

Four new species of the *Triplophysa stoliczkai*-complex from China (Pisces: Cypriniformes: Balitoridae)

A.M. Prokofiev

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Four new species of the genus *Triplophysa* (*T. aquaeaeeruleae*, *T. hialmari*, *T. rossoperegrinatorum* and *T. alexandrae* spp. n.) from China are described. All these species belong to the *T. stoliczkai*-complex. A revised diagnosis of this complex is given. Validity of *T. tenuis* (Day), *T. dorsonotata* (Kessler) and *T. stenura* (Herzenstein) is briefly discussed.

A.M. Prokofiev, Laboratory of Fishes and Fish-like Vertebrates, Palaeontological Institute, Profsoyuznaya ul. 123, Moscow 117647, Russia; e-mail: vnikit@paleo.ru

Introduction

The genus *Triplophysa* Rendahl, 1933, one of the largest in the subfamily Nemacheilinae, comprises about 90 valid species, most of which are distributed in the High Asiatic basins. One of the widely distributed species of the genus is *T. stoliczkai* (Steindachner, 1866). Its range covers a large territory from the upper reaches of Amudarya, Syrdarya, Chu and Indus rivers through N India and inner basins of Kokonor, Qinghai and Qaidam to headwaters of the Hwang-ho and Changjiang rivers in NW China (Turdakov, 1946, 1952; Berg, 1949; Jayaram, 1981; Menon, 1987; Zhu, 1989). Within this large territory, *T. stoliczkai* shows a great variability and was described as a number of nominal species (*Cobitis uranoscopus* Kessler, 1872; *C. elegans* Kessler, 1874; *Nemacheilus tenuis* Day, 1876; *N. dorsonotatus* Kessler, 1879; *N. stenurus* Herzenstein, 1888; *N. fedtschenkoae* A. Nikolski, 1903; *N. cueljuensis* Anikin, 1905), which were synonymized with *T. stoliczkai* by Berg (1949). Berg (op. cit.) also suggested the synonymy of *T. stoliczkai* with *Nemacheilus lhasae* Regan, 1905 and *N. choprai* Hora, 1922, but these two taxa seem to be valid (Tchang et al., 1962; Jayaram, 1981). The first investigations of the *T. stoliczkai*-complex were made by Berg (1931) and

Turdakov (1946, 1954). Berg described a closely related but well distinct *Nemacheilus lacusnigri* from Karakol Lake. Turdakov in 1946 first revised intraspecific variability of *Nemacheilus stoliczkai* and later (in 1954) distinguished one more *N. stoliczkai*-related species from the Syrdarya River, *N. conipterus*. Subsequently, Chinese authors described further new taxa from China [*T. tanggulaensis* (Zhu, 1982); *T. xingshanensis* (Yang & Xie, 1983); *T. cakaensis* Cao & Zhu, 1988; *T. gerzeensis* Cao & Zhu, 1988 and others (see below)], which seem to be close to *T. stoliczkai* (Zhu, 1982; Yang & Xie, 1983; Cao & Zhu, 1988; Wu & Wu, 1988; Zhao & Wang, 1988; Ding, 1993).

The author revised the collection of loaches of the Zoological Institute, St.Petersburg (ZISP) and revealed there 4 new species closely related, but not identical to *T. stoliczkai*. These new species (*T. aquaeaeeruleae*, *T. hialmari*, *T. rossoperegrinatorum* and *T. alexandrae* spp. n.) are described in the present paper. The collection of the Zoological Museum, Moscow University (ZMMU) was examined as well. Our analysis showed that further study of Chinese nemacheilins related to *T. stoliczkai* is needed, because some identifications of loaches as *T. stoliczkai* known in literature are uncertain. Turdakov (1952) noted that some Chinese

populations of this species may represent distinct subspecies. Likewise, the specimens from Tsangpo described and figured by Tchang et al. (1962, p. 625; fig. 1-3) as *Nemacheilus stoliczkai* actually belong to an undescribed species on the basis of their coloration, proportions, air bladder capsule and intestine morphology.

Many Chinese authors considered *T. dorsonotata* and *T. stenura* as distinct species (Zhu, 1982, 1989; Yang & Xie, 1983; Zhao & Wang, 1988, etc.). Our examination of two syntypes of *T. dorsonotata* (ZISP, no. 4175), holotype of *T. stenura* (ZISP, no. 7355) and 65 specimens of *T. stoliczkai* from Amudarya, Syrdarya, Chu and upper reaches of Hwang-ho and Changjiang river basins, and from inner basins of Qaidam and Kokonor (ZISP: nos 7257, 7272, 7312, 7855, 9712, 10422, 16376, 22056; ZMMU: nos 2248, 2541, 3499, 3644, 3646, 5520, 5558) made evident that the former two taxa are conspecific, while *T. stenura* differs in the presence of characteristic yellowish dark markings on the caudal base, more anterior position of the dorsal fin, more pores in the supratemporal commissure (5 vs. typically 3) and is possibly a distinct species, but for its re-evaluation much more material is needed. Also, *T. tenuis* (6 specimens from Kalai-Vamar, Pamir, ZISP no. 20718, examined) is a distinct species rather than a variety or synonym of *T. stoliczkai*, because it differs from the latter in the more elongate body, longer and shallower caudal peduncle, more anterior position of dorsal fin (dorsal originates closer to snout than to caudal base, in contrast to reverse condition, or equidistant position of dorsal in *T. stoliczkai*), also in the shape of brush-like pads in preorbital/suborbital of males and in more pores in the supratemporal commissure (typically 5 or 6, rarely 3 vs. typically 3, rarely 4 in *T. stoliczkai*).

T. stoliczkai and related species (including all of those described below as new), forming the *T. stoliczkai*-group, differ from other species and species groups of the genus *Triplophysa* in the following combination of characters.

Body elongate cylindrical, thick (but relatively compressed in *T. alexandrae* sp. n.), with nearly straight dorsal profile; caudal peduncle moderately to very elongate; head strongly depressed. Eyes moderate to small (minute in *T. microps*); interorbital region flat and moderately broad. Nasal flap short, broad and rounded. Posterior

and anterior nasal openings closely spaced, the posterior encloses the anterior. Lips more or less furrowed, lower lip with mental lobes (sometimes weakly expressed), but without lateral lobes; upper lip without lateral prolongation above the third pair of barbels. Upper margin of lower lip not close to margin of lower jaw. Processus dentiformis or keel on upper jaw absent. Dorsal fin origin slightly posterior to midbody or equidistant to snout and caudal base (except *T. tenuis*), with 6-9 (usually 7-8) branched rays. Anal fin with 5-6 branched rays. Pectoral fin not reaching ventral fin origin. Ventral fins placed from slightly anterior to slightly posterior to dorsal fin origin. Anus removed from anal fin origin not more than by the distance between posterior border of second nare to posterior border of eye (usually not more than by eye diameter). Caudal fin emarginate to moderately forked. No traces of adipose crests on caudal peduncle. Air-bladder bony capsule with rounded, well spaced lateral plates and short (sometimes indistinct) posterior corners. Intestine with 4 or more coils (except *T. hialmari* sp. n. with 2 coils). Sexual dimorphism pronounced; males with two or more brush-like pads of tubercles in preorbital/suborbital region on each side of head; in most species these pads also present on broadened pectoral rays.

