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The first records of the genus *Calycomyza* Hendel (Diptera, Agromyzidae) from the South Caucasus

Первые находки рода *Calycomyza* Hendel (Diptera, Agromyzidae) с Южного Кавказа

N.M. Grigoryan*, V.S. Hovhannisyan**
Н.М. Григорян*, В.С. Оганисян**

* Artsakh State University, Biology and Chemistry Department, 5 Mkhitar Gosh Str., Stepanakert 375000. E-mail: nonna.grigoryan.88@mail.ru.
* Арцахский государственный университет, кафедра биологии и химии, ул. Мхитар Гош 5, Степанакерт 375000.

** Scientific Center of Zoology and Hydroecology, NAS of Armenia, P. Sevak Str. 7, Yerevan 0014 Armenia. E-mail: varugh_zool52@mail.ru.
** Научный центр зоологии и гидроэкологии НАН РА, ул. П. Севака 7, Ереван 0014 Армения.

Key words: Agromyzidae, mining fly, larva, pupa, Artsakh, fauna, aedeagus.
Ключевые слова: Agromyzidae, минирующая муха, личинка, куколка, Арцах, фауна, эдеагус.

Abstract. From 2018 to the present day we study the species composition of the Agromyzidae family in the Artsakh region of the South Caucasus. Our research aims to detect pests of cultivated as well as non-cultivated plants. During the studies we discovered mining flies that damage wild medicinal, ornamental plants and weeds. The article presents the species morphological and ecological characteristics of the genus *Calycomyza* mentioned for the first time in the region of South Caucasus, described the mines types formed by the larvae, the host plants and the damage degree of infected plants.

Резюме. С 2018 года по настоящее время проводится изучение видового состава семейства Agromyzidae в регионе Арцах Южного Кавказа. Исследование направлено на обнаружение вредителей культурных, а также некультивируемых растений. В ходе исследований обнаружены минирующие мухи, повреждающие дикорастущие лекарственные, декоративные растения и сорняки. В статье представлена морфологическая и экологическая характеристика двух видов рода *Calycomyza*, впервые упоминаемого в регионе исследования, описаны типы мин, образуемых личинками, растения-хозяева и степень поражения заражённых растений.

Introduction

Calycomyza is a small genus with 60 known species, 56 of which occur in the Nearctic and Neotropic regions. Only 3 species are found in Europe and 1 species in Africa [Chen, Wang, 2003]. Among the Nearctic species, only *Calycomyza humeralis* (Roser, 1840) (semi-cosmopolitan) and *C. solidaginis* (Kaltenbach, 1869) are present in Europe, *C. novascotiensis* (Spencer, 1969) and *C. sonchi* (Spencer, 1969) species are considered endemic species in Canada [Spencer, Steyskal, 1986].

According to recent data, in the Palearctic region *Calycomyza* genus is represented by 8 species [Ortiz, 2009]. M. Martinez [Martinez, 2004] mentions the presence of 5 species in Europe and 3 in Spain (*Calycomyza artemisiae* (Kaltenbach, 1856), *Calycomyza flavomaculata* (Spencer, 1960) and *Calycomyza humeralis* (von Roser, 1840)).

The aim of the work is to reveal species of the Agromyzidae family in Artsakh region, describe their morphological, eco-biological characters, mine types, discover host plants, natural enemies of the mining flies, as well as the damage degree of the leaves.

