

The First Record of the Family Chamaemyiidae (Diptera: Lauxanioidea) from Korea

Jongwon Kim^{1,2}, Sang Jae Suh^{1,3,*}

¹School of Applied Biosciences, Kyungpook National University, Daegu 41566, Korea

²Division of Zoology, Honam National Institute of Biological Resources, Mokpo 58762, Korea

³Institute of Plant Medicine, Kyungpook National University, Daegu 41566, Korea

ABSTRACT

The family Chamaemyiidae is commonly referred to as aphid flies, as all larvae are predators of sternorrhynchous aphidoid or coccoid hemiptera, as well as a small group of acalyptratae flies found worldwide. Adults are small flies and typically found near their larval prey in grasslands and forests. They have a silver-gray body with dark gray or black markings on the abdominal tergites. This family is described for the first time in the Korean fauna, based on the discovery of two nominated species: *Leucopis argentata* and *Leucopis glyphinivora*. Diagnoses and figures about the firstly recorded species, and a key to the Korean species are provided herein.

Keywords: taxonomy, Insecta, Diptera, Chamaemyiidae

INTRODUCTION

The aphid fly, Chamaemyiidae Hendel, 1916 is a small family of Lauxanioidea with over 330 described species in 30 extant genera worldwide. In the palearctic region, 190 species are classified into six genera (Tanasijtshuk, 1984; Nakamura et al., 2014; Ebejer and Barták, 2019; Gaimari 2021).

The family Chamaemyiidae was proposed a group in allying with Lauxaniidae by Hendel (1916), but was initially treated by Malloch (1922) as a subfamily of Agromyzidae, a position he later abandoned (Malloch, 1930) to follow Hendel (1916). McAlpine (1963) divided the family into two subfamilies, Cremifaniinae and Chamaemyiinae, which was strongly endorsed by Hennig (1965) (Tanasijtshuk, 1996; Gaimari, 2021).

Adults are small (1.0–5.0 mm) and typically covered in silver-gray dust. As a result, they are also referred to as silver flies. They are typically found in grasslands, forests, reeds, or coastal biotopes. Aphid flies feed primarily on aphid honey dews with their fore tarsi. Their larvae are well-known predators of Heteropterns such as aphids, scale insects, wooly aphids, and gall-forming jumping plant-lice nymphs. So, they are frequently used for biological control of these pests (Tanasijtshuk, 1970; McLean, 1998; Barriault et al., 2018).

The family Chamaemyiidae was discovered for the first time in Korean fauna, with two named species: *Leucopis argentata* Heeger, 1848 and *Leucopis glyphinivora* Tanasijtshuk, 1958 belonging to the genus *Leucopis* Meigen, 1830. Descriptions, illustrations of these previously unrecorded species, and a key to the Korean species are provided herein.

MATERIALS AND METHODS

All specimens in this study were collected from the Korean Peninsula using the net-sweeping method, and stored in a deep freezer for preservation. For morphological research, several of the specimens were dried and glued to pointed triangular paper. To dissect the genital structures, abdominal segments were removed using a pair of minute insect pins, cleaned with 10% potassium hydroxide (KOH), and then heated for 20 min on a 95°C heating block. After the genital segments were immersed in glycerin to facilitate identification, they were observed using either a stereoscopic microscope (Olympus SZX 16, Japan) or an optical microscope (Olympus BX50). All photographs were taken with an Olympus DP 71 camera and blended using the software Helicon Focus (7.5.4). They were then modified in Adobe Photoshop CS6. The specimens are

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

***To whom correspondence should be addressed**

Tel: 82-53-950-7767, Fax: 82-53-950-6758
E-mail: sjsuh@knu.ac.kr

housed in the collection of Kyungpook National University's School of Applied Biosciences in Daegu, Korea. The following is the terminology for the morphological characteristics by Merz and Haenni (2000) and McLean (1998).

SYSTEMATIC ACCOUNTS

Order Diptera Linnaeus, 1758

Superfamily Lauxanioidea Hendel, 1922

¹*Family Chamaemyiidae Hendel, 1916

Chamaemyiidae Hendel, 1916: 297 (type species: *Ochtiphila elegans* Panzer, 1809).