Included species (validity of the two species marked with * was proved by Zhao, 1984): *T. alexandrae* sp. n.; *T. aquaecaeruleae* sp. n.; *T. brevibarba* Ding, 1993; **T. brevicauda* (Herzenstein, 1888); *T. cakaensis* Cao & Zhu, 1988; *T. choprai* (Hora, 1934); *T. coniptera* (Turdakov, 1954); *T. gerzeensis* Cao & Zhu, 1988; *T. hialmari* sp. n.; *T. intermedia* (Kessler, 1876); **T. leptosoma* (Herzenstein, 1888); *T. lhasae* (Regan, 1905); *T. microps* (Steindachner, 1866); *T. obtusirostra* Wu & Wu, 1988; *T. rossoperegrinatorum* sp. n.; *T. stoliczkai* (Steindachner, 1866); *T. tanggulaensis* (Zhu, 1982); *T. tenuicauda* (Steindachner, 1866); *T. tenuis* (Day, 1876); *T. texiensis* (Zhao & Wang, 1988); *T. xingshanensis* (Yang & Xie, 1983); *T. yasinensis* (Alcock, 1889).

Remarks. Species of this complex are most closely related to the *T. bombifrons*-complex. *T. bombifrons* (Herzenstein, 1888), the only described species of the latter group, differs from the studied complex in the convex interorbital, smaller eyes, arched dorsal profile, pectinated lips with upper lip forming a finger-like projections laterally above the base of third pair of barbels,

much more elongated and narrow caudal peduncle and deeply forked caudal fin. Also *T. macromaculata*-complex (included species: *T. macromaculata* Yang, 1990; *T. nandanensis* Lan, Yang & Chen, 1995; *T. nanpanjiangensis* Zhu & Cao, 1988) seems to be closely related to the *T. stoliczkai*-complex although differs from the latter in the presence of elongate barbel-like nasal flap, longer pectoral fin and lips without furrows. *T. griffithi* Günther, 1868, from the Indus basin, also is very close to *T. stoliczkai*-complex but differs in the presence of slight dorsal tidge on the last third of caudal peduncle.

In the descriptions of new species, the formula NF is given after Naseka (1996), measurements and ratios for holotype are given first and followed by data for paratype(s) in parentheses.

***Triplophysa aquaeaeeruleae* sp. n.** (Figs 1-6)

Holotype. ZISP no. 12494, female, 94 mm SL; locality: Ba-tshu [Ba Qu?] River, a tributary of Blue (= Changjiang) River, [env. of Yushu, Qinghai, ca. 33°N 92°E], NW China; coll.: Kozlov & Kaznakov, August 1900.

Paratypes: ZISP no. 12494a, 3 specimens, 80-108 mm SL, same locality and date.

Diagnosis. Body thick, maximum width subequal to maximum depth. Caudal peduncle length contained 3.76-4.5 times in standard length (SL). Caudal peduncle depth contained 5.0-5.3 times in its length. Snout slightly longer than postorbital part of head. Anterior margin of eye situated posterior to mouth corner. Infraorbital canal without angular flexure. Brush-like pads on preorbital/suborbital region of males finely granulated. Dorsal fin origin closer to caudal base than tip of snout, with slightly concave upper margin and eight branched rays. Tip of adpressed dorsal fin extending posterior to vertical of anal fin origin. Tips of pectoral fins formed by second and third or only third branched rays. Pores in lateral line 78-86. Intestine with 5-6 coils. Coloration on dorsal and lateral surfaces of body very dark, with 4 to 10 pale saddles of various shape on dorsum.

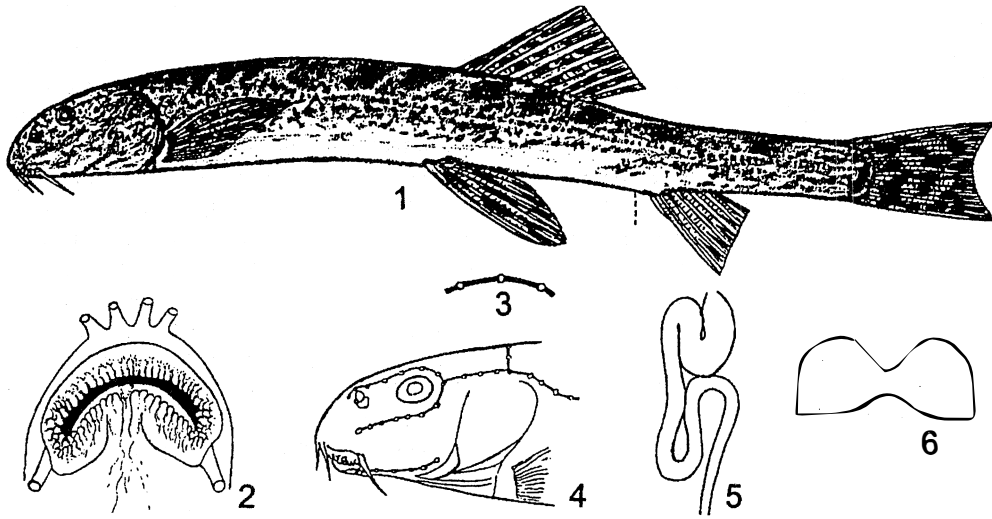
Description. D III, 8. A II, 5. P I, 9-11. V I, 6-7. C I+8+8+I. Sp. br. 12. Vert. 4+37-38+1=42-43. NF 42-43 (17-18) 22-24 (3) + (1) 19-20 (18-19).

Body scaleless, cylindrical, thick, with more or less uniform depth and width before dorsal fin, but becoming shallower and slightly compressed toward caudal peduncle; maximum body

depth 8.2 (8.0-10.3) times in standard length (SL). Caudal peduncle of moderate depth, the latter contained 18.8 (19.6-24.0) times in SL and 5.0 (5.0-5.3) times in the caudal peduncle length. Length of caudal peduncle much greater than maximum depth of body and greater than head length, contained 3.76 (3.9-4.5) times in SL. Maximum width of body equal to maximum depth. Head strongly depressed, conical, bluntly rounded anteriorly; much wider than deep, its length contained 4.7 (4.4-5.0) times in SL. Snout length contained 2.0 (2.0-2.3) times in head length and slightly greater than length of postorbital part of head. Eyes moderate, dorsal in position; eye diameter contained 1.4 (1.25-1.3) times in interorbital distance. Proportions are given in Table 1.

