

**Research article**[urn:lsid:zoobank.org:pub:37C79C19-FAF6-4900-BB9B-7D43EC1AE371](http://urn:lsid:zoobank.org:pub:37C79C19-FAF6-4900-BB9B-7D43EC1AE371)**Revision of the *Trichoclinocera yixianensis* species-group from eastern Asia (Diptera: Empididae: Clinocerinae)****Toyohi Saigusa<sup>1</sup> & Bradley J. Sinclair<sup>2,\*</sup>**<sup>1</sup>7-1-402 Baikoen 2-chome, Chuo-ku, Fukuoka-shi 810-0035, Japan<sup>2</sup>Canadian National Collection of Insects & Canadian Food Inspection Agency, OPL-Entomology, K.W. Neatby Bldg., C.E.F., 960 Carling Ave., Ottawa, ON, Canada K1A 0C6\*Corresponding author: Email: [bradley.sinclair@canada.ca](mailto:bradley.sinclair@canada.ca)<sup>1</sup>[urn:lsid:zoobank.org:author:390F7B16-1B9D-419F-B0CD-F3279B89DF1D](http://urn:lsid:zoobank.org:author:390F7B16-1B9D-419F-B0CD-F3279B89DF1D)<sup>2</sup>[urn:lsid:zoobank.org:author:4516327F-B73E-456C-927F-18EFB0B9E08B](http://urn:lsid:zoobank.org:author:4516327F-B73E-456C-927F-18EFB0B9E08B)

**Abstract.** The *Trichoclinocera yixianensis* species-group from eastern Asia is revised and includes five species: *T. emotoi* sp. nov., *T. maculata* sp. nov., *T. nakanishii* sp. nov., *T. pakistanensis* sp. nov. and *T. yixianensis* Li & Yang, 2009. A key to all five species is provided and their distributions mapped.

**Key words.** Aquatic dance flies, Empididae, Diptera, Bhutan, China, Nepal, Pakistan.

**INTRODUCTION**

Adults of the genus *Trichoclinocera* Collin, 1941 (Diptera: Empididae: Clinocerinae) are normally encountered on emergent rocks in large streams and rivers (Saigusa & Sinclair 2016), usually where the riparian vegetation is open overhead (Sinclair 1994). Larvae inhabit the riffle zones, moving among the rocks and moss and the immature stages have been described (Sinclair 1994; Lanning et al. 2020). Prior to this study, there were 40 described species found in the Nearctic, Palearctic and Oriental Regions (Yang et al. 2007; Li & Yang 2009; Sinclair & Shamshev 2014; Saigusa & Sinclair 2016; Sinclair et al. 2020).

This is third in a series of papers revising the eastern Asian species of *Trichoclinocera*. The first contribution revised the species of the *T. dasyscutellum* species-group and included eight species (Sinclair & Saigusa 2005). The second study revised the Japanese fauna and included nine species (Saigusa & Sinclair 2016). In this study, the species of the *Trichoclinocera yixianensis* species-group are revised, presently occurring in Bhutan, China, Nepal and Pakistan.

**MATERIAL AND METHODS**

This study is based on material deposited in the following institutions: Biosystematics Laboratory, Kyushu University, Fukuoka, Japan (KUMF); and Canadian National Insect Collection, Ottawa, Canada (CNC). Label data for primary types are cited from the top downward, with the

data from each label in quotation marks. Labels are cited in full, with original spelling, punctuation, and date, and label lines are delimited by a slash (/). The repository of each type is given in parentheses. Secondary type data are abridged and listed alphabetically.

Methods used in specimen preparation follow Sinclair (1994, 1995) and Saigusa & Sinclair (2016).

**Abbreviations used in the description**

acr	= acrostichal setulae
dc	= dorsocentral setae
dm	= discal medial cell
npl	= notopleural setae
pal	= postalar seta
ph	= posthumeral seta
pprn	= postpronotal setae
presut spal	= presutural supra-alar setae
psut spal	= postsutural supra-alar setae
R	= radial vein
sctl	= scutellar setae
T	= tergite

Terms used for adult structures follow those of Cumming & Wood (2017).

Some photographs were taken with a Leica camera model DFC5400 using Leica Application Suite X. Additional images were taken using an Olympus SZ60 microscope and camera on Xperia 1011 or Olympus BX-50 and Nikon Coolpix 995 camera. Maps were constructed by using the location data on the specimen labels. If coordinates were not present on specimen labels, the collection locality data were used to estimate approximate

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coordinates, through the use of Google Earth® and Google Maps®. SimpleMappr (Shorthouse 2010) was used to plot the distribution of each species.

## TAXONOMY

### *Trichoclinocera* Collin, 1941

*Trichoclinocera* Collin, 1941: 237. Type species, *T. stackelbergi* Collin, 1941 (original designation).

*Seguyella* Vaillant, 1960: 179 *nec* Kelsey (1969: 294). Type species, *S. rostrata* Vaillant, 1960 (original designation). Sinclair, 1994: 1012 (synonymy).

*Acanthoclinocera* Saigusa, 1965: 53. Type species, *A. dasyscutellum* Saigusa, 1965 (original designation). Sinclair, 1994: 1012 (synonymy).

**Recognition.** *Trichoclinocera* is distinguished from other clinocerine genera by the following combination of characters:  $R_1$  setose,  $R_4$  and  $R_5$  normally nearly parallel,

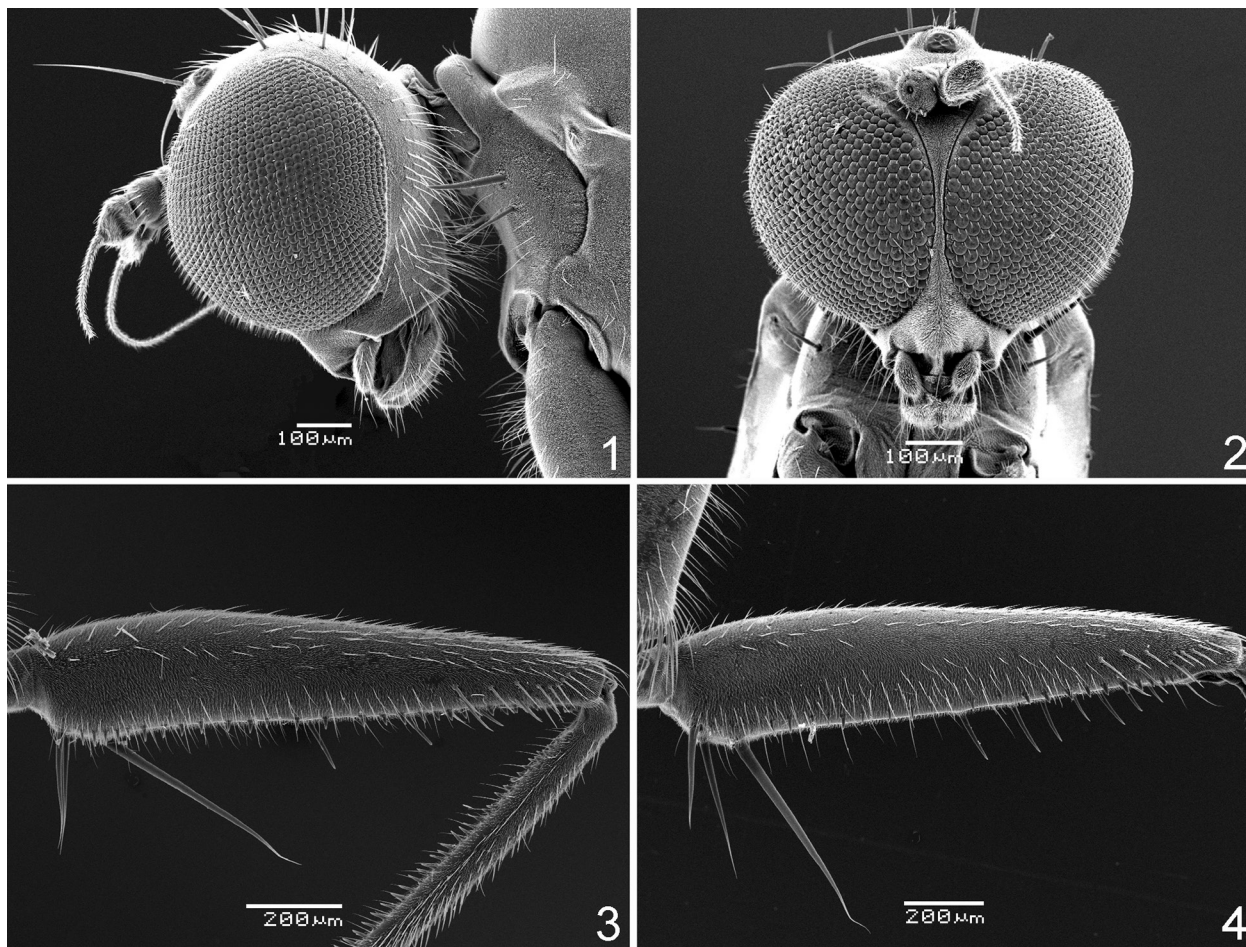
apex of cell dm not strongly produced,  $M_1$  and  $M_2$  arising separately from cell dm, fore femur with rows of ventral setae; female abdomen truncate, with tergite 9+10 setose (acanthophorite-like); and apex of phallus membranous, lacking filament.