Diagnosis. Small size (1–5 mm); silver-gray or occasionally golden tinted body, rarely shiny black. No vibrissa; palpus small and sparsely setulose. Scutellum with two pairs of setae; 1 postpronotal, 1 presupra-alar, 1 supra-alar, 1 postsupra-alar, 1 intrapostalar, and 2 notopleural setae; anepisternum usually bare; katepisternum with 1 strong seta and some setulae; proepimeron, proepisternum, and prosternum bare. Hyaline or milky white wings, occasionally patterned in Nearctic species; C veins complete, extend to M (in *Lipoleucopis*, extend to R4+5); subcostal veins complete and separate from R1; A1 abruptly terminates at the basal 1/3; posterior cubital cell present. Tergites 1–5 typically marked with dark markings or longitudinal median line; phallus typically simple and tube-shaped; phallapodeme and hypandrium connected on one side (Hendel, 1910; Tanasijtshuk, 1993, 1996; McLean, 1998; Gaimari, 2010).

²*Genus *Leucopis* Meigen, 1830

Leucopis Meigen, 1830: 133 (type species: *Anthomyza gris-eola* Fallén, 1823).

Diagnosis. Body pale gray color. In lateral view, head height greater than length; orbital seta fine; ocellar seta absent, with the exception of small subgenus *Xenoleucopis*; lunule large and setulose; postpedicel round. Thorax with bright/rusty brown longitudinal band running along dorsocentral line, and gray median stripe running from anterior to middle; 2–3 dorsocentral setae; anepisternum bare. Generally, abdomen with dark rounded margin on tergites 1+2 and single spot or longitudinal stripe on tergites 3–5 (Tanasijtshuk, 1993).

³**Leucopis (Leucopis) argentata* Heeger, 1848 (Fig. 1)

Leucopis argentata Heeger, 1848: 998 (type locality: Austria). *Leucopis argentata*: Xue and Chao, 1996: 272; Tanasijtshuk,

1996: 58.

Material examined. Korea: 11♂♂, 17♀♀, Gyeonggi-do: Hwaseong-si, Songsan-myeon, Gojeong-ri, 3 Jun 2020, Suh SJ coll.; 1♂, Gyeongsangbuk-do: Gunwi-gun, Hyoryeong-myeon, Hwagye-ri, 18 Jun 2019, Suh SJ coll.; 7♂♂, 13♀♀, Uljin-gun, Geunnam-myeon, Susan-ri, 8 Jul 2020, Suh SJ coll.; 2♂♂, Jeollabuk-do: Gochang-gun, Simwon-myeon, Gungsan-ri, 12 May 2020, Suh SJ coll.

Distribution. Korea (new record: Central, South), China (Neimenggu, Hebei), Japan (Honshu), Russia, Australia, Austria, Finland (Tanasijtshuk, 1984; Xue and Chao, 1996; Nakamura et al., 2014).

Description. Body pale gray color. Head nearly twice as high as long; ocellar tubercle pale silver and gray pattern extended to the frontal suture; orbital plate pale silver; postocellar and ocellar seta absent; orbital seta fine; lunule broad and setulose; gena about 1/5 the height of eye in lateral view; pedicel black; postpedicel black and rounded; arista base yellow or occasionally brown; palpus brown black. Thorax silver-gray and vittae-free; dorsocentral setae 0+2. Femora and tibiae all dark gray with yellow joints, while tarsi all pale yellow with dark tip. Tergites 3–5 with dark gray median vitta. Epandrium massive and scutiform in shape, tapering laterally; pregonite reduced in size, postgonite rod-shaped; phallus complex and dichotomous.

Body length: male 1.8–2.5 mm; female 1.8–2.6 mm.

Wing length: male 1.6–2.4 mm; female 1.6–2.4 mm.

Habitat. *Phragmites australis* (Cav.) Trin. ex steud. (Tanasijtshuk, 1999).

Prey. *Hyalopterus pruni* (Geoffroy, 1762) (Tanasijtshuk, 1999).

Remarks. This species is easy to be distinguished from the similar species by following features: massive epandrium, reduced pregonite and postgonite, and dichotomous phallus. This larva is monophagous, only preys on *Hyalopterus pruni* (Hemiptera, Aphididae) on *Phragmites australis* (Tanasijtshuk, 1999).

