

## A synopsis of the bionomics and geographical distribution of *Phtheochroa* species in Hungary (Lepidoptera: Tortricidae, Cochylini)

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**Abstract.** This is the first part of a series of papers on the bionomics and geographical distribution of Hungarian Tortricidae, which covers *Phtheochroa* Stephens, 1829 species. The study presents partial flight data, food plants and preferred habitats of Cochylini species. A distribution map of each species has been produced.

**Keywords.** Lepidoptera, Tortricidae, *Phtheochroa* Stephens, 1829, bionomy, distribution, Hungary

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### Zusammenfassung

Fazekas I. 2022: Eine Übersicht über die Bionomie und die geografische Verbreitung von *Phtheochroa*-Arten in Ungarn. – Lepidopterologica Hungarica 18(1): 23–43.

Dies ist der erste Teil einer Reihe von Beiträgen über die Bionomie und die geografische Verbreitung der ungarischen Tortricidae, die *Phtheochroa* Stephens, 1829 Arten umfasst. Die Studie enthält partielle Flugdaten, Nahrungspflanzen und bevorzugte Lebensräume der Cochylini-Arten. Für jede Art wurde eine Verbreitungskarte erstellt.

Die Arten von *Phtheochroa* Stephens, 1829 kommen in einem großen geografischen Gebiet vor: Holarktische, neotropische und afrotropische Regionen. Nach Razowski (2009) stammt die Mehrzahl der Arten aus der Paläarktis, und von den ca. 100 in der Region bekannten Arten sind zehn *Phtheochroa*-Arten in der ungarischen Fauna bekannt, über die jedoch nur sehr wenig geschrieben wurde (Fazekas 1991–1995). Einige sind im ganzen Land verbreitet (z. B. *Ph. schreibersiana*, *Ph. pulvillana*), die meisten sind jedoch sehr selten und lokal begrenzt (z. B. *Ph. annae*, *P. procerana*) oder sind aus den früher bekannten Lebensräumen verschwunden.

In dieser zusammenfassenden Studie werden die Flugzeiten, Nahrungspflanzen, bevorzugten Lebensräume und die geografische Verbreitung der aus Ungarn bekannten *Phtheochroa*-Arten beschrieben. Die Verbreitung der einzelnen Arten in Ungarn wird anhand der üblichen ungarischen naturgeografischen Landschaftsklassifizierung kartiert. Dieser Kartentyp zeigt die Topografie, die Hydrologie, die Vegetation und die allgemeine Ökologie Ungarns besser als die so genannte UTM-Gitterkarte, bei der nur Punkte das Vorkommen von Arten angeben. Diese Kartierungsmethode wurde bereits in "Sesiidae fauna of Hungary" (Fazekas 2017) und "The Eupitheciini of Hungary" (Fazekas 2020) verwendet. Dies ist ein völlig neues Kartierungskonzept in Ungarn.

Nach bisherigen Erkenntnissen sind in Ungarn 10 Arten von *Phtheochroa* bekannt. Das Vorkommen mehrerer Arten ist nur aus alter Literatur bekannt, und in ungarischen Sammlungen wurden keine authentischen Exemplare gefunden. Es ist bekannt, dass viele in Ungarn gesammelte Exemplare in anderen Sammlungen, vor allem in Österreich, Deutschland, Italien und England, aufbewahrt werden, aber ihr Vorhandensein wurde von ungarischen Forschern, die ihre Untersuchungen auf das Material in ungarischen Sammlungen beschränkt haben, stark vernachlässigt. Dies ist eindeutig falsch, und das Problem sollte angegangen werden.

## Introduction

Hungary is located in the western Palearctic Region. The entire territory of the country is part of the Pannonian biogeographical region. Special mention should be made of the large areas of lowlands. The Great Hungarian Plain is a very special landscape in Europe. In summer, the permanent saline lakes are among the hottest in Europe: they expand in springtime but recede and become very shallow by July and August; during very dry and hot summers many of them may even dry out (as indicated on old maps of the Austro-Hungarian monarchy-at a time when about half of the entire area was an immense self-contained watery empire. The dune region is geomorphologically, botanically and zoologically unique in Europe: nothing like this inland sand-hill world exists west of the Pannonian Basin.

In addition to the lowlands, Hungary's most diverse habitats are found in the so-called low middle mountains west of the Danube and in the north of the country, the Transdanubian Mountains and North Hungarian Mountains. As most of Hungary is under intensive agricultural cultivation, the last refuges for moths are in the mid-mountains, which are protected under nature conservation law. All the species described in this study have secure habitat in mountain areas. Unfortunately, the Hungarian nature conservation authorities do not pay much attention to the so-called "Microlepidoptera" species. Many people explain this simply by a lack of specialists.

The fauna of Hungary is extremely diverse. There is a strong Balkan and continental Eurasian influence, with species from the Atlantic regions being the least frequent. One could say that the flora and fauna are a 'meeting' of east, south and west. This is why it is important to understand and explore the faunal composition of the Western Palearctic, Europe, and especially Central Europe. We are looking for isolates of similar species in Hungary, such as *Phtheochroa procerana*. In this paper, a synopsis of a genus of Lepidoptera (Tortricidae: *Phtheochroa* Stephens, 1829) is presented, for which no similar Hungarian study has yet been published.

Although the *Phtheochroa* fauna of the Palearctic region is reasonably well-known through the work Microlepidoptera Palearctic (Razowski 1970, 2009), some parts of the region were not fully investigated and studied.

Species of *Phtheochroa* Stephens, 1829 are found over a vast geographical area: Holarctic, Neotropical, and Afrotropical regions. According to Razowski (2009), the majority of species are Palearctic, and of ca. 100 species known in the Region, ten *Phtheochroa* species are known in the Hungarian fauna, but very little has been written about them (Fazekas 1991–1995). Some are generally distributed in the country (e.g., *Ph. schreibersiana*, *Ph. pulvillana*), but most are very rare and local (e.g. *Ph. annae*, *Ph. procerana*) or have disappeared from habitats known in the past.

In this summary study, the flight periods, food plants, preferred habitats and geographical distribution of the *Phtheochroa* species known from Hungary are described. The distribution of each species in Hungary is mapped, with the usual Hungarian natural geographic landscape classification (Marosi, Somogyi 1990). This map type shows the topography, hydrology, vegetation, and general ecology of Hungary better than the so-called UTM Grid map, where only points indicate the occurrence of species. This mapping method has been employed previously in "Sesiidae fauna of Hungary" (Fazekas 2017) and "The Eupitheciini of Hungary" (Fazekas 2020). This is a completely new mapping concept in Hungary. This series of Tortricidae studies, and the planned book, are nothing like the "Fauna Hungariae" series of books, the concepts of which were conceived in the 1950's but are no longer useful in the 21st century. One of these "old-fashioned", very slow practices was the drawing of species habitus images in black ink. This can be easily replaced by computer-based digital techniques (see Fazekas 2009, 2017, 2020).

According to research to date, 10 species of *Phtheochroa* are known in Hungary. The occurrence of several species is only known from old literature, and no authentic specimens have been found in Hungarian collections. It is well known that many specimens collected in Hun-

gary are preserved in other collections, mainly in Austria, Germany, Italy and England, but their presence has been large neglected by Hungarian researchers who have restricted their investigations to material in Hungarian collections. Clearly, this is wrong, and the problem should be addressed.

### Material and methods

The author's personal interest in Lepidoptera began in the early 1980s, and for the last 40 years he has been collecting in all natural geographic regions of Hungary, where he has studied habitats, larval food-plants, flight periods. Adult specimens were mostly collected at night, at street lights and with the use of light traps, mostly 160 Watt HMLI and 125-Watt mercury vapour lamps. Specimens were also obtained by day by netting and tapping vegetation.

Between 1986 and 2021, all the available literature on Tortricidae was consulted, the most important of which is given at the end of the paper. All the major museum and private collections in Hungary were visited in search of material. For accurate and authentic identification, thousands of genital preparations were made.