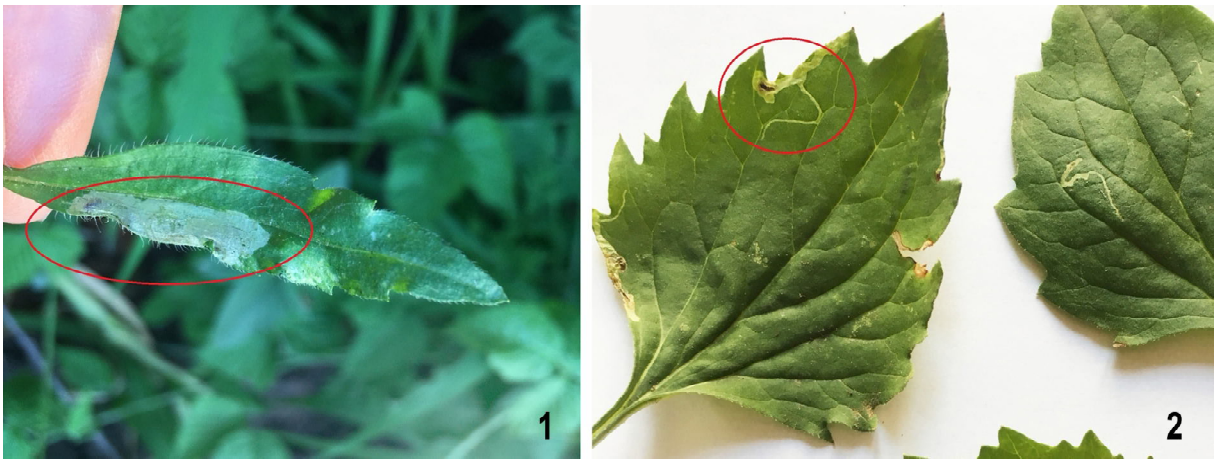
Material and Methods

The study material was the damaged leaves gathered from different regions of the Artsakh region in 2018–2022, as well as larvae, pupae and adults bred under the laboratory conditions. Data collection and statistical analysis made by the methods accepted for the family [Hering, 1951; Lakin, 1990; Capinera, 2001].Various guides have been used for identification mining flies and their natural enemies [Opredelitel'…, 1970; Spencer, Steyskal, 1986; Achterberg, 1993]. The degree of plant damage was determined by the number of mined leaves of the infected plant. For accurate identification of adults, it's necessary to examine the male genitalia which were carried out using the Optika B-290 digital microscope in the laboratory of the Artsakh Scientific Center within the framework of the scs21–002 scientific program. The article presents all species quantitative data, collecting dates and GPS data.

Abbreviations used in the text: *acr* — acrostichal bristles, *dc* — dorsocentral bristles, *ori* — lower orbital setae, *ors* — upper orbital setae, *vte* — outer vertical setae, *vti* — inner vertical setae.

Results

During the research 2 species of the genus *Calycomyza* were found: *Calycomyza humeralis* (Roser, 1840) and *Calycomyza cynoglossi* (Frick, 1956), which mine the plants leaves.



Figs 1–2. Linear-blotch mines of the *C. humeralis* larvae on leafs. 1 — *Erigeron canadensis*; 2 — *Ageratum houstonianum*.
Рис. 1–2. Линейные-пятновидные мины личинки *C. humeralis* на листьях растений. 1 — *Erigeron canadensis*; 2 — *Ageratum houstonianum*.

Calycomyza humeralis (von Roser, 1840)

