

Larva, pupa and adults of *Nothopsyche nigripes* Martynov, 1914 (Trichoptera, Limnephilidae), with biological notes

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Abstract The larva, pupa and female of *Nothopsyche nigripes* Martynov are described for the first time, and the male is redescribed. This species is newly recorded from Korea. The larva of this species inhabits small streams or brooks near the coast or large rivers, and probably feeds on decomposed plant material. The final instar larva aestivates during the summer, and most aestivating sites probably become terrestrial at the low-water season in autumn.

Key words: *Nothopsyche nigripes*, larva, pupa, adult, biology.

Introduction

The genus *Nothopsyche* is a small genus of 18 species distributed in the eastern Asia (Schmid, 1955; Mey, 1996; Park & Bae, 2000; Mey & Yang, 2001; Nozaki, 2002; Leng & Yang, 2004). The biology and morphology of this genus are relatively well studied for Japanese species (Nozaki, 2002). On the other hand, information about continental species is quite limited. Although adults (mostly males) of 11 *Nothopsyche* species are recorded from Russia, China, Korea, Thailand, and Vietnam, their immature stages are yet unknown (Schmid, 1952; Malicky & Chantaramongkol, 1989; Mey, 1996; Park & Bae, 2000; Mey & Yang, 2001; Leng & Yang, 2004).

In 1988, K. Vshivkov, the son of the second author (TSV), collected unknown limnephilid larvae on June 27 from a small and shallow brook near Vladivostok, and TSV successfully collected additional larval specimens from similar habitats in South Primorye. Furthermore, TSV and the third author (TI) surveyed one of the habitats on October 19 and 20 in 1992, and found many cases of this species; most of them were empty, but five included pupal remnants. Based on the identification of male genitalia remaining in one pupal skin, we concluded that the species belongs to *Nothopsyche nigripes* Martynov, 1914. This species has been rarely recorded from Ussuri Region (South Primorye), and only the adult male was described (Martynov, 1914; Schmid, 1952; Nimmo et al., 1997). In this paper, we describe the larva, pupa, and female of this species for the first time, and the male is redescribed. We also briefly report the habitat and biology.

Morphological terms used in this paper follow those of Nozaki (2002). Specimens are deposited in the collections of the National Museum of Natural History, Smithsonian Institute, Washington DC (NMNH), and of the authors (TN & TSV).

***Nothopsyche nigripes* Martynov, 1914 (Fig. 1)**

Nothopsyche ruficollis nigripes Martynov, 1914: 272-275, male, female.

Nothopsyche nigripes: Martynov, 1930: 101; Schmid, 1952, 145-147, male; Nimmo et al., 1997, 101, male.

Adult. Head, meso- and metanota black, their setal warts lighter; pronotum clear yellow with similarly colored setal warts; legs mostly black except fore coxae clear yellow; abdominal segments yellow to yellowish brown. Male maxillary palpi black, each about 2.5 mm long, second and third segments very long, relative lengths of three segments about 1:9:9. Female maxillary palpi black, each about 1.9 mm long, relative lengths of five segments about 1.0:3.2:3.9:3.0:3.2. Male labial palpi black, each 1.5 mm long, relative lengths of three segments about 1.0:2.0:2.8. Female labial palpi black, each 0.8 mm long, relative lengths of three segments about 1.0:1.4:2.0. Antennae black, longer than fore wings in male and approximately same length in female; scapes about twice as long as wide. Pronotum with pair of dorsal setal warts large, oval. Mesoscutal setal warts elongate-oval, mesoscutellar setal area represented by several circular setal sockets or small setal warts. Legs with tibial spurs 1,2,2 in both sexes. Fore wings black, each about 8.5 mm long in both sexes. Hind wings gray, thin, each about 8 mm long. Fifth sternite with pair of small internal glands opening near anterolateral margins.

