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SPECIES OF *AMAUROMYZA HENDEL* IN ARTSAKH REPUBLIC

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The article presents two species of the genus *Amauromyza* (Diptera, Agromyzidae): *A. leonuri* (Spencer, 1971) and *A. flavifrons* (Meigen, 1830), which are widespread in Artsakh Republic. Their biological, ecological and morphological features, prevalence and intensity of infestation, as well as the types of mines are described.

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***Keywords*:** diptera, mines, leaf-miners, host-plants, prevalence and intensity.

Introduction. *Amauromyza Hendel* was originally considered as a subgenus *Dizygomyza Hendel*, which included several black European species with black halteres. It is noteworthy that in some species with white or yellow halteres, the reproductive system does not differ from the same system of representatives with black halteres. Due to the fact that adults of different colors do not morphologically differ from each other, Nowakowski [1] grouped them into one genus, which was confirmed by other scientists as well [2, 3].

The main typical morphological features of the genus are the following ones: wing costa extending to vein M_{1+2}, which ends nearest the wingtip; orbital setulae reclinate or erect; presutural dorsocentral bristle is usually strongly developed, but sometimes may be weak or even absent. According to the literary sources, the host plants used by the species of the genus *Amauromyza* belong to the following families: Amaranthaceae, Bignoniaceae, Buddlejaceae, Campanulaceae, Caryophyllaceae, Chenopodiaceae, Compositae, Elaeagnaceae, Iridaceae, Lamiaceae, Polygonaceae and Scrophulariaceae [4, 5].

Materials and Methods. The material used for the study was leaves infested with mining flies, larvae and pupae extracted from the mines, as well as the adults reared from the pupae that were collected in various regions of Artsakh Republic from the beginning of 2018. The prevalence of plant infestation was determined by counting 100 plants, the infestation intensity was been determined by counting the number of infested leaves per plant. Statistical data processing, as well as the collection and processing of the material were implemented by classical methods

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accepted for the Agromyzidae family [6, 7]. Morphological studies of leaf mining flies were carried out at the biological research laboratory of Artsakh State University using an XSZ-0800 and ADSM302 digital microscopes. Different identification guides were used to identify the species [8–10].

Results and Discussion. Our studies have shown that plants infested with leaf-miners belong to the Lamiaceae and Caryophyllaceae families. The leaf miner *A. leonuri* (Spencer, 1971) infests *Lamium album* and *Ballota nigra* plant species belonging to the family Lamiaceae, the species *A. flavifrons* (Meigen, 1830) damages the leaves of *Saponaria officinalis* belonging to the family Caryophyllaceae. Prior to this, these two species have already been described in Europe, but the description of these species are given for the first time in the fauna of the South Caucasus, including Armenia and Artsakh Republic.

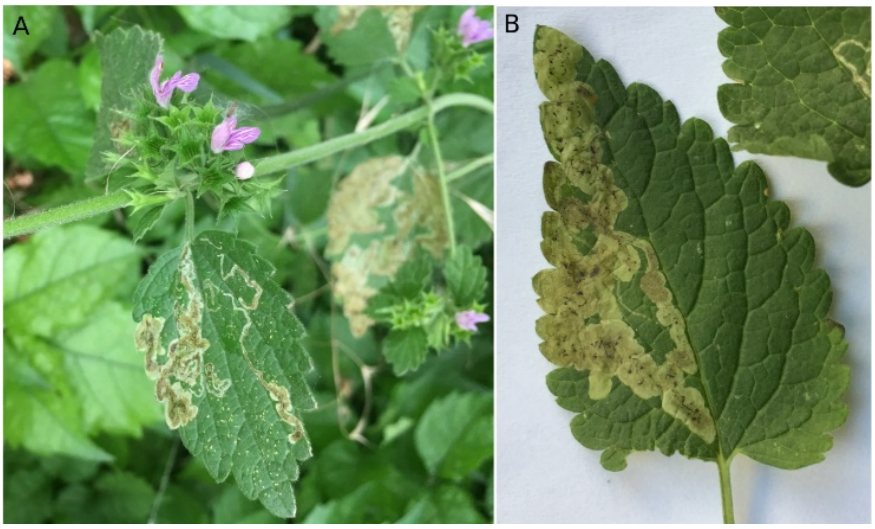

Fig. 1. The mines of *Amauromyza leonuri*: A – the linear mine on the *Ballota nigra* leaf; B – the blotch mine.