**Distribution.** The genus occurs in the Palearctic, Nearctic and Oriental Regions.

### *Trichoclinocera yixianensis* species-group

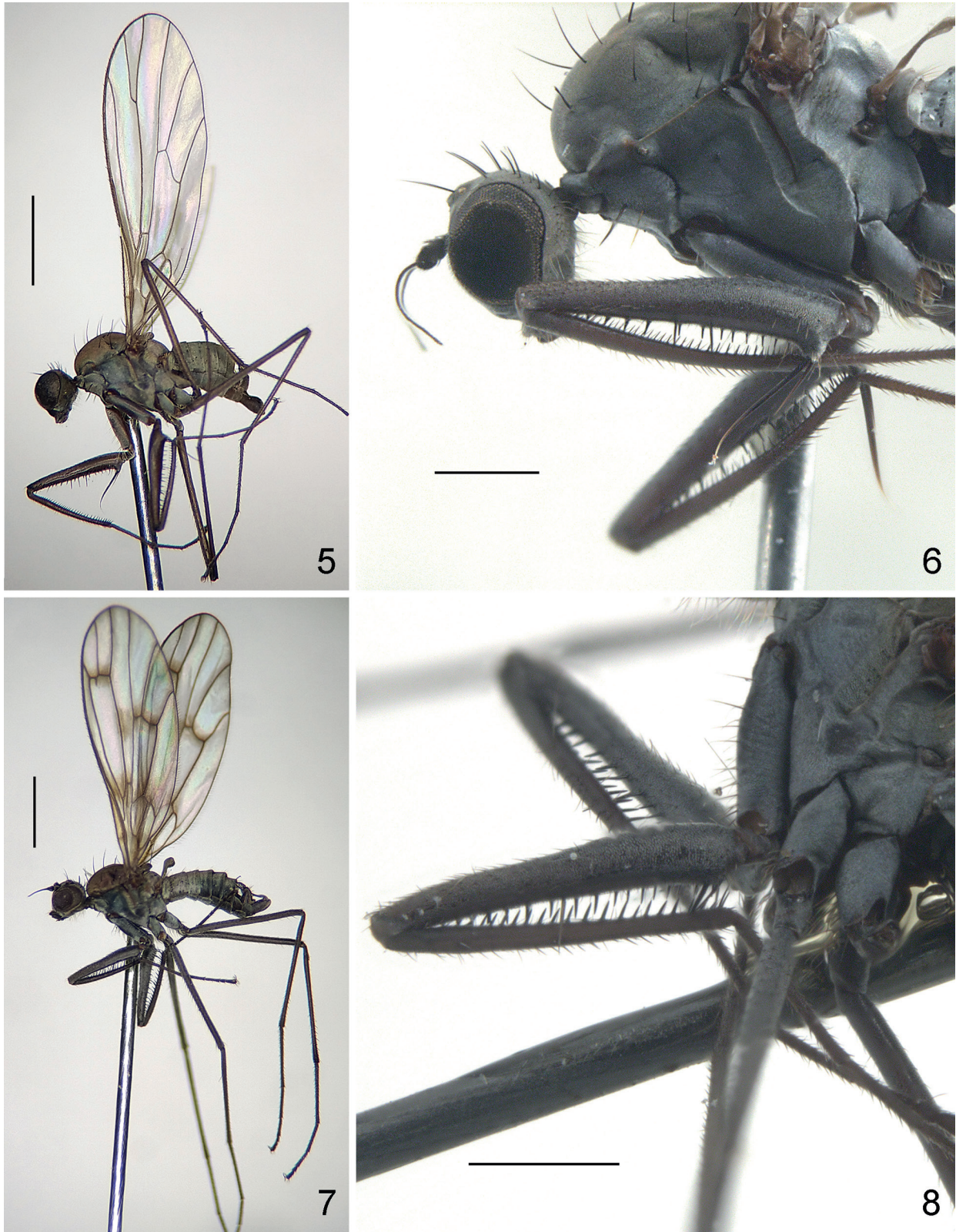
**Recognition.** These are very unusual species of *Trichoclinocera*, characterized by long spine-like setae at the base of the fore femora (Figs 3–4), often one-third to one-half length of the segment; face greatly narrowed, eyes somewhat narrowed, with facets enlarged antero-ventrally (Fig. 2), and bacilliform sclerite extending apically beyond base of claspings cercus.

**Remarks.** Specimens of this group were collected in seepages and small streams with overhead canopy, in contrast to broad streams and rivers which are the usual habitat for *Trichoclinocera* (see Discussion).



**Figs 1–4.** Scanning Electron photographs of *Trichoclinocera yixianensis* Li & Yang. 1. Female head, lateral view. 2. Female head, anterior view. 3. Male fore femur, anterior view. 4. Female fore femur, anterior view.





**Figs 5–8.** Habitus and forelegs of *Trichoclinocera yixianensis* species-group. **5.** *T. emotoi* sp. nov., male habitus. **6.** *T. emotoi* sp. nov., female forelegs. **7.** *T. maculata* sp. nov., male habitus. **8.** *T. maculata* sp. nov., male forelegs. Scale bars: Figs 6, 8 = 0.5 mm; Figs 5, 7 = 1.0 mm.



***Trichoclinocera emotoi* sp. nov.**

(Figs 5–6, 13, 17–18, 35, 41)

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**Type material.** **HOLOTYPE** ♂, labelled: “(E. NEPAL)/ Thurukpa (2600m)/ 27°36' N, 87°36' E - - / (E. NEPAL)/ Topke Gola (3700m)/ 27°38' N, 87°35' E”; “June 12, 1972/ J. Emoto leg./ Kyushu Univ. Col.”; “[HOLOTYPE]/ *Trichoclinocera/ emotoi/ Saigusa & Sinclair* [red label]” (KUMF). **PARATYPES: NEPAL:** same data as holotype (2 ♂♂, 2 ♀♀, CNC; 3 ♂♂, 1 ♀, KUMF); Penmaten, 2600 m, 27°36' N, 87°36' E / Topke Gola, 3700 m, 27°38' N, 87°35' E, 30.vi.1973/ H. Maki-hara (1 ♂, KUMF); NE of Thudam, 4000 m, 27°47' N 87°36' E, 25.vi.1972, H. Shima (1 ♂, CNC).

**Recognition.** This species is distinguished by the pair of long spur-like setae mounted on a short tubercle at the base of the fore femur, greyish legs, clear wings and clasping cercus with broad U-shaped notch near base.

**Description.** Wing length 3.6–4.0 mm. **Male.** Grey-blue pruinescence and dark legs (Fig. 5). Head narrowed ventrally, compound eyes oval; facets enlarged antero-ventrally. Face greatly narrowed medially, ca. width of antennal socket, with bright whitish pruinescence; lower margin of face straight, lacking cleft and carina; gena one-seventh as wide as eye height. Frons slightly darker than face in dorsal view; vertex and ocellar triangle dark brown, lower postociput brown, gena lightly pruinescent. Ocellar seta longest among cranial setae; occiput with 3–4 pairs of long setae posterior to ocellar triangle; postocular with row of short setae along eye margin, upper 5–6 setae dark, stouter than lower setae; postgena with numerous long, white silky setae. Arista-like stylus long and slender, not tapered apically. Palpus short, pointed apically, ca. one-fourth eye height.

Pleura grey with pale blue pruinescence; scutum greyish brown with somewhat bluish lateral margins, medially paler brown in posterior view; posterolateral margin of postpronotal lobe shiny brown; faint black vitta along inner edge of dc; prescutellar depression somewhat bluish posteromedially in posterior view. Thoracic setae long, ca. subequal to width of eye; acrostichal setulae lacking; 5–6 dc; 0–1 very short, pale prn, at most one-fourth length of dc, with 0–2 pale setulae; 1 presut spal; 2 npl; 2 psut spal; 1 pal; 2 pairs sctl and several pale marginal setulae; several pale setulae on notopleural depression. Laterotergite with patch of pale setae; prothoracic episternum with several setulae and 2 long, spine-like setae, longer than width of fore coxa, shorter seta often pale; anepisternum with a few pale setulae along posterior margin; katapisternum with a few minute pale setulae; hind margin of metepisternum with white setulae.

Wing (Fig. 35) narrow, lightly infusate, without markings; pterostigma very narrow, faint, elliptical. One basal costal seta, two-thirds length of posterior dc. Sparse row of setulae from base of R to mid-length of R<sub>5</sub>; auxiliary

crossvein lacking; cell dm produced apically; R<sub>4</sub> and R<sub>5</sub> divergent apically; base of R<sub>4</sub> often with short spur vein. Halter dark.

