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A New Record of *Nematus tibialis* Newman, 1837 (Hymenoptera: Tenthredinidae) from South Korea

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한국의 미기록종 *Nematus tibialis* Newman, 1837 (벌목: 잎벌과)에 대한 보고

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ABSTRACT: In this study, *Nematus tibialis* Newman, 1837 (Hymenoptera: Tenthredinidae), is firstly reported in South Korea. The manuscript provides diagnostic illustrations, diagnosis, color variations, development stages and distribution of *N. tibialis*.

Key words: Hymenoptera, Nematinae, *Nematus tibialis*, New record, South Korea

초 록: 본 연구에서 *Nematus tibialis*를 국내에서 처음으로 보고한다. 이 종의 사진과 진단, 색 변이, 발육 단계와 분포 등을 제공하였다.

검색어: 아까시잎벌(신칭), 벌목, 수염잎벌아과, 미기록, 한국

Nematus tibialis is belonging to the subfamily Nematinae and it was native to North America and found in Western Europe, Japan, and Russian Far East (Roques, 2010; Maslyakov and Izhevskii, 2011; Hara, 2020; Kolyada et al., 2022). This species has currently known to damage Acacia and was confirmed to damage *Robinia phseudoacacia* (Kolyada et al., 2022). It also subfamily Nematinae has a variety of feeding habits including external leaf feeding, leaf mining, and gall forming, and feed on a variety of hosts (Smith, 2003). Generally, females oviposit along the midribs of leaves (Smith, 2008), and larvae are external feeders on leaves of the host (Smith, 2003), sometimes gregariously, sometimes singly. At maturity, the larvae fall to the ground and spin cocoons in which they pupate or overwinter (Smith, 2008). Adults occur in May and June, depositing eggs in association with the young growth of Acacia. Following egg hatch, the young larvae feed on expanded leaves, each forming a small hole through the leaf blade and resting along the cut edge; later, the larvae devour more of the

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tissue. Larvae are fully fed in two or three weeks, but the overall damage was not significant. Then, they enter soils and pupate in tough, dark brown cocoons. Adults emerge shortly afterward. A second generation occurs in the late summer with in favourable seasons, a partial third developing in the autumn (Alford, 2012). From this study, we observed that *N. tibialis* showed variations in their color development according to seasonal changes or temperature changes. In this study, we report *N. tibialis* for the first time in Korea with morphological variations according to seasonal changes for the species and providing information about each step of the species.

Materials and Methods

Materials examined in this study were collected by Malaise trap from 2017 to 2022 Which were installed in sites of SMNE in Geochang (Fig. 1). It also collected from Sacheon, Goesan (Cheonghwasan Mt.), Gochang, and Andong in South Korea. The collected samples were stored in 99% alcohol and the microscope used to photograph morphological features for species is Leica M205.

Abbreviations as follows: SMNE, the Science Museum of Natural Enemies, Geochang; GB, Gyeongsangbuk-do; GN Gyeongsangnam-do; CB, Chungcheongbuk-do; JB Jeollabuk-do; GB, Gyeongsangbuk-do.

Taxonomic Accounts

Family Tenthredinidae Latreille, 1802

Subfamily Nematinae Thomson, 1871

***Nematus tibialis* Newman, 1873** 아까시잎벌(신칭) (Fig. 2)

Nematus tibialis Newman, 1837: 260; Benson, 1958: 223; Smith, 1979: 69; Darling and Smith, 1985: 225; Liston, 2011: 190; Ichikawa, 2015: 22.

Nematus hortensis Hartig, 1837: 195.

Nematus trilineatus Norton, 1867: 215.

Nematus similaris Norton, 1880: 224; Comstock, 1880: 222; Dyar, 1895: 301.

Pteronidea tibialis: Enslin, 1916: 432.

Pteronidea trilineata: Lorenz and Kraus, 1957: 231.

Hypolaepus (*Pteronidea*) *tibialis:* Lacourt, 1999: 143.

Euura tibialis: Hara, 2019: 75; Hara, 2020: 88, 348.

Nematus tibialis, Kolyada et al., 2022: 215-218.

Diagnosis. Body length 5.2-7 mm. Head in dorsal view 1.4-1.6 times as broad as long. Wings fully developed. Ovipositor is longer than two basal tarsomeres of hind tarsus. fore wing length 4.8 mm. Antenna 4.8 mm long and dark-brown all over. Whole body is yellow and legs with black on the vertex, mesoscutum, hind tibia and tarsus.