⁴**Leucopis (Leucopis) glyphinivora* Tanasijtshuk, 1958 (Fig. 2)

Leucopis glyphinivora Tanasijtshuk, 1958: 92 (type locality: Russia).

Leucopis taurica Tanasijtshuk, 1959: 933.

Leucopis glyphinivora: Xue and Chao, 1996: 273.

Material examined. Korea: 1♂, Gyeongsangbuk-do: Pohang-si, Buk-gu, Cheongha-myeon, Yongdu-ri, 22 May 2020, Suh SJ coll.; 1♂, Yecheon-gun, Eunpung-myeon, Ugok-ri,

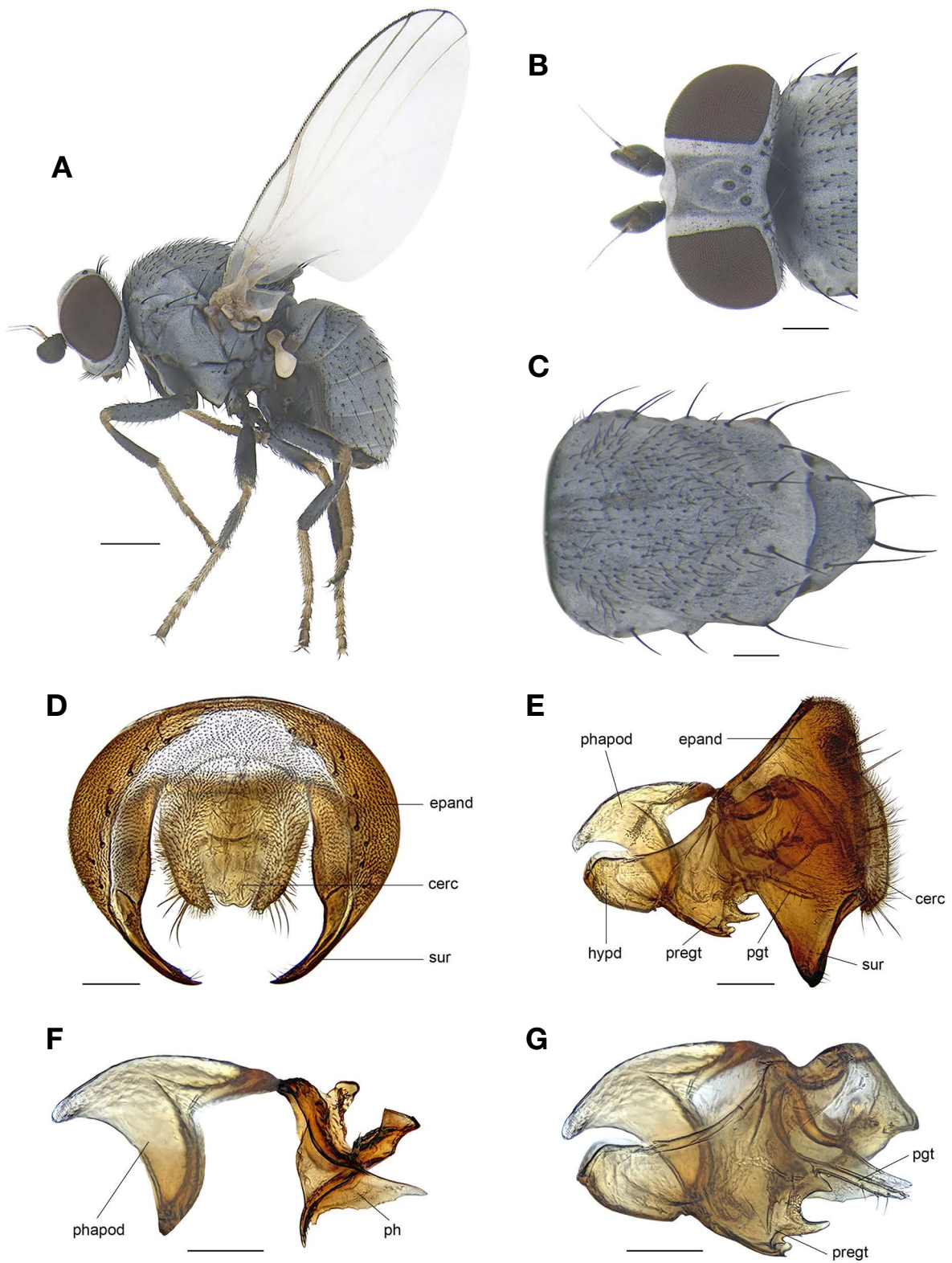


Fig. 1. *Leucopis argentata*, male. A, Habitus, lateral view; B, Head, dorsal view; C, Thorax, dorsal view; D, Epandrium, posterior view; E, Genitalia, lateral view; F, Phallus with phallapodeme, lateral view; G, Genitalia excluded epandrium, lateral view. cerc, cercus; epand, epandrium; hypd, hypandrium; pgt, postgonite; ph, phallus; phapod, phallapodeme; pregt, pregonite; sur, surstylus. Scale bars: A=0.3 mm, B, C=0.2 mm, D-G=0.05 mm.