We have recorded that in the first instar of development, the larvae of *A. leonuri* form long and narrow linear mines on the upper leaf surface (Fig. 1, A). After a molt, the larva changes its behavior, and makes a large upper-surface blotch mines, which during further development involve the initially formed linear mines (Fig. 1, B). In linear mines, the frass is thready and stretches along the entire mine; in blotch mines, the frass looks like green scattered piles. The prevalence of plant infestation amounts to 90% for *Ballota nigra* and 70% for *Lamium album*.

The development of larvae lasts 4–5 days at a temperature of 25±2°C, after which they leave the mine and fall to the ground, where, prior to pupation, the larva removes metabolic products from the body that can be seen on the ground surface as green mass. After that, they go deep into the soil by 1–3 *cm* and pupate. The pupa turns dark brown in 10–15 *min*. Pupae are deeply segmented; and on the last segment, posterior spiracles can be seen each with 3 bulbs (Fig. 2). The pupal stage lasts 10–12 days at a temperature of 25±1ºC.

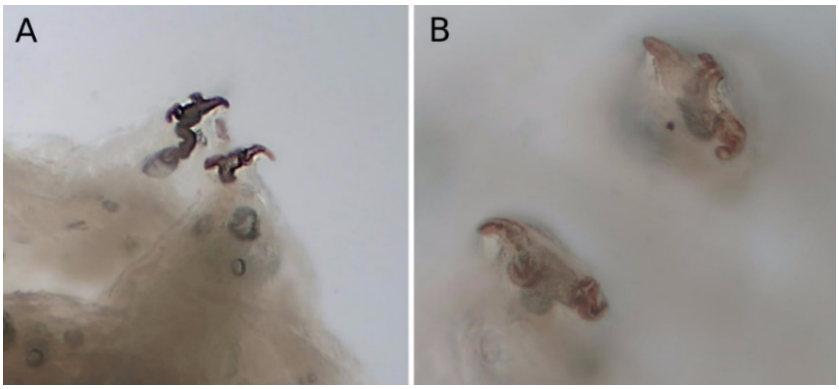

Fig. 2. Posterior spiracles of the larva *Amauromyza leonuri*.

Fig. 2 shows the last larvae section that has posterior spiracles with 3 bulbs (Fig. 2, B), one of which (fig. 2, A) is larger than the other two and looks like a small hook. The latter is considered as a characteristic feature of the species [11].

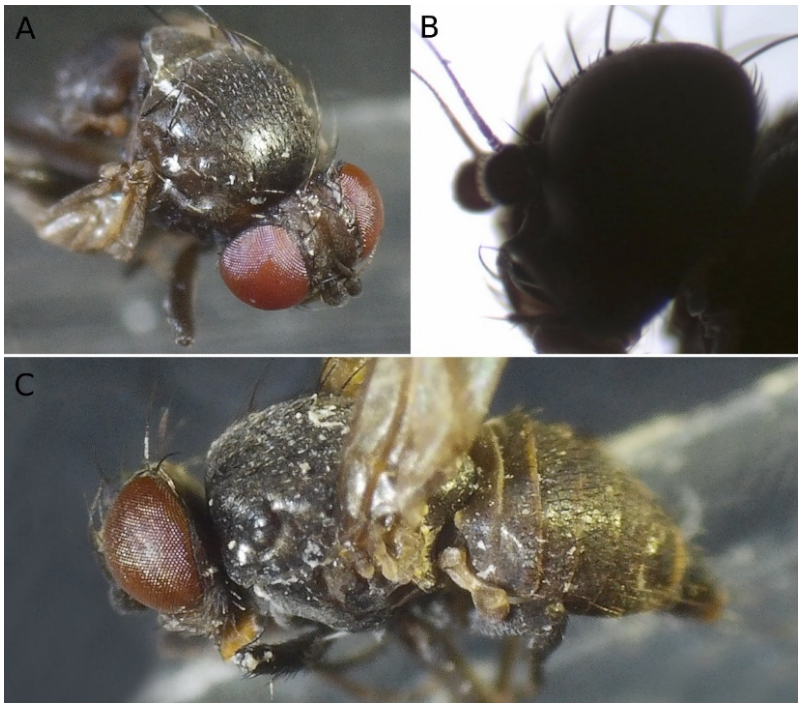

Fig. 3. The external structure of the species *Amauromyza leonuri*.