Genitalia dissections were made in accordance with Robinson (1976). Some of the genitalia were mounted in Euparal on slides; others are preserved in micro-vials filled with glycerol. Genital analysis of worn, damaged specimens of Cochylini was performed using the simple and rapid method of Fazekas (2020, 2021), Wanke & Rajaei (2018). More than 850 collection specimens of Hungarian *Phtheochroa* species have been examined, about 300 dissected and their genitalia analysed.

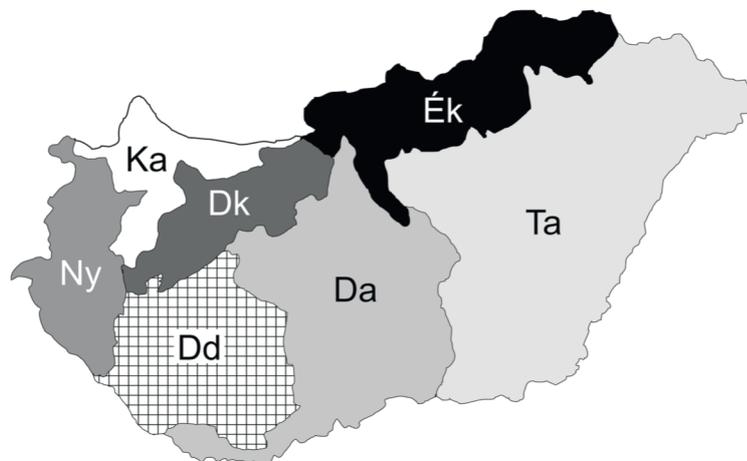
The data of the Hungarian distribution maps are stored in a computer database, partly in Word and Excel formats.

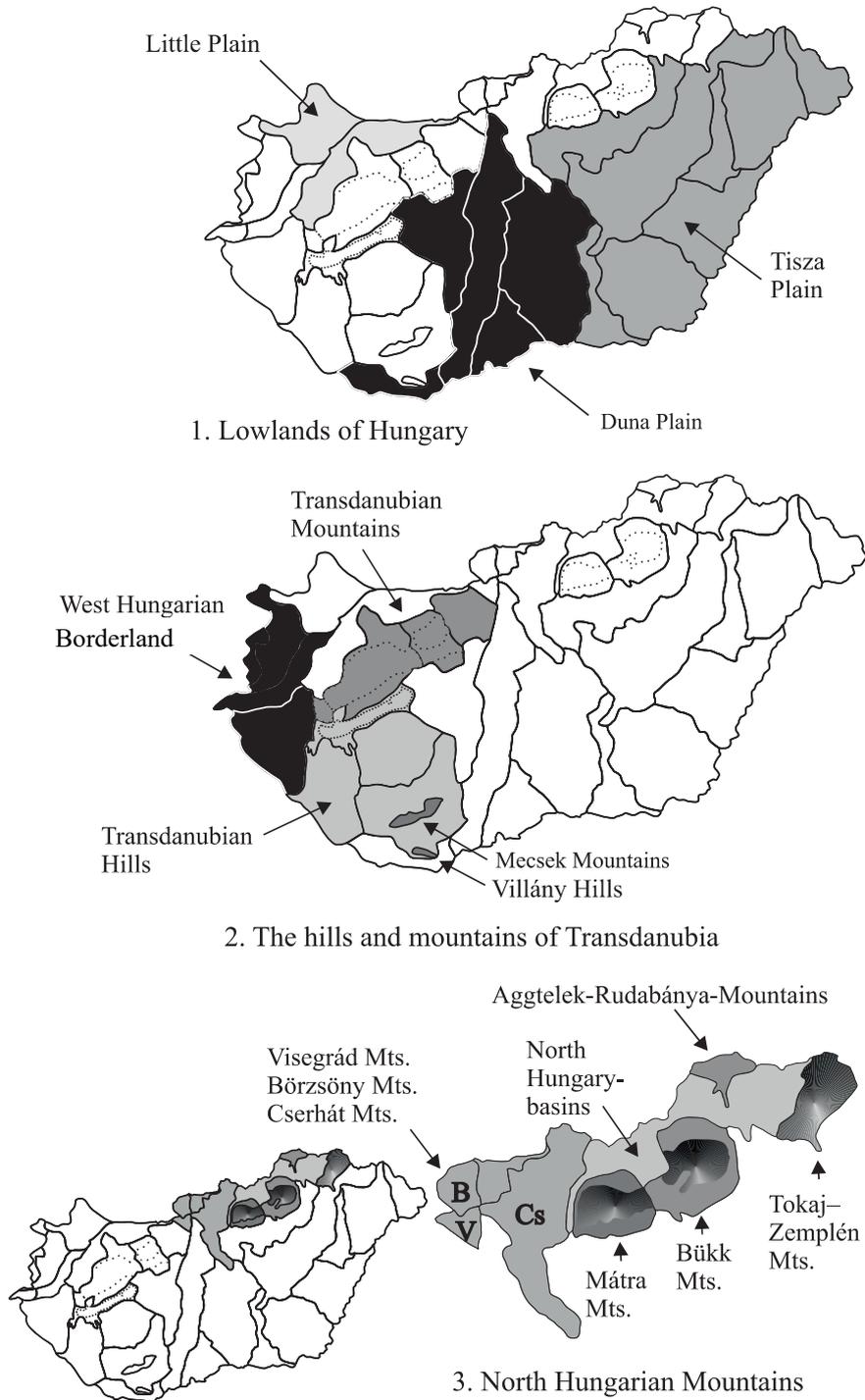
The vector maps were created with CorelDraw. The digital maps are interactive and can be continuously updated and corrected.

The correct identification of all *Phtheochroa* specimens was checked personally. The identified specimens are deposited in the following collections:

- Bakonyi Természettudományi Múzeum, Zirc | Bakony Natural History Museum, Zirc
- Janus Pannonius Múzeum, Pécs | Janus Pannonius Museum, Pécs,
- Jász Múzeum, Jászberény | Jász Museum, Jászberény
- Magyar Természettudományi Múzeum, Budapest | Hungarian Natural History Museum, Budapest
- Mátra Múzeum, Gyöngyös | Mátra Museum, Gyöngyös
- Pannon Intézet, Pécs | Pannon Institute, Pécs,
- Rippl-Rónai Múzeum, Kaposvár | Rippl-Rónai Museum, Kaposvár
- Természettudományi Gyűjtemény, Komló | Natural History Collection, Komló

**Fig. 1.**  
Natural landscape units in Hungary.  
**Dd:** Transdanubian Hills (with Mecsek Mts and Villány Hills)  
**Ny:** West Hungarian Borderland  
**Ka:** Little plain  
**Dk:** Transdanubian Mountains  
**Ék:** North Hungarian Mountains  
**Ta:** Tisza Plain  
**Da:** Duna Plain (Ta and Da= English Great Hungarian Plain)





**Fig. 2.** Hungary's major natural landscapes and major ecological impact areas.

## Results

### Biology and distribution of *Phtheochroa* species in Hungary

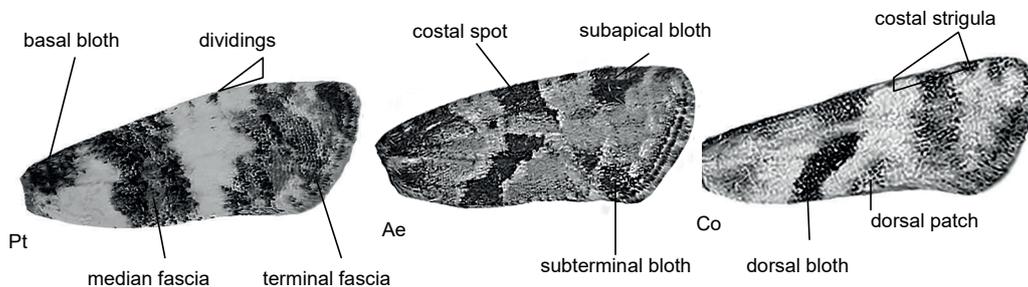
#### Tortricidae

#### Tortricinae - Cochylini

#### *Phtheochroa* Stephens, 1829

The species of *Phtheochroa* have usually been described or placed under its junior synonym *Hysterosia* Stephens, 1852 or *Trachysmia* Guenée, 1845. Full synonymy and comments on the genus are in my revision of the genera of Tortricidae (Razowski 1987). Since publication of the revision of the Palearctic fauna of Cochylini (Razowski 1970) only little new data have appeared in the literature. The larvae of *Phtheochroa* feed in seeds, fruits, stems or roots being probably oligophagous. Unfortunately, knowledge on their bionomy is very limited. Of the best-known Palearctic fauna ten species of *Phtheochroa* are known to be associated with fifteen plant species in the families Berberidaceae, Chenopodiaceae, Compositae, Liliaceae, Rhamnaceae, Rosaceae, Salicaceae and Ulmaceae. Of palaeartic species only three (*Phtheochroa decipiens* Walsingham, 1900, *Ph. sodaliana* Haworth, 1811 and *Ph. schreibersiana* Frölich, 1828) feed on deciduous trees (Razowski 1991).

