韓應昆誌 49(4): 269~272 (2010)
Kor. J. Appl. Entomol.

Taxonomic Study of the Larvae of the Genus *Mantura* Stephens (Coleoptera: Chrysomelidae: Alticinae) from Korea

Jinyoung Park, Jong Eun Lee[1] and Jong Kyun Park*

Department of Applied Biology, College of Ecology & Environmental Sciences, Kyungpook National University, Sangju 742-711; [1]Department of Biological Science, College of Natural Sciences, Andong National University, Andong 760-749, Republic of Korea

한국산 통벼룩잎벌레속 (딱정벌레목: 잎벌레과: 벼룩잎벌레아과) 유충의 분류학적 연구

박진영 · 이종은[1] · 박종균*

경북대학교 생태환경대학 생물응용학과, [1]안동대학교 자연과학대학 생명과학과

ABSTRACT: Immature stages of *Mantura rustica* (Linnaeus) are described in detail for the first time in Korea. A key to identifying larvae of Korean *Mantura* is provided, with their illustrations and larval tubercle pattern.

Key words: Coleoptera, Chrysomelidae, *Mantura, immature* stages, Korea

초 록: 본 연구를 통해 소리쟁이류(*Rumex* spp.)를 기주로 하는 통벼룩잎벌레(*Mantura* rustica)의 미성숙단계에 대한 그림과 기재를 우리나라에서는 처음으로 보고한다. 또한 한국산 통벼룩잎벌레속의 유충의 검색표와 소결절(tubercle) 패턴도 작성하였다.

검색어: 딱정벌레목, 잎벌레과, *Mantura*, 미성숙단계, 한국

The leaf beetle subfamily Alticinae is composed of small to medium-sized, compact beetles whose enlarged hind femora and renowned jumping ability have earned them the name of flea beetles. These enlarged femora allow for the springing action of these insects when disturbed. Although flea beetles feed on almost all higher plant families, the individual species (of which there are well over 4,000) are often highly specific in their feeding habits. This trait has transformed some species into severe agricultural pests, while others have risen to prominence for their beneficial role in controlling introduced weeds. Several outstanding successes in the biological control of weeds have involved the introduction of foreign flea beetles into the United States and Canada (Hansen *et al.*, 1997). Among these, are species established for the control of alligator weed in southern waterways, tansy ragwort in western pastures, and leafy spurge in pastures and rangelands (Diane and Grace, 2004; Gassmann *et al.*, 1996; Kirby *et al.*, 2000; Lym and Nelson, 2000; Nowierski *et al.*, 2002).

The genus *Mantura* Stephens contains fifteen species in Palearctic, about twenty species worldwidely. The majority of species occurs in the Palearctic region, a few species occurs in the New World, Africa, China and Vietnam. Up to now, two species, *M. clavareaui* Heikertinger and *M. rustica* (Linnaeus) were recorded in Korea (Lee and An, 2001).

Larvae and adults of *M. rustica* (Linnaeus) are known as biological control agent of broad and curly duck weed (Crofts and Jefferson, 1999), and the larva are leaf miners.

*Corresponding author: entopark@knu.ac.kr
Received November 2 2010; revised November 15 2010; accepted November 22 2010

The immature stages of *M. clavareaui* Heikertinger and *M. fulvipes* Jacoby has been briefly described and illustrated by Kimoto and Takizawa (1994). However, the larva of *M. rustica* have not been thoroughly described, except for the key and tubercle pattern, and brief illustration provided by Medvedev and Zaitsev (1978) and Ogloblin and Medvedev (1971).

The purpose of this paper is to describe and illustrate the immature stages of *M. rustica* (Linnaeus) for the first time in Korea. Also, a key to known larvae of Korean *Mantura* is given.

Materials and Methods

Immature stages of *Mantura rustica* were reared on the host plants, *Rumex* spp. in the laboratory. Materials used in this study were preserved in 70% ethyl alcohol. Larvae and pupae were cleared in 10% KOH solution for 30 minutes and then rinsed in water. The dissection was done under a stereoscopic microscope (SZX12; Olympus, Japan). For morphological studies of the minute structure, the parts were mounted on slides and observed through the compound microscope (SZ4045; Olympus, Japan). Slide mounting procedures were carried out according to LeSage (1984), and terminology followed Anderson (1947), Kimoto (1962) and Burke (1968). Abbreviations of L, S, M, D, DL, EP, P, S, ES, SS, a, p, i and e in parentheses stand for long, short, microseta, dorsal tubercle, dorso-lateral tubercle, epipleural tubercle, pleural tubercle, sternal tubercle, eusternal tubercle, sternellar tubercle, anterior, posterior, interior and exterior, respectively. The specimens examined were deposited in the Insect Collection of the Department of Applied Biology, Kyungpook National University in Sangju, Korea.