The external morphology (color, wing structure, chaetotaxy of the head and mesonotum) of the imago plays an important role in the differentiation of *A. leonuri*. Diagnostic characteristics of the adults (Fig. 3) of *A. leonuri* are as follows: entirely dark species, frons dark brown; orbit black; orbital bristles strong, 2 *ors*, 3 *ori*; orbital setulae reclinate or erect; 3rd antennal segment small, round and black; mesonotum and scutellum black with 3 strong postsutural *dc*; *acr* in 4 rows; wing costa extending

to vein M_{1+2}, which ends nearest the wingtip; last section of M_{3+4} twice length of penultimate; haltere and all legs black; abdomen with front tergites broadly yellow bordered. The table below presents the statistical analysis of *A. leonuri* (Tab. 1).

Table 1

Results of morphometric measurements of the species Amauromyza leonuri

Morphometric parameter	*Gender*	*Sample size*	*Mean length, mm*	*Mean error*	*Standard deviation*	*Coefficient of variation, %*
Body	♂	10	1,79	0.04	0.12	6.7
	♀	13	2.1	0.04	0.14	6.4
Wing	♂	10	1.63	0.03	0.09	5,8
	♀	13	2	0.03	0.12	6
Pupae	–	12	2.1	0.03	0.10	4.9

Analysis of variance shows that this species has pronounced sexual dimorphism, which is expressed by the predominance of morphometric data in females.

Fig. 4. The blotch mines of *Amauromyza flavifrons* on the leaf of *Saponaria officinalis*.

Another leaf-miner of the genus *Amauromyza* is *A. flavifrons* (Meigen, 1830), a species that damages the leaves of *Saponaria officinalis*. Fig. 4 shows that *A. flavifrons* larvae also form linear mines at an early stage of development, which are replaced by white blotch mines after a molt. The frass in the mines looks like dispersed small black grains. The larval stage lasts 6–7 days at a temperature of 24±1°C. One can usually count 4–5 infested leaves per plant and 2–3 larvae or mines per leaf. The prevalence of infestation is 50%. Pupation takes place in the soil, where pupal development lasts 13–14 days at a temperature of 25±2°C. Puparium is reddish brown in color. The last segment of the pupa bears posterior spiracles each with 3 bulbs, one of which looks like hook (Fig. 5, C) and is larger than the other two [12].

The study has shown that the larvae of the two species of the genus *Amauromyza* have spiracles of the same shape and number, therefore, for accurate identification of the species, the external structure of the imago must be studied (Fig. 3, 5).

Diagnostic characteristics of the adult *A. flavifrons* are as follows: frons and gena yellow, frons slightly projecting above eye; 2 reclinate *ors*, 3 inclined *ori*; orbital setulae sparse and reclinate or erect; 1st and 2nd antennal segments yellowish, 3rd largely brownish, small and round (Fig. 5, A); outer vertical bristle (*vte*) and

inner vertical bristle (*vti*) on the black ground; mesonotum shining black with 3+1 strongly developed dorsocentral (*dc*) bristles; haltere entirely yellow (Fig. 5, D); costal vein reaches vein M_{1+2}; discal cell small; last section (a) of vein M_{3+4} 2.5–3 times length of penultimate (b) (Fig. 5, B); legs black, only foreknee at most slightly yellowish. The statistical analysis of *A. flavifrons* is presented in Tab. 2.