Diagnosis: The genus includes about 120 species in Holarctic, Neotropical and Afrotropical regions, of which about 50 occur in the Palearctic. The number of Nearctic species is now close to 20. The species are generally associated with steppe-forest and arid regions. The number of food plants known so far is between 17 and 20, most of them Asteraceae. Larvae feed in seeds, fruits, roots or stems of dicotyledonous plants, hibernation in larval or pupal stages. Flight period within a species is strongly related to altitude and the climatic and ecological conditions of the geographical area.



**Fig. 3.** Comparative features (with indicated) of forewing pattern in *Phtheochroa* (Pt), *Aethes* (Ae) and *Cochylimorpha* (Co).

Valva of males of several species of *Phtheochroa* may be distinguished by the presence of a terminal process of sacculus; all species apart from the *P. rugosana* group have well-developed uncus. Examination of the genitalia is often essential for the exact identification of species, and it is often very important to separate the aedeagus and to examine it carefully, especially in regard to the structure of the cornutus. In female genitalia, the corpus bursae is broad and sclerotized; accessory bursa and ductus seminalis variable.

#### List of Hungarian *Phtheochroa* species

1. *Ph. inopiana* (Haworth, [1811])
2. *Ph. schreibersiana* (Frölich, 1828)
3. *Ph. pulvillana* (Herrich-Schäffer, 1851)
4. *Ph. sodaliana* (Haworth, 1811)
5. *Ph. fulvicinctana* Constant, 1893
6. *Ph. procerana* (Lederer, 1863)
7. *Ph. purana* (Guenée, 1845)
8. *Ph. duponchelana* (Duponchel, 1843)
9. *Ph. rugosana* (Hübner, 1799)
10. *Ph. annae* Huemer, 1990

### 1. *Phtheochroa inopiana* (Haworth, [1811])

Biology: Bivoltine. Flight periods June-July and August-September. Larva oligophagous on *Artemisia campestre*, *Eupatorium cannabinum* and *Pulicaria dysenterica*; the overwintering larvae feed within the roots of the food plants. This species occurs in xero-, and mesotrophic meadows and tall herb communities, colline and montane hay meadows, acid grasslands and heaths, riverine and swamp woodlands and wooded pastures. It prefers dolomitic steppe meadows in hilly and mountainous areas but is not common anywhere. It is worth looking for on the edges of forests and in shrubby, bushy vegetation, especially on south-facing hillsides and mountainsides.

Range in Hungary: *Ph. inopiana* is mainly known locally in the low mountain ranges, mostly in the western part of the country (Transdanubia). It is very scattered in the lowlands (e.g., in Kiskunság and the Tápó protected area). It is not uncommon in lowland mosaics of marshy and sandy hilly habitats (see later at *Phtheochroa pulvillana* in the description of the "turján" landscape).

Distribution: trans-Palaearctic. Known from Japan through Central Asia to Asia Minor, west to the British Isles and the Iberian Peninsula. It is fragmented over large geographical areas.

Remark: Sexually dimorphic, the females usually plainer than the males.

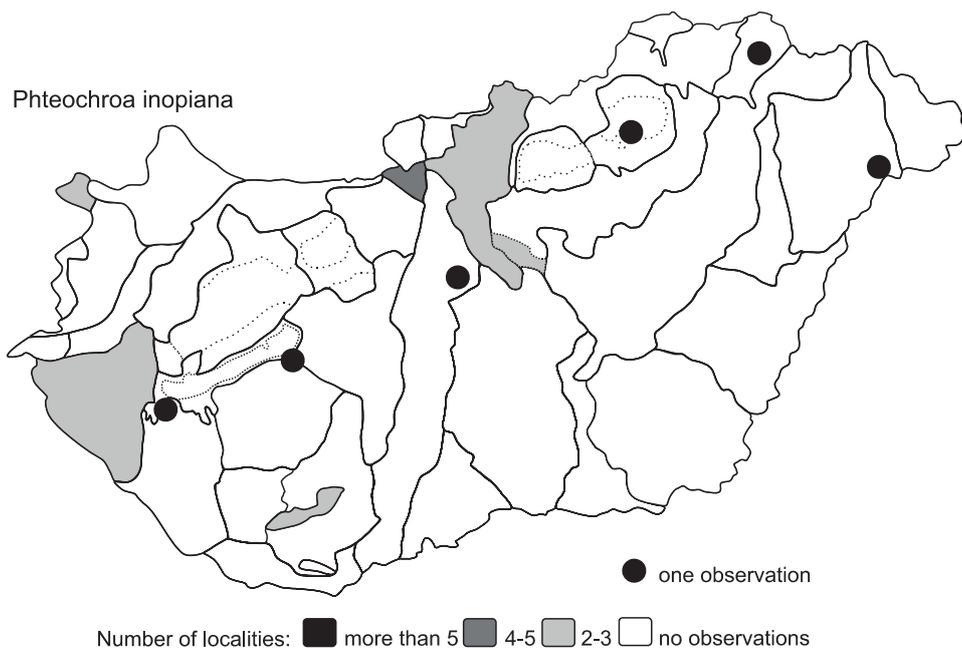


Fig. 4. Localities of *Phtheochroa inopiana* in Hungary

### 2. *Phtheochroa schreibersiana* (Frölich, 1828)

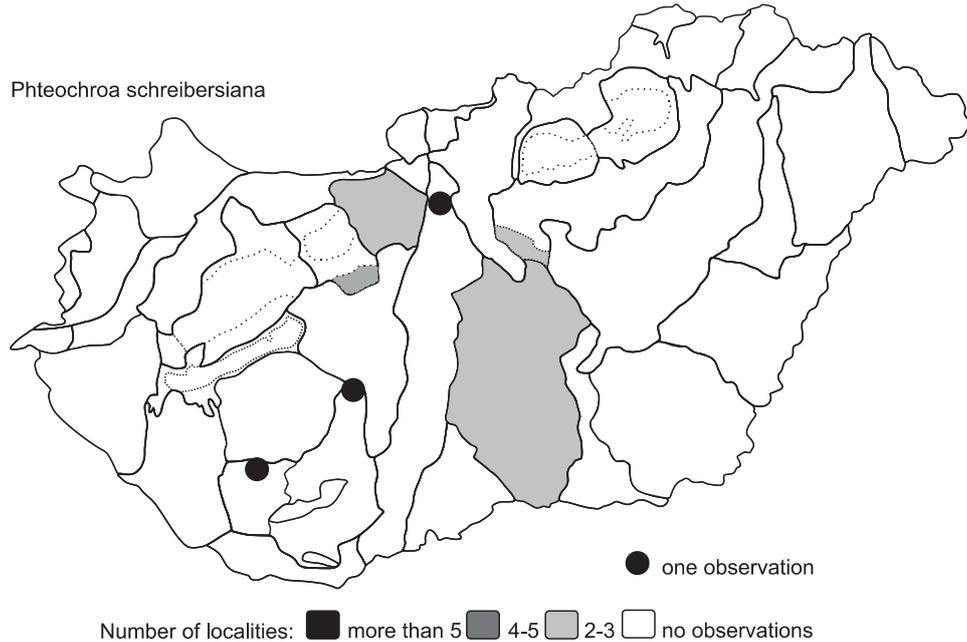
Biology: Univoltine. Flight period from April to early July. Larvae on foliage of *Prunus padus* (not native shrub in Hungary), *Populus nigra* and *Ulmus minor* to September; hibernating until the following spring, pupating in early April in the bark of the food plant. Habitat lowland oak-hornbeam and closed sand steppe oak woodlands, pannonic oak-hornbeam woodlands, Illyrian beech, and oak-hornbeam woodlands, closed dry deciduous woodlands, forest edges, forest clearings. Less frequently in riverine willow-poplar woodlands.