Taxonomic Accounts

Subfamily Alticinae Lacordaire, 1845.

Genus *Mantura* Stephens, 1831.

Diagnosis. Body without defensive glands. Tubercles small and brown, well chitinized, D-DL-EPa type on prothorax, EPp indistinct. Meso- and metathorax with Da and Dp on both sides separated to each other. Head with coronal suture extremely short, and with frontal sutures V-shaped; leaf-mining larva.

Key to known larvae of Korean genus *Mantura* Stephens

1. 7th and 8th abdominal segments with Dpi or Dp on both sides fused into transverse bands; anal plate with 3 pairs of setae ····· *M. clavareaui*
- 7th abdominal segment with Dpi or Dp on both sides separated to each other; anal plate with 6 pairs of setae ····· *M. rustica*

Mantura rustica (Linnaeus, 1766) 통벼룩잎벌레 (Figs. 1-2)

Chrysomela rustica L., 1766. Syst. Nat. ed. 12, p. 595 (Europe; Sweden (Uppsala)).

Altica rustica : Gmelin, 1790. IN L., Syst. nat. ed. 13, p. 1695.

Galleruca semiaenea Fabr., 1792. Ent. Syst. 1, 2 : 30 (Europe; Denmark (Copenhagen=$K_{\phi BENHAVN}$)).

Mantura rustica : Stephens, 1831. Illustr. Brit. Ent. Mamdib. 4 : 322-Heikertinger, 1912. IN Reitter, Fauna Germ. 4 : 162, pl. 162, fig. 23. - Chen, 1935. Sinensia 6(6) : 772 (Nanking, E. Siberia).

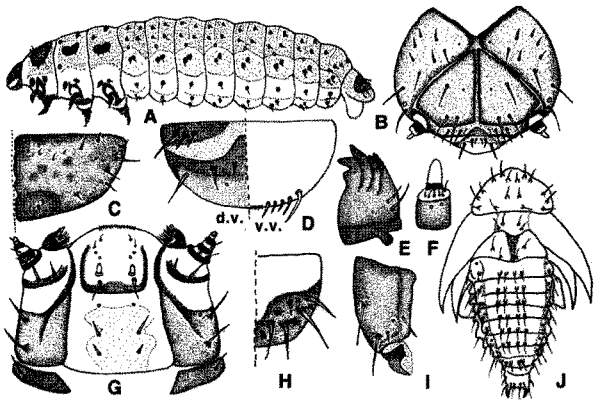

Fig. 1. *Mantura rustica* (Linnaeus, 1766).
A. Last instar larva (l.v.); B. head (d.v.); C. pronotum (d.v.); D. clypeus and labrum (d.v. and v.v); E. mandible (b.v.); F. antenna (d.v.); G. lower mouth parts (v.v.); H. anal plate (d.v.); I. tibia (d.v.); J. pupa (d.v.); b.v., buccal view; d.v., dorsal view; l.v., lateral view; v.v., ventral view.

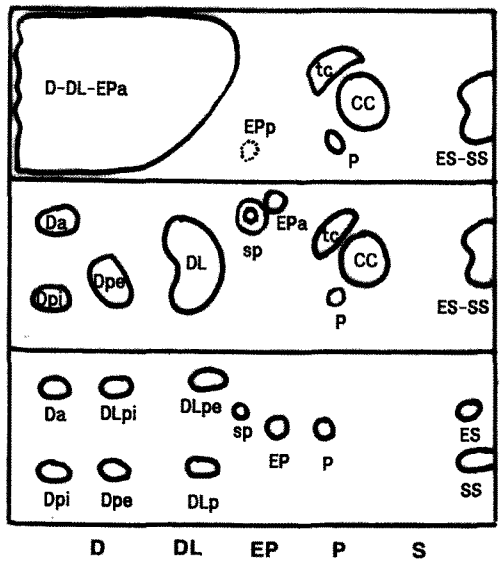

Fig. 2. Schematics of larval tubercle pattern.
D: dorsal region; DL: dorso-lateral region; EP: epipleural region; P: pleural region; S: sternal region.

