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New observations on *Aristotelia calastomella* (Christoph, 1872) in Hungary and further additions to the bionomics and geographical distribution of the species (Lepidoptera, Gelechiidae)

Imre Fazekas

Abstract. New locality of *Aristotelia calastomella* (Christoph, 1872) from Hungary. Summary description of the geographical distribution and bionomics of the species from the Western Palearctic.

Keywords. New occurrence, habitat description, phylogeographical note.

Author's address. Imre Fazekas | Pannon Institute | 7625 Pécs Magaslátó út 24. | Hungary
E-mail: fazekas@outlook.com

Résumé. Dans cet article, je résume les connaissances que j'ai rassemblées sur l'espèce. En particulier, je considère qu'il est important de présenter les habitats fragmentés en Hongrie, car ces isolats se trouvent à la limite occidentale de l'aire de répartition géographique d'*A. calastomella* et ont une importance historique sur le plan de la faune. Je présente une carte préliminaire des sites de toutes les espèces d'*Aristotelia* en Hongrie. Il s'agit de la première tentative en Hongrie d'examiner ensemble les schémas de répartition géographique des espèces.

Zusammenfassung. In dieser Abhandlung fasse ich das Wissen zusammen, das ich über die Art gesammelt habe. Insbesondere halte ich es für wichtig, die fragmentierten Lebensräume in Ungarn vorzustellen, da diese Isolate am westlichen Rand des geografischen Verbreitungsgebiets von *A. calastomella* liegen und von faunistischer historischer Bedeutung sind. Ich präsentiere eine vorläufige Standortkarte aller *Aristotelia*-Arten in Ungarn. Dies ist der erste Versuch, die geografischen Verbreitungsmuster der Arten in Ungarn zusammenzufassen.

Introduction

So far, 6 species of the genus *Aristotelia* Hübner, 1825 have been identified in Hungary: *A. decurtella* (Hübner, [1813]), *A. decoratella* (Staudinger, 1879), *A. ericinella* (Zeller, 1839), *A. subdecurtella* (Stainton, 1859), *A. subericinella* (Duponchel, 1843), *A. calastomella* (Christoph, 1872). Most of the species have been observed in many areas of the country. The *A. ericinella* species was collected only in the Bakony mountains [Salföld, Uzsa] (see Gozmány 1958, Szabóky 1982). The most interesting is the occurrence of *A. calastomella* in Hungary. In Central Europe, it was first discovered in Eastern Hungary, near the Romanian border (Bélmegyer) in 1995. Since then, no new Hungarian locality has been discovered until 2021. In that year, moth collector Szilvia Gulyás caught an unknown moth in Egerfarnos. She sent me this specimen for identification. After examining the genitalia, I determined that it was a female *A. calastomella*. This was the second locality discovered in Hungary. The settlement of Egerfarnos is 130 km northwest of the first Hungarian site (Bélmegyer).

In this paper, I summarise the knowledge I have gathered about the species. I consider it important to present the fragmented habitats in Hungary, as these isolates are on the western edge of the geographical range of *A. calastomella* and have faunistic historical significance. I present a preliminary site map of all the *Aristotelia* species in Hungary. This is the first attempt in Hungary to see together the geographical distribution patterns of the species.

Material and methods

Recognisable, undamaged specimens were identified by stereomicroscopy. I also examined the genitalia of all problematic specimens. Genitalia dissections were made following Robinson (1976). Some of the genitalia were mounted in Euparal on slides; others were preserved in mi-

crovials filled with glycerol. Analysis of genitalia of worn, damaged specimens of *Aristotelia* was performed using the simple and rapid method by Fazekas (2020, 2021: p. 87, Fig 1.), and Wanke & Rajaci (2018). The data of the Hungarian distribution maps are stored in a computer database, partly in Word and Excel formats. I have drawn only the sites of clearly identified specimens on the maps.