Both anterior and posterior nares close together, the latter larger than anterior one and encloses it posteriorly. Nasal flap short, rounded. Mouth inferior in position (Fig. 2); lips strongly furrowed. Lower lip wide, with well-developed, flat mental lobes. Upper margin of lower lip separated from upper margin of lower jaw. Lower jaw broadly rounded in outline, without median keel. No processus dentiformis or keel on upper jaw. Three pairs of moderately long barbels. Length of first (rostral) pair contained 1.6 (1.4-1.6) times in the length of the second (maxillary), and the latter 1.3 (1-1.2) times in the length of the third (mandibular) pair. Mandibular barbels extend to posterior margin of orbit, their length contained 2.25 (3.3) times in head length. Supraorbital sensory canal of head (cso) continuous, confluent with infraorbital canal (cio); the latter confluent with supratemporal commissure (cst) and body lateral line (cLL) (Figs 3, 4). Cio bears no angular flexure below posteroventral orbital margin. Preoperculo-mandibular canal (cpm) ends on the line of mouth. Number of pores in laterosensory system: cso 7-8, cio 11-14, cst 3, cpm 6, cLL 78-86. Lateral line complete.

Dorsal fin originates slightly closer to caudal base than to tip of snout; tip of adpressed dorsal fin extending nearly to the vertical through the middle of anal fin base. Upper margin of dorsal fin slightly concave. Anal fin short-based, with straight lower margin. Pectoral fins moderately long, extending for nearly two-thirds pecto-ventral distance in length. Outer pectoral fin rays broadened, tip of fin formed by second and third or only third branched rays. Ventral fins situated



Figs 1-6. *Triplophysa aquaecaeruleae* sp. n.: 1, lateral view; 2, ventral view of mouth; 3, 4, cephalic laterosensory system (3, supratemporal commissure pattern; 4, lateral view); 5, intestine; 6, air bladder bony capsule. Abbreviations for laterosensory canals are given in text.

from slightly anterior to slightly posterior to dorsal fin origin., their fins formed by second and third or only second branched rays. Ventrals extended slightly beyond anus, sometimes to the anal fin origin. Caudal fin slightly forked, a little shorter than head.

Anus close to anal fin origin; distance between them subequal to eye diameter. Intestine long, with 5-6 coils (Fig. 5). Air bladder capsule as in Fig. 6. Free portion of air bladder reduced. Sexual dimorphism present; males with a pair of elongate brush-like pads of tubercles in suborbital/preorbital region. Tuberculation on pads very fine. No such pads on the broadened pectoral fin rays.

Coloration: Body very dark, brownish anteriorly, and passing to marbled with pale background posteriorly; no distinct dark spots or bars. Head dark dorsally, marbled on cheeks and opercular region; lower part of head and belly pale. From 4 to 10 large pale saddles or bars, variable in shape, on dorsum. Poorly-visible darkish markings occur on all fins, but only dark streak on the base of unsegmented dorsal fin rays full-coloured. Peritoneum silvery, becoming darker near vertebral column.

Etymology: The species name formed from aqua (water in Latin) and caeruleus (blue in Latin) refers to the distribution in the Blue River system.

Comparison. This new species strikingly differs in the coloration from all other species of the genus. It also differs from other species of the *T. stoliczkai*-complex (except *T. tenuicauda*, *T. choprai* and *T. coniptera*) in the concave upper dorsal fin margin. The additional distinctions are as follows. The new species differs from *T. tenuicauda* in the more robust caudal peduncle (depth of caudal peduncle is 6.3 in its length in *T. tenuicauda*), greater maximum body depth (8.0-10.3 vs. 7.7 in *T. tenuicauda*) and straight (vs. concave in *T. tenuicauda*) lower margin of the anal fin. The new species differs from *T. coniptera* in the gently sloping (not humped) dorsal profile of snout, silvery peritoneum (brownish to blackish in *T. coniptera*), shorter intestine, larger number of branched rays in the dorsal fin (8 vs. 7 in *T. coniptera*) and better developed tuberculated pads on the preorbital/suborbital region in males. The much finer tuberculation on the brush-like suborbital pads of males as well as the form of the pectoral fin (apex formed by second-third vs. third-fifth (usually fourth) branched rays in compared species) distinguishes the new species from both *T. stoliczkai* and *T. choprai*. *T. choprai* also has slightly deeper caudal peduncle (4.5-5.2 in its length vs. 5.0-5.3 in the new species) and the upper pore of the preoperculo-mandibular canal

Table 1. Measurements for *Triplophysa aquaecaeruleae* sp. n. (n = 4)

Character	Holotype	Lim	M ± m	σ
In percentage of standard length				
HL	21.3	19.9-22.5	21.3 ± 0.53	1.07
BD	12.2	10.2-12.5	11.6 ± 0.72	1.25
CPD	5.3	4.2-5.3	4.9 ± 0.24	0.48
CPL	26.6	22.2-26.6	24.8 ± 0.94	1.87
aD	51.1	51.0-53.1	51.6 ± 0.50	0.99
aV	52.1	51.5-52.5	52.0 ± 0.29	1.50
aA	67.0	67.0-70.0	68.95 ± 0.67	1.33
PV	28.7	28.7-30.6	26.4 ± 0.62	1.07
VA	17.3	17.3-18.4	17.7 ± 0.34	0.59
IP	19.7	17.6-19.7	18.6 ± 0.44	0.87
IV	16.8	15.7-16.8	16.15 ± 0.25	0.51
IC	16.5	16.3-18.1	16.9 ± 0.41	0.82
IDb	8.5	8.5-13.9	11.85 ± 1.28	2.56
hD	18.1	17.1-18.9	18.2 ± 0.42	0.83
lAb	6.9	6.9-8.2	7.38 ± 0.31	0.62
hA	14.9	11.4-16.3	15.35 ± 0.43	0.86
an-A	4.3	3.8-4.6	4.2 ± 0.17	0.34
BW	11.7	10.2-11.7	11.0 ± 0.75	1.06
In percentage of head length				
ao	50.0	42.9-50.0	47.35 ± 1.69	3.39
oo	20.0	18.6-20.0	19.28 ± 0.29	0.59
io	28.75	23.3-28.75	25.2 ± 1.23	2.46
hbr	40.0	33.3-40.0	36.1 ± 1.43	2.86
an-A	20.0	16.7-23.3	19.8 ± 1.37	2.73

Note. Abbreviations are as follows: n – number of samples; Lim – maximum variations of character; M – mean; m – standard error of mean; s – standard deviation; HL – head length; BD – maximum body depth; CPD – caudal peduncle depth; CPL – caudal peduncle length; aD – predorsal distance; aV – preventral distance; aA – preanal distance; PV – ecto-ventral distance; VA – ventro-anal distance; IP – pectoral fin length; IV – ventral fin length; IC – length of caudal fin; IDb – dorsal fin base length; hD – dorsal fin height; lAb – anal fin base length; hA – anal fin height; an – A – distance from anus to anal fin origin; BW – maximum body width; ao – snout length; oo – horizontal diameter of eye; io – interorbital width; hbr – height of branchial aperture.