Male genitalia (Fig. 1a-c). Tergite VIII remarkably produced posterodorsally. Segment IX L-shaped in lateral aspect; posterodorsal sclerotized plate broad with fine setae, bases of setae forming spinous processes near ventromesal margin. Inferior appendages short, each 2-segmented; distal segment vestigial with long setae. Segment X membranous, extended posterad; external branches ear-like in lateral aspect; internal and inferior branches vestigial. Phallus mostly membranous and folded, but apex (phallicata) sclerotized, darkly pigmented,

apically round in lateral aspect. Parameres strongly sclerotized, curved dorsad at apices, spines present on mesal surface of each apex.

Female genitalia (Fig. 1d, e). Sternite VIII broadly sclerotized ventrally. In tergite IX, each ventral margin protruding posterad, round in lateral aspect, acute in ventral aspect. Segment X triangular in lateral aspect, with short apical lobes. Supragenital plate large, semicircular. Median vulval lobe rectangular, lateral vulval lobes triangular in ventral aspect. Vaginal sclerite tapered apically, extended slightly beyond vaginal chamber.

Larva (Fig. 1f). Length up to 14 mm. Head with pale brown bands on frontoclypeal and coronal sutures; frontoclypeal apotome with pair of dark markings on anterior margin and pair of large, closely parallel, dark marking on posterior part; setae 1, 4, 10, 13, and 16 transparent; seta 5 approximately same length as seta 17; seta 6 thin, slightly shorter than seta 5; seta 14 longest. Mandibles each with four apical teeth. Pronotum furrowed transversely at anterior 1/3, brown with pair of dark brown markings on posterior margin. Mesonotum brown with dark brown marking on central area of each sclerotized plate, but sometimes indistinct. Metanotal sclerites dark brown; setae arising on sclerites and on membrane between sa2 and sa3, and between sa2 sclerites.

Abdominal gills multiple, at least some gills with more than ten branches, present on following segments: dorsal and ventral gills on segments II to VII (anterior and posterior) and VIII (anterior), but anterior gills sometimes absent on venter of VI to VIII; lateral gills on II (posterior) and III (anterior). Ventral chloride epithelia present on segments II to VIII.

Pupa. Only five already-dead specimens were examined. Length about 11 mm. Antennae coiled apically in male, but not in female, with ventrolateral and dorsal tufts on scapes and pedicels, respectively. Head with three pairs of long setae on vertex and frons, pair of setae on vertex longer than others. Labrum with five pairs of long setae on dorsum, curved apically; pair of short transparent setae present apicodorsally. Mandibles acute at apices. Middle tarsi with sparse hair-like setae on first to third segments. In abdominal segments, anterior hook plates present on segments III to VII each with two or three hooks and on segment VIII with zero to two hooks; posterior hook plates on segment V each with four to five hooks. Abdominal gills multiple at least on segment II. Anal processes short, each about 7 times as long as width of middle part, apices curved dorsomesad.

Case (Fig. 1g). Case of final instar larva up to 13 mm, constructed of sand grains, cylindrical, slightly curved and tapered. In pupal case, anterior opening closed by silk disk with hole near center.

Specimens examined. [RUSSIA] South Primorye: 15 larvae, a small stream near Amurskii Zaliv Railway Station, 27.VI.1988, K. Vshivkov (TN); 9 larvae, *ibid.*, 1989, K. Vshivkov (TN); 2 larvae, a small stream near Station 1 at Russian-Chinese boundary, Razdolnaya River Basin, 24.VI.1992, T. S. Vshivkova (TN); 1 larva, L-24 Stream at Russian-Chinese boundary, Razdolnaya River Basin, 25.VI.1992, T. S. Vshivkova (TN); 1 male, left bank of Kijevka River, lower Kijevka Village 23.IX.1974, N. Storozheva (TN); 25 larvae, a small stream flowing into Idol Bay, Troitza Bay, Khasanskii District, 1.VII.1988, T.

S. Vshivkova (TN); 2 pupal remnants, *ibid.*, 19.X.1992, T. S. Vshivkova (TSV); 3 pupal remnants, *ibid.*, 20.X.1992, T. Ito (TN); 10 males 1 female, a stream flowing into Srednyaya Bay, 28.IX.1983, T. M. Tiunova (TN). [KOREA] 1 male, Kangnung, 20 km NE Seoul, 19.X.1975, P. W. Schaefer (NMNH).