Legs dark, coxae with blue pruinescence, concolourous with pleura. Coxae with long, pale marginal setae; fore coxa with long pale anterolateral setae. Fore femur (Fig. 6) distinctly swollen on basal half, with pair of setae mounted on short single tubercle: anterior seta spur-like, ca. one-half length of femur, posterior seta pale, thinner and one-half length of anterior seta; anteroventral row of ca. 20 spine-like setae extending length of femur, length ca. one-fourth width of femur, decreasing in length apically; 3–4 preapical anterior setae, longer than anteroventral setae; row of slender, pale posteroventral setae extending length of femur, some subequal in length to width of femur; 2–3 posteroventral, spine-like setae near mid-length of femur, ca. subequal in length to width of femur; dense, very short, white pile beneath. Fore tibia slightly sinuous to arched in shape with row of stout setae beneath, biserial apically; setae increasing in length apically to width of tibia; row of posterodorsal setae prominent on apical half. Mid femur with slender anteroventral and posteroventral preapical setae; without anterodorsal and posterodorsal setae. Hind femur with anteroventral setae; without anterodorsal and posterodorsal setae. Hind tibia without posterodorsal spur-like seta near base; 1 erect, spine-like posterodorsal preapical seta. Tarsi longer than corresponding tibiae. Empodium pulvilliform, subequal in length to claw, less than half length of tarsomere.

Abdomen concolourous with thoracic pleura in lateral view, with mostly pale setae, darker along posterior margin. Terminalia (Figs 13, 15–16): hypandrium narrow, cylindrical, tapered apically, 1.5x length of epandrium; anterior margin pointed. Phallus extending beyond clasping cercus; strongly bent sub-basally; shaft narrow with broad, expanded base; apex with cup-like opening, with small, round, bulbous membranous swelling, slightly wider than diameter of apex of phallus; membrane lacking microtrichia; ejaculatory apodeme arched strongly within base of phallus. Epandrium subtriangular, with large membranous area at basal margin with hypandrium. Surstylus slender, two-thirds length of clasping cercus, lacking apical setae and microtrichia. Clasping cercus finger-like, tapered on apical half; basal half with broad U-shaped notch on dorsal margin; long, fine setae on ventral margin; inner dorsal margin with peg-like setae along entire length, except in notch.

**Female.** Similar to male including chaetotaxy of legs. Terminalia (undissected): Tergite 9+10 with 4 straight spine-like setae on apical margin.

**Distribution.** This species is confined to eastern Nepal known from 2600–4000 m (Fig. 41), often collected together with *T. maculata* sp. nov.





**Figs 9–12.** Habitus and forelegs of *Trichoclinocera yixianensis* species-group. **9.** *T. nakanishii* sp. nov., male habitus, holotype (terminalia dissected). **10.** *T. nakanishii* sp. nov., male forelegs, holotype. **11.** *T. pakistanensis* sp. nov., male habitus, holotype (terminalia dissected). **12.** *T. pakistanensis* sp. nov., male forelegs, holotype. Scale bars: Figs 10, 12 = 0.5 mm; Figs 9, 11 = 1.0 mm.

**Etymology.** The specific epithet is named after Jun Emoto, the collector of the holotype of this species and many other valuable specimens.

***Trichoclinocera maculata* sp. nov.**

(Figs 7–8, 14, 19–20, 36, 41)

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**Type material.** **HOLOTYPE** ♂, labelled: “(E. NEPAL)/ Thurukpa (2600m)/ 27°36' N, 87°36' E - - / Topke Gola (3700m)/ 27°38' N, 87°35' E”; “June 12, 1972/ H. Shima leg./ Kyushu Univ. Col.”; “[HOLOTYPE]/ *Trichoclinocera/ maculata/* Saigusa & Sinclair [red label]” (KUMF). **PARATYPES: NEPAL:** same data as holotype (1 ♂, KUMF); same data as holotype except, J. Emoto (1 ♂, KUMF); same data as holotype except, 9.vii.1972, J. Emoto (1 ♂, CNC); Thudam, 3500–3800 m, 27°45' N 87°31' E–27°46' N 87°33' E, 18.vi.1972, H. Shima (1 ♂, CNC).

**Recognition.** This species is distinguished by 2–3 long, spine-like setae at the base of the fore femur, greyish legs, spotted wings and auxiliary crossvein between veins  $R_{2+3}$  and  $R_4$ .

**Description.** Wing length 3.5–3.8 mm. **Male.** Grey-blue pruinescence and dark legs (Fig. 7). Head narrowed ventrally, compound eyes oval; facets enlarged anteroventrally. Face narrowed medially, narrower than width of antennal sockets, with bright whitish pruinescence; lower margin of face with short, narrow cleft, lacking carina; gena one-eighth as wide as eye height. Frons darker than face in dorsal view; vertex and ocellar triangle dark brown, lower postociput brown, gena lightly pruinescent. Ocellar seta longest among cranial setae; occiput with 3 pairs of long, stout setae posterior to ocellar triangle; postocular with row of short setae along margin of eye, upper 4–5 setae dark, stouter than lower setae; postgena with numerous long, white silky setae. Arista-like stylus long and stout, slightly tapered apically. Palpus tapered apically, ca. one-fourth eye height.

Pleura grey with blue pruinescence; scutum greyish-brown with paler lateral margins, medially paler brown in posterior view, bluish on postalar callus extending medially; dark vitta along inner edge of dc inconspicuous. Thoracic setae long, some subequal to width of eye; acrostichal setulae lacking; 5 dc, prescutellar pair longest; 1 short pprn, one-fourth length of dc; 1 presut spal; 2 npl; 1–2 psut spal; 1 pal; 2 pairs sctl, without setulae; several pale setulae near notopleural depression. Laterotergite with patch of pale setae; prothoracic episternum with 1 dark, spine-like seta and 1 narrower, pale seta, longer than width of fore coxa; anepisternum with setulae along posterior margin; katapisternum and hind margin of metepisternum without setulae.

Wing (Fig. 36) narrow, infusate, with bands of clouding at basal third of wing, across apex of cell dm to  $R_{4+5}$ , and base of  $R_4$  and along auxiliary crossvein. Pterostig-

ma very narrow, faint, elliptical; 1 basal costal seta, two-thirds length of posterior dc. Row of long setulae from base of R to mid-length of  $R_1$ ; auxiliary crossvein between  $R_{2+3}$  and  $R_4$ ; cell dm truncate apically;  $R_4$  and  $R_5$  nearly parallel-sided, somewhat divergent apically. Halter dark.

Legs dark, coxae with blue pruinescence, concolourous with pleura. Coxae with long, dark marginal setae; fore coxae with row of erect setae along anterolateral margin, subequal to width of coxa. Fore femur (Fig. 8) distinctly swollen on basal half, with 2–3 black, spine-like basal setae, posterolateral seta less than one-fourth length of femur; anteroventral row of ca. 20 stout, spine-like setae extending length of femur, length ca. one-fourth width of femur; 2–3 preapical anterior setae, longer than anteroventral setae; row of slender, pale posteroventral setae extending length of femur, ca. one-half width of femur; 1 spine-like posteroventral seta near mid-length of femur, subequal in length to basal width of femur; dense, very short, white pile beneath. Fore tibia straight with row of stout setae beneath, subequal to width of tibia and anteroventral setae of femur. Mid femur with slender anteroventral and posteroventral preapical setae; without anterodorsal and posterodorsal setae. Hind femur without distinct anteroventral setae; with a few anterodorsal and posterodorsal setae. Hind tibia without posterodorsal spur-like seta near base; several erect dorsal setae on apical fourth. Tarsi longer than corresponding tibiae. Empodium pulvilliform, subequal in length to claw, ca. half length of tarsomere.