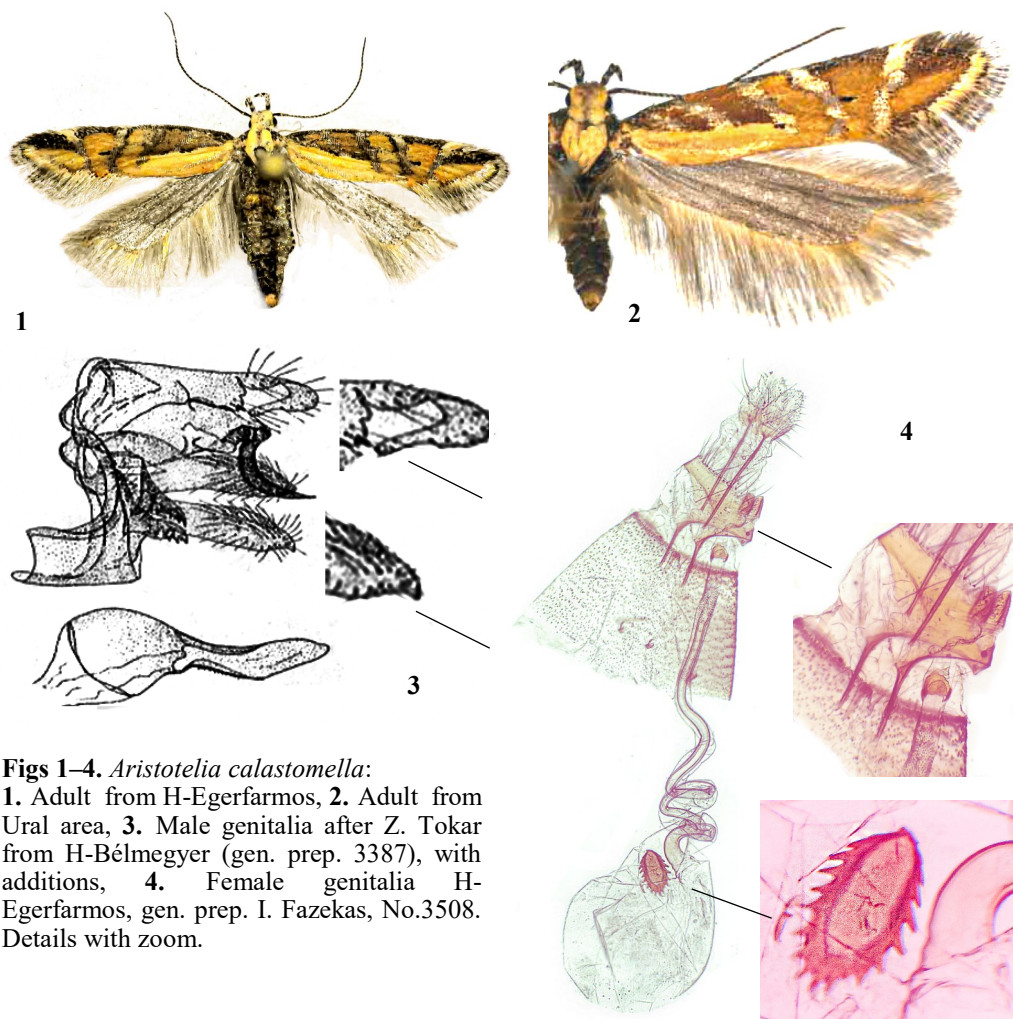
Results

Aristotelia calastomella (Christoph, 1872) (Fig. 1–2)

Ergatis calastomella Christoph, 1872; Horae Soc. ent. Ross. 9: 24, pl. 2a, f. 21. Locus typicus: Uralsk.

New data: ♀, Egerfarmos, 08.14.2021, leg. et coll. Szilvia Gulyás; det. et gen. prep. Imre Fazekas, No. 3508. One female genitalia preparation was preserved in glycerol. Cattle and sheep graze in the meadow and the meadow is also mown.

Distribution in Hungary. The first specimens (42 specimens) were collected in Hungary east of the Tisza River, near the Hungarian-Romanian border in 1995 (see Szabóky 1998): Hungary, Bélmegyer, Fáspusztá, Szolga-erdő, 3–14.08.1995, leg. et coll. Szabóky Cs. (Budapest), gen. prep. No. 3222, 3387, Tokár Z., det. Karsholt O.



Figs 1–4. *Aristotelia calastomella*:

1. Adult from H-Egerfarmos, **2.** Adult from Ural area, **3.** Male genitalia after Z. Tokar from H-Bélmegyer (gen. prep. 3387), with additions, **4.** Female genitalia H-Egerfarmos, gen. prep. I. Fazekas, No.3508. Details with zoom.