Material examined. [KOREA] (CB) Samson, Cheongcheon, Goesan, Malaise Trap, 17.VIII-5.X.2021, 1 female -coll. SMNE; (JB) Seongnae, Gochang, Malaise Trap, 30.VI-14.VII.2021, 6 females -coll. SMNE; (GB) Daehyeon, Bukhu, Andong, Malaise Trap, -coll. SMNE, 20.IV-V.04.2020, 4 females, 18.V-02.VI. 2020, 1 female, 15.VI-29.VI.2020, 2 females, 29.VI-VII.14. 2020, 5 females, 21.VII-28.VII.2020, 2 females, 10.VIII-24. VIII.2020, 4 females, 31.V-16.VI.2021, 1 female, 16.VI-31. VI.2021, 4 females, 13.VII-28.VII.2021, 1 female, 01.IX-16. IX.2021, 1 females, 16.IX-28.IX.2021, 1 females, 01.X-15.X.

Fig. 1. Malaise trap installed in SMNE.

2021, 3 females -coll. SMNE; (GN) Geochang, Science Museum Natural Enemy, Malaise Trap, 02.VI-16.VI.2020, 144 females, 16.VI-30.VI.2020, 61 females, 01.VII-15.VII.2020, 121 females, 16.VII-04.VIII.2020, 12 females, 04.VIII-16.VIII.2020, 11 females, 16.VIII-04.IX.2020, 19 females, 04.IX-16.IX.2020, 16 females, 06.X-16.X.2020, 3 females, 16.X-06.XI.2020, 4 females, 06.XI-12.XII.2020, 1 female; coll. Ku Deokseo, Lee Jaehyeon; same locality, 05.V-20.V.2021, 51 females, 20.V-03.VI.2021. 12 females, 03.VI-16.VI.2021, 113 females, 16.VI-30.VI.2021, 73 females, 30.VI-14.VII.2021, 221 females, 14.VII-30.VII.2021, 17 females, 30.VII-11.VIII.2021, 2 females, 11.VIII-25.VIII.2021, 1 female, 25.VIII-23.IX.2021, 3 females, 23.IV-07.V.2022, 1 female, 07.V-21.V.2021, 8 females, 21.V-04.VI.2022, 20 females, 04.VI-18.VI.2022, 79 females; coll. Ku Deokseo, Lee Jaehyeon, Jeong Hyojin -coll. SMNE.

Distribution. Korea (new record), North America, Japan,

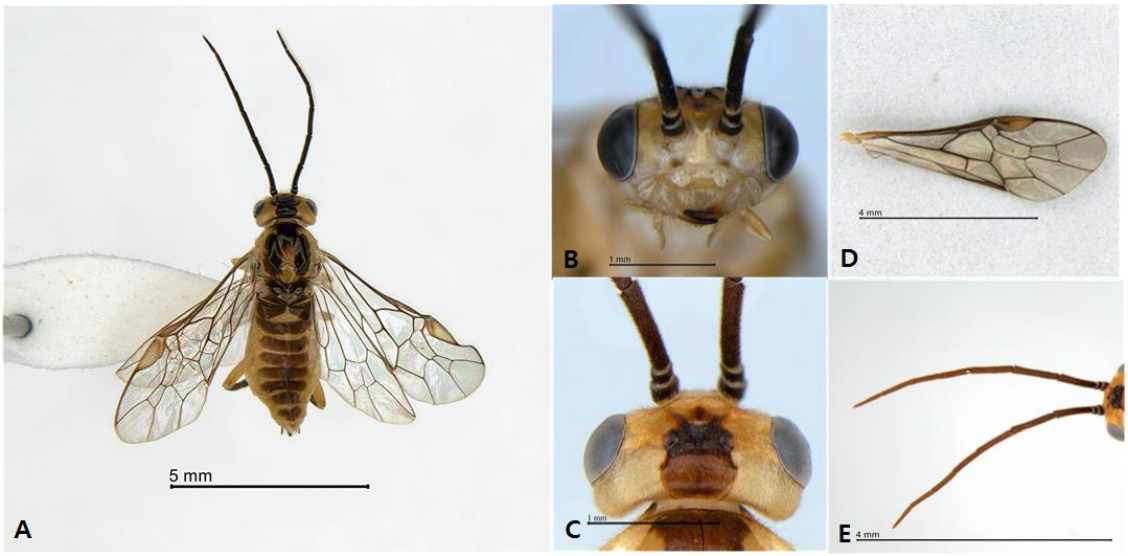

Fig. 2. *Nematus tibialis*, A, Habitus, dorsal view; B, Head, frontal view; C, Head, dorsal view; D, Fore wing; E, Antenna.