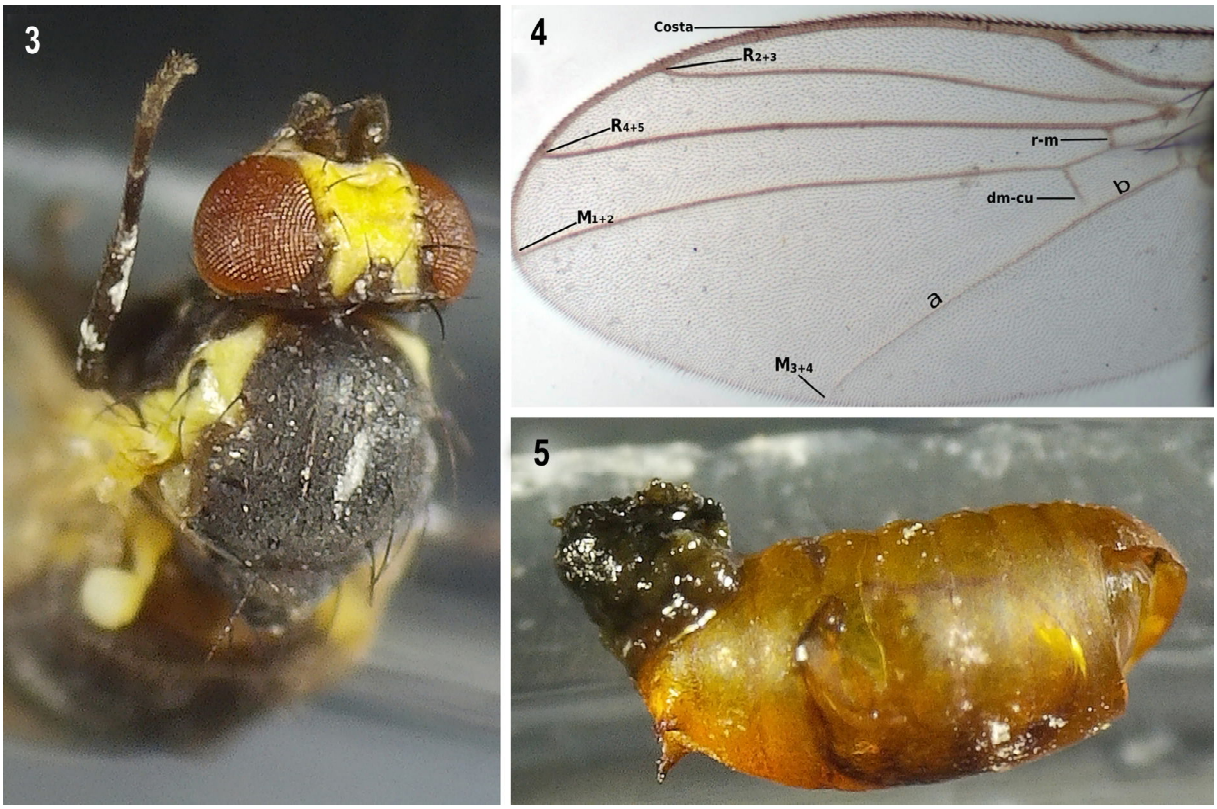
Figs 1–8.

= *Agromyza atripes* Brischke, 1880;

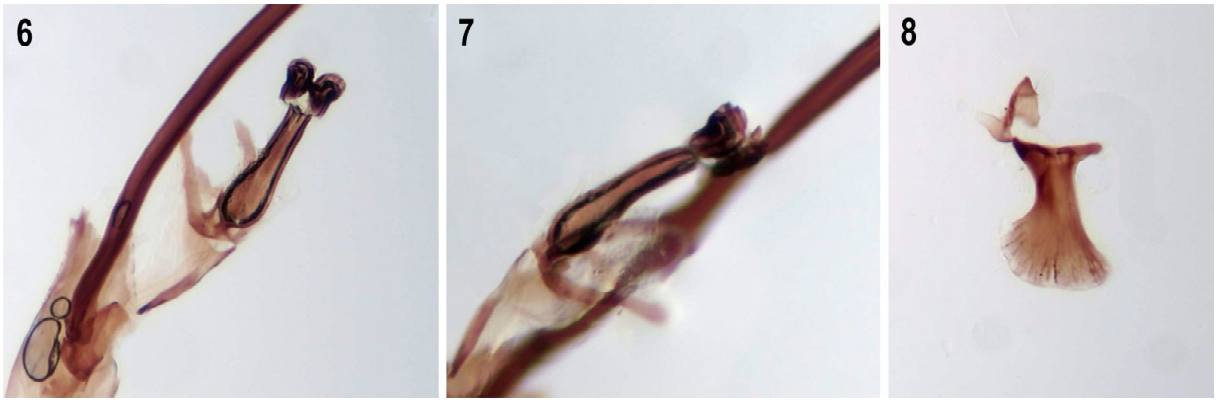
= *Agromyza bellidis* Kaltenbach, 1873.