Range in Hungary: In hilly and mountainous areas; South-Transdanubia, Bakony Mts., Vértes Mts., Mátra and Zemplén Mts. Lowland only in Kiskunság. The pattern of the area in

Hungary has a more hilly and mountainous character.

Distribution: European, Asia Minor species. Known from the Ural Mountains through the Balkans to Scandinavia, the British Isles in the west, Spain and Italy in the south.

Remark: Monitoring data in Hungary are incomplete, with a total of 16 known sites. There are very few new observations, and most of the specimens were collected in the first half of the 20th century. Analysis of the data suggests that the species is probably in regression in Hungary.



**Fig. 5.** Localities of *Phtheochroa schreibersiana* in Hungary

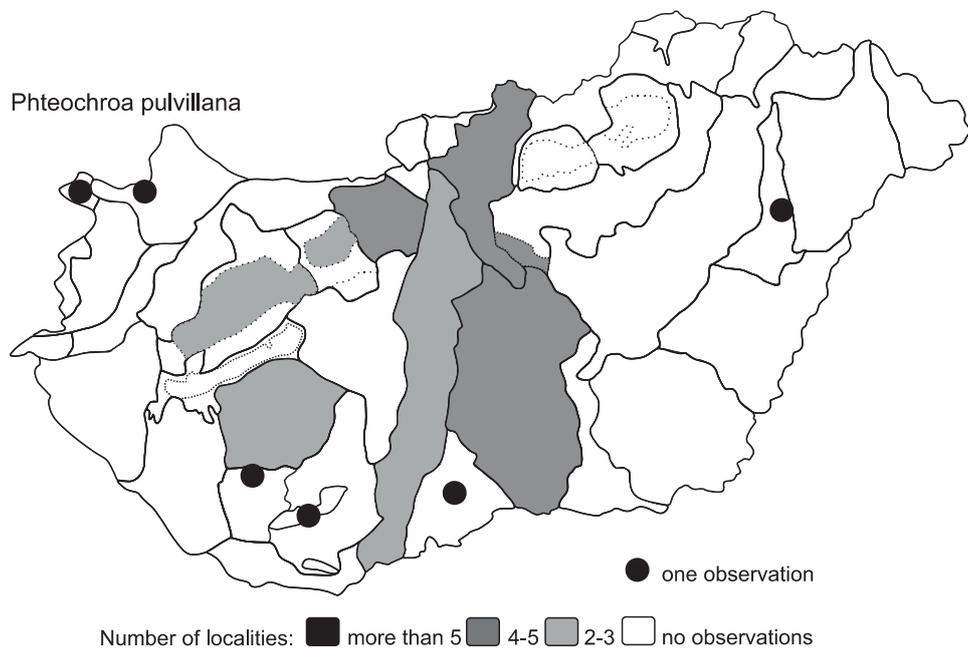
### 3. *Phtheochroa pulvillana* (Herrich-Schäffer, [1851])

Biology: Univoltine, with a long flight period extending from May to July, with a peak between mid-May and mid-June. Larva monophagous on *Asparagus officinalis*. Habitats include margins of hilly and mountainous mesophilous and thermophilous deciduous forests, dry grasslands, grasslands and pastures; lowland sand dunes, steppe meadows, saline meadows, planted forest pine forests. Also in agricultural land along roadsides and field margins.

Range in Hungary: In the western and northern parts of the country, *P. pulvillana* is known in the mid-altitude mountain ranges and hills. In the lowland areas it has been collected only between the Danube and Tisza rivers (Kiskunság, Tápió region), in the east in the salt meadows of the Hortobágy. The typical habitat in the Hungarian lowlands is the so-called "Turján-region": the waterlogged, boggy, difficult to walk on vegetation is called "turjános", from which the whole area and the Natura 2000 site takes its name: "Turján-vidék" (in Hungarian). It is the largest coherent wetland and sand habitat system in Central Hungary. Many species live here that are typical only for the Pannonian biogeographical region, so its protection is a priority task of Hungarian nature conservation. Natura 2000 identification code: HUDI 20051.

Distribution: *Ph. pulvillana* is a widespread, subspecific, mostly fragmented species in the Palaearctic. Wieser et al. (2001) reported it from Iran: Ghale-e Palangān (Golestān National Park).

Remark: The European populations belong to the nominotypical subspecies described from Germany.



**Fig. 6.** Localities of *Phtheochroa pulvillana* in Hungary

4. *Phtheochroa sodaliana* (Haworth, [1811])

**Biology:** Univoltine. Flight period May and June, becoming active from just before dusk. Larvae on *Rhamnus catharticus* and *Frangula alnus*; they spin the berries together. Habitats are mesophilic and xerophilic deciduous forest margins, shrublands, karst scrub forests on hills and mountains; sporadic lowland groves, and secondary (non-native) birch forests on sand, near streams and watercourses. Hársbokor-hegy (-Mount), Fót, Somlyó-hegy (-Mount), Jászság (birch forests, Hungarian “nyírfás”).

**Range in Hungary:** very few sightings are known. *Ph. sodaliana* is very local and rare in the mountains around Budapest and in the lowlands (e. g. Nagykáta, Kunféhértó) between the Danube and Tisza rivers.

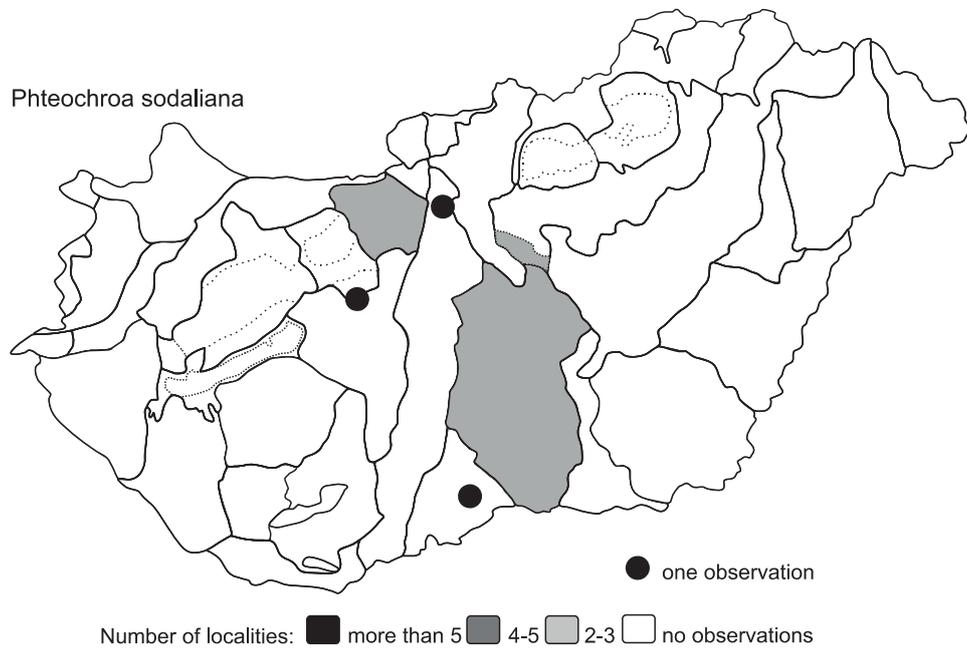
**Distribution:** this species inhabits large areas of the western Palaearctic but is absent from North Africa. In the east it reaches the Caucasus and has even been caught in Kazakhstan. Specimens from Asia need to be reassessed.