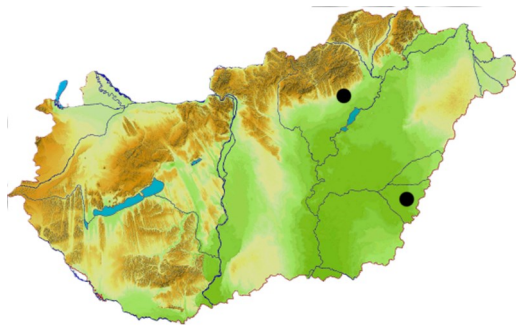


Fig. 5. Localities of *Aristotelia calastomella* in Hungary

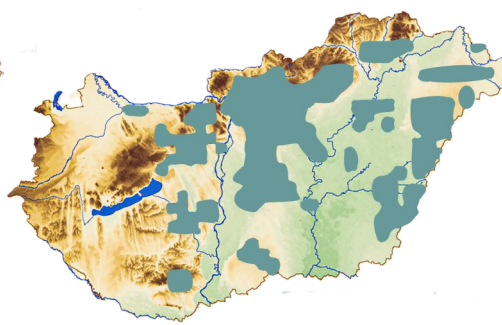


Fig. 6. Euro Siberian steppe forests with *Quercus* spp. in Hungary (schematic map)

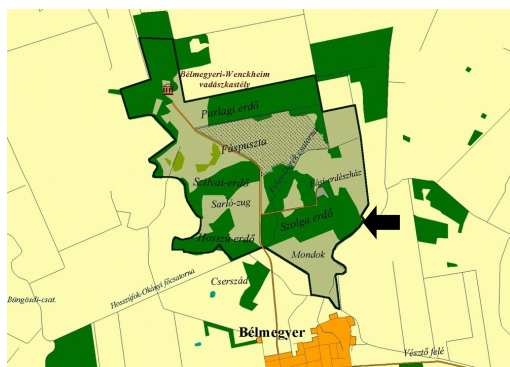


Fig. 7. The first collection site of *A. calastomella* in Hungary (black arrow): Bélmegyer, a near the Romanian border (see Figure 5)



Fig. 8. The second collection site of *A. calastomella* in Hungary: habitat photo at Egerfarmos (© Sz. Gulyás)

The moths flew from midnight to dawn to a 125-watt mercury vapour lamp in a forest clearing. The site is one of the last remaining intact "closed lowland steppe oak forests" in Hungary. This habitat is of outstanding value because it was once a typical forest community of the Great Hungarian Plain. The distribution pattern of this relict community (Natura 2000: 9110 Euro Siberian steppe forests with *Quercus* spp.) is presented and described Bölöni et al. (2011).

Bionomics. The adults have so far been collected in June, July, and August. The exact flight data are not yet known. No exact data on larvae and food plants are available. Mainly based on the collection sites in Russia, it is a salt-steppe species. However, this standpoint is much more nuanced by the knowledge of the Hungarian localities.

General description of the new site and its surroundings

Hevesi Grasslands Landscape Protection Area (= Hevesi Füves Puszták Tájvédelmi Körzet (Natura 2000: HUBN10004)

The protected area is dominated by mosaic rocky vegetation communities. Loess grasslands have been exploited here since the Neolithic. These areas are characterised by sessile grassland, loess grassland, and herbaceous sessile grassland. Most of these flats are bare bogs or contain a few small groups of trees, mainly *Pseudoacacia*, but there are also occasional patches of sand oak communities in the large lowland wooded heaths that once formed the landscape. Here and there, small streams or watercourses cross the dry habitats of the salt marshes, but due to poor drainage of the streams, they are transformed into small or large marshy, brackish habitats, sometimes with salt marshy, cattail willow or poplar groves along their banks.

The area falls within the warm, moderately hot, dry climate zone. It is among the driest landscapes in Hungary. The annual precipitation in the area is between 450 and 550 mm, with a