Material. **South Caucasus,** ***Artsakh region:*** Martakert district, vill. Vank, 40°03' N, 46°32' E, 6.VI.2019, N.M. Grigoryan — 4♂♂, 6♀♀; Askeran district, vill. Patara, 39°55' N, 46°39' E, 12–16.VI.2019, N.M. Grigoryan — 7♂♂, 10♀♀; c. Stepanakert, 39°49' N, 46°45' E, 5–10.VII.2020, N.M. Grigoryan — 6♂♂, 11♀♀; Martuni district, vill. Nngi, 39°47' N, 46°53' E, 25.V–20.VI.2022, N.M. Grigoryan — 4♂♂, 5♀♀.

Host plant and natural history notes. At the beginning of June larvae of the *Calycomyza humeralis* form linear-blotch mines on the adaxial surface of the *Erigeron canadensis* L. and *Ageratum houstonianum* Mill. (Figs 1–2). Larval development takes 4 days (26 ± 1 °C). Pupation takes place in the mine. Pupal development takes 8–10 days at an air temperature of 26 ± 1 °C. Each of the posterior spiracles of the pupa consists of 9 pores, 4 of which are elongated, finger-shaped,



Figs 3–5. Details of *C. humeralis* morphology. 3 — external appearance; 4 — wing structure; 5 — pupa with frass.
Рис. 3–5. Детали строения *C. humeralis*. 3 — внешний вид; 4 — структура крыла; 5 — куколка с выделениями.



Figs 6–8. Aedeagus of *C. humeralis*. 6 — ventral view; 7 — lateral view; 8 — sperm pump.
Рис. 6–8. Эдеагус вида *C. humeralis*. 6 — вид снизу; 7 — вид сбоку; 8 — семенная помпа.

and the others are short, more curved. The degree of plant damage is 30–40 %.

Key characters. The body length of males averages 1.5 mm, and females 1.7 mm. 3rd antennal segment is oval and black, and the upper edge is angular. Yellow frons slightly prominent above eyes in profile, upper orbits black (Fig. 3). They have 2 inclinate *ori* and 2 reclinate *ors, vti* and *vte* are on black background. Mesonotum shining black with 3 *dc*, *acr* arranged in 4 rows. Mesopleura largely black, notopleural area and rear of humerus callus yellow, scutellum black. The legs are completely black, the front knees slightly yellow. Halteres yellow.

Investigation of Artsakh parasitoids revealed *Opius* sp. (Hymenoptera: Braconidae) as a natural enemy of *C. humeralis*.

Wing. Costa extends to vein M_{1+2}, second cross-vein (dm-cu) present, discal cell is small, the *a* section of the vein M_{3+4} 3 times larger than the *b* section. (Fig. 4). Squamae and fringe white. The average wing length of males is 1.3 mm, females 1.7 mm. According to various literature data, the wing length of *C. humeralis* varies between 2.0–3.5 mm [Spencer, Steyskal, 1986] and 2.0–2.35 mm [Ortiz, 2009]. Comparing the obtained results with the literature data, it was found that the wing length of *C. humeralis*, common in the Artsakh region, is shorter by 0.7–1.8 mm and 0.7–0.65 mm, respectively.

Male genitalia. Distyphallus consists of a pair of symmetrical outgrowths (Figs 3, 4), sperm pump is small (Fig. 8).

Calycomyza cynoglossi (Frick, 1956)

Figs. 9–15.

Material. **South Caucasus,** ***Artsakh region:*** Martuni district, vill. Nngi, 39°47' N, 6°53' E, 20–25.VI.2019, N.M. Grigoryan — 9♂♂, 13♀♀; c. Stepanakert, 39°49' N, 46°45' E, 2–5.VI.2022, N.M. Grigoryan — 1♂♂, 3♀♀.

Host plant and natural history notes. *C. cynoglossi* described for the first time in the Caucasus. Literature data for the species characteristics are scarce. According to K.A. Spencer the larvae of *C. cynoglossi* damage the leaves of *Cynoglossum* plants [Spencer, Steyskal, 1986; Benavent-Corai et al., 2005].

