

Immature Stages of *Tipula patagiata* (Diptera, Tipulidae) from Korea

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한국산 어리아이노각다귀(파리목, 각다귀과)의 미성숙 단계의 형태

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ABSTRACT : The immature stages of *Tipula patagiata* Alexander (Diptera, Tipulidae) are described. Detailed illustrations of the immature stages are provided.**KEY WORDS :** *Tipula patagiata*, Immature stages, Crane fly, Tipulidae**초 록 :** *Tipula*속 에 속 하는 한국산 어리아이노각다귀(*Tipula patagiata* Alexander)의 알, 유충, 번데기 단계에 대한 분류학적 연구를 수행하였으며, 각 단계 및 영기별로 기재하고, 형태적 특징을 그림으로 나타내었다. 이 종의 미성숙 단계는 한국에서 처음 기재된다.**검색어 :** 파리목, 어리아이노각다귀, *Tipula patagiata*, 미성숙단계, 한국

The genus *Tipula* is the largest one of Tipulidae, which includes about 650 species, found in most parts of the world and very abundant on most of the continental areas but rare or lacking on many of the smaller oceanic islands (Alexander, 1919, 1920). The immature stages of the various species in this genus are diverse, ranging from strictly aquatic forms to those occurring in wet mud, in moist soil, and in decaying wood.

In Europe, a great number of life histories of the genus have been worked out in commendable detail, mainly through the efforts of Beling (1873, 1879, 1884), who discussed 30 species. His descriptions give a clear idea of the range in structure and habitat to be expected in the genus. Gelhaus (1986) studied the relationships between *Tipula* larvae and adults in North America, and classified to subgenera based on the characters of larvae. Yoon and Kim (1992) described 16 species of *Tipula* 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. latemarginata* Alexander, 1921, from egg to pupa, which was the first study to investigate the relationships among larvae, pupae and adults

of *Tipula* in Korea.

Tipula patagiata Alexander, 1924, investigated in the present paper is not abundant, but widely distributed in Korea. The larvae of the species are found in slow flowing mountain streams, and the adults can be easily found in grass field around such streams. We describe and illustrate here the eggs, larvae and pupae of the species collected and reared in Korea.

Materials and Methods

The eggs, larvae and pupae examined were collected in the field and reared in the laboratory from March 2002 to June 2003. The larvae used in this study were killed by dropping them into hot 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 the morphological study of microstructures, the parts were mounted on slides and observed through a

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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 patagiata Alexander, 1924 어리아이노각다귀(Fig. 1A-O)

Egg

Length 0.86-0.88 mm; width 0.28-0.29 mm.

Coloration of chorion shining dark, without sculpturing; elongated-ovoid. Both ends 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 reddish brown.

Material examined. 62 indiv., obtained from the adults reared in the laboratory, 30 April 2003.

First instar larva

Length 3.8-7.5 mm; width (on 2nd abdominal segment) 0.4-1.0 mm.

Coloration light yellowish brown, body moderately elongated, integument subtransparent. Head capsule reddish brown, lateral plates light brown; antennae pale yellow, hair-like. Spiracular disc with two lateral lobes and two ventral lobes developed, dorsal lobes undeveloped. Lateral lobes and ventral lobes pigmented with brown; each lateral lobe with brush of 11 long setae; each ventral lobe with 9 setae on apex, 3 separated, 6 grouped brush-type. Spiracles with one ring, brown. Anal gills with two pairs.

Material examined. 47 indiv., reared in the laboratory, 15 May 2003 (oviposited 30 April 2003).

Second instar larva

Length 8.0-15.0 mm; width 0.9-1.8 mm.

Coloration light yellow. Spiracular disc with three pairs of lobes, each lobe pigmented with brown. Spiracles three rings; inner ring black, intermediate one light yellow, and outer one yellowish brown, Anal gills with three pairs, pale yellow. Other characters very similar to fourth instar larva.

Material examined. 42 indiv., reared in the laboratory, 26 May 2003 (oviposited 30 April 2003).

Third instar larva

Length 19.5-31.0 mm; width 2.2-3.6 mm.