lies on the line of infraorbital canal (vs. on the line of mouth in the new species). *T. aquaecaeruleae* sp. n. may be distinguished from *T. breviparba* by the longer head and barbels, from *T. tanggulaensis* by the presence of 5-6 (vs. 4) intestine coils and typical rounded (not "shovel-like" as noted by Zhu, 1982, p. 224) lower jaw, from *T. microps* by the larger eyes, narrower interorbital, smaller maximum body depth (7.5 in SL in *T. microps*), form of the pectoral fin (apex formed by fourth branched ray in *T. microps*) and more furrowed lips. The new species is distinct from *T. intermedia* in the position of the upper end of the preoperculo-mandibular sensory canal on the line of mouth (vs. on the line of infraorbital canal in *T. intermedia*) and smaller number of pores in the supratemporal commissure (3 vs. 4). From *T. tenuis*, the new species differs in the more robust caudal peduncle, more posterior position of the dorsal fin origin and in the number of pores in the supratemporal commissure. *T. lacusnigri* differs from the new species in the general head configuration, shape of brush-like pads in suborbital region of males, much larger posterior nares, longer fins and caudal peduncle shorter than head (vs. longer than head in the new species). The distinctions from *T. lhasae* include the deeper caudal peduncle (5.3 or less times in caudal peduncle length vs. 5.8 or more in *T. lhasae*), tip of the adpressed dorsal fin extending to the vertical through the middle of anal base (instead of being more posterior in *T. lhasae*) and the pectoral fin shape (apex formed by second-third branched rays in the new species vs. third-fourth in *T. lhasae*). *T. yasinensis* differs from the new species in three (vs. two) brush-like pads on each side of head in males, rougher surface of these pads and in the form of the pectorals (apex formed by the fourth branched ray in *T. yasinensis*). For the distinctions of *T. aquaecaeruleae* sp. n. from *T. hialmari* sp. n., *T. rossoperegrinatorum* sp. n. and *T. alexandrae* sp. n. see the diagnoses and descriptions of these species.

***Triplophysa hialmari* sp. n.**
(Figs 7-12)

Holotype. ZISP no. 26245, male, 89 mm SL; Ba-tshu [Ba Qu?] River, a tributary of Blue (=Changjiang) River, [env. of Yushu, Qinghai, ca. 33°N, 92°E], NW China; coll.: Kozlov & Kaznakov, August 1900.

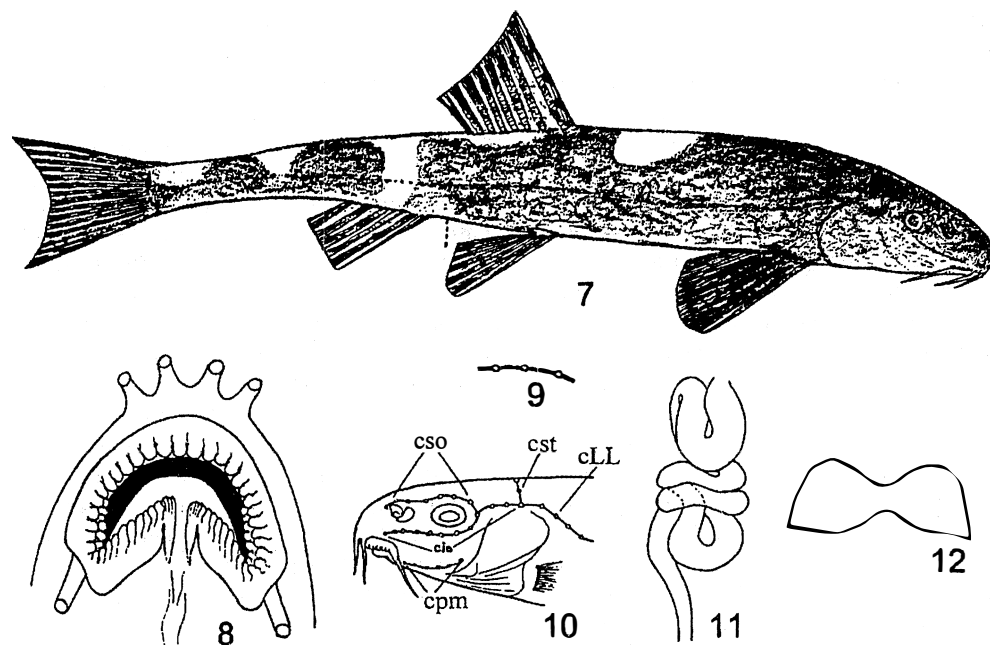
Paratype. ZISP no. 26245a, 1 specimen (female), 87 mm SL, same locality and date.

Diagnosis. Body thick, its maximum width subequal to maximum depth. Caudal peduncle length contained 4.9-5.3 times in SL. Caudal peduncle depth contained 2.75-3.3 times in its length. Head more blunt than in other species of the complex. Snout shorter than or as long as postorbital part of head. Anterior margin of eye placed posterior to mouth corner. Infraorbital canal without angular flexure. Brush-like pads on preorbital/suborbital region of males finely granulated. Dorsal fin origin closer to caudal base than tip of snout, with straight upper margin and seven branched rays. Tip of adpressed dorsal fin not extending to vertical of anal fin origin. Tips of pectoral fins formed by second and third branched rays. Pores in lateral line 86-91. Intestine with two coils. Body with darker marblings or reticulations and 10-11 brownish crossbars on dorsum from nape to caudal base, three anterior of which closely spaced. Longitudinally arranged blackish dots on dorsum present.

Description. D III, 7. A II, 5. P I, 9-10. V I, 7. C I+8+8+I. Sp. br. 10. Vert. 4+40+1=45. NF - 45: (20) 27 (4) + (1) 18 (17).

Body scaleless, cylindrical, thick, more or less uniform in depth and width before dorsal fin, but becoming shallower and slightly compressed on caudal peduncle; maximum body depth 8.9 (7.4) times in SL. Caudal peduncle moderately deep, its depth contained 16.2 (14.5) times in SL and 3.3 (2.75) times in caudal peduncle length. Length of caudal peduncle much greater than maximum depth of body and slightly greater than, or equal to, the head length; it is contained 4.9 (5.3) times in SL. Maximum width of body subequal to maximum depth. Head much wider than deep, strongly depressed, conical, bluntly rounded anteriorly; with sloping dorsal contour from the interorbital to snout tip. Head length contained 4.9 (4.8) times in SL. Snout shorter than or as long as postorbital part of head; its length contained 2.6 (2.25) times in the head length. Eyes moderately small, dorsal in position, with eye diameter contained 1.7 (1.5) times in interorbital space.