high degree of precipitation uncertainty. The wettest month is June. The average rainfall is 55–70 mm. The average temperature fluctuation in the area is high. The mean annual temperature is 10.0–10.2 °C. Winters are relatively harsh, with mean temperatures in January ranging from -2 to -3 °C. The average number of snow days per year is around 35, with an average snow depth of 16–18 mm. Despite the relatively cold winter, the thaw starts early, with daily mean temperatures reaching 10 °C between 10 and 15 April and remaining below this level until around 20 October. Summer is hot. The average temperature in July is around 21–21.5°C. The number of summer days is 75–85, and the number of heat days is 20–25. The annual daylight hours are between 1930 and 2000. The frequent fog in winter is not conducive to sunshine, but in the summer half-year, the area falls within the zone of optimum sunshine. So far, nearly 400 Lepidoptera species are known from the region. Of these, 3 species are specially protected, 30 species are protected, and 23 species are of faunistic interest. Among the protected species, the Hungarian spring spotted moth (*Dioszeghyana schmidtii*), which lives on the chert oak, is known from a few large forest patches. The great rock moth (*Gortyna borelii lunata*), which lives in the chicory, has been found in several grassland fragments, while the steppe moth (*Paracossulus thrips*), which inhabits roots of *Phlomis tuberosa*, has been found in only one loess grassland.

Geographical distribution

Extremely local, little-known species; in Central Europe only reported from Hungary. Also known from southern Russia, the Crimean Peninsula and Cyprus.

According to Junnilainen et al. (2010), “The species was described from the vicinity of Volgograd (Sarepta), Russia. Anikin et al. (1999) mention that they have seen only a single old



Fig. 9. Preliminary geographical distribution map of *Aristotelia calastomella* based on observations. Distances between fragmented populations are marked in km. Details are given in the text.

specimen originating from the region collected by Christoph and suppose that the species has vanished from its type locality. Thus, our records might represent the first record from Russia since the original description in the 19th century. The habitat is a meadow with plenty of *Glycyrrhiza glabra* L. and *Limonium gmelini* (Willd.).” Burannoe: Orenburg oblast, 50°58'N 54°25'E, 100 m, near Burannoe village, Ilek river valley. Lowland *Artemisia* steppes, moist meadows, and wetlands.

The details of Junnilainen and his colleagues are further amended by the new Russian catalogue. Distribution data for Russia in more detail (Sinev et al. 2019): Mid-Volga region: Nizhny Novgorod, Penza, Ulyanovsk and Samara regions, Republics of Tatarstan, Mari El, Chuvashia, Mordovia. Volga-Don region: Saratov, Volgograd, and Rostov Oblasts. Crimean region: the Crimean Peninsula. South Urals region: Republic of Bashkortostan, Orenburg, Chelyabinsk, and Kurgan oblasts.

From a zoogeographical point of view, the occurrence of the species in Cyprus (in the Larnaca area) deserves special attention. Arenberger (1994, p. 281) wrote very briefly about the species: “127. *Aristotelia calastomella* Christoph, 1872 | Ar: Larnaca, 3.-7.8.81. Verbreitung: Russland.” The analysis fauna of Cyprus does not contain any notes on the species *A. calastomella*. At the time of the publication of this study, only the Russian sites were known. Either the author did not realise the importance of the Cyprus occurrence for the zoogeography of the study, or he forgot about it while writing the study.

Historically, the species was first discovered in Central Europe (Hungary: Bélmegyer) only in 1995. This was a very important faunistic record, as the species is extremely rare and local in the Palearctic.

If we look at the natural vegetation of Eurasia, we can see that the habitats of the species are in the so-called temperate grasslands. The island of Cyprus does not fit in this distribution pattern. The island is an area of Mediterranean forests and shrublands, at a considerable geographical distance from the disjunct areas in Hungary and Russia.

Phylogeographical notes

Aristotelia calastomella is a highly fragmented species. The current distribution of European *Aristotelia* species in the last ice age may have played the most important role in shaping the pattern of the last ice age. It is a well-known phenomenon that during the ice ages individual species or species groups are relegated to a refuge. During the coldest period of the last ice age (18,000–10,000 years ago), three major refuges (Balkans, Apennine- and Iberian Peninsula) in southern Europe are thought to have been where organisms may have retreated. The phylogeography of several disciplines (molecular biology, genetics, and ecology) aims to understand the spatial and temporal structure of populations and temporal changes in the structure of moths, using molecular biological methods, and historical events that may play a role in the evolution of lineages currently occurring in the geographical distribution of lineages. Phylogeographic methods have rarely been used in moth research. This would be much needed in the future. Perhaps an explanation could be found for the extremely interesting geographical distribution of species such as *Aristotelia calastomella*. The prediction of the area should be investigated using geo-referenced bioclimatic variables in the currently known dispersal area.

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