Coloration yellowish brown. Spiracles three rings;

inner ring black, intermediate one yellowish brown, outer one reddish brown. Other characters very similar to fourth instar larva.

Material examined. 32 indiv., reared in the laboratory, 20 June 2003 (oviposited 30 April 2003).

Fourth instar larva

Length 43.0-59.0 mm; width 4.7-7.0 mm.

Coloration yellowish brown to reddish brown. Form large-sized, terete. Body smooth, covered with a very short pubescence.

Head capsule rather small, vertex to clypeus and lateral plates yellowish brown, other parts black. Mentum of head capsule with seven distinct teeth, median tooth largest with rounded tip; mandible with four teeth. Antennae reddish brown; apex with very small apical disc, button-like.

First abdominal segment shorter than remaining segments. Abdominal segments II-VII respectively divided into two rings; long ring anterior and short one posterior. Chaetotaxy of abdominal segments II-VII as follows: Dorsum with six setae arranged two (D5-D6) in anterior row and four (D1-D4) in posterior row; D1 short and strong, D2-D3 close together, D4 very long and surrounded by short hairs, D5 surrounded by short hairs, and D6 very slender. Lateral region with four setae; L1 very slender, L2 very long, L3 short and strong, and L4 very long. Venter with five setae; V1 very slender, V2 strong and surrounded by short hairs, V3 very long, V4 long, V5 short, strong and surrounded by short hairs.

Spiracular disc with three pairs of lobes; dorsal and lateral lobes subequal in length. Dorsal lobes with no setae and lateral ones with 3 setae on apex, one long and strong, two short and slender. Ventral lobes with a setigerous protuberance, a brown marking with a pair of distinct spot at base; with 4 setae, two on apex, two on outer side; protuberance of ventral lobes with 4 setae, one on base, three on apex. Spiracles with three rings; inner ring black, intermediate one yellowish brown, outer one reddish brown. Anal gills with three pairs, rather small, light yellow.

Material examined. 25 indiv., Mt. Sobeak, Gyeongbuk Prov., 31 March 2002, D. S. Kim; 16 indiv., same locality, 25 March 2003, D. S. Kim.

Remarks. *T. patagiata* is characterized by ventral lobes with a setigerous protuberance and a brown marking with a pair of distinct spot at the base. *T. latemarginata* has been described in Korea (Kim and Lee, 2002), but the species is characterized by dorsal part of the body with button hole-like markings and a median longitudinal brown stripe.