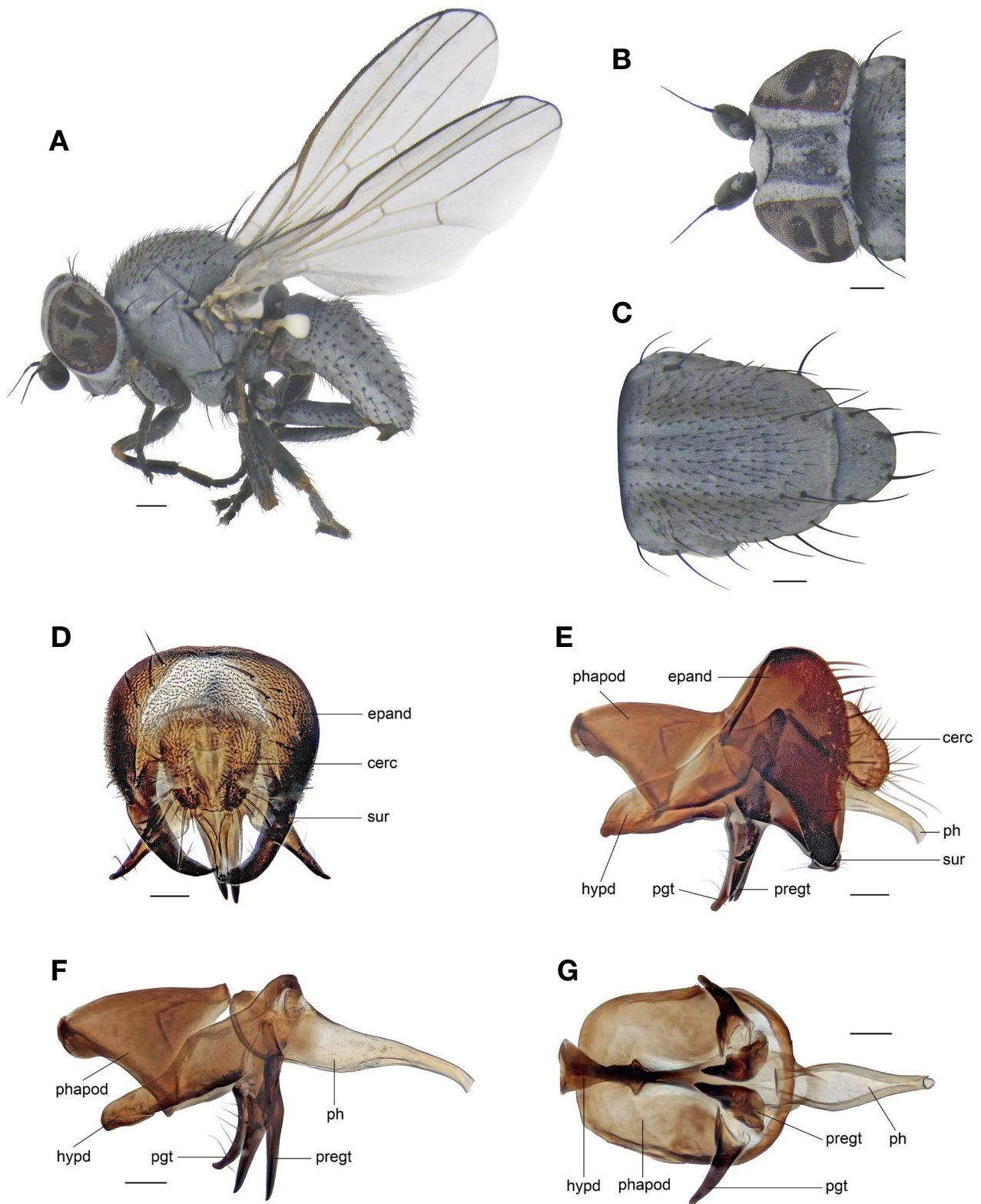


Fig. 2. *Leucopis glyphinivora*, male. A, Habitus, lateral view; B, Head, dorsal view; C, Thorax, dorsal view; D, Epandrium, posterior view; E, Genitalia, lateral view; F, Genitalia excluded epandrium, lateral view; G, Genitalia excluded epandrium, ventral view. cerc, cercus; epand, epandrium; hypd, hypandrium; pgt, postgonite; ph, phallus; phapod, phallapodeme; pregt, pregonite; sur, surstylus. Scale bars: A=0.3 mm, B, C=0.2 mm, D–G=0.1 mm.

23 Jul 2019, Suh SJ coll.; 11♂♂, 9♀♀, Jeju-island: Seogwipo-si, Youngnam-dong, 6 May 2019, Suh SJ coll.

Distribution. Korea (new record: South, Jeju-do), China (Beijing, Guizhou, Hebei, Jilin, Neimenggu, Shaanxi), Russia, Afghanistan, Bulgaria, Finland, France, Hungary, Mongolia, Poland (Tanasijtshuk, 1984; Xue and Chao, 1996).

Description. Silver-gray body. Head nearly twice as high as long in lateral view, dark gray pattern along orbital plate; orbital plate pale silver; postocellar and ocellar seta absent; orbital seta fine; lunule broad and setulosed; gena approximately 1/5–1/4 height of eye in lateral view; pedicel black; postpedicel black and rounded; arista black; palpus black. Thorax setulosed with dark brown dorsocentral lateral vittae and dark