Distribution (Fig. 2). Russia (South Primorye), Korea (near Seoul: new record for Korea).

Habitat and biology. *Nothopsyche nigripes* larvae examined in this study were collected from small and shallow streams or brooks flowing through small valleys or meadows in lowlands. A small stream flowing into Idol Bay near the Biological Station of the Institute of Marine Biology, Far Eastern Branch of Russian Academy of Sciences, Troitza, Khasansky (42°36'N, 131°14'E) is a typical habitat in South Primorye (Fig. 3). The width of flow is 30-100 cm and the maximum depth is 8 cm. Emergent plants grow profusely in and around the flow, and coarse and fine fragments of the plants are densely deposited on the bottom. Gut contents of three final instar larvae collected from this habitat on July 1, 1988 were fine particulate organic material including vascular plant fragments.

The collections of final instar larvae in early summer and pupae and adults in autumn suggest that the larva of this species aestivates during the summer as the Japanese *Nothopsyche* species do. Furthermore, since many cases of this species including pupal cases were collected on land near the flow in autumn, most aestivating sites probably become terrestrial at the low-water season in autumn as the habitat of *Nothopsyche longicornis* Nakahara, 1914 (Aoya & Nozaki, 2001). A prepupa and a pupa collected on land were parasited by a wasp. The larva and pupal cocoon of the wasp are very similar to those of a Japanese wasp, *Sulcarius* sp., which is a parasite of terrestrial larvae and pupae of *Nothopsyche ruficollis* (Ulmer, 1906) (Konishi, unpublished).

Remarks. Schmid (1952) assigned this species to the *N. ruficollis* Group based on the adult morphology. Although immature stages of this Group are known only for two Japanese species, *N. ruficollis* and *N. longicornis*, the larva and pupa of *N. nigripes* are most similar to those of *N. ruficollis*; especially in the color pattern of the larval head, the arrangement of chloride epithelia on the larval abdomen, shape of the anal processes of the pupa, and cases of the larva and the pupa. These morphological similarities support the assignment by Schmid (1952).

Kim (1988) described the larval stage of a Korean species as *Nothopsyche* KUb. The color pattern of the larval head and the larval case of *N.* KUb are very similar to those of *N. nigripes*. Although the abdominal gill arrangement of *N.* KUb is different from that of *N. nigripes*, not having anterior gills on the venter of abdominal segments IV and V (Kim, 1988), *N.* KUb may be the same species as *N. nigripes*. A single male of *N. nigripes* collected from Kangnung, 20 km NE Seoul, Korea, was found in the collection of the NMNH.

