

Immature Stages of *Tipula nova* (Diptera: Tipulidae) from Korea

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ABSTRACT

The present paper is a part of the study on the immature stages of genus *Tipula* in Korea. It described and illustrated egg, each larval stage and pupa of *Tipula nova*. It is the first to deal the all immature stages of the species in Korea. Their taxonomic remarks and habitats are also given.

Key words: *Tipula nova*, immature stages, crane-fly, Tipulidae, Korea

INTRODUCTION

The immature stages of Tipulidae have been studied by many workers from the morphology and biological aspects (Beling, 1884; Alexander, 1920; Savchenko, 1954; Chiswell, 1956; Thoewald, 1957; Brindle, 1960; Foote, 1963; Hofsvang, 1979; Gelhaus, 1986). But the knowledge about the immature stages of Tipulidae is still fragmentary. The immature forms of probably fewer than 10% of known species have been described.

There have been some works about Korean Tipulidae. Alexander (1935) described *Nephrotoma pselliphora*. Masaki (1939) dealt with *Pselliphora koreana*. Alexander (1945) described 9 new species and 1 new subspecies. Kim (1971) reviewed 17 previously described species from Korea. Yoon and Kim (1992) described 16 species of *Tipula* larvae and 2 species of *Nephrotoma* larvae in Korea, but they tentatively classified these species and didn't investigate any relationships with previously known adults. Kim and Lee (2002) described and illustrated each immature stage of *T.*

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latemargina from egg to pupa. Their study was the first to investigate the relationships between larvae, pupae and adults of Tipulidae in Korea.

T. nova investigated in the present paper is a widely distributed, common crane-fly in Korea. The adults can be easily observed in grass field near streams, rivers, ponds, lakes and so on. We describe and illustrate the eggs, larvae, and pupae of the species reared and collected in Korea.

MATERIALS AND METHODS

The egg, larval and pupal specimens examined were collected in the field and reared in the laboratory from December 2000 to December 2002. Larvae used in this study were killed by dropping them into water near boiling. After 5 minutes, specimens were transferred to 10% formalin and left for several weeks. Then they were preserved in 70% ethanol for permanent storage. Pupae were immersed in Kahle's fluid for two days, then they were transferred to 70% ethanol for permanent storage. For fine morphological studies on the minute structure, the parts were mounted on slides and observed through a compound microscope. The abbreviations used in this paper are as follows: V, ventral; L, lateral; D, dorsal region. Materials used in this paper are deposited in the Insect Collection of Andong National University (ADU), Andong, Korea.

SYSTEMATIC ACCOUNTS

***Tipula nova* Walker, 1848 (Fig. 1A-O)**

Egg. Length 0.75-0.80 mm; width 0.25-0.26 mm. Coloration of chorion shining dark, without sculpturing. Form elongated-ovoid. Two sides of egg equally wide, one end a little more pointed than the other. Micropyle subapical on convex side of egg, situated in center of raised, subcircular pit. A coiled, thread-like filament at the end opposite the micropyle.

Material examined. 45 ind., Naeseong Stream (Bonghwa-gun, Gyeongbuk Prov.) 1 Sep. 2001 (D. S. Kim).

Description. First instar larva. Length 1.6-5.3 mm; width (2nd abdominal segment) 0.2-0.6 mm. Coloration pale yellow; body slender, moderately elongated; integument subtransparent, with abundant minute hairs and many long, pale setae. Head capsule lightly pigmented; antennae slender and hair-like. Spiracular disc with two lateral lobes and two ventral lobes; each lateral lobe with brown stripe, apex with brush of 16 long, pale setae; each ventral lobe with somewhat broader, brown stripe, apex with 3 strong setae and 4-5 brush-type setae. Dorsal border of disc with eight pencils of 2-3 setae. Spiracles one ring, brown. Anal gills with two pairs, pale, long and tapering, subequal in length.