grayish median vitta; dorsocentral setae 0+2; prescutellar acrostichal seta absent. All legs are black. Tergite 3 with a black spot; tergites 3–5 with dark gray median vitta; pregonite and postgonite develop downward; phallus club-shaped and broad at middle in ventral view.

Body length: male, 2.4–2.5 mm; female, 1.7–2.6 mm.

Wing length: male, 2.3–2.5 mm; female, 1.5–2.4 mm.

Habitat. Over 70 plants (Barriault et al., 2018).

Prey. Over 80 species of aphids (Barriault et al., 2018).

Remarks. This species can be distinguished from other species by the following features: subtriangular phallapodeme, developed pregonite and postgonite, and club-shaped phallus.

Key to the species of Korean Aphid flies

1. Arista mostly yellow; mesonotum entirely silvery gray without vitta; tarsi pale yellow *Leucopis argentata* Heeger, 1848
- Arista entirely black; mesonotum with dark grayish median and dark brown lateral vitta; tarsi black *Leucopis glyphinivora* Tanasijtshuk, 1958

ORCID

Jongwon Kim: <https://orcid.org/0000-0002-1793-8041>

Sang Jae Suh: <https://orcid.org/0000-0002-7489-3193>

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

This research was supported by Kyungpook National Uni-

versity Development Project Research Fund, 2019.