Measurements in % of SL: head length 20.2 (20.9); maximum body depth 11.2 (12.6); depth of caudal peduncle 6.2 (6.9); length of caudal peduncle 20.2 (19.0); pecto-ventral distance 32.0 (28.7); ventro-anal distance 20.8 (26.4); predorsal distance 53.4 (56.3); preanal distance 73.0 (75.9); preventral distance 52.3 (51.2); length of fins:



Figs 7-12. *Triplophysa hialmari* sp. n.: 7, lateral view; 8, ventral view of mouth; 9, 10, cephalic laterosensory system (9, supratemporal commissure pattern; 10, lateral view); 11, intestine; 12, air bladder bony capsule.

pectoral 15.2 (17.2), ventral 12.9 (17.2), caudal 15.2 (17.2); length of dorsal fin base 9.0 (9.8); length of anal fin base 6.7 (6.9); dorsal fin height 15.7 (17.8); anal fin height 12.9 (14.9); distance anus-anal origin 3.9 (4.6); maximum body width 10.1 (12). Measurements in % of head length: snout length 38.9 (44.4); eye diameter 16.7 (22.2); interorbital width 27.8 (33.3); branchial aperture height 36.1 (36.1); distance between anus and anal fin origin 19.4 (22.2).

Anterior and posterior nares close together, the latter larger than anterior one and encloses it posteriorly. Nasal flap short and rounded. Mouth inferior in position (Fig. 8); lips strongly furrowed. Lower lip wide, with pronounced mental lobes. Upper margin of lower lip separated from upper margin of lower jaw. Lower jaw broadly rounded in outline, with median keel. No processus dentiformis or keel on upper jaw. Three pairs of moderately long barbels. The first (rostral) pair 1.7 (1.25) times shorter than the second (maxillary) one, the second pair equal to (in holotype), or 1.4 times shorter (in paratype) than the third (mandibular) pair. Mandibular barbels extend to, or end slightly beyond, the posterior margin of orbit and are contained 3.6 (2.6)

times in head length. Supraorbital sensory canal of head (cso) uninterrupted, confluent with infraorbital canal (cio); the latter joining supratemporal commissure (cst) and body lateral line (cLL) (Figs 9, 10). Cio without angular flexure below posteroventral orbital margin. Upper pore of preoperculo-mandibular canal (cpm) on the line passing through the mouth corner. Number of pores in laterosensory system: cso 7, cio 12, cst 3, cpm 6, cLL 86-91. Lateral line complete.

Dorsal fin origin slightly closer to caudal base than to the tip of snout; the tip of adpressed dorsal fin does not reach slightly to anal fin origin. Upper margin of dorsal fin straight. Anal fin short based, with straight lower margin. Pectoral fins contained 2.1 (1.7) times in pectoventral distance. Outer pectoral fin rays broadened; tip of fin formed by second and third branched rays. Ventral fins placed anteriorly to dorsal fin origin; their tips formed by second or third branched ray; tips of ventral fins end slightly in front of anus. Caudal fin slightly forked, a little shorter than head.

Anus close to anal fin origin, distance between them subequal to or slightly greater than eye diameter. Intestine moderate, with two coils (Fig.

11). Air bladder capsule as in Fig. 12. Free portion of air bladder reduced. Sexual dimorphism expressed, males with brush-like pads of very fine tubercles in preorbital/suborbital region. No such pads on the broadened pectoral rays.

Coloration: Background coloration pale, brownish grey above and whitish below. Scattered brownish markings present on dorsal and lateral surfaces of body and head forming a marbled or reticulate pattern. Very short (not exceeding half distance between dorsal contour and lateral line) dark-brown dorsal bars present all over the area from nape to caudal base. Number of bars 10-11, of which six are situated in front of the dorsal origin. Three anterior dorsal bars closely spaced, those from 3 to 11 well spaced (by a distance equal to their width). Two parallel rows of minute blackish dots in front of dorsal fin and one median row behind it. Darkish markings present on dorsal, caudal, pectoral and ventral fins, but pronounced are only those on the caudal and on unbranched rays of dorsal fin. Anal fin pale. Peritoneum silvery.

Etymology. The species name is given after Swedish ichthyologist Hjalmar Rendahl for his great contribution to the systematics of Central Asian fishes.

Comparison. This new species differs from its closest relatives in the moderate intestine with 2 coils, blunter snout, which is as long as or slightly shorter than postorbital distance (vs. more or less opposite condition in other species of the group, except for *T. tanggulaensis* with snout as long as postorbital distance, see Zhu, 1982, p. 223, fig. 1), in that the tip of the addressed dorsal fin does not reach the anal fin origin (vs. extends more or less beyond this point) and in the coloration pattern. Most species of the complex have the ventral fins placed on, or slightly posterior to, the vertical of the dorsal fin origin; only in *T. hialmari* sp.n., and some individuals of *T. stoliczkai* and *T. aquaecaeruleae* sp. n. the ventrals are placed slightly anterior to the vertical of the dorsal fin origin. The new species is unique among all known species of *T. stoliczkai*-complex in the possession of 2 vs. 4 or more (usually 5 or more) coils of intestine. Only *T. tanggulaensis* has less than 5 coils of intestine, but the new species differs from *T. tanggulaensis*, judging from Zhu's (1982) description of the latter, in the shorter intestine (2 vs. 4 coils in *T. tanggulaensis*), the shape of the lower jaw (which is "shovel-like"

in *T. tanggulaensis* and rounded in other species of the complex), smaller number of gill-rakers (always 10 vs. 10-13), shorter ventrals (which extend to anal fin origin in compared species) and less deep body. Compared with the form discussed, the most similarly coloured species is *T. rossoperegrinatorum* sp. n. (see below); but in contrast to it, *T. hialmari* sp. n. lacks any spots on sides of the body and caudal peduncle. In addition, it has the dorsal bars in front of the dorsal fin origin as well pronounced as those behind it and also displays unusual blackish dots on the dorsal surface of the body and caudal peduncle. *T. hialmari* sp. n. also differs from *T. rossoperegrinatorum* sp. n. in the absence of the angular flexure of the infraorbital sensory canal, anterior margin of the orbit situated posterior to the vertical of the mouth corner, much finer tuberculation of the preorbital/suborbital pads in males, smaller number of gill-rakers (10 vs. 12-13), caudal peduncle nearly as long as head (vs. much longer than head), and in some measurements (see descriptions of these two species). *T. hialmari* sp. n. differs from the sympatric *T. aquaecaeruleae* sp. n. in the above mentioned characters and also in the shorter ventrals, caudal peduncle nearly as long as head (vs. longer than head), smaller number of branched dorsal rays (7 vs. 8) and gill-rakers (10 vs. 12), more numerous lateral line pores (86-91 vs. 78-86), and in some measurements (see descriptions of these species).