Material examined. 12 ind., Naeseong Stream (Bonghwa-gun, Gyeongbuk Prov.) 29 Sep. 2001 (D. S. Kim); 10 ind., same locality, 9 Oct. 2001 (D. S. Kim); 10 ind., same locality, 27 Sep. 2002 (D. S. Kim).

Second instar larva. Length 6.4-12.5 mm; width 0.8-1.5 mm. Coloration yellowish brown. Spiracular disc with three pairs of lobes, each lobe pigmented with brown. Spiracles two rings,

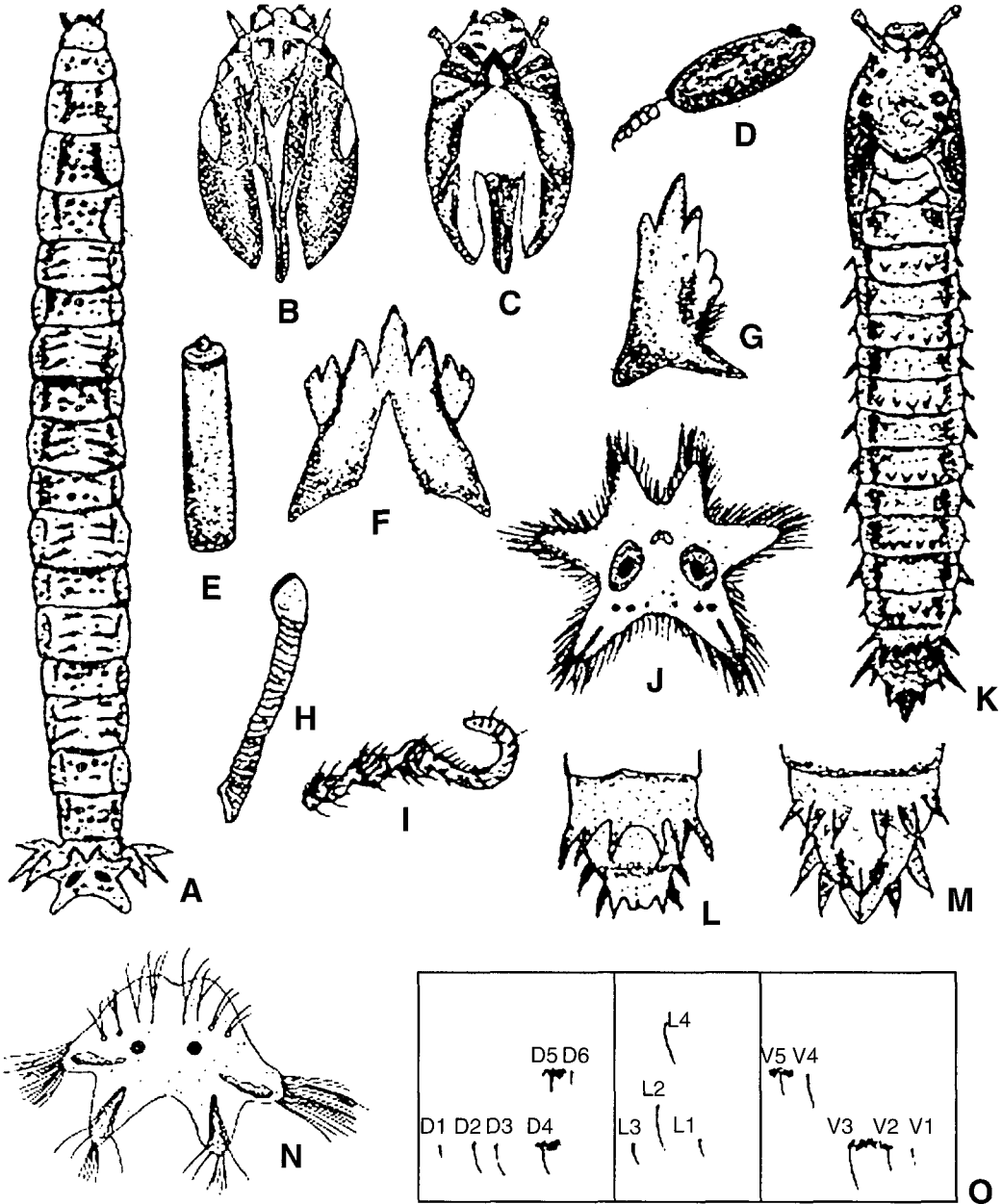


Fig. 1. Immature stages of *Tipula nova*. Fourth instar larva: A, larva (dorsal view); B, head capsule (dorsal view); C, head capsule (ventral view); E, antenna; F, mentum; G, mandible; J, spiracular disc; O, chaetotaxy of abdominal segments 2-7. Pupa: K, female pupa (dorsal view); H, pronotal breathing horn; I, maxillary palp; L, cauda (♂); M, cauda (♀). First instar larva; N, spiracular disc. Egg: D.

inner ring black, outer ring brown. Other characters very similar to fourth instar larva.

Material examined. 11 ind., Munsusan (Mt.) (Bonghwa-gun, Gyeongbuk Prov.) 17 Dec. 2000 (D).

S. Kim); 15 ind., Naeseong Stream (Bonghwa-gun, Gyeongbuk Prov.) 9 Oct. 2001 (D. S. Kim); 7 ind., same locality, 11 Nov. 2001 (D. S. Kim); 1 ind., same locality, 17 Nov. 2002 (D. S. Kim); 1 ind., same locality, 16 Dec. 2002 (D. S. Kim).

Third instar larva. Length 12.0-25.5 mm; width 1.7-3.2 mm. Coloration yellowish brown to reddish brown. Spiracular disc with three pairs of lobes, each lobe lightly pigmented with brown. Spiracles two rings, inner ring black, outer ring reddish brown. Other characters very similar to fourth instar larva.