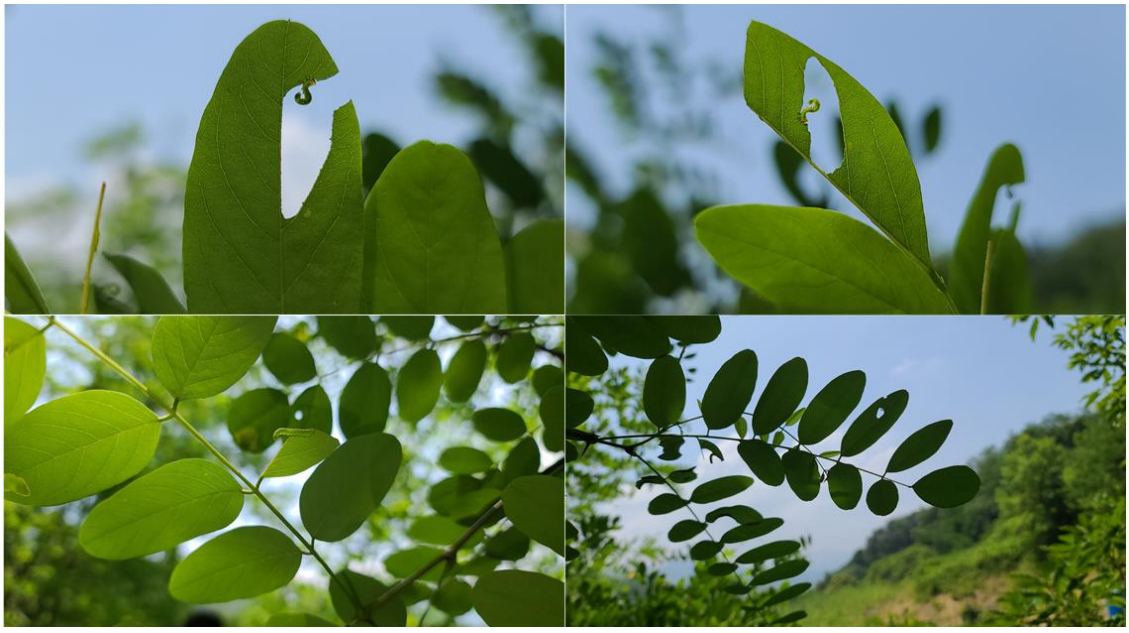

Fig. 3. *Nematus tibialis* on *Robinia pseudoacacia*.