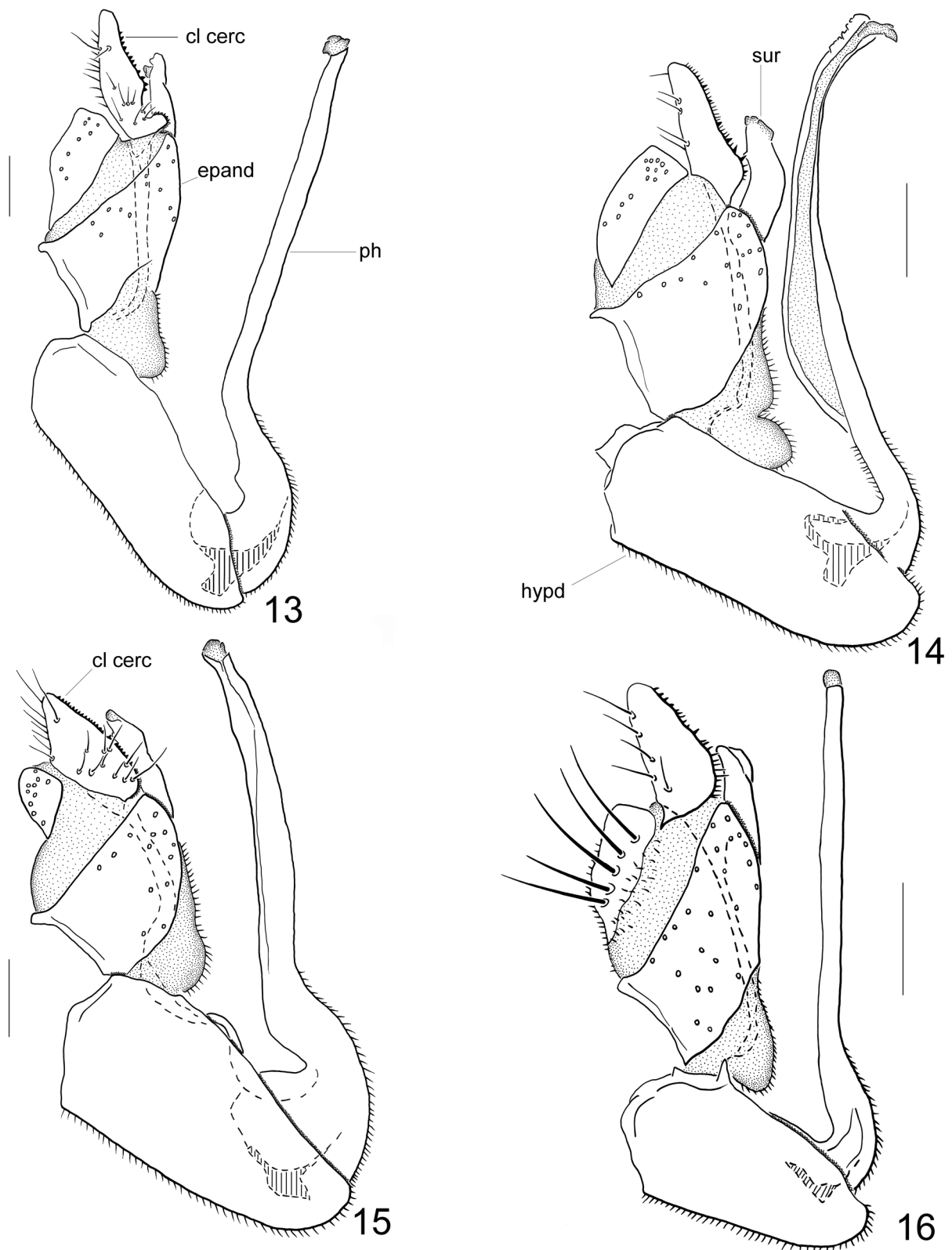
Abdomen concolourous with thoracic pleura in lateral view, with mostly pale setae. Terminalia (Figs 14, 19–20): hypandrium narrow, cylindrical, 1.3x length of epandrium; anterior margin pointed. Phallus extending beyond clasping cercus, gently arched; shaft narrow, without basal expansion; apex with cup-like opening, with small, tubular membrane; membrane lacking microtrichia; ejaculatory apodeme arched strongly anteriorly. Epandrium with large membranous area at basal margin with hypandrium. Surstylus slender, two-thirds length of clasping cercus, lacking apical setae and microtrichia. Clasping cercus finger-like, tapered throughout length to rounded apex; base expanded posteriorly; fine setae on ventral margin; inner dorsal margin with sharp, peg-like setae along entire length.

**Female.** Unknown.

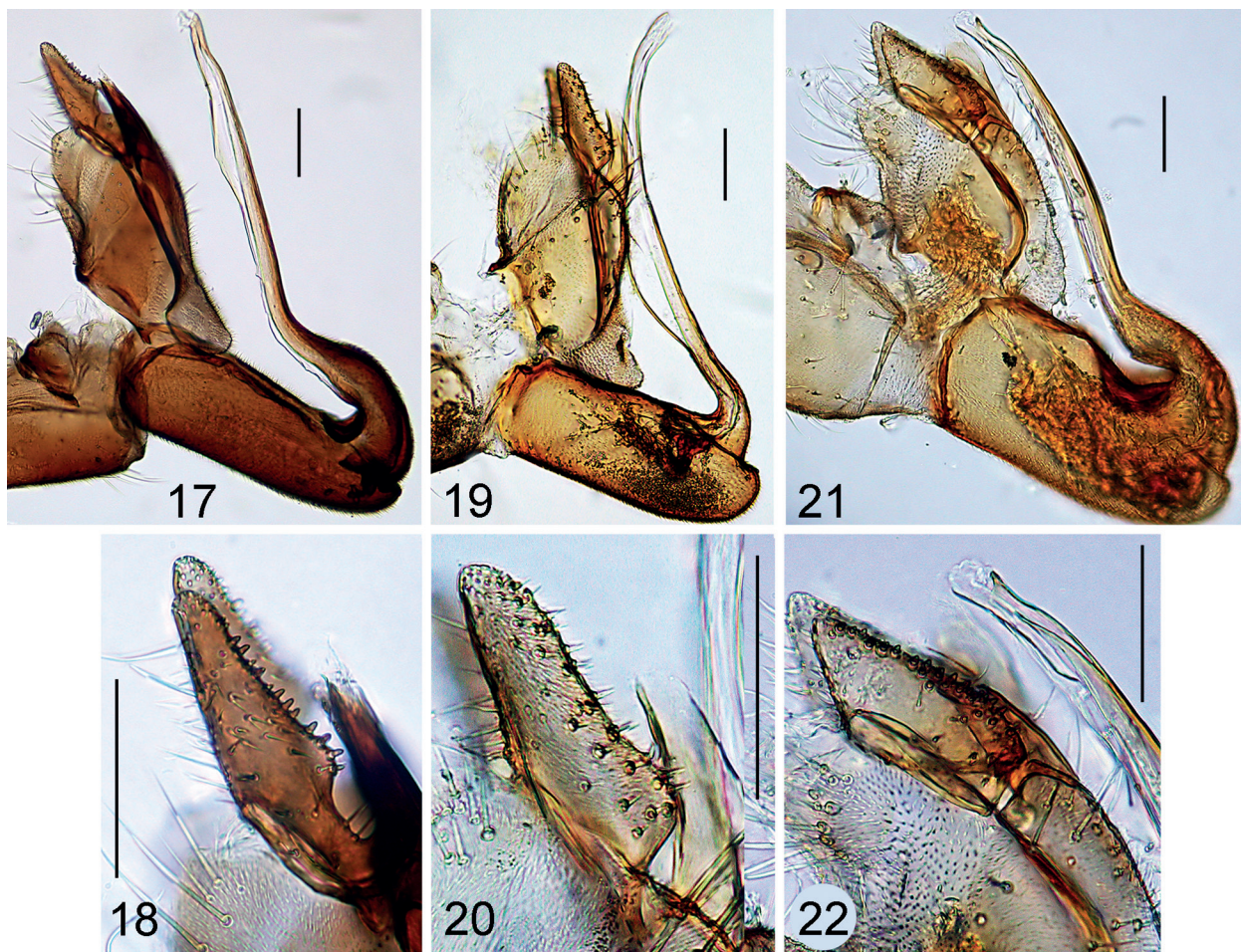
**Distribution.** This species is confined to eastern Nepal known from 2600–3800 m near the Tibet border (Fig. 41), often collected together with *T. emotoi* sp. nov.

**Etymology.** The specific epithet is from the Latin *maculatus* (spot, stain, speckle), in reference to the spotted wings.





**Figs 13–16.** Male terminalia of *Trichoclinocera yixianensis* species-group, lateral view. **13.** *T. emotoi* sp. nov. **14.** *T. maculata* sp. nov. **15.** *T. nakanishii* sp. nov. **16.** *T. pakistanensis* sp. nov. Scale bars = 0.1 mm. Abbreviations: cl cerc = clasper; epand = epandrium; hypd = hypandrium; ph = phallus; sur = surstylus.



**Figs 17–22.** Male terminalia of *Trichoclinocera yixianensis* species-group, lateral view. **17–18.** *T. emotoi* sp. nov. **17.** Terminalia. **18.** Clasper. **19–20.** *T. maculata* sp. nov. **19.** Terminalia. **20.** Clasper. **21–22.** *T. nakanishii* sp. nov. **21.** Terminalia. **22.** Clasper. Scale bars = 0.1 mm.

***Trichoclinocera nakanishii* sp. nov.**

(Figs 9–10, 15, 21–22, 37, 41)

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**Type material.** **HOLOTYPE** ♂, labelled: “(NEPAL)/ Chhouban, Kharka, 3400m/ 83°25′ E. 28°43′ N./ Sept. 28. 1971/ A. Nakanishi”; “[HOLOTYPE]/ *Trichoclinocera/ nakanishii*/ Saigusa & Sinclair [red label] [dissected]” (KUMF).

**Recognition.** This species is distinguished by three long spine-like setae at the base of the fore femur, greyish legs, clear wings, and shape of the clasper.