Material examined. 11 ind., Munsusan (Mt.) (Bonghwa-gun, Gyeongbuk Prov.) 17 Dec. 2000 (D. S. Kim); 13 ind., Naeseong Stream (Bonghwa-gun, Gyeongbuk Prov.) 17 Nov. 2001 (D. S. Kim); 8 ind., same locality, 14 Dec. 2001 (D. S. Kim); 5 ind., same locality, 13 Jun. 2002 (D. S. Kim).

Fourth instar larva. Length 25.0-44.0 mm; width 2.5-5.5 mm. Coloration reddish brown to dark brown. Body moderately elongated, terete, pubescent. Head capsule rather small, black; color in thinner part of lateral plates yellowish brown. Mentum of head capsule with seven distinct teeth anteriorly, median tooth largest; mandible with five teeth. Antennae reddish brown, elongate, cylindrical; apex with very small apical disc, button-like. First abdominal segment shorter than remaining segments; abdominal segments II-VII each divided into two rings, long anterior and short posterior. Dorsum of abdominal segments II-VII with three pairs of crescent-like markings.

Chaetotaxy of abdominal segments II-VII as follows: Dorsum with six setae arranged in anterior row of two (D5-D6) and posterior row of four (D1-D4); D2-D4 long, D6 very slender and short, many macroscopic hairs around D5, D4 surrounded by short hairs, D2-D3 close together. Lateral region with four setae, L1-L3 fairly close together on posterior ring, L4 on anterior ring; L2 and L4 long, L3 short, L1 very slender, short, two-forked. Venter with five setae; V4-V5 slightly anterior to V1-V3, V3-V4 long, many macroscopic hairs between V2 and V3, V1 very slender and short, V5 short and surrounded by short hairs.