Fig. 5. Morphological distinguishing features of *Amauromyza flavifrons.*

Table 2

Results of morphometric measurements of Amauromyza flavifrons

Morphometric parameter	*Gender*	*Sample size*	*Mean length, mm*	*Mean error*	*Standard deviation*	*Coefficient of variation, %*
Body	♀	15	2.2	0.04	0.16	7.1
Wing	♀	15	1.92	0.02	0.08	4
Pupae	-	10	2.2	0.06	0.19	8.8

Conclusion. Thus, mining flies of the genus Amauromyza are described for the first time in Artsakh Republic, they are quite widespread and considered as serious pests of both wild (*Lamium album*, *Ballota nigra*) and cultivated plants (*Saponaria officinalis*). As a result of the study, the infestation intensity for *Ballota nigra* and *Lamium album* plant species was found to be 5–7 leaves, the infestation prevalence was 90% for *Ballota nigra* and 70% for *Lamium album*. The infestation intensity of *A. flavifrons* for *Saponaria officinalis* was 4–5 leaves, and the infestation prevalence constituted 50%. Findings of *Amauromyza* species in Artsakh Republic are of great scientific and practical importance, providing additional information on the species' biogeographical distribution, development, host-plants and infestation characteristics.

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REFERENCES

1. Nowakowski J.T. Introduction to a Systematic Revision of the Family Agromyzidae (Diptera) with Some Remarks on Host Plant Selection by These Flies. *Ann. Zool. Warsz.* **20** (1962), 67–183.
2. Spencer K.A. Notes on a Revision of the British Agromyzidae (Diptera), Including the Description of 14 New Species. *Entomologist's Gazette* **22** (1971), 114–195.
3. Spencer K.A. *A Revision of the Australian Agromyzidae (Diptera)*. Western Australian Museum Special Publication No. 8 (1977), 255 pp.
4. Spencer K.A. *A Revisionary Study of the Leaf-mining Flies (Agromyzidae) of California*. University of California, Division of Agricultural Sciences (1981), 141–161.
5. Spencer K.A. *Host Specialization in the World Agromyzidae (Diptera)*. Springer, Dordrecht (1990). https://doi.org/10.1007/978-94-009-1874-0
6. Lakin G.F. Biometria. Moscow, Visshaya Shcola (1990). (in Russian)
7. Hering M.E. The Study of Miners. In: *Biology of the Leaf Miners*. Springer, Dordrecht (1951), 301–330. https://doi.org/10.1007/978-94-015-7196-8_21
8. Spencer K.A., Steyskal G.C. *Manual of the Agromyzidae (Diptera) of the US*. Agriculture Handbook **638**. Washington, DC, United States Department of Agriculture (1986). 478 pp.
9. Beĭ-Bienko G.Ya *Keys to the insects of the European part of the USSR*. Vol. 5, Part 2. Leningrad: Nauka (1970), 946 pp.
10. Spencer K. A. *Diptera Agromyzidae. Handbook for the identification of British insects*. Royal Entomological Society of London (1972), 136 pp.
11. Ortiz R.G. *Biosystematic Contributions to Agromyzidae*. PhD Thesis. Valencia (2009), 85–88.
12. Boucher S. Revision of the Canadian Species of *Amauromyza* Hendel (Diptera: Agromyzidae). *Can. Entomol.* **144** (2012), 809–833. https://doi.org/10.4039/tce.2012.80

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AMAUROMYZA HENDEL ՑԵՂԻ ՆԵՐԿԱՅԱՑՈՒՑԻՉՆԵՐԸ ԱՐՑԱԽԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆՈՒՄ

Հոդվածում ներկայացված են Արցախի հանրապետությունում լայն տարածում ունեցող (Diptera, Agromyzidae) *Amauromyza* ցեղի 2 տեսակի ականաճանճեր՝ *A. leonuri* (Spencer, 1971) և *A. flavifrons* (Meigen, 1830): Նկարագրված են դրանց կենսաբանական, էկոլոգիական և մորֆոլոգիական առանձնահատկությունները, վարակի էքստենսիվությունը և ինտենսիվությունը, ինչպես նաև ականների տիպերը:

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ПРЕДСТАВИТЕЛИ РОДА *AMAUROMYZA HENDEL* В РЕСПУБЛИКЕ АРЦАХ

В статье представлены два вида минирующих мух (Diptera, Agromyzidae) рода *Amauromyza*: *A. leonuri* (Spencer, 1971) и *A. flavifrons* (Meigen, 1830), которые широко распространены в Республике Арцах. Описаны их биологические, экологические и морфологические особенности, экстенсивность и интенсивность заражения, а также типы мин.