Descriptions

Egg. Length 1.0 ± 0.1 mm, width 0.8 ± 0.1 mm (n=10), yellow, oval.

Last instar larva (Fig. 1A). Body length 3.8 ± 0.2 mm, width 1.0 ± 0.1 mm, head width 0.05 ± 0.1 mm (n=10). Body yellowish, flat, and body covered with aculeae as figured. Defensive glands absent.

Head (Fig. 1B). Hypognathous, black, well sclerotized, coronal suture extremely short, and with frontal sutures V-shaped. Antenna (Fig. 1F) with one article, a conical sensory papilla and with six setae at apex and two sensilla. Frons with three pairs of setae. Clypeus (Fig. 1D) with three pairs of setae; labrum (Fig. 1D) with three pairs of setae and one sensillum; epipharynx with five pairs of anterolateral setae, numerous median setae. Mandible (Fig. 1E) with five-toothed and 2 madibular setae and 1 sensillum. Maxillary palp (Fig. 1G) three-segmented; palpifer with two setae; stipes with two setae and one sensillum; cardo with one seta; galea with eleven setae. Labial palp (Fig. 1G) one-segmented; prementum with distinct dividing line from postmentum and three pairs of setae with two pairs of sensilla; postmentum with two pairs of setae and one sensillum.

Thorax (Figs. 1C, 2). Pronotum (Fig. 1C) pale brown except median region, weakly sclerotized. Dorsal and epipleural regions of prothorax with a tubercles D-DL-EPa (1L, 11-15S); pleural region with a tubercle P (1S); sternal region with a primaty tubercle ES-SS (2S). Dorsal region of meso- and metathorax with four tubercles Da (1S), Dpi (1S), Dpe (1S) and DL (3L); epipleural region with a tubercle EPa, but indistinct; pleural region with a tubercle P (1S); sternal region with a tubercle ES-SS (2S). Mesothoracic spiracles annuliform, located on EPai. Tibia (Fig. 1I) with five setae; tarsus strongly curved with pointed tip, enlarged basally, with a seta; pulvillus present.

Abdomen (Fig. 2). Dorsal region with six tubercles Da (1S), Dpi (1S), DLpi (1S), Dpe (1S), DLpe (1S, 1M) and DLp (1S); epipleural region with a tubercle EP (1S); pleural region with a tubercle P (1S); sternal region with two tubercles ES (1S) and SS (1S). Seventh segment with Dpi or Dp on both sides separated to each other; Eighth segment with Dpi or Dp on both sides separated or fused to each other. Spiracles present on segments Ⅰ-Ⅷ; anal plate (Fig. 1H) with 6 pairs of setae. Pygopod well developed.

Pupa (Fig. 1J). Body length 2.3 ± 0.2 mm, width 1.0 ± 0.1 mm (n=10), yellow.

Head. One pair of frontal setae; one pair of basirostral setae.

Thorax. Pronotum with two pairs of anteromedian setae; two pairs of posteromedian setae and four pairs of posterolateral setae present. Mesonotum with two pairs of setae. Metanotum with two pairs of setae.

Abdomen. Two pairs of postdorsal setae; one pair of pleural setae; one pair of spiracular setae. Seventh abdominal segment slightly larger than previous ones; segment Ⅸ with five pairs of setae at the base of cerci; cerci with outer margin round.

Materials examined. 50 exs., Kajangdo Isl., Yeosu City, Jeollanam-do, 27.Ⅴ. 2010, J.Y. Park.

Distribution. Korea, China, Europe, Siberia.

Host plants. *Rumex* spp. (*R. japonicas* and *R.obtusifolius*)

Remarks. The larva of this species are closely similar to *Mantura clavareaui*, but is distinguished by the following characters : 7th abdominal segment with Dpi or Dp on

both sides separated to each other ; anal plate with 6 pairs of setae.

Biological note. This species has one generation per year and overwinters in the adult stages. Adults appear in early April, and begin oviposition from early May. Eggs are laid singly inside the leaf or stem. Larvae show leaf-mining habit and pupation is become in the soil. The emergence of adults starts from early June to later July. The adults are very active on host plants, especially during hot sunny days. The total life cycle from egg to adult ranged from 25 to 30 days in the room temperature.