Spiracular disc with three pairs of lobes; each lobe with numerous marginal hairs and marginal brown stripes. Ventral lobes with markings and stripes; two distinct black spots at base of each lobe, a small black disc on apex, and a median longitudinal brown stripe from base to apex. Each lateral lobe with three setae, each ventral lobe with nine setae; one on apex, eight on other site. Spiracles with two rings; inner ring black, outer ring dark brown. Anal gills with three pairs developed, large, pale yellow.

Material examined. 23 ind., Munsusan (Mt.) (Bonghwa-gun, Gyeongbuk Prov.) 17 Dec. 2000 (D. S. Kim); 9 ind., Naeseong Stream (Bonghwa-gun, Gyeongbuk Prov.) 11 Jan. 2001 (D. S. Kim); 5 ind., same locality, 17 Nov. 2001 (D. S. Kim); 3 ind., same locality, 10 Mar. 2002 (D. S. Kim); 4 ind., same locality, 5 Apr. 2002 (D. S. Kim); 12 ind., Sobaeksan (Mt.) (Yeongju-si, Gyeongbuk Prov.) 31 Mar. 2002 (D. S. Kim).

Remarks. *Tipula nova* is characterized by dorsum of abdominal segments II-VII with three pairs of crescent-like markings. Another characteristic of the species is that the ventral lobes of the spiracular disc have two distinct black spots at base.

Pupa. Length: male, 21.0-26.5 mm; female, 22.0-33.0 mm. Width (at the wing base): male, 2.8-4.2 mm; female, 3.4-5.2 mm. Coloration yellowish brown, reddish brown or dark brown; wing sheaths dark brown to light brown; pleural region of abdomen light yellow. Form moderately elongated, somewhat stout. Head rather small. Antenna slender, moderately elongated, extending

some distance beyond wing root. Pronotal breathing horns short, with tips a little enlarged, flattened, smooth. Labrum broad, apex pointed. Labial lobes oval. Maxillary palpi strongly recurved at tips, with many strong setae in older individuals, no setae in young individuals; terminal segment of maxillary palpi elongate, longer than previous 2 segments combined. Thoracic mesonotum very convex, transversely wrinkled. Wing sheaths extending just beyond base of third abdominal segment. Leg sheaths extending beyond end of third abdominal segment.

Abdominal tergites with spines weak; spines with a transverse row at base of posterior ring; no spines on anterior ring. Sternites with very strong spines on posterior ring; two transverse row of spines on abdominal segments II-VII, with two spines on fore row and 6-12 stronger spines on hind row. Pleurites with a single strong spine on each ring, spine larger on anterior ring.

Male cauda on dorsum with six lobes spinous-tipped, sharply pointed. Eighth segments with eight spines; on ventral and lateral region with six very powerful spines, on dorsal region two small hook-like spines. Female cauda on dorsum with six spinous lobes; female ovipositor elongate, tergal valves long and straight, sternal valves a little shorter. Eighth segments on ventral and lateral region with six very strong spines.

Material examined. 17 ♂♂, 14 ♀♀, Naeseong Stream (Bonghwa-gun, Gyeongbuk Prov.) 28 Apr. 2001 (D. S. Kim); 7 ♂♂, 6 ♀♀, same locality 25 Apr. 2002 (D. S. Kim); 7 ♂♂, 5 ♀♀, same locality, 5 May 2002 (D. S. Kim).

Habitats. The Larvae of *Tipula nova* were found in the streams, rivers, paddy fields or in damp soil of their marginal areas. Pupae of the species were found in drier land near the places where the larvae were collected. Eggs were collected from the floating mats of algae and wet soil around the edge of the streams, rivers and paddy fields.

Distribution. Korea, Japan, China, Taiwan.

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한국산 애잠자리각다귀 (파리목: 각다귀과)의 미성숙 단계의 형태

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요 약

Tipula 속에 속하는 한국산 애잠자리각다귀 (*Tipula nova*)의 알, 애벌레, 번데기 단계에 대한 분류학적 연구를 수행하였으며, 이 종의 미성숙 단계의 형태는 한국에서 처음 기재된다.