**Remark:** *Ph. sodaliana* is reminiscent in some respects of a small *Ph. rugosana* but is quickly distinguished by the conspicuous ferruginous-red apical spot and the generally white basal area of the forewing. In collections where specimens that are slightly frayed or fragmented in light traps have not been genitally examined, there are many misidentifications.

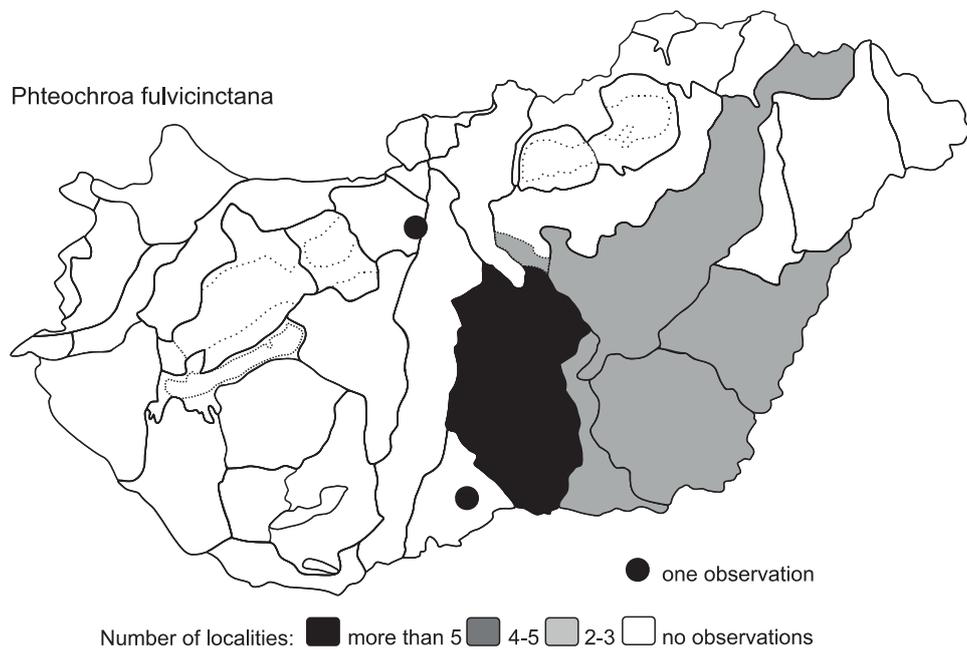
5. *Phtheochroa fulvicinctana* (Constant, 1893)

**Biology:** flight period from June to September, probably in two generations, but this needs to be investigated further. Larvae on *Limonium vulgare* and *Limonium gmelinii*. The native range of *L. gmelinii* is Central and Southeast-Europe to Siberia and Iran, but its presence in Hungary is accepted. Further breeding experiments are needed to confirm additional food plants. Habitats are mountainous karst scrub forests on dolomitic bedrock, dry sandy and saline grasslands, meadows.

**Range in Hungary:** only a few sites are known west of the Danube River (Budai Mts.). Most are located in the Great Hungarian Plain, mainly in the sandy areas between the Danube and Tisza rivers, in the east (Tiszántúl region) more locally in the salt marshes, pastures or



**Fig. 7.** Localities of *Phtheochroa sodaliana* in Hungary



**Fig. 8.** Localities of *Phtheochroa fulvicinctana* in Hungary

around salt lakes. The climate of these lowland areas is typically continental. Native wooded heathland survives only in patches.

Distribution: Razowski (2001) does not mention the species in his book on Central Europe,

but in his Palaearctic volume (Razowski 2009), he gives: "S Europe from France to Albania, in more northern territories locally: Switzerland, Romania and Hungary; Dageshestan. It is a sub-Mediterranean fauna element". However, its range is significantly larger. In Ukraine it has been found in Crimea, and in Russia along the Volga and in the Caspian lowlands (Sinev et al. 2019), and it is evidently not a sub-Mediterranean species. Further chorological studies are needed.

Remark: *Ph. fulvicinctana*, described from France, is a characteristic species of the Hungarian lowlands; most of the known localities are in national parks. Population abundance is low. According to Gozmány et al. (1986) the species has recently invaded Hungary from the SE; the known habitats are natron flats and grasslands in the Plain.

#### 6. *Phtheochroa procerana* (Lederer, 1863)

Biology: the exact flight period is uncertain at present. So far, specimens have been collected only in June and July. The food plant is unknown. To date, only one known locality survives, which can be described as follows: rock grass slope steppe, Buda rabbit-tail grass rock grassland closed; on dolomitic rock grassland.

Range in Hungary: collected solely in and around Budapest. Three specimens are known. (all in coll. HNHM, Budapest): Budapest, Farkas-völgy (= valley), [1]912.VI.20. leg. Uhrik-M.; T.; Budafok, [1]918.VII.6. leg. Uhrik-M.; T. Budapest, Sas-hegy, 1942.VI.28. leg. Neugebauer T. There have been no records of *P. procerana* since 1942.

Distribution: According to Razowski (2009) only occurrence in Europe in Hungary, Romania, Bulgaria; in addition, Asia Minor.

Remark: The forewing of the Hungarian specimens seen so far has a lighter ground colour than that of the nominotypical subspecies described from Bulgaria. This is clearly visible in the book by Razowski (2009, Plate 1., Figs 34, 34a). In addition, further differences in habitus can be seen. A comparative study of the Balkan and Hungarian populations should be carried out. However, since the species has not been seen in Hungary for over 80 years, the Hungarian population has probably become extinct, and the habitats in Budapest, the Hungarian capital, the sites Budafok (1918) and Farkas-völgy (1912) have been destroyed and built up with houses and roads.

The "Sas-hegy" in Budapest (47°28'56.5 "N 19°01'04.5 "E) is the northernmost geographic occurrence of *Phtheochroa procerana* in Central Europe. The mountain has been studied for 120 years and has been a Nature Reserve since 1958.

The dolomite bedrock mountain is home to the following plant communities: open dolomitic rock grassland (*Seseli leucospermo-Festucetum pallentis*); rock grass slope steppe (*Chrysopogono-Caricetum humilis*); Sesleria rock grassland (*Seslerietum sadlerianae*); closed dolomitic rock grassland (*Festuco pallenti-Brometum pannonicum*).

The geographic structure of species populations can be understood in terms of two closely related components: 1) population demographic structure, 2) and its genetic structure. This method makes it possible to study processes of conservation biological importance: migration and gene flow, genetic drift and selection, population survival and extinction.

In phylogeographic terms, the analysis of these processes provides an understanding of the structure of the geographical distribution of *Phtheochroa procerana*, its current and evolutionary dynamics and the evolutionary changes that occur during the change in distribution.

Molecular studies could provide insights into where *Phtheochroa procerana* may have been a potential refugium for the species in the Balkans during the last glacial climatic depression and provide answers about the highly isolated occurrence of the species in Hungary. Only studies of this type can answer the questions of fragmentation and isolation.

#### 7. *Phtheochroa purana* (Guenée, 1845)

Biology: according to literature, the moth flies in June and July. Probably a monophagous species, larvae have been observed on *Cephalaria leucantha* (Swatschek 1958). This plant is present in northern Africa and in southern Europe (Albania, former Yugoslavia, Greece, Italy,



**Fig. 9.** Distribution clades of *Phtheochroa procerana* in SE Europe based on the main observation points. The historical antecedents of the distribution trends shown on the map were established during a favourable postglacial period. The reasons for the strong fragmentation, persistence and extinction are not known.