Pupa

Length: male, 30.0-32.0 mm; female, 32.5-34.5

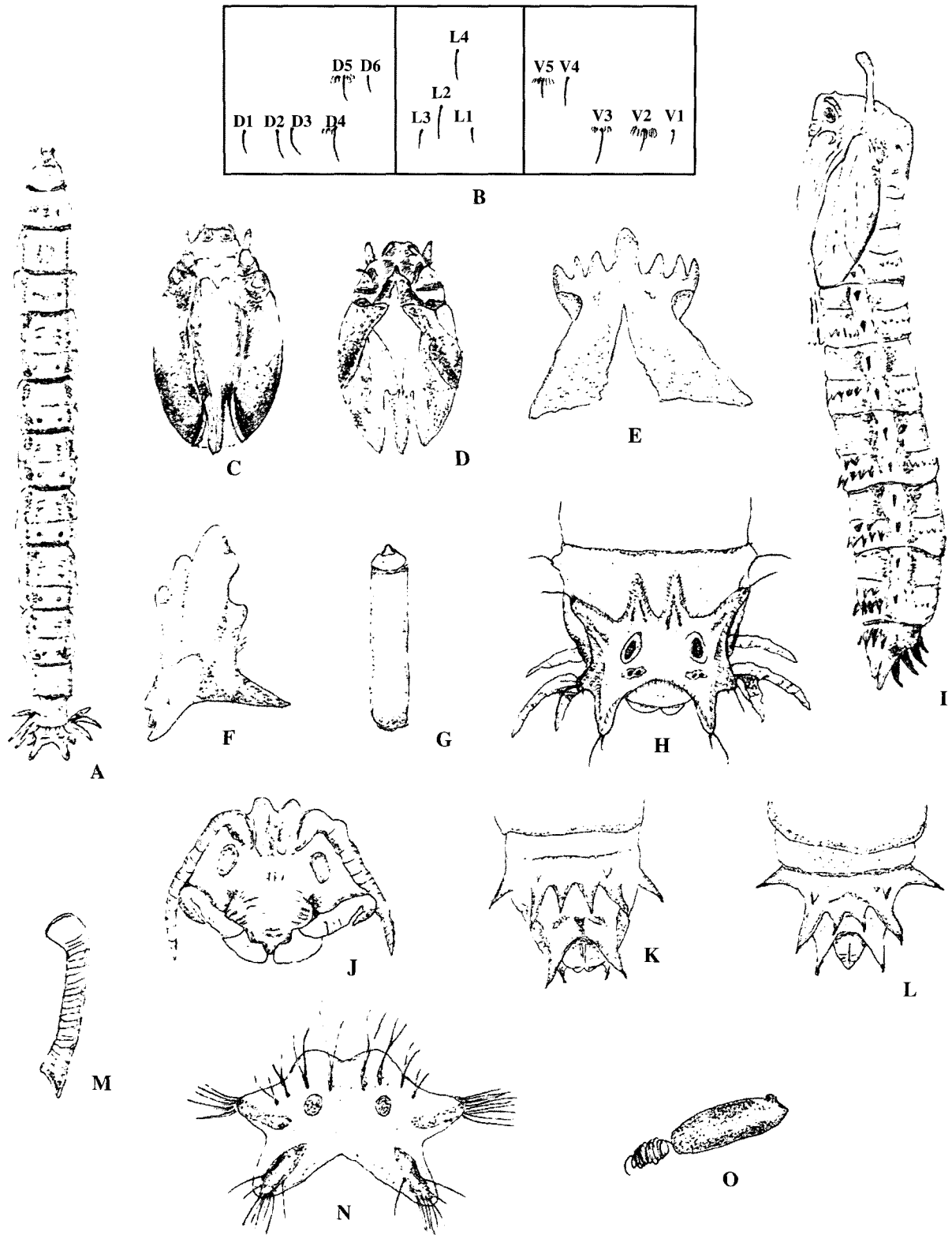


Fig. 1. Immature stages of *Tipula patagiata*. Fourth instar larva (A-H); A: body in dorsal view, B: chaetotaxy of abdominal segments II-VII, C: head capsule (dorsal view), D: head capsule (ventral view), E: mentum, F: mandible, G: antenna, H: spiracular disc; pupa (I-M); I: lateral view of female. J: head (ventral view), K: cauda (♂), L: cauda (♀), M: pronotal breathing horn; first instar larva (N-spiracular disc); egg (O).

mm.

Width (at the wing base): male, 4.1-4.2 mm; female, 4.8-5.2 mm.

Coloration yellowish brown to reddish brown; wing sheaths light yellowish brown; pleural region of abdomen light yellow. Form rather stout.

Head rather small. Cephalic crest very small. Antenna slender, moderately elongated, extending some distance beyond wing root. Pronotal breathing horns short, with tips slightly enlarged, flattened, smooth. Labrum broad, apex pointed. Labial lobes oval. Maxillary palpi strongly recurved at tips. Wing sheaths extending just beyond end of second abdominal segment. Leg sheaths extending nearly to base of fourth abdominal segment.

Abdominal tergites with weak spines; 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 anterior row and 8-13 spines on posterior 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 segment with eight spines; on ventral and lateral region with six strongly sclerotized spines, on dorsal region with 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 segment on ventral and lateral region with six very strong spines.

Material examined. 8 ♂♂, 5 ♀♀, Mt. Sobeak, Gyeongbuk Prov., 22 April 2002, D. S. Kim; 7 ♂♂, 5 ♀♀, same locality, 14 April 2003, D. S. Kim.

Distribution. Korea, Japan.

Habitat. The larvae of *T. patagiata* were collected in a slow flowing stream of the mountain. Pupae of the species were found in drier land near the place where the larvae lived.

Biological notes. The adult emergence of *T. patagiata* takes place two times a year, spring and autumn, periodically in the field. The larvae of the species are herbivorous and feed on algae and leaf litters in slow flowing streams.

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