**Description.** Wing length 3 mm. **Male.** Grey-blue pruinescence and dark brownish legs (Fig. 9). Head pointed ventrally, compound eyes oval; facets enlarged antero-ventrally. Face greatly narrowed medially, ca. width of antennal socket, with bright whitish pruinescence for full length; lower margin of face with short, narrow cleft, lacking carina; gena one-seventh as wide as eye height.

Frons greyish brown; vertex and ocellar triangle dark brown, lower postocciput brown, gena lightly pruinose. Ocellar setae longest among cranial setae; occiput with 3 pairs of setae posterior to ocellar triangle; post-ocular with row of short setae along margin of eye, upper 3–4 setae dark, stouter than lower setae. Arista-like stylus short and stout, not tapered apically. Palpus pointed apically, ca. one-fourth height of eye.

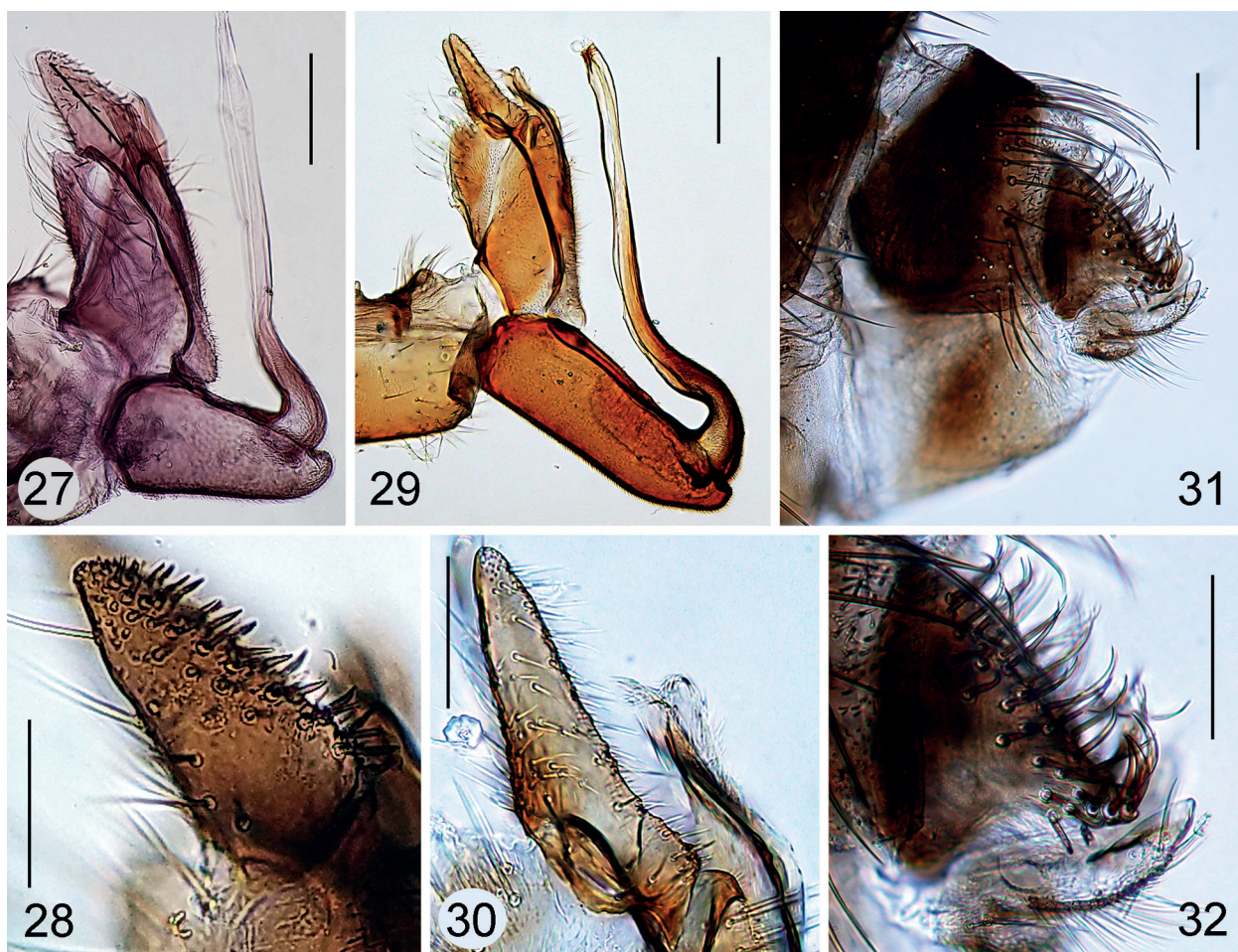
Pleura grey with pale blue pruinescence; scutum brown, paler medially and on postpronotal lobe, somewhat bluish lateral margins; apex of postpronotal lobe shiny brown, dark vitta along edge of dc inconspicuous; prescutellar depression brown in posterior view. Thoracic setae long, ca. subequal to width of eye; acrostichal setulae lacking; 5 pairs dc; 1 very short ppn, one-fourth length of dc; 1 presut spal; 2 npl; 1 psut spal; 1 pal; 2 pairs sctl and pairs of pale marginal setulae; several pale setulae on postpronotal lobe and notopleural depression. Laterotergite with patch of pale setae; prothoracic epi-





**Figs 23–26.** Habitus, forelegs and head of *Trichoclinocera yixianensis* Li & Yang. **23.** Male habitus, lateral view (Shaanxi). **24.** Male forelegs, lateral view (Shaanxi). **25.** Male habitus, lateral view (Shaanxi). **26.** Female head, anterior view (Shaanxi). Scale bars: Fig. 26 = 0.5 mm; Figs 23–25 = 1.0 mm.





**Figs 27–32.** Terminalia of *Trichoclinocera yixianensis* species-group, lateral view. **27–28.** *T. pakistanensis* sp. nov. **27.** Male terminalia, stained with Delafield hematoxyline. **28.** Clasper, inner view. **29–30.** *T. yixianensis* Li & Yang. **29.** Male terminalia. **30.** Clasper. **31–32.** *T. yixianensis* Li & Yang. **31.** Female terminalia. **32.** Close-up of female proctiger. Scale bars: Figs 28, 30 = 0.5 mm; Figs 27, 29, 31–32 = 1.0 mm.

sternum with 1 long, spine-like seta and several pale setae, longer than width of fore coxa; anepisternum with a few pale setulae on ventral part; katepisternum with a few minute pale setulae; hind margin of metepisternum with 1 white setula.

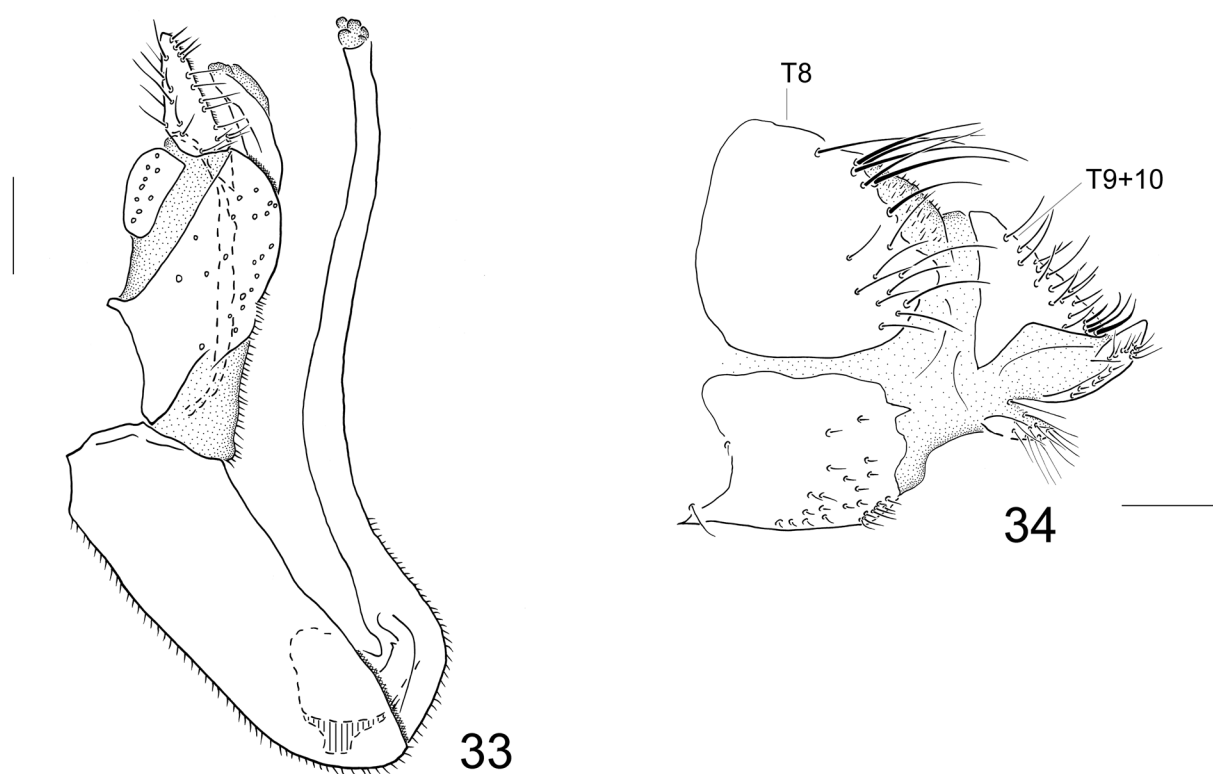
Wing (Fig. 37) narrow, lightly infusate, without markings; pterostigma very inconspicuous, possibly lacking. One basal costal seta, one-half length of posterior dc. Sparse row of setulae from base of R to mid-length of R<sub>1</sub>; auxiliary crossvein lacking; cell dm produced apically; R<sub>4</sub> and R<sub>5</sub> divergent. Halter knob dark, base of shaft paler.