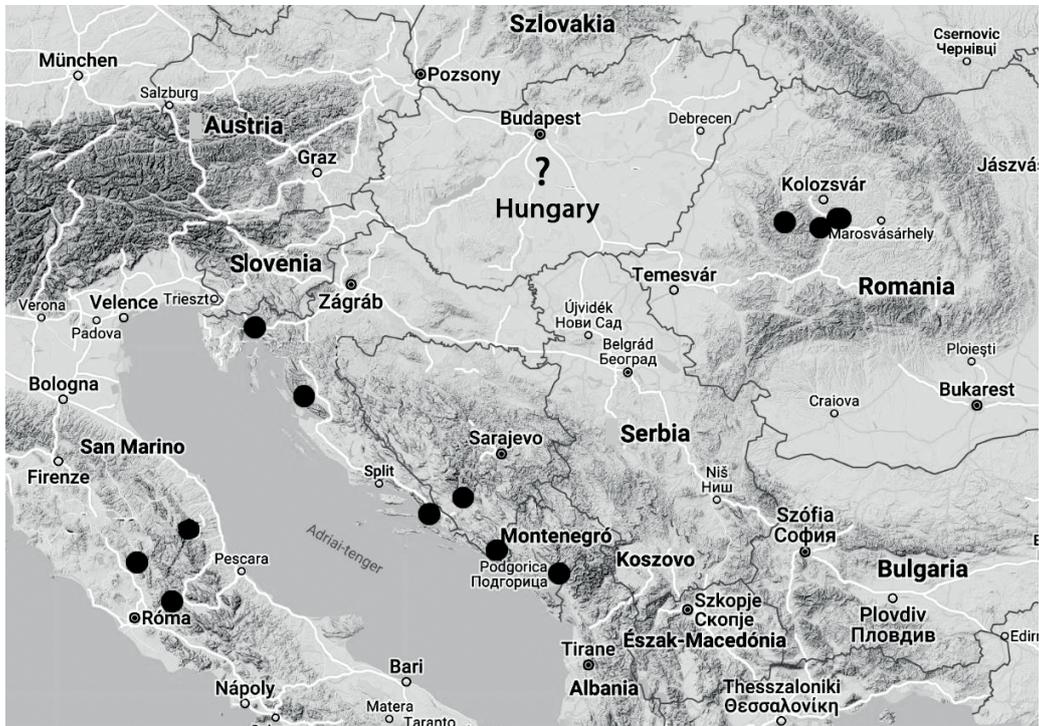
The hypothetical geographic range of the species is 154 766 km<sup>2</sup>, and 20 isolated sites are known in this geographic area. The northernmost occurrence (HU, Budapest) is 692 km from the nearest Balkan site (BG, Veliko Tarnovo).

France, Portugal, and Spain). In the Western Balkans, in the 1980's, it was noted sporadically in along xerothermophilous paths and roadsides, in disturbed zones, along the margins of Mediterranean Pine woods and shrubland and in rocky areas on karst.

Range in Hungary: in the Hungarian faunistic literature, the name of the species can only be found in the publications of Gozmány (1968, 1971), in which there is no mention of any specific locality. Razowski (2001, 2009) does not mention *P. purana*. In his earlier, Palearctic volume (Razowski 1970), he mentions Hungary, citing Kennel (1913). In addition, see Kennel (1921), page 297, where he wrote: "Hab. Südfrankreich, Ungarn, Bithynien". During personal investigations, no specimens have been found in any Hungarian collections.

Distribution: according to Razowski (2009), *Ph. purana* is a sub-Mediterranean faunal element, found mainly in southern Europe, France, Croatia, and Bosnia.

Remark: it is assumed that Kennel's (1913) Hungarian data (specimens) are from the Adriatic coast of historic Hungary, which is now part of Croatia. The find site labels of specimens collected here were always marked "Hungaria". This is probably the reason for the misunderstanding even today. The food plant is planted in gardens, so it is not impossible that *Phtheochroa purana* will also appear in Central Europe as an adventive species. Its permanent establishment in that region is unlikely.



**Fig. 10.** Geographical distribution of *Phtheochroa purana* in Italy, the Western Balkans and Romania (preliminary, verified map)

8. *Phtheochroa duponchelana* (Duponchel, 1843)

Biology: according to Razowski (2009) the moth flies in two generation late March to mid-May, and July. The larva and the food plant are unknown. It is assumed that it lives on *Acanthus spinosus*. This plant is native to Mediterranean regions but is planted in many areas as an ornamental.

Range in Hungary: only Gozmány (1968, 1971) and Razowski (2009) mention the species from Hungary, without any evidence. There are no identified specimens in Hungarian collections. There is only one, unlabelled, specimen in the Hungarian Museum of Natural History in Budapest. It is said to have been collected on the "Csiki" hill near Budapest a few decades ago. The area has since been developed and the habitat destroyed.

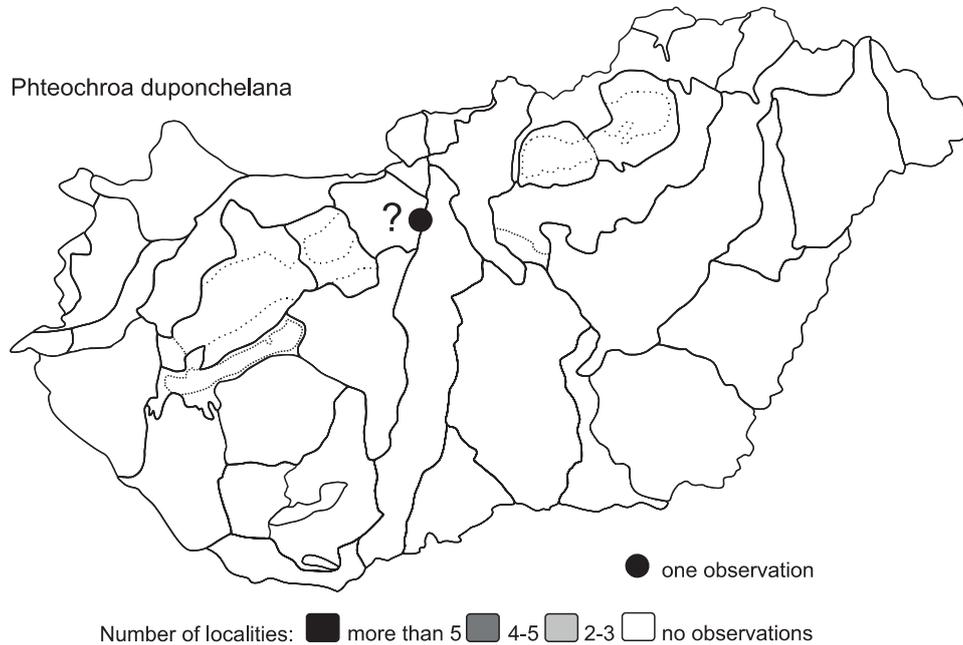
Distribution: elsewhere, the range of *Ph. duponchelana* is not clearly understood. It has been collected from the Caucasus region through Asia Minor and Syria to North Africa and is also found in Greece and probably in many areas of the Western Balkans (e. g., Montenegro). It is probably a highly fragmented Holomediterranean faunal element.

Remark: it cannot be proved, but probably *Ph. duponchelana* is extinct in Hungary.

9. *Phtheochroa rugosana* (Hübner, [1799])

Biology: flight period early May and June. Inactive by day. It may sometimes be seen on warm evenings flying about its habitat, but is usually more active towards dusk, occasionally observed at light. Larvae oligophagous on flowers and leaves *Bryonia dioica*, and probably *Echballium elaterium*. Preferred habitats are mesophilic and xerophilic meadows, roadsides, weedy areas, edges of groves. There are also populations in arboreta (e.g., Szombathely).

Range in Hungary: *Ph. rugosana* is known mainly from low mountainous areas (e.g., Ba-



**Fig. 11.** Localities of *Phtheochroa duponchelana* in Hungary

kony Mts., Mátra Mts., Vértes Mts.), and hills, but it also occurs sporadically on the edges of the Hungarian lowlands (e.g., Tápió-vidék).