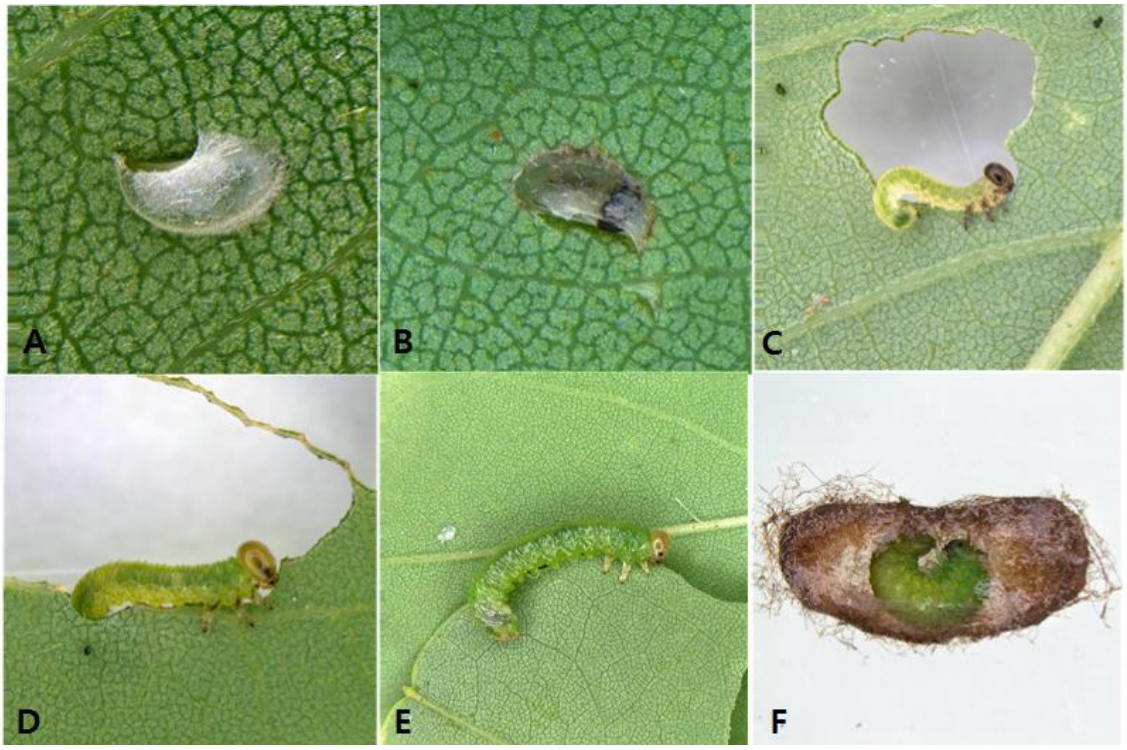

Fig. 4. The stage of development of *Nematus tibialis*, A, egg; B, 1st instar larva; C, 2nd instar larva; D, 3rd instar larva; E, 4th instar larva; F, prepupa.

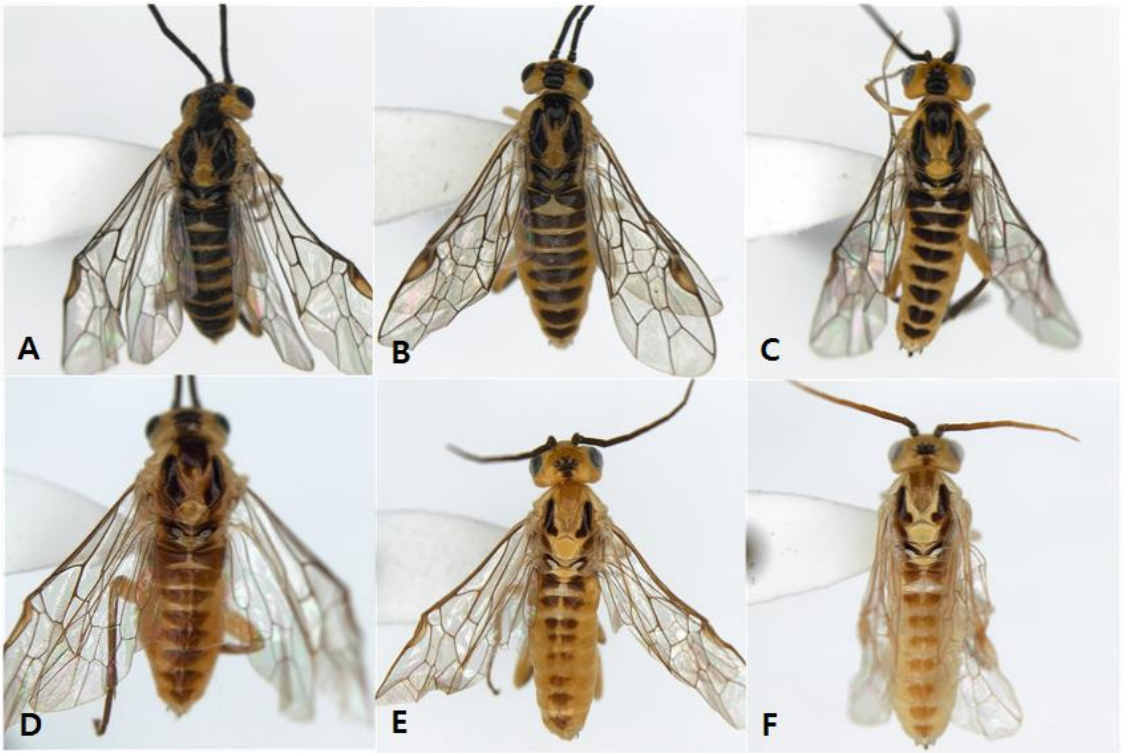

Fig. 5. Color variations of *Nematu tibialis*.

Russian Far east, and Europe.

Host Plant. *Robinia pseudoacacia* (Kolyada et al., 2022)

Ecology. This species fables from eggs through pupa processes to adult insects. When they hatch, the female lay eggs on the leaves of *Robinia pseudoacacia* and begin to grind and eat them (Fig. 3). In most cases, pupae fall to the ground and open cocoons, and in this experiment, they were photographed from eggs before adult to pupa stage, and the complete pupa was not photographed, each providing a cycle as a picture (Fig. 4).

Fig. 6. Collection sites of *Nematus tibialis* in South Korea.

Color variation. The patterns of scutellum, propodum, and gaster were different according to the seasonal changes of this species (Fig. 5). When the pattern first appeared, the pattern was dark black, and as winter approached, the pattern was lighter, and it is believed that the pattern of this species changes according to temperature changes. The individuals collected in the month are not generally characterized, but some of the objects with severe variations were selected (Fig. 5E and 5F).