Legs dark, brownish; coxae with blue pruinescence, concolourous with pleura. Coxae with long, pale marginal setae; fore coxa with erect, pale, anterolateral setae, longer than width of coxa. Fore femur (Fig. 10) evenly tapered apically, except extreme base distinctly swollen; base with 3 black, spine-like setae, anterior posterolateral seta ca. one-half length of femur, remaining setae one-third length of anterior seta; anteroventral row of ca. 20 stout, spine-like setae extending length of femur,

length less than one-fourth width of femur, decreasing in length apically; lacking conspicuous preapical anterior setae; row of slender, pale posteroventral setae extending length of femur, some subequal in length to width of femur; 1 spine-like posteroventral seta near mid-length of femur, subequal in length to basal width of femur; dense, very short, white pile beneath. Fore tibia slightly arched with row of stout setae beneath, length of some subequal to width of tibia, shorter proximally. Mid femur with slender anteroventral and posteroventral preapical setae; lacking anterodorsal and posterodorsal setae. Hind femur lacking distinct anteroventral setae; lacking anterodorsal and posterodorsal setae. Hind tibia lacking posterodorsal spur-like seta near base; several erect dorsal and anteroventral setae on apical fourth. Tarsi nearly subequal in length to corresponding tibiae. Empodium pulvilliform, subequal in length to claw, less than half length of tarsomere.

Abdomen concolourous with thoracic pleura in lateral view. Terminalia (Figs 15, 21–22): hypandrium broad ba-





**Figs 33–34.** Terminalia of *Trichoclinocera yixianensis* Li & Yang, lateral view. **33.** Male. **34.** Female. Scale bars = 0.1 mm. Abbreviation: T = tergite.

sally, tapered apically, nearly 1.5x length of epandrium; anterior margin with small projection. Phallus extending beyond clasping cercus; strongly bent subbasally; shaft narrow with broad, expanded base; apex with cup-like opening, with small, round, bulbous swelling of membrane, slightly wider than diameter of apex of phallus; membrane lacking microtrichia; ejaculatory apodeme arched strongly within base of phallus. Epandrium with large membranous area at basal margin with hypandrium. Surstylus slender, two-thirds length of clasping cercus, lacking apical setae and microtrichia. Clasping cercus subtriangular, tapered apically; long, fine setae on ventral margin; inner dorsal margin with peg-like setae along entire length.

**Female.** Unknown.

**Distribution.** Known only from the holotype, collected in central Nepal, west of Pokhara (Fig. 41).

**Etymology.** The specific epithet is named after Akinori Nakanishi, the collector of the holotype of this species.

***Trichoclinocera pakistanensis* sp. nov.**

(Figs 11–12, 16, 27–28, 38, 41)

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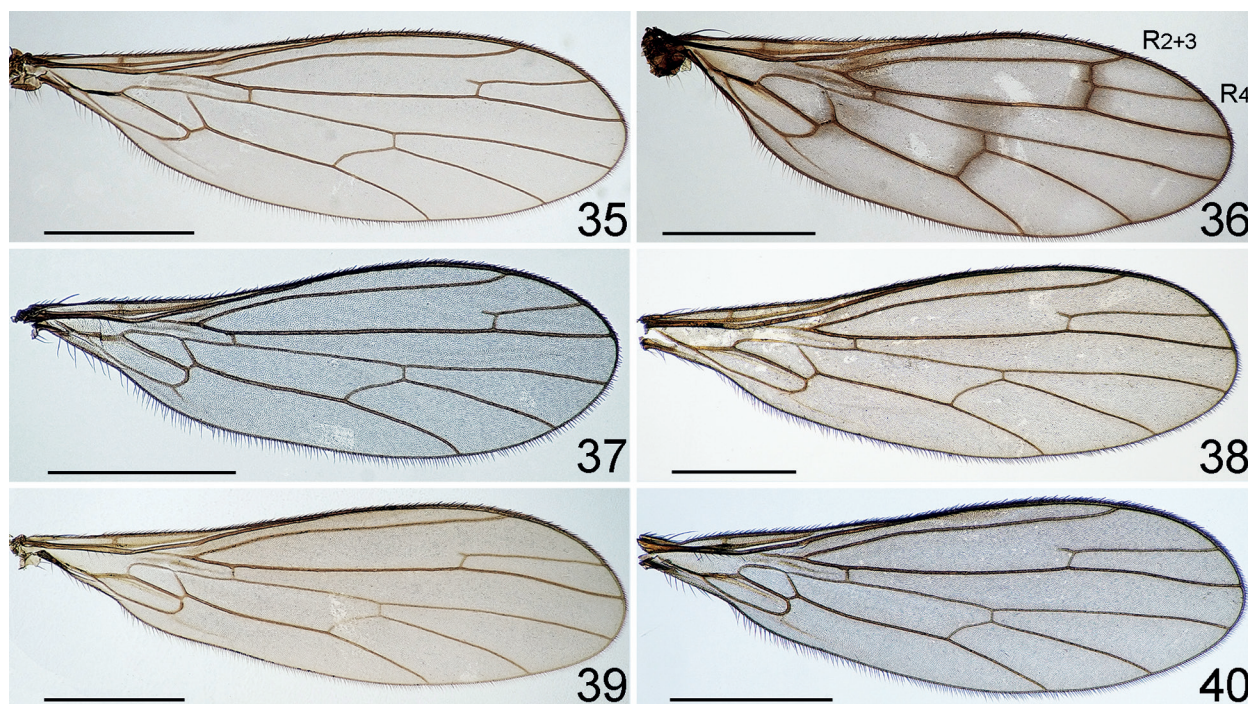
**Type material.** **HOLOTYPE** ♂, labelled: “(PAKISTAN)/ Naran/ Kagan V./ 1800m/ 22.vii.1987/ K. Kanmiya”; “[HOLOTYPE]/ *Trichoclinocera/ pakistanensis* / Saigusa & Sinclair [red label]” (KUMF). **PARATYPES:**

**PAKISTAN:** same data as holotype [34°54' N 73°39' E] (1 ♀, CNC; 1 ♀, KUMF).

**Recognition.** This species is distinguished by the pair of long spine-like setae at the base of the fore femur, very short anteroventral setae at mid-length of fore femur hidden within pile, giving appearance of a broad gap, pale yellowish-brown legs and clear wings.

**Description.** Wing length 3.9–4.3 mm. **Male.** Pale grey-blue pruinescence and pale yellowish-brown legs (Fig. 11). Head pointed ventrally, compound eyes oval; facets enlarged anteroventrally. Face greatly narrowed medially, less than width of antennal socket, with bright whitish pruinescence for full length; lower margin of face with short, narrow cleft, lacking carina; gena one-seventh as wide as eye height. Frons greyish brown; vertex and ocellar triangle dark brown, lower postocciput brown, gena lightly pruinescent. Ocellar setae longest among cranial setae; occiput with 3–4 pairs of setae posterior to ocellar triangle; postocular with row of short setae along margin of eye, upper 3–4 setae dark, stouter than lower setae. Arista lost in type series. Palpus pointed apically, ca. one-fourth height of eye.

Pleura grey with pale grey-blue pruinescence; scutum brown with pale, somewhat bluish lateral margins and median paler stripe extending full length of scutum; postpronotal lobe and postalar callus paler brown; faint dark vitta along inner edge of dc in dorsal view. Thoracic setae long, some subequal to width of eye; acrostichal setulae



**Figs 35–40.** Wings of *Trichoclinocera yixianensis* species-group. **35.** *T. emotoi* sp. nov. **36.** *T. maculata* sp. nov. **37.** *T. nakanishii* sp. nov., holotype. **38.** *T. pakistanensis* sp. nov. **39.** *T. yixianensis* Li & Yang (Bhutan). **40.** *T. yixianensis* Li & Yang (Shaanxi). Scale bars = 1.0 mm. Abbreviations:  $R_{2+3}$  = second branch of radius;  $R_4$  = upper branch of third branch of radius.

lacking; 5 pairs dc; 1 very short, pale pprn, one-fourth length of dc; 1 presut spal; 2 npl; 2 psut spal; 1 pal; 2 pairs setl, lacking setulae; several pale setulae on postpronotal lobe and notopleural depression. Laterotergite with patch of pale setae; prothoracic episternum without spine-like setae; anepisternum with posterior setulae; katepisternum without setulae; hind margin of metepisternum with white setulae.