Distribution: incompletely known. Razowski (2009) states that it is a European faunal element, but this is disputed. According to several literature records (cf. Bradley et al. 1972, Razowski 2009, etc.) it has been found in North Africa, the Canary Islands, Asia Minor, and in Europe from the British Isles through central Europe to the Balkan Peninsula, and is a local and uncommon species. It is most likely an expansive Holomediterranean faunal element.

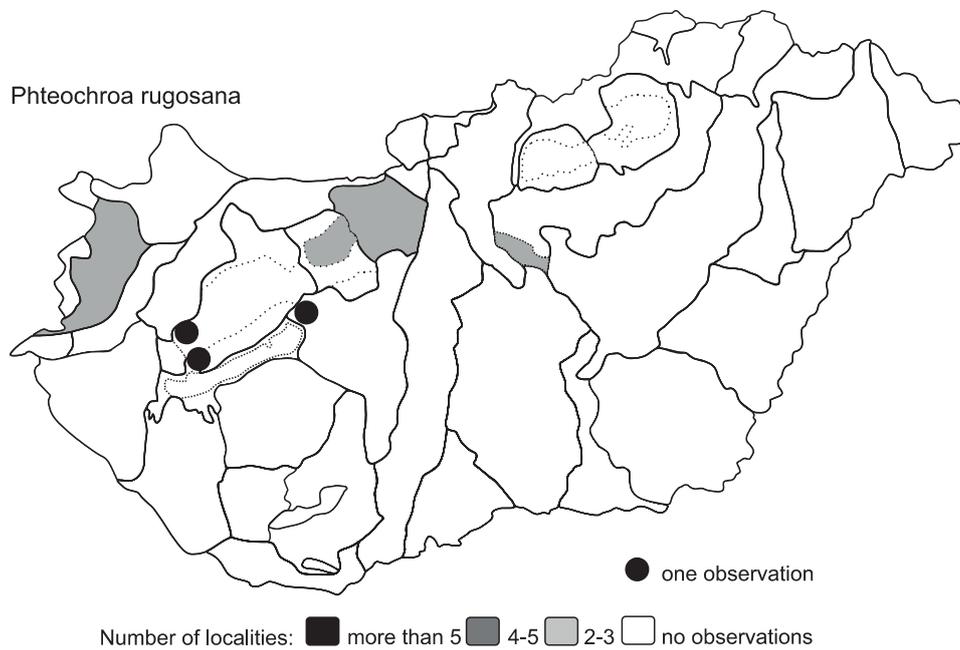
Remark: according to Razowski (2009), imagines fly in the Palearctic from April to July. Such a long flight period is not known in Hungary. Relatively few specimens and literature data are known from Hungary. Most of the identified specimens were collected in the first half of the 20th century, since then there have been very few new observations.

#### 10. *Phtheochroa annae* Huemer, 1990

Biology: specimens have so far only been collected at night with a lantern in April and May. During the day, they sit on leaves in the vegetation, whence they can be disturbed. The larvae feed on seeds in fruits of *Bryonia dioica*, but also on the leaves. They pupate in a fine web on the food plant. The habitats studied so far are dominated by forested areas.

*Ph. annae* has been found along the fringes of hornbeam-oak forests, thermophilic oak woods, scrub oak woods and occasionally alder groves, but it has also been collected in loess meadows and sand meadows. Habitat preference needs to be further investigated.

Range in Hungary: the first specimens were collected in Hungary between 1908 and 1915 (Simontornya [Paratype], Nagymaros, Isaszeg, in coll. HNHM, Budapest), but were identified as *Ph. rugosana*. Subsequently, it has been found from Nemesgulács and also from Vértes Mountains (Fazekas 1991, Pastoralis & Szeőke 2018). These localities are located in the Transdanubian Mountains at low altitudes (250-300 m). Since the sister species *Ph. annae* and *Ph. rugosana* occur sympatrically, their identity should be checked with care.

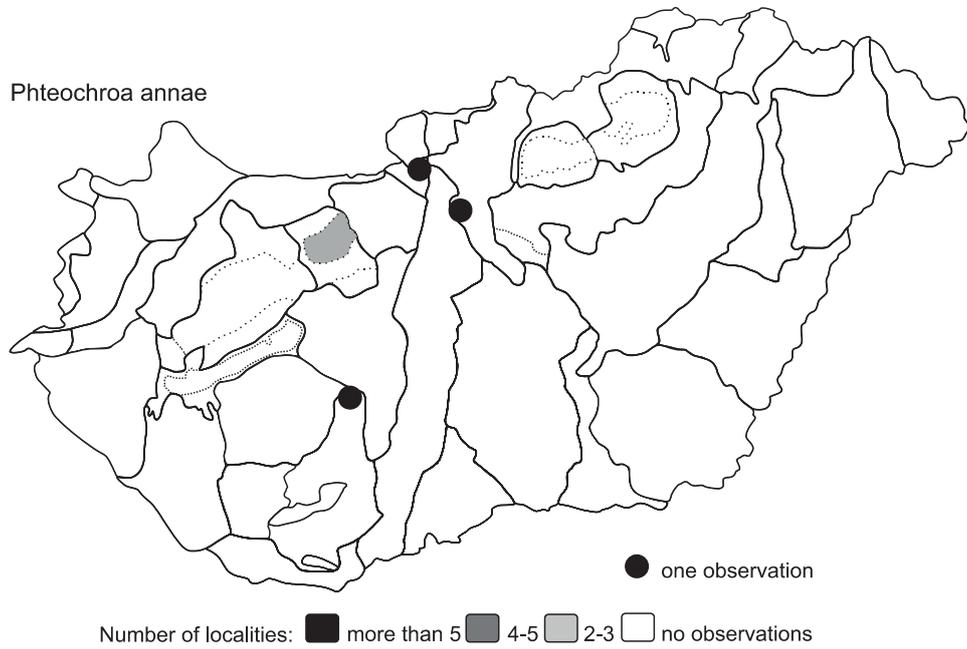


**Fig. 12.** Localities of *Phtheochroa rugosana* in Hungary

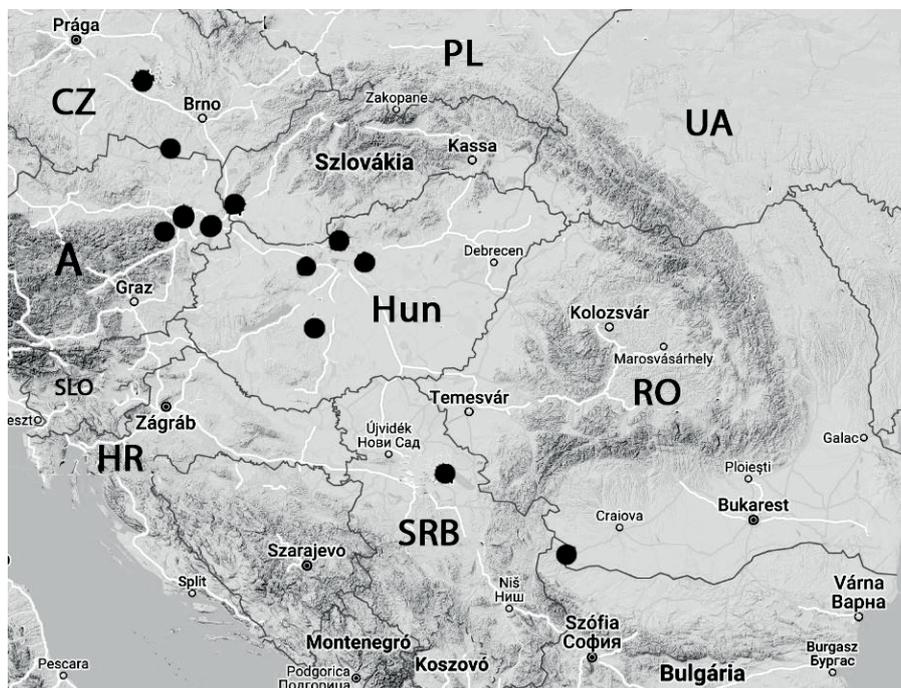
Distribution: only few confirmed records are known from Austria, Hungary, Romania, Bulgaria (Zlatkov & Sivilov 2012) and Greece. The geographical distribution of *P. annae* will only be worked out following a revision of the species in collections. Material from Greece requires molecular data and re-examination (P. Huemer pers. comm).