***Triplophysa rossoperegrinatorum* sp. n.**

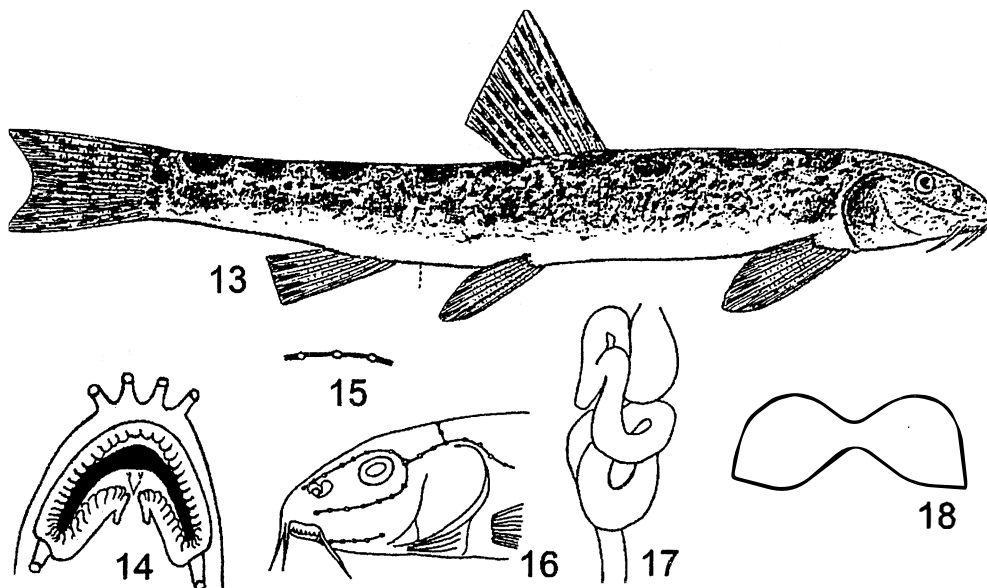
(Figs 13-18)

Nemacheilus dorsonotatus: Herzenstein, 1888: 30 (partim).

Holotype. ZISP no. 3719, female, 87 mm SL; North-western Gansu, in small mountain streams; coll.: N.M. Przewalski, 1880. Judging from the Przewalski's route in 1880, the type locality lies in the mountains north of Xining and Lanzhou.

Paratypes. ZISP no. 3719a, 4 specimens, 64-88.5 mm SL, same locality and date.

Diagnosis. Body thick, its maximum width subequal to maximum depth. Caudal peduncle length contained 3.95-4.6 times in SL. Caudal peduncle depth contained 3.5-4.9 times in its length. Snout longer than postorbital part of head. Anterior margin of eye situated on the vertical through mouth corner. Infraorbital canal of cephalic sensory system with angular flexure be-



Figs 13-18. *Triplophysa rossoperegrinatorum* sp. n.: 13, lateral view; 14, ventral view of mouth; 15, 16, cephalic laterosensory system (15, supratemporal commissure pattern; 16, lateral view); 17, intestine; 18, air bladder bony capsule.

low posteroventral border of orbit. Brush-like pads on preorbital/suborbital region of males roughly granulated. Dorsal fin origin closer to caudal base than tip of snout, with straight upper margin and 6-7 branched rays. Tip of adressed dorsal fin extending beyond vertical of anal fin origin. Tips of pectoral fins formed by third branched ray. Pores in lateral line 68-74. Intestine with 5-6 coils. Body coloration similar to that of *T. hialmari* sp. n., but crossbars on dorsum become distinct only posterior to dorsal fin origin and longitudinally arranged blackish dots on dorsum absent.

Description. D III, 6-7. A II, 5. P I, 9. V I, 6. C I+8+8+I. Sp. br. 12-13. Vert. 4+37-38+1=42-43. NF - 42-43: (18-19) 23-25 (3-4) + (1) 18-19 (17-18).

Body scaleless, cylindrical, thick, more or less uniform in depth in front of dorsal fin, but becoming shallower and more compressed along caudal peduncle; maximum body depth contained 8.3 (8.0-10.6) times in SL. Caudal peduncle moderate in depth and thickness, its depth contained 17.4 (16.0-19.7) times in SL and 4.4 (3.5-4.9) times in caudal peduncle length. The latter is much greater than maximum depth of body or head length; and is contained 3.95 (4.0-4.6) times

in SL. Maximum width of body equal to or slightly less than maximum depth. Head strongly depressed, bluntly conical, its width much exceeds the depth. Head length contained 5.0 (4.9-5.4) times in SL. Snout length contained 2.3 (2.4-2.5) times in head length and slightly greater than length of postorbital part of head. Eyes moderate to small, dorsal in position; eye diameter contained 1.7 (1.3-1.8) times in interorbital space. Proportions are given in Table 2.

Anterior and posterior nares close together, the latter larger than anterior one and enclosing it posteriorly. Nasal flap short and rounded. Mouth inferior (Fig. 14); lips strongly furrowed. Lower lip with inconspicuous mental lobes. Upper margin of lower lip separated from upper margin of lower jaw. Lower jaw broadly rounded in outline, without median keel. No processus dentiformis or keel on upper jaw. Three pairs of barbels, short in females and moderately long in male. Rostral barbels two-thirds as long as the maxillary ones, the latter slightly shorter than mandibular ones. Mandibular barbels extending slightly anterior to middle of orbit in females, but to posterior margin of orbit in male. Supraorbital sensory canal of head (cso) uninterrupted, confluent with infraorbital canal (cio); the latter confluent with supratemporal commissure

Table 2. Measurements for *Triplophysa rossoperegrinatorum* sp. n. (n = 5)

Character	Holotype	Lim	M ± m	σ
In percentage of standard length				
HL	20.1	18.0-20.3	19.3 ± 0.44	0.98
BD	12.1	9.4-12.5	11.2 ± 0.70	1.56
CPD	5.75	5.1-6.25	5.6 ± 0.20	0.44
CPL	25.3	21.9-25.3	23.15 ± 0.75	1.50
aD	52.9	51.4-54.1	52.8 ± 0.46	1.03
aV	54.0	53.7-55.9	54.8 ± 0.46	1.03
aA	70.1	70.1-72.9	71.1 ± 0.90	1.56
PV	34.5	31.3-34.5	33.15 ± 0.67	1.34
VA	15.5	15.1-16.0	15.58 ± 0.15	0.34
IP	16.1	15.5-21.2	17.7 ± 1.28	2.56
IV	15.5	14.1-15.5	14.7 ± 0.30	0.60
IC	17.2	17.2-21.2	19.1 ± 0.79	1.76
lDb	10.35	9.9-10.9	10.4 ± 0.17	0.38
hD	17.8	16.8-18.8	17.6 ± 0.46	0.91
lAb	7.5	5.4-7.5	6.6 ± 0.30	0.67
hA	14.4	14.4-15.6	14.9 ± 0.20	0.45
an-A	4.6	4.5-5.3	4.8 ± 0.15	0.33
BW	10.9	9.4-12.4	10.8 ± 0.50	1.11
In percentage of head length				
ao	42.9	41.4-42.9	42.25 ± 0.31	0.63
oo	17.1	15.4-20.9	17.9 ± 0.89	2.00
io	28.6	27.3-33.3	29.2 ± 1.40	2.79
hbr	40.0	36.4-40.0	38.4 ± 0.81	1.61
an-A	22.9	22.9-27.6	25.0 ± 1.02	2.27

Note. Abbreviations as in Table 1.