Wing (Fig. 38) narrow, lightly infusate, without markings; pterostigma very narrow, faint, elliptical. One basal costal seta, one-half length of posterior dc. Sparse row of setulae from base of R to mid-length of  $R_5$ ; auxiliary crossvein lacking; cell dm produced apically;  $R_4$  and  $R_5$  divergent. Halter pale brown.

Legs yellowish-brown, darker towards tarsi, coxae with faint blue pruinescence. Coxae with long, pale marginal setae; fore coxa with long, pale anterolateral setae, shorter than width of coxa. Fore femur (Fig. 12) distinctly swollen, tapered apically evenly throughout; base with 2 black, spine-like setae, posterolateral seta ca. one-third length of femur, anterolateral seta thinner and one-half length of posterolateral seta; anteroventral row of stout, spine-like setae extending length of femur, setae very short medially hidden within pile, setae of apical and basal fourth pronounced ca. one-fourth width of femur; 5–6 slender, preapical anterior setae, longer than anteroventral setae; row of slender, pale posteroventral setae extending length of femur, length less than width of femur; without spine-like, posteroventral setae near mid-length;

dense, very long, white pile beneath. Fore tibia straight to distinctly curved, with row of stout setae beneath, nearly subequal in length to width of tibia; apical third with long spine-like seta, 2x width of tibia. Mid femur with slender anteroventral and posteroventral preapical setae; lacking anterodorsal and posterodorsal setae. Hind femur without distinct anteroventral setae; lacking anterodorsal and posterodorsal setae. Hind tibia without posterodorsal spur-like seta near base; 2–3 erect, dorsal spine-like setae and 1 similar ventral seta on apical fourth. Tarsi one-third to one-half longer than corresponding tibiae. Empodium pulvilliform, subequal in length to claw, less than half length of tarsomere.

Abdomen concoloured with thoracic pleura in lateral view. Terminalia (Figs 16, 27–28): hypandrium slender, tapered apically, subequal in length to epandrium; anterior margin rounded. Phallus extended slightly beyond clasping cercus; straight beyond base; shaft narrow with expanded base; apex with small, round, membranous swelling; membrane lacking microtrichia; ejaculatory apodeme arched within base of phallus. Epandrium subtriangular, with large membranous area at basal margin with hypandrium. Surstylus slender, slightly shorter than length of clasping cercus, lacking apical setae or long microtrichia. Clasping cercus broad, subtriangular, tapered apically; long, fine setae on ventral margin; inner dorsal margin lacking peg-like setae.



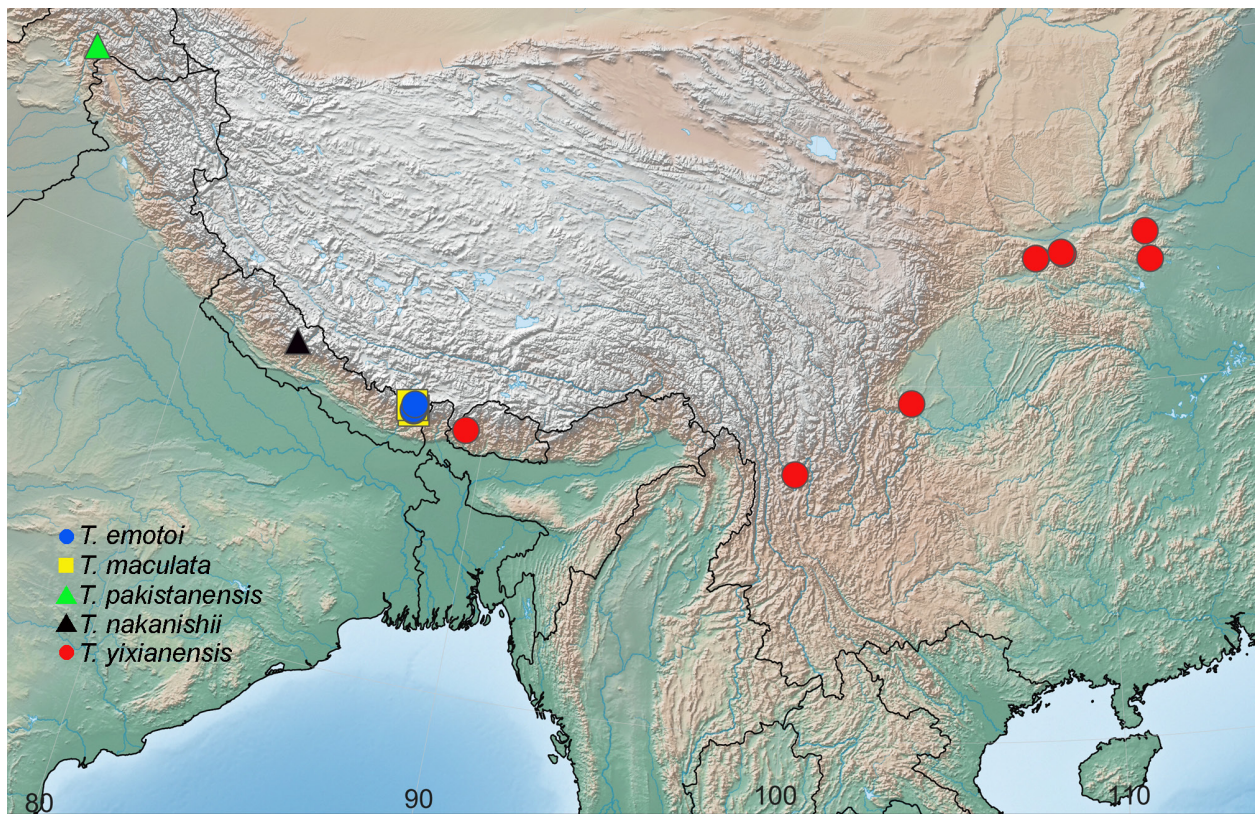


Fig. 41. Known distribution of the *Trichoclinocera yixianensis* species-group.

**Female.** Similar to male including chaetotaxy of legs; posterolateral basal seta of fore femur more than one-third length of femur.

**Distribution.** Known only from the type locality in the western Himalayas (Fig. 41).

**Etymology.** The specific epithet is in reference to the country of the type locality.

*Trichoclinocera yixianensis* Li & Yang, 2009  
(Figs 1–4, 23–26, 29–30, 33–34, 39–41)

*Trichoclinocera yixianensis* Li & Yang, 2009: 134. Type locality: China: Henan, Yixian, Huaguoshan Mountain [34°18' N 111°50' E].

**Material examined.** **BHUTAN:** E of Jilay La [27°22' N 89°22' E], 3000 m, 19.viii.1993, T. Saigusa (1 ♂, KUMF). **CHINA: Shaanxi:** Zuoshui-x, Brook nr tunnel, Hetaoping [33°47' N 108°54' E], 1650–1750 m, 20.vi.1997, T. Saigusa (4 ♂♂, 1 ♀, CNC; 21 ♂♂, 24 ♀♀, KUMF); Zuoshui-x, Brook nr tunnel, Hetaoping 1650–1750 m, 20.vi.1997, T. Saigusa (1 ♀, KUMF); Fuping-x, Bridge 3 km NW of Donghetai [33°41' N 107°57' E], 1500 m, 28.vi.1997, T. Saigusa (12 ♂♂, 5 ♀♀, KUMF); Fuping-x, Dadianzi, 1850–1960 m, 5 km N of Donghetai, 8.vii.1997, T. Saigusa (2 ♂♂, 3 ♀♀, KUMF); Fuping-x, Daping-Huanmuqiao, 1550–1600 m, WNW of Donghetai, 28.vi.1997, T. Saigusa (1 ♀, CNC); Fuping-x,

Daping-Huanmuqiao, 1500–1600 m, WNW of Donghetai, 28.vi.1997, T. Saigusa (3 ♂♂, 1 ♀, KUMF); Fuping-x, Huanmuqiao, 1600–1700 m, WNW of Donghetai, 28.vi.1997, T. Saigusa (2 ♂♂, 1 ♀, CNC; 1 ♂, 3 ♀♀, KUMF); Fuping-x, Wangkoushang, 1450 m, 2 km NE Donghetai, 25.vi.1997, T. Saigusa (2 ♀♀, KUMF); Zuoshui-x, W of Hetaoping, 1500–1550 m, 10.vii.1997, T. Saigusa (6 ♂♂, 3 ♀♀, KUMF); Zuoshui-x, Yingpan-linchang [33°50' N 108°50' E], 1850 m, 10.vii.1997, T. Saigusa (4 ♂♂, 5 ♀♀, KUMF); Fuping-x, Liangfengya, 2000–2100 m, 12 km WNW Longcaoping [33°41' N 107°56' E], 24.vi.1997, T. Saigusa (7 ♂♂, 1 ♀, KUMF). **Sichuan:** Jingding, 2900–3030 m, Emeishan [29°30' N 103°40' E], 8.viii.1998, T. Saigusa (2 ♂♂, 1 ♀, CNC; 5 ♂♂, 10 ♀♀, KUMF). **Yunnan:** Zhongdian, Tuomunan [27°20' N 99°59' E], 3030–3500 m, 42 km N Qiaotou, 11.vi.1996, T. Saigusa (1 ♂, KUMF).