Remark: in very local populations in Hungary, numbers are very low. In some years the species is not even detected. According to Huemer (1990) *Ph. annae* should show only a small geographical range of variation: specimens from Austria, Hungary and Romania show no variability, the examined individuals from Greece differ somewhat in the width of the valva and the antrum but are nevertheless regarded as conspecific.

The following points should be considered when distinguishing the species *Phtheochroa rugosana*: *Ph. rugosana* varies externally both in size and in the markings of the forewings. The genitalia show only a very small range of variation that cannot be geographically correlated: the male genitalia vary only slightly in the valve with, but also in the number of transtilla teeth; the female genitalia show a certain range of variation, especially in the extent of the corpus bursae sclerotization (see Fazekas 1991, Huemer 1990).



**Fig. 13.** Localities of *Phtheochroa annae* in Hungary



**Fig. 14.** The geographical distribution of *Phtheochroa annae* in Central and South-Eastern Europe. The known range is 450 000 km<sup>2</sup>, the total number of occurrences is only 15. It reaches the coast of Asia Minor in the south and the Czech Republic in the north. It is probably an Anatolian, Balkan and Central European species with a less known chorology.

## Review

This is the first study in Hungary to review the biology and geographical distribution of *Phtheochroa* species. It concludes that 10 species have been documented in the country so far.

*Phtheochroa duponchelana* is probably extinct in Hungary. *Phtheochroa procerana* has its northernmost distribution in Hungary (Budapest). The survival of this highly isolated population is questionable, the last specimen was collected in 1942 and no observations have been made since then.

Chorologically, the faunal elements were examined, and within them the so-called faunal components. The results are presented in a table (see Table 1). The fauna types (see table) is dominated by Mediterranean species, with very few widespread Palearctic or Euro-Siberian species. Faunal component analysis shows that species are predominantly associated with mesophilic and xerophilic habitats. They prefer warm, steppe-like hilly areas and the southern slopes of low mountain ranges. Geographically, the sandy areas between the Danube and Tisza rivers and the remaining patches of the forested steppe are very important for the distribution of Hungarian species.

**Table 1.** List of the Hungarian *Phtheochroa* species faunal types and faunal components.

Faunal types: Trpal= Transpalearctic, EuSib = Euro-Siberian, Eur-Cauc= European-Caucasian,

Eur-Am= European-Asia Minor, Submed= Submediterranean, Pmed-Anat= Pontomediterranean-Anatolian, Hmed= Holomediterranean

Faunal components: Rst= rock grass slope steppe, Mes-sil= mesophil-silvicol, Mes-eur= mesophile-  
euryök,

Ndf= nemoral deciduous forest, MeXerMe= mesophilic and xerophilic meadow.

Species	Faunal types	Faunal components
1. <i>Phtheochroa inopiana</i>	EuSib	Mes-eur
2. <i>Ph. schreibersiana</i>	EuAm	Ndf
3. <i>Ph. pulvillana</i>	Trpal	Steppe
4. <i>Ph. sodalina</i>	Eur-Cauc	Mes-sil
5. <i>Ph. fulvicinctana</i>	Submed	Steppe
6. <i>Ph. procerana</i>	Pmed-Anat	Rst
7. <i>Ph. purana</i>	Submed	Rst
8. <i>Ph. duponchelana</i>	Hmed	MeXerMe
9. <i>Ph. rugosana</i>	Hmed	MeXerMe
10. <i>Ph. annae</i>	unknown	Mes-sil

The majority of the Hungarian *Phtheochroa* species are oligophagous; monophagous species are very rare. The majority of species live on herbaceous plants. *P. schreibersiana* and *Ph. sodaliana* are associated with shrubs or trees. A total of 15 food plants have been identified:

*Asparagus officinalis*  
*Acanthus spinosus*  
*Artemisia campestre*  
*Bryonia dioica*  
*Cephalaria leucantha*  
*Echballium elaterium*  
*Eupatorium cannabinum*  
*Frangula alnus*

*Limonium gmelinii*  
*Limonium vulgare*  
*Populus nigra*  
*Pulicaria dysenterica*.  
*Prunus padus*  
*Rhamnus cathartica*,  
*Ulmus minor*

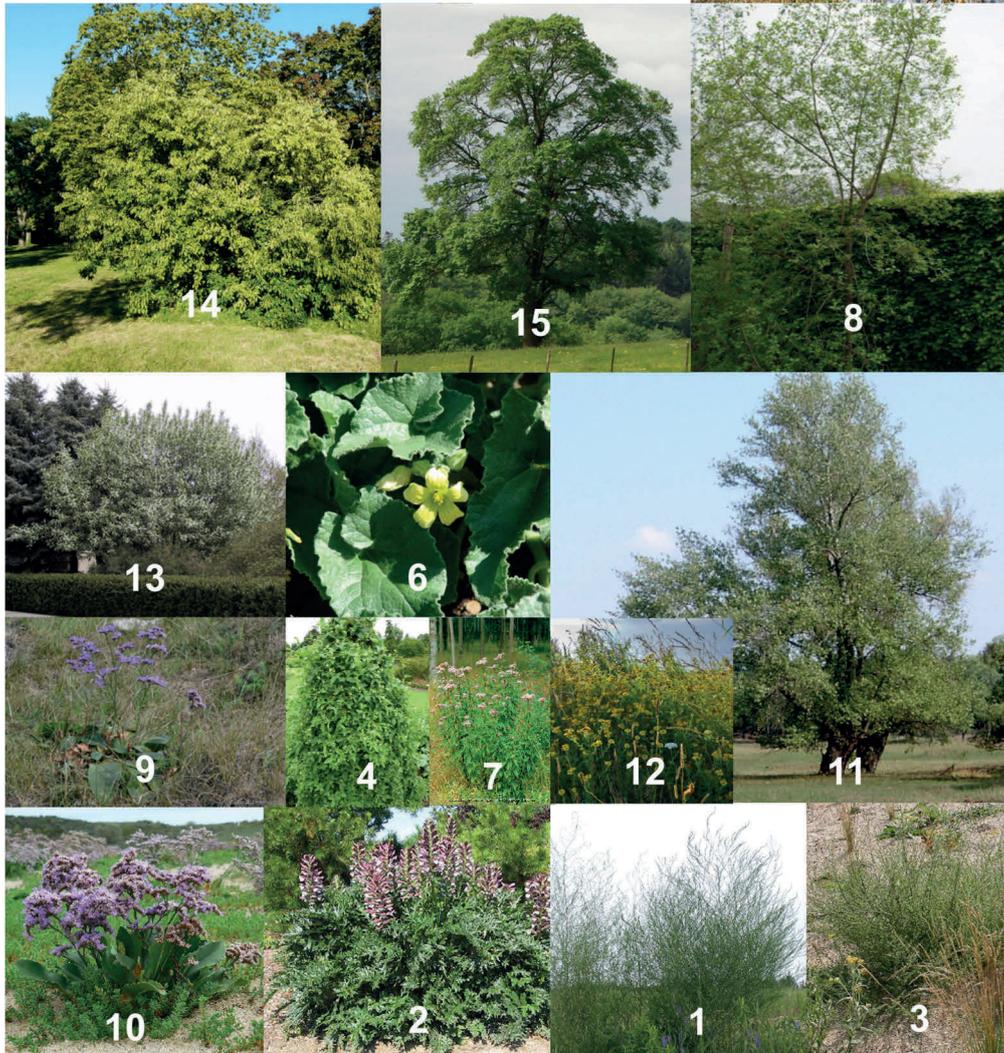
**Table 2.** Food plants spectrum and preferred habitat types of *Phtheochroa* species in Hungary. Larval foodplants information: the botanical nomenclature of Hungarian plants in this list is based on "Új magyar fűvészkönyv" by Király [ed.] (2009).

