USA), Takao Nozaki (Kanagawa, Ninomiya-machi, Japan), Masahiro Ôhara (The Hokkaido University Museum, Japan), Ayuko Ohkawa (The University of Tokyo, Japan), Toshio Hattori (Shizuoka, Japan), Juha Salokannel (Siikinkatu, Tampere, Finland), Changhai Sun (Department of Entomology, Nanjing Agricultural University, Nanjing, China), Yanka Vidinova (Institute of Zoology, Bulgarian Academy of Sciences, Sofia, Bulgaria), Wolfgang Tobias (Natural History Museum, Leibniz Institute of Humboldt University, Berlin, Germany), T. S. Vshivkova (Institute of Biology and Soil Sciences, Russian Academy of Sciences, Vladivostok, Russia), Lianfang Yang (Department of Entomology, Nanjing Agricultural University, Nanjing, China). Specimens of *Oxyethira ozea* sp. n. was collected under the special permission for the Oze National Park, Japan.

REFERENCES

AREFINA, T. I. & ARMITAGE, B. J. (2003): New findings of micro-caddisflies (Trichoptera: Hydroptilidae) from the Russian Far East. *Braueria,* 30: 15–18.

BOTOSANEANU, L. & LEVANIDOVA I M. (1988): Trichoptera Hydroptilidae (Insecta) from Soviet Union Far-Eastern Territories. *Bulletin of Zoological Museum, University of Amsterdam*, 11: 169–176.

CURTIS, J. (1834): Descriptions of some nondescript British species of may-flies of anglers. *The London and Edinburgh Philosophical Magazine and Journal of Science*, 4: 212–218.

EATON, K. J. (1873): On the Hydroptilidae, a family of Trichoptera. *Transactions of the Entomological Society of London*, 1873: 125–150.

FLINT, O. S. (1968)**:** The caddisflies of Jamaica. *Bulletin of the Institute of Jamaica, Science Series*, 19: 1–68.

ITO, T. (2005): *Hydroptilidae*. In. KAWAI, T. & TANIDA, K. (eds.) Aquatic Insects of Japan: Manual with Keys and Illustrations. Tokai University Press, Kanagawa, pp. 440–446. [in Japanese].

ITO, T. & KAWAMULA, H. (1984): Morphology and ecology of immature stages of *Oxyethira acuta*

Kobayashi (Trichoptera, Hydroptilidae). *The Japanese Journal of Limnology*, 45: 313–317.

KELLEY, R. W. (1984): Phylogeny, morphology and classification of the micro-caddisfly genus *Oxyethira* Eaton (Trichoptera: Hydroptilidae). *Transactions of the American Entomological Society*, 110: 435–463.

KELLEY, R. W. (1985): Revision of the micro-caddisfly genus *Oxyethira* (Trichoptera: Hydroptilidae). *Transactions of the American Entomological Society*, 111: 223–253.

KELLEY, R. W. (1989): New species of micro-caddisflies (Trichoptera: Hydroptilidae) from New Caledonia, Vanuatu and Fiji. *Proceedings of the Entomological Society of Washington*, 91: 190–202.

KIMMINS, D. E. (1958): The British species of the genus *Oxyethira* (Trichoptera: Hydroptilidae). *Entomologist's Gazette*, 9: 7–17.

KOBAYASHI, M. (1977): The list and new species of the caddisflies from Hokkaido, Japan (Trichoptera, Insecta). *Bulletin of the Kanagawa Prefectural Museum*, 10: 1–14.

KUMANSKI, K. (1990): Studies on the fauna of Trichoptera (Insecta) of Korea. I. Superfamily Rhyacophiloidea. *Historia naturalis bulgarica*, 2: 36–60.

MALICKY, H. & CHANTARAMONGKOL, P. (2007): Beiträge zur Kenntnis asiatischer Hydroptilidae (Trichoptera). *Linzer Biologische Beitrage*, 39: 1009–1099.

MARSHALL, J. E. (1979): A review of the genera of the Hydroptilidae (Trichoptera). *Bulletin of the British Museum (Natural History), Entomology series*, 39(3): 135–239.

MCLACHLAN, R. (1874–1880): *A monographic revision and synopsis of the Trichoptera of the European fauna*. Reprinted 1968, E. W. Classey Ltd. 353 Hanworth Road, Hampton, Middlesex, pp. 523.