REFERENCES

- Barriault S, Fournier M, Soares AO, Lucas E, 2018. *Leucopis glyphinivora*, a potential aphidophagous biocontrol agent? Predation and comparison with the commercial agent. *Aphidoletes aphidimyza*. *Biocontrol*, 64:21-31. <https://doi.org/10.1007/s10526-018-09909-x>
- Ebejer MJ, Barták M, 2019. An annotated list of the Chamaemyiidae (Diptera, Acalyptrata) of Turkey with new records and additional data. *Zookeys*, 838:35-48. <https://doi.org/10.3897/zookeys.838.33027>
- Fallén CF, 1823. *Phytomyzides et Ochtidiae Sveciae*. Vol. 2. Litteris Berlingianis, Lundae [=Lund], pp. 8-9.
- Gaimari SD, 2010. Chamaemyiidae (Chamaemyiid flies). In: *Manual of Central American Diptera*, Vol. 2 (Eds., Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado M). National Research Council Press, Ottawa, pp. 997-1007.
- Gaimari SD, 2021. Chamaemyiidae (Silver flies) [Chapter 76]. In: *Manual of afrotropical Diptera*, Vol. 3, Suricata 8 (Eds., Kirk-spriggs AH, Sinclair BJ). South African National Biodiversity Institute, Pretoria, pp. 1791-1814.
- Heeger E, 1848. Beiträge zur Naturgeschichte der Kerfe in Beziehung auf ihre verschiedene. Lebenszustände, ihre Feinde in jedem Zustande, ihre Nahrung. *Oken's Isis*, 12:968-1002.
- Hendel F, 1910. Über die Nomenklatur der Acalyptratengattungen nach Th. Beckers Katalog der paläarktischen Dipteren, Band 4. *Wiener Entomologische Zeitung*, 29:307-313.
- Hendel F, 1916. Beiträge zur Systematik der Acalyptraten Musciden (Dipt.). *Entomologische Mitteilungen*, 5:294-299.
- Hennig W, 1965. Die Acalyptratae des Baltischen Bernsteins. *Stuttgarter Beiträge zur Naturkunde*, 145:1-215.
- Malloch JR, 1922 (1921). Forest insects in Illinois. I. The subfamily Ochthiphilinae (Diptera, family Agromyzidae). *Illinois State Natural History Survey Bulletin*, 13:345-361.
- Malloch JR, 1930. Notes on Australian Diptera. XXVI. Proceedings of the Linnean Society of New South Wales, 55:488-492.
- McAlpine JF, 1963. Relationships of *Cremifania* Czerny (Diptera: Chamaemyiidae) and description of a new species. *The Canadian Entomologist*, 95:239-253.
- McLean IFG, 1998. Family Chamaemyiidae. In: *Contribution to a manual of palaeartic Diptera*, Vol. 3 (Eds., Papp L, Darvas B). *Sciences Herald*, Budapest, pp. 415-423.
- Meigen JW, 1830. Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. T. 5. Schulzische, Hamm [= Hamburg], pp. 90, 401
- Merz B, Haenni JP, 2000. Morphology and terminology of adult Diptera. In: *Contributions to a manual of palaeartic Diptera*, Vol. 1. General and applied dipterology (Eds. Papp L, Darvas B). *Sciences Herald*, Budapest, pp. 21-51.

- Nakamura T, Saigusa T, Suwa M, 2014. Catalogue of the insects of Japan. Vol. 8. Part 2. Brachycera Schizophora. The Entomological Society of Japan, Fukuoka, p. 562.
- Tanasijtshuk VN, 1958. New species of the genus *Leucopis* (Diptera, Chamaemyiidae) from Leningrad region. Trudy Zoologicheskogo Instituta Akademii Nauk SSSR, 24:89-98.
- Tanasijtshuk VN, 1959. Species of the genus *Leucopis* Mg. (Diptera, Chamaemyiidae) from the Crimea. Entomological Review of Washington, 38:829-844 (original in Russian: Entomologicheskoye Obozrenie, 38:923-940).
- Tanasijtshuk VN, 1970. The Palaearctic species of the genus *Chamaemyia* Panz. (Diptera: Chamaemyiidae) in the collections of the Zoological Institute of the Academy of Sciences of the U.S.S.R. Entomologicheskoye Obozrenie, 49:227-243.
- Tanasijtshuk VN, 1984. Family Chamaemyiidae (Ochthiphiliidae). In: Catalogue of palaeartic Diptera, Vol. 9. Micropezidae-Agromyzidae (Eds., Soós A, Papp L). The Publishing House of the Hungarian Academy of Sciences, Budapest, pp. 220-231.
- Tanasijtshuk VN, 1993. Morphological differences and phylogenetic relationships of genera of Chamaemyiidae (Diptera). Entomological Review, 72:66-99.
- Tanasijtshuk VN, 1996. Silver-flies (Diptera, Chamaemyiidae) of Australia. International Journal of Dipterological Research, 7:1-62.
- Tanasijtshuk VN, 1999. *Leucopis formosana* Henning (Diptera, Chamaemyiidae): synonymy, distribution, food links. Entomologica Fennica, 10:235-238.
- Xue W, Chao C, 1996. Flies of China. Liaoning Science and Technology Press, Shenyang, pp. 262-279.

Received April 7, 2022
Revised April 25, 2022
Accepted April 25, 2022