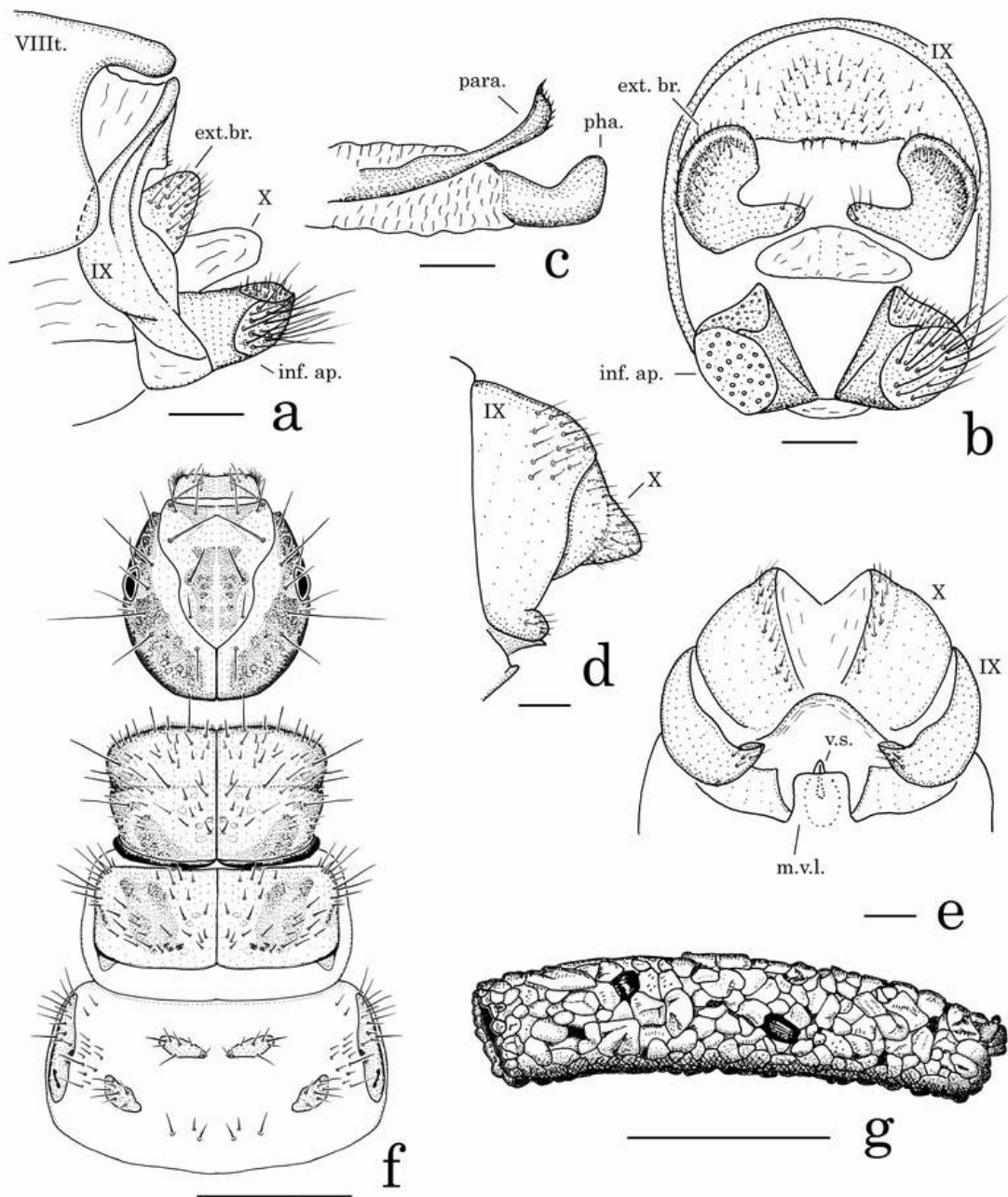


Fig. 1. *Nothopsyche nigripes*. a-c, male genitalia: a, left lateral; b, caudal; c, phallus, left lateral. d, e, female genitalia: d, left lateral; e, ventral. f, larva, head, pro-, meso-, and metanota, dorsal. g, larval case, left lateral. Scales: 0.1 mm for a-e, 1.0 mm for f, 5.0 mm for g. Abbreviations: VIII., tergite VIII; IX, X, abdominal segments IX and X, respectively; ext. br., external branch of segment X; inf. ap., one inferior appendage; m.v.l., median vulval lobe; para., one paramere; pha., phallicata; v.s., vaginal sclerite.