(cst) and body lateral line (cLL) (Figs 15, 16). Cio with angular flexure below posteroventral orbital margin (on seventh pore). Upper pore of preoperculo-mandibular canal (cpm) lying on the line passing through the mouth corner. Number of pores in laterosensory system: cso 8, cio 11-12, cst 3, cpm 6, cLL 68-74. Lateral line complete.

Dorsal fin origin slightly closer to caudal base than to tip of snout; tip of adpressed dorsal fin extending nearly to the vertical through the middle of anal fin base. Upper margin of dorsal fin straight. Anal fin short based, with straight lower margin. Pectoral fins contained 2.14 (1.6-2.25) times in pectoventral distance. Four outer pectoral-fin rays broadened, tip of fin formed by third branched ray. Ventral fins situated slightly posterior to dorsal fin origin. Tips of these fins formed by second and third or only third branched rays. Ventrals extend beyond anus, sometimes nearly to anal fin origin. Caudal fin emarginated, nearly equal to or slightly longer than head.

Anus close to anal fin origin, distance between them greater than eye diameter and equal to or slightly less than distance between posterior border of second nare and anterior margin of eye. Intestine long, with 5-6 coils (Fig. 17). Air bladder capsule as in Fig. 18. Free portion of air bladder reduced. Sexual dimorphism present, male with a pair of elongate brush-like pads of tubercles in suborbital/preorbital region. These pads also present in broadened pectoral fin rays in males. Mature females with orange-coloured eggs of 0.5 mm in diameter. Barbels shorter in females than in male (see above).

Coloration: Body mainly light brown above and white below. Anterior part of body up to dorsal fin origin marbled or reticulated by chestnut-brown markings, which become replaced posteriorly by widely spaced cross-bars or duplicated (dorsal and lateral) row of spots. There are 5-6 cross-bars or dorsal spots between dorsal fin origin and caudal base. Anterior to dorsal fin, dorsal bars or spots may be also present, but usually they become indistinct, narrow, closely spaced and confluent with the marbled pattern. Head densely mottled with small brownish dots dorsally and laterally, and whitish ventrally. Distinct dark rows of spots on dorsal and caudal fins, and similar but less marked dots on pectoral fin. Ventral and anal fins pale or with a few very fine greyish dots. Peritoneum silvery and becomes darker near vertebral column.

Etymology. The species name is given after Russian travellers (peregrinator in Latin), in honour of famous Russian explorers of Central Asia.

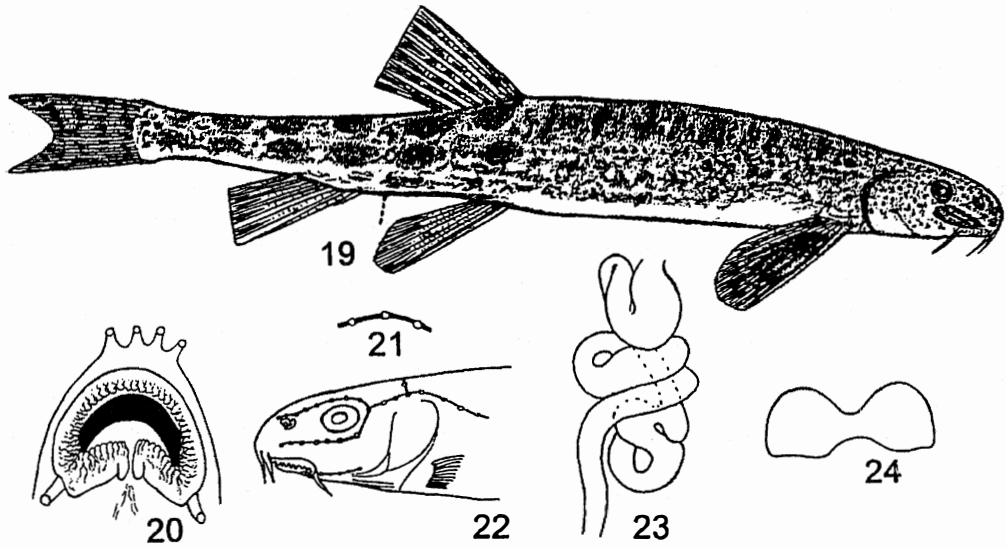
Comparison. This new species differs from other species of the *T. stoliczkai*-complex in the position of the anterior margin of the eye on the vertical of the mouth corner and in the presence of the flexure of the infraorbital sensory canal (vs. gentle bend of this canal in other species). The coloration in the new species is also distinct. It bears closest resemblance with that in *T. hialmari* sp. n. (see above) and *T. stoliczkai*; but the latter species usually has a lateral row of spots extending from the cleithrum to the caudal base, and the dorsal bars or spots, well spaced both anteriorly and posteriorly. *T. stoliczkai* seems to be the most closely related species to the form discussed. Apart from above mentioned characters, both species are distinct in the length of barbels in females (shorter in the new species), means of predorsal distance (52.8 in the new species vs. 51 in *T. stoliczkai*; n = 30), caudal peduncle length (23.15 in the new species vs. 26 in *T. stoliczkai*; n = 30), and lesser number of pores in the lateral line (74 or less vs. close to 80 or more). *T. rossoperegrinatorum* sp. n. also differs from *T. aquaecaeruleae* sp. n. in the straight (vs. concave) upper margin of the dorsal fin, lesser number of the branched rays in this fin (6-7 vs. 8) and of the lateral line pores (68-74 vs. 78-86), in some body proportions and rougher surface of the suborbital pads in males.

***Triplophysa alexandrae* sp. n.**
(Figs 19-24)

Holotype. ZISP no. 16335, 72 mm SL; Sichuan, China; coll. Potanin, 3/IV-1893. Judging by the date and collector's route (Komarov, 1928), the type locality is the Dadu He River east of Kangding (ca 30°N, 102°E), in the basin of the Min River.

Paratypes: ZISP no. 16335a, 4 specimens, 59-72 mm SL, same locality and date.

Diagnosis. Body laterally compressed, its maximum width much less than maximum depth. Caudal peduncle length contained 4.5-5.2 times in SL. Caudal peduncle depth contained 1.3-2.4 times in its length. Snout longer than postorbital part of head. Anterior margin of eye situated posterior to mouth corner. Infraorbital canal without angular flexure. Brush-like pads on preorbital/suborbital region of males possibly



Figs 19-24. *Triplophysa alexandrae* sp. n.: 19, lateral view; 20, ventral view of mouth; 21, 22, cephalic laterosensory system (21, supratemporal commissure pattern; 22, lateral view); 23, intestine; 24, air bladder bony capsule.

absent. Dorsal fin origin nearly equidistant between tip of snout and caudal base, with straight upper margin and 7-8 branched rays. Tip of adpressed dorsal fin extending posterior to vertical of anal fin origin. Tips of pectoral fins formed by second and third or only third branched rays. Pores in lateral line 56-58. Intestine with 5 coils. Dark markings on body present, sometimes forming lateral row of spots on posterior half and 7-10 brownish saddles on dorsum.