MORTON, K. J. (1893): Notes on Hydroptilidae belonging to the European fauna, with descriptions of new species. *Transactions of the Entomological Society of London*, 1893: 75–82.

NEBOISS, A. (1963): The Trichoptera types of species described by J. CURTIS. *Beitrage zur Entomologie*, 13(5–6): 582–635.

NIELSEN, A. (1957): A comparative study of the genital segments and their appendages in male Trichoptera. *Biologiske Skrifter*, 8(5): 1–159.

NOZAKI, T. & TANIDA, K. (2007): *The caddisfly fauna of a huge spring-fed stream, the Kakida River, in central Japan*. In BUENO-SORIA, J. *et al*. (eds.), Proceedings of the 12th International Symposium on Trichoptera. The Caddis Press, Ohio, p. 243–255.

NYBOM, O. (1983): *Oxyethira klingstedti* sp. n. (Trichoptera, Hydroptilidae) from Finland. *Notulae Entomologicae*, 63: 65–66.

OLÁH, J. (1989): Thirty-five new hydroptilid species from Vietnam (Trichoptera, Hydroptilidae). *Acta Zoologica Academiae Scientiarum Hungaricae*, 35(3–4): 255–293.

OLÁH, J. & JOHANSON, K. A. (2007): Trinominal terminology for cephalic setose warts in Trichoptera (Insecta). *Braueria*, 34: 21–28.

OLÁH, J. & JOHANSON, K. A. (2008): Reasoning an appendicular and functional caddisfly genital terminology. *Braueria*, 35: 29–40.

OLÁH, J. & JOHANSON, K. A. (2011): New Neotropical Hydroptilidae (Trichoptera). *Annales Historico-Naturales Musei Nationalis Hungarici*, 103: 117–255.

OLÁH, J., KOVÁCS, T., SIVEC, I., SZIVÁK, I. & URBANIC, G. (2012): Seven new species in the *Chaetopteryx rugulosa* species group: applying the phylogenetic species concept and the sexual selection theory (Trichoptera, Limnephilidae). *Folia Historico Naturalia Musei Matraensis*, 36: 51–79.

PICTET, F. J. (1834) *Recherches pour Servir a l'Histoire et l'Anatomie des Phryganides*. Cherbuliez, Genève, pp. 235, 20 pls.

ROSS, H. H. (1938): Description of Nearctic caddis flies (Trichoptera) with special reference to the Illinois species. *Bulletin of the Illinois Natural History Survey*, 21(4): 101–183.

ROSS, H. H. (1944): The caddis flies or Trichoptera, of Illinois. *Bulletin of the Illinois Natural History Survey*, 23(1): 1–326.

ROSS, H. H. (1948): Notes and descriptions of Nearctic Hydroptilidae (Trichoptera). J*ournal of the Washington Academy of Sciences*, 38(6): 201–206.

SCHMID, F. (1959): La genre *Stactobia* MCL. *Miscelánea Zoológica*, 1(2): 1–56.

SCHMID, F. (1983): Encore quelques *Stactobia* McLachlan (Trichoptera, Hydroptilidae). *Le Naturaliste Canadien*, 110(3): 293–283.

VAILLANT, F. (1951): Contribution a l'étude des Trichoptéres de genre *Stactobia* MAC LACHLAN. *Bulletin de la Société Zoologique de France*, 76: 13–17.

WELLS, A. (1979): The Australian species of *Orthotrichia* Eaton (Trichoptera: Hydroptilidae). *Australian Journal of Zoloogy*, 27: 585–622.

WELLS, A. (2005): Parasitism by hydroptilid caddisflies (Trichoptera) and seven new species of Hydroptilidae from northern Queensland. *Australian Journal of Entomology*, 44: 385–391.

YANG, L., KELLEY, R. W. & MORSE, J. C. (1997): Six new species of *Oxyethira* from southern China. *Aquatic Insects*, 19(2): 91–105.

XUE, Y. & YANG, L. (1991): Six new records of Hydroptilidae from China (Insecta: Trichoptera). *Acta Agriculturae Universitatis Henanensis*, 25(1): 19–23.