**Recognition.** This species is distinguished by the three long spine-like setae at the base of the fore femur and apical half with 4–5 spine-like posteroventral setae, generally pale yellowish-brown legs, elongate hypandrium and clear wings.

**Redescription.** Wing length 3.9–4.4 mm. **Male.** Pale grey-blue pruinescence and yellowish-brown legs (Figs 23, 25). Head pointed ventrally, compound eyes oval; facets enlarged anteriorly (e.g., Fig. 26). Face greatly narrowed medially, less than width of antennal socket, with bright whitish pruinescence for full length; lower

margin of face with short, narrow cleft, lacking carina; gena one-seventh as wide as height of eye. Frons slightly darker than face; vertex and ocellar triangle dark brown, lower postociput brown, gena lightly pruinose. Ocellar setae longest among cranial setae; occiput with 3–4 pairs of setae posterior to ocellar triangle; postocular with row of short setae along margin of eye, upper 3–4 setae dark, stouter than lower setae. Arista-like stylus long and slender, somewhat tapered apically. Palpus pointed apically, ca. one-fourth height of eye.

Pleura brownish with pale grey-blue pruinescence; scutum brown with pale, somewhat bluish lateral margins; posterolateral margin of postpronotal lobe shiny brown; black vitta along inner edge of dc inconspicuous. Thoracic setae long, some subequal to width of eye; acrostichal setulae lacking; 5 pairs dc; 1 pprn reduced to black or pale setula, very short, inconspicuous; 1 presut spal; 2 npl, lower slender; 1–2 psut spal, anterior more slender and shorter than posterior; 1 pal; 2 pairs sctl, lacking setulae; several pale setulae on postpronotal lobe and notopleural depression. Laterotergite with patch of pale setae; prothoracic episternum with pair of pale spine-like setae; anepisternum with short pale posterior setulae; katapisternum and hind margin of metepisternum with pale setulae.

Wing (Figs 39, 40) narrow, lightly infuscate, lacking markings; pterostigma very narrow, faint, elliptical. One basal costal seta, one-half length of posterior dc. Row of setulae extending from base of R to just beyond Rs branching; auxiliary crossvein lacking; cell dm produced apically;  $R_4$  and  $R_5$  divergent throughout; base of  $R_4$  with small spur. Halter dark, except extreme base orange-brown.

Legs yellowish-brown, tarsi darker towards tips, coxae with faint blue pruinescence, especially darker on fore coxa. Coxae with long, pale marginal setae; fore coxa with long pale anterolateral setae. Fore femur (Figs 3, 24) distinctly swollen, tapered apically evenly throughout; base with 3 black, spine-like setae, posterolateral seta ca. one-half length of femur, anterolateral and posterior setae thinner and one-half length of posterolateral seta; anteroventral row of short, stout spine-like setae extending length of femur, becoming stouter apically, setae longer than pile; 5–6 slender, preapical anterior setae, longer than anteroventral setae; row of slender, pale posteroventral setae extending length of femur, length less than width of femur; apical half with 4–5 spine-like, posteroventral setae, basal seta ca. two-thirds width of femur, remaining setae decreasing in length apically; dense, long, white pile beneath. Fore tibia slightly curved with row of stout setae beneath, length ca. one-half width of tibia; setae of equal length, except apical seta. Mid femur with 1 (sometimes 2) pairs of spur-like anteroventral and posteroventral preapical setae; lacking anterodorsal and posterodorsal setae. Hind femur with 1 preapical anteroventral seta; lacking anterodorsal and posterodorsal setae.

Hind tibia without spur-like posterodorsal seta near base; sometimes spur-like, dorsal seta on apical fourth; erect dorsal and ventral spine-like setae on apical third. Tarsi ca. one-third longer than corresponding tibia. Empodium pulvilliform, shorter than length of claw, less than half length of tarsomere.

Abdomen concolourous with thoracic pleura in lateral view, with mostly dark setae in dorsal view. Terminalia (Figs 29–30, 33): hypandrium slender, slightly tapered apically, nearly 1.3x length of epandrium; anterior margin somewhat pointed. Phallus extending slightly beyond clasping cercus; gradually arched to strongly bent subbasally; shaft narrow with expanded base; apex with cup-like opening, with small, round, bulbous swelling of membrane, slightly wider than diameter of apex of phallus; membrane lacking microtrichia; ejaculatory apodeme arched within base of phallus. Epandrium subtriangular, with large membranous area at basal margin with hypandrium. Surstylus slender, two-thirds length of clasping cercus, lacking apical setae or long microtrichia. Clasping cercus narrow, digitiform, tapered apically; long, fine setae on ventral margin; inner dorsal margin lacking peg-like setae.

**Female.** Similar to male including chaetotaxy of legs (Fig. 4). Sclerites of segment 8 not overlapped laterally (Figs 31, 34); T8 with posterior row of long and short setae, T9+10 with stout, curved setae along inner margin, with apical setae more stout than remaining setae (Fig. 32); anteroventral corner of T9+10 narrowed and prolonged obliquely.

**Distribution.** This is the most widespread species of this group, found in Bhutan and China (Henan, Shaanxi, Sichuan, Yunnan) (Fig. 41).

#### Key to species of the *T. yixianensis* species-group

- 1 Wings spotted and auxiliary crossvein between  $R_4$  and  $R_{2+3}$  present (Figs 7, 36) ..... *T. maculata* sp. nov.
- Wings not spotted and without auxiliary crossvein between  $R_4$  and  $R_{2+3}$  (Figs 35, 37–40) ..... 2
- 2 Legs dark (Figs 5, 6, 9, 10) ..... 4
- Legs yellowish-brown (Figs 11–12, 23–25) ..... 3
- 3 Fore femur with posteroventral spine-like seta near mid-length (Figs 3, 24); mid femur with one pair of stout preapical anteroventral and posteroventral setae; anteroventral setae at mid-length of fore femur extending beyond pile (Fig. 24); clasping cercus narrow, digitiform, with slender inner setae (Fig. 30) ..... *T. yixianensis* Li & Yang
- Fore femur without posteroventral spine-like seta near mid-length (Fig. 12); mid femur without pair of stout preapical anteroventral and posteroventral setae; anteroventral setae at mid-length of fore femur hidden within pile (Fig. 12); clasping cercus subtriangular, with stout inner setae (Fig. 28) ..... *T. pakistanensis* sp. nov.



- 4 Fore femur with pair of stout setae mounted on short tubercles (Fig. 6); clasping cercus finger-like, tapered on apically half, with broad U-shaped notch at base (Figs 13, 18) ..... *T. emotoi* sp. nov.
- Fore femur with pair of stout setae not mounted on short tubercles (Fig. 10); clasping cercus subtriangular, tapered apically, without U-shaped notch at base (Figs 15, 22) .... *T. nakanishii* sp. nov.

## DISCUSSION

There are now 44 described species of *Trichoclinocera* worldwide, of which 28 species are known from the eastern Palearctic and Oriental Regions. Currently most species are recorded from the Himalayas with eight species and Japan with nine species. An additional 26 undescribed species from species-groups not yet treated have been identified by the authors.

Adults of *Trichoclinocera* normally occur on large, emergent rocks or boulders in fast flowing streams and rivers together with other clinocerine genera. But exceptions have been noted and summarized as follows: adults of two Japanese species (*T. miranda* Saigusa & Sinclair, 2016 and *T. shinogii* Saigusa & Sinclair, 2016) were observed on moist sand close to water of slowly moving rivers, or on pebbles in shallow streamlets partially separated from the main river, a rather unusual habitat for this genus. The first author notes that *T. dasyscutellum* (Saigusa, 1965) has almost always been collected along narrow, shallow streamlets in forests, whereas adults of *T. yixianensis* were surprisingly collected on vertical rock seepages and steeply inclined or cliff-like surfaces of small streams.

Sinclair (1994) initially recognized six species-groups of *Trichoclinocera* in a revision of the Nearctic species (*comata*, *dasyscutellum*, *dolicheretma*, *lapponica*, *longipes*, *stackelbergi* groups). Some of the definitions of these groups were re-evaluated by Saigusa & Sinclair (2016), with the *T. longipes* species-group transferred into an expanded concept of the *T. stackelbergi* species-group. Most described and undescribed Palearctic and Oriental species are assigned to the *T. lapponica* species-group. In the present study, the *T. yixianensis* species-group is newly described for a morphologically unusual group of Palearctic/ Oriental species. A small group of species related to *T. maewa* Smith, 1965 appear to form an additional species-group, defined on the basis of a cluster of spicule-like projections near the apex of the phallus. Future studies will focus on this latter group, as well as new species in the *T. lapponica* and *T. stackelbergi* species-groups.

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