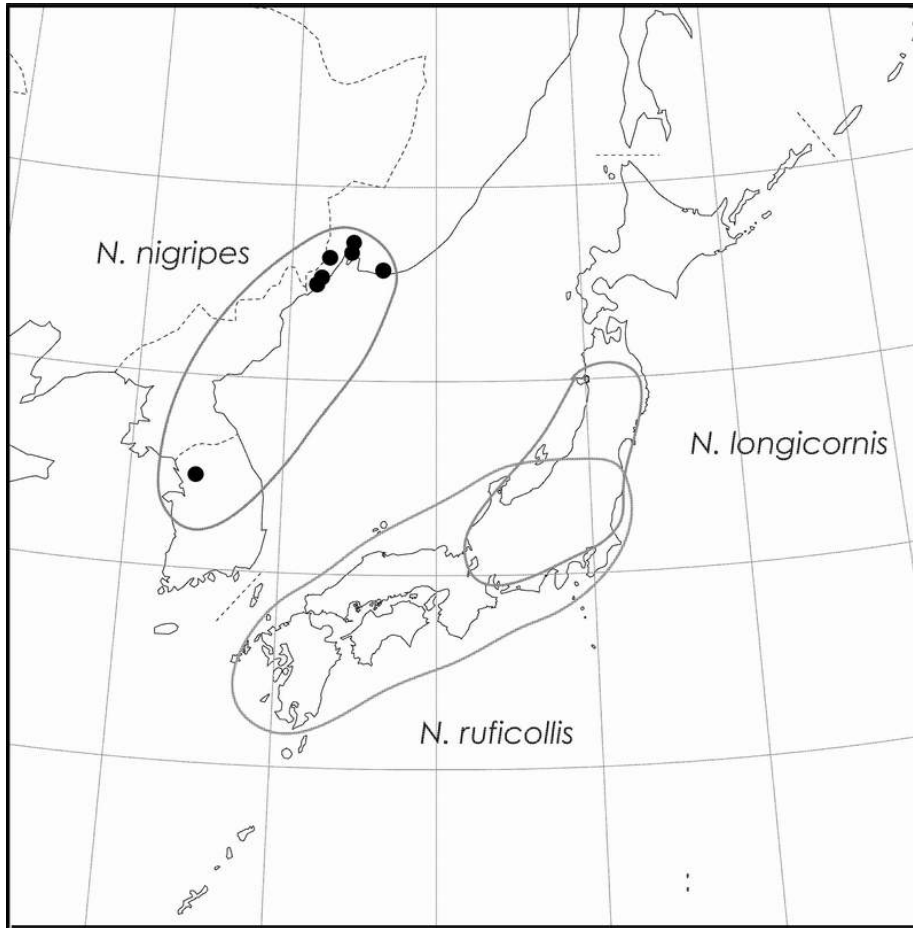


Fig.2. Distribution of *N. nigripes* and two related species, *N. ruficollis* and *N. longicornis* (data of the latter two species cited by Nozaki, 2002).

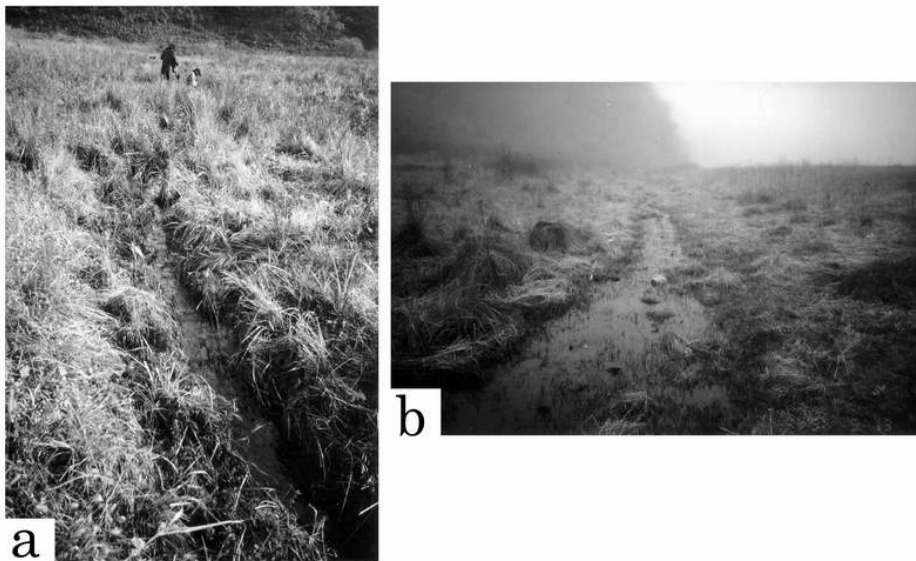


Fig. 3. A typical habitat of *N. nigripes* in South Primorye. A small stream flowing through a meadow into Idol Bay in Troitsa Bay. a: 20 Oct. 1992; b: 13 May 1996.

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