Larvae form wide linear mines on the leaves of *Rubia tinctorum* (L.) (Rubiaceae). Larval development lasts 4 days at 26±1 °C temperature. Pupation takes place in the soil. The posterior spiracles of the pupa have a peculiar arrangement of pores. Pupal development lasts 10–12 days at 26–27 °C temperature. The degree of plant damage is 30–35 %.

Key characters. Small species with a body size of 1.6–1.8 mm. Frons yellow-orange, 2 inclinate *ori* and 2 reclinate *ors*, orbits brown or black (Fig.10). Rear of the eye is also black. Antennal all segments yellow or orange, 3rd segment oval. Mesonotum and scutellum shining black, with 3+1 *dc*, *acr* in 4–5 rows. Femora and tibia black, knees and tarsus brown. Halteres yellow.

Wing. Costa reaches the vein M_{1+2}, have a small discal cell, the *a* section of the vein M_{3+4} is 3–3.5 times larger than *b* section (Fig.11). Males wing length reaches 1.5 mm, in females 1.6 mm. Squamae and fringe black. The average wing length of *C. cynoglossi* males is 1.75 mm, females 2.25 mm [Spencer, Steyskal, 1986]. Comparison of literature data with the results of our statistical analysis shows the male's wing length of the species *C. cynoglossi*, common in Artsakh Republic is shorter by 0.25 mm, and that of the female by 0.65 mm.

Male genitalia. Distyphallus consists of 2 parts partially connected on the ventral side (Figs 10–11), sperm pump large with dark and wide blade (Fig. 12).

Fig. 9. The mine of *C. cynoglossi* larvae on the *R. tinctorum* leaves.
Рис. 9. Мина личинки *C. cynoglossi* на листьях *R. tinctorum*.

Figs 10–12. Details of *C. cynoglossi* morphology. 10 — external view; 11 — wing structure; 12 — posterior spiracles of pupa.
Рис. 10–12. Детали строения *C. cynoglossi*. 10 — внешний вид; 11 — структура крыла; 12 — задние дыхальца куколки.

Conclusion

As a result of scientific research, the fauna of the Artsakh region was replenished with new species of the Agromyzidae family, and the species *C. cynoglossi* is described for the first time in the Caucasus. Host plants study revealed that the species *C. humeralis* is considered to be the main pest of the Asteraceae family. Morphometric measurements showed that the wing length of the species found in the Artsakh Republic is shorter compared to the literature data.

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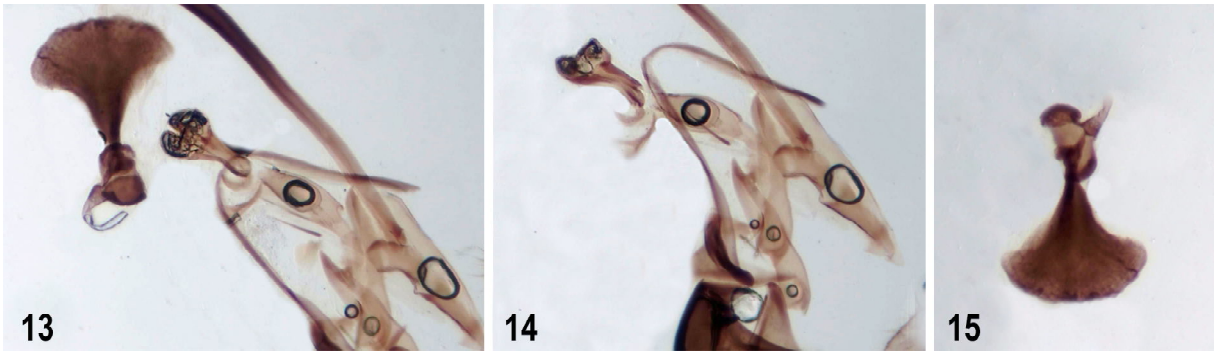

Figs 13–15. Aedeagus of *C. cynoglossi*. 13 — ventral view; 14 — lateral view; 15 — sperm pump.
Рис. 13–15. Эдеагус вида *C. cynoglossi*. 13 — вид снизу; 14 — вид сбоку; 15 — семенная помпа.

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