Number of populations. It provides the area where *Nematus tibialis* identified in this study was collected (Fig. 6). And we provide the following populations by period collected from 2017 to 2022 in SMNE, but not 2019. Although it has been steadily investigated since 2017, the first time it appeared was

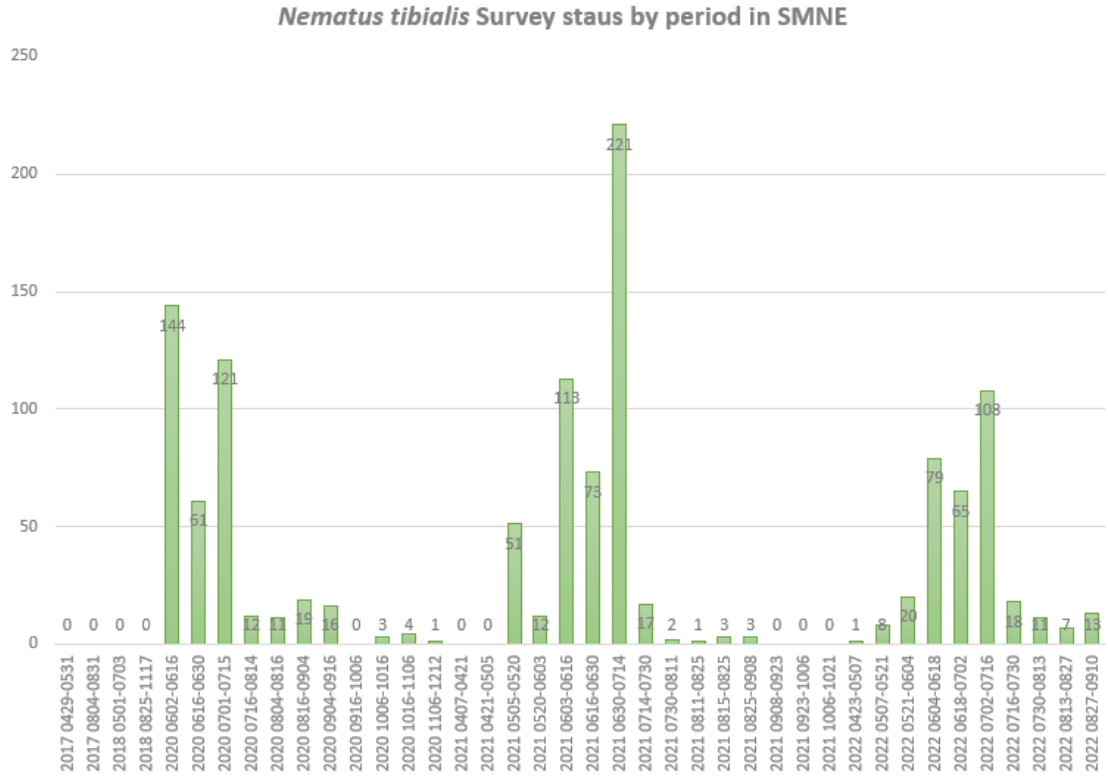

Fig. 7. Number of individuals collected by *Nematus tibialis* by period in SMNE.

in June 2020, and the most collected time was from June 30 to July 14, 2021(Fig. 7). In the occasional Andong-si, it was also caught through night collection.

Discussion

We've been collecting a lot of insects over the years by installing Malaise traps, and *N. tibialis* has been discovered since 2020. *N. tibialis* changed the colors of scutellum, propodum, and gaster according to the seasonal flow. We also registered DNA information on this species with the NCBI (Accession number : KC974415).

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Statements for Authorship Position & Contribution

Lee, J.-H.: The Science Museum of Natural Enemies, M.S; Designed the research, wrote the manuscript and examined specimens

Jeong, H.: The Science Museum of Natural Enemies, M.S; Collected and examined specimens

Lee, H.-R: Restoration Research Team (Insects), Division of Restoration Research, National Institute of Ecology; Collected and examined specimens

Choi, J.-K: Daegu National University of Education, Ph.D; Collected and examined specimens

Lee, G.-S.: Rural Development Administration (RDA), Researcher; Collected and examined specimens

Kwon, G.-M.: Bio Utilization Institute, Researcher; Collected and examined specimens

Ku, D.-S.: The Science Museum of Natural Enemies, Ph.D; Collected and examined specimens

An, T.-H.: Jinju Girls' High School, M.S; Collected and examined specimens

Lee, W.: Gyeongsang National University, Professor, Ph.D; Examined specimens and designed the research

All authors read and approved the manuscript.

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