Acknowledgments

This work was supported by the National Research Foundation of Korea Grant funded by the Korean Government [NRF-2009-351-C00151].

Literature Cited

Anderson, W.H. 1947. A terminology for the anatomical characters useful in the taxonomy of weevil larvae. Proceedings of the Entomological Society of Washton. 49: 123-132.

Burke, H.R. 1968. Pupae of the weevil tribe Anthonomini (Coleoptera: Curculionidae). Technical Monograph. 5: 7-92.

Chen, S. 1935. New and rare Chinese Coleoptera. Sinensia. 6(6): 772.

Crofts, A. and R.G. Jefferson (eds), 1999. Lowland Grassland Management Handbook. 2nd Edition, English Nature/The Wildlife Trusts.

Diane L.L. and J.B. Grace. 2004. Temporal dynamics of leafy spurge (*Euphorbia esula*) and two species of flea beetle (*Aphthona* spp.) used as biological control agents. Biol. Control. 29: 207-214.

Fabricius, J.Ch. 1972. Entomologia Systematica emendata et aucta. Secundum classes, ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus. I. Impensis Christ. Gottl. Proft., Hafniae, 1: X X + 330 pp, 2: p. 30.

Gassmann, A., D. Schroeder, E. Maw and G. Sommer. 1996. Biology, ecology, and host specificity of european *Aphthona* spp. (Coleoptera: Chrysomelidae) used as biocontrol agents for leafy spurge, *Euphorbia esula* (Euphorbiaceae), in North America. Biol. Control. 6: 105-113.

Gmelin, J.F. 1790. Caroli a Linné Systema Naturae per regna tria nature, secundum classes, ordines, genera, species, cum characteribus, differentis, synonymis, locis. Editio decima tertia aucta, reformata. I. 4. Lipsiae. p. 1695.

Hansen, R.W., R.D. Richard, P.E. Parker and L.E. Wendel. 1997. Distribution of biological control agents of leafy spurge (*Euphorbia esula*) in the United States: 1988-1996. Biol. Control. 10: 129-142.

Heikertinger, F. 1912. Halticinae. In: Reitter E. Fauna Germanica. Die Kater des Deutschen Reiches. Stuttgart. 4: 143-212.

Kimoto, S. 1962. A phylogenetic consideration of Chrysomelidae based on immature stages of Japanese species. J. Fac. Agric. Kyushu Univ. 12: 67-116.

Kimoto, S. and H. Takizawa. 1994. Leaf beetles (Chrysomelidae) of Japan. Tokai Univ. Press. pp. 1-539.

Kirby, D.R., R.B. Krabbenhoft, D. Mundal and M.M. Kirby. 2000. Biological control of leafy spurge with introduced flea beetles (*Aphthona* spp.). J. Rang Manage. 53: 305-308.

Lee, J.E. and S.L. An. 2001. Family Chrysomelidae. Economic insects of Korea 14. 231 pp.

LeSage, L. 1984. Immature stages of Canadian *Neochlamisus* Karren (Coleoptera: Chrysomelidae). Canadian Entomology. 116: 383-409.

Lym, R.G. and J.A. Nelson. 2000. Biological control of leafy spurge (*Euphorbia esula*) with *Aphthona* spp. along railroad right-of-ways. Weed Technol. 14: 642-646.

Medvedev. L.N. and Y.M. Zaitzev. 1978. Larven der Blattkäfer aus dem östlichen Teil der USSR. Moskau. 183 pp. (russ.).

Nowierski, R.M., Z. Zeng, D. Schroeder, A. Gassmann, B.C. FitzGerald and M. Crisofaro. 2002. Habitat associations of *Euphorbia* and *Aphthona* species from Europe: development of predictive models for natural enemy release with ordination analysis. Biol. Control. 23: 1-17.

Oglobin, D.A. and L.N. Medvedev. 1971. The larvae of leaf beetles (Coleoptera: Chrysomelidae) of the European part of the USSR. Isdat. Nauka Opred. Faune SSSR. Leningrad. 124 pp. (russ.).

Stephens, J.F. 1831. Illustrations of British Entomology. Mandibulata. London. 4: 408 pp.