Description. D III-IV, 7-8. A II, 5. PI, 9. VI, 6. C I+8+8+I. Sp. br. 9-10. Vert. 4+33-35+1=38-40. NF - 38-40: (15) 20-22 (3) + (1) 18 (17).

Body scaleless, moderately elongate and conspicuously compressed laterally, with short and deep caudal peduncle; maximum body depth 6.9 (5.9-7.7) times in SL. Caudal peduncle depth contained 11.5 (9.9-10.7) times in SL and 2.4 (1.3-2.3) times in caudal peduncle length; the latter contained 4.8 (4.5-5.2) times in SL. Maximum width of body much less than maximum depth. Head moderately compressed laterally, conical, bluntly pointed anteriorly; wider than deep. Head length contained 4.8 (4.7-5.1) times in SL. Snout length contained 2.0 (2.5-3.3) times in head length and slightly greater than length of postorbital part of head. Eyes moderately large, dorsolateral in position; eye diameter contained 1.8 (1.14-1.3) times in interorbital space. Pro-

portions are given in Table 3.

Anterior and posterior nares close together, the latter is larger than anterior one and enclosing it posteriorly. Nasal flap short and rounded. Mouth inferior in position (Fig. 20); lips furrowed. Lower lip narrower than in most other species of the complex, with inconspicuous mental lobes. Upper margin of lower lip well separated from upper margin of lower jaw. Lower jaw broadly rounded in outline, with marked median keel. No processus dentiformis or keel on upper jaw. Three pairs of very short, nearly equidimensional barbels, each of them about one-third as long as head. Mandibular barbel does not reach the vertical passing through the middle of orbit. Supraorbital sensory canal of head (cso) continuous, confluent with infraorbital canal (cio); the latter joins supratemporal commissure (cst) and body lateral line (cLL) (Figs 21, 22). Cio lacks angular flexure below posteroventral margin of eye. Upper pore of preoperculo-mandibular canal (cpm) lies on the line passing through mouth corner. Number of pores in laterosensory system: cso 7, cio 10-11, cst 3, cpm 6, cLL 56-58. Lateral line complete, but pores become very small and indistinct in its posterior half.

Dorsal fin originates near midlength of body; tip of adpressed dorsal fin extending nearly to the vertical through the middle of anal fin base. Upper

Table 3. Measurements for *Triplophysa alexandrae* sp. n. (n = 5)

Character	Holotype	Lim	M ± m	σ
In percentage of standard length				
HL	20.8	19.4-21.2	20.5 ± 0.39	0.77
BD	14.6	13.6-17.0	14.95 ± 0.73	1.45
CPD	8.7	8.7-10.1	9.5 ± 0.24	0.53
CPL	20.8	20.5-22.2	21.4 ± 0.43	0.85
aD	50.0	49.2-50.8	50.0 ± 0.33	0.65
aV	52.8	52.8-54.2	53.5 ± 0.41	0.70
aA	72.9	71.7-74.6	73.0 ± 0.52	1.16
PV	33.3	28.3-36.1	33.3 ± 1.33	2.96
VA	20.8	18.0-22.0	20.0 ± 0.07	1.52
IP	18.1	16.4-18.1	17.3 ± 0.34	0.75
IV	16.0	15.3-16.7	16.1 ± 0.28	0.64
IC	22.9	20.5-22.9	21.9 ± 0.51	1.01
IDb	11.8	10.2-11.8	11.1 ± 0.28	0.62
hD	21.2	17.2-22.0	20.3 ± 1.06	2.13
lAb	7.6	6.7-7.6	7.0 ± 0.16	0.35
hA	19.4	16.4-19.4	17.8 ± 0.62	1.24
an-A	5.6	5.1-6.75	6.0 ± 0.31	0.69
BW	9.0	8.2-10.1	9.0 ± 0.35	0.78
In percentage of head length				
ao	33.3	33.3-40.0	38.15 ± 1.63	3.25
oo	16.7	16.7-25.0	20.9 ± 4.15	5.87
io	30.0	28.6-34.0	31.15 ± 1.18	2.36
hbr	43.3	43.3-50.0	46.3 ± 1.60	3.21
an-A	26.7	26.7-32.0	29.35 ± 2.65	3.75

Note. Abbreviations as in Table 1.

margin of dorsal fin straight. The last unbranched dorsal ray not thickened. Anal fin short based, with straight lower margin. Pectoral fins slightly less than half as long as pectoventral distance. Outer pectoral fin rays broadened; tips of fins formed by second and third or only third branched ray. Ventral fin origin situated slightly posterior to dorsal fin origin. Tips of ventral fins formed by second branched ray. Ventrals extend slightly beyond anus, but not to anal fin origin. Caudal fin moderately forked, slightly longer than head.

Distance between anus and anal fin origin subequal to eye diameter. Intestine long, with five coils (Fig. 23). Air bladder capsule as in Fig. 24. Free portion of air bladder reduced. Sexual dimorphism weakly expressed; both sexes have broadened four outer branched pectoral rays, but in males they are much more thickened. Characteristic brush-like pads of tubercles on head and pectoral fin rays not found in males examined, but this may be a result of bad preservation. Mature females contain orange-coloured eggs of 0.5 mm in diameter.

Coloration: General body coloration yellowish, with scattered brownish markings. Along the area from nape to caudal base 7 to 10 pronounced brownish saddles on dorsum. Saddles descend laterally not more than half the distance between dorsal contour and lateral line. Sides of body with scattered brownish markings, which give the impression of marbled appearance, sometimes with tendency to forming a lateral row of spots. When lateral row of spots present, the spots do not extend anterior to dorsal fin origin. On head, dark pigmentation well developed and making the pale background indistinct. Branchial membrane and belly yellowish, without markings. Dorsal and caudal fins with distinct rows of dark spots; other fins pale. Caudal fin base with a transverse brownish streak. Peritoneum silvery.

Etymology. The species is named after Alexandra Viktorovna Potanina (1843-1893), wife and companion of G.N. Potanin, Russian investigator of Central Asia.

Comparison. The species differs from all other members of the *T. stoliczkai*-complex in the much more compressed body (the width of which is much less than maximum depth and nearly equal to caudal peduncle depth, in contrast to reverse condition in other members of the *T. stoliczkai*-complex), relatively shorter and deeper caudal peduncle (with maximum body depth/caudal pe-

duncle depth ratio being 1.34-1.68, vs. (1.8)2 or more), higher dorsal and anal fins, and markedly smaller number of the lateral line pores (less than 60 vs. 68 and more). The coloration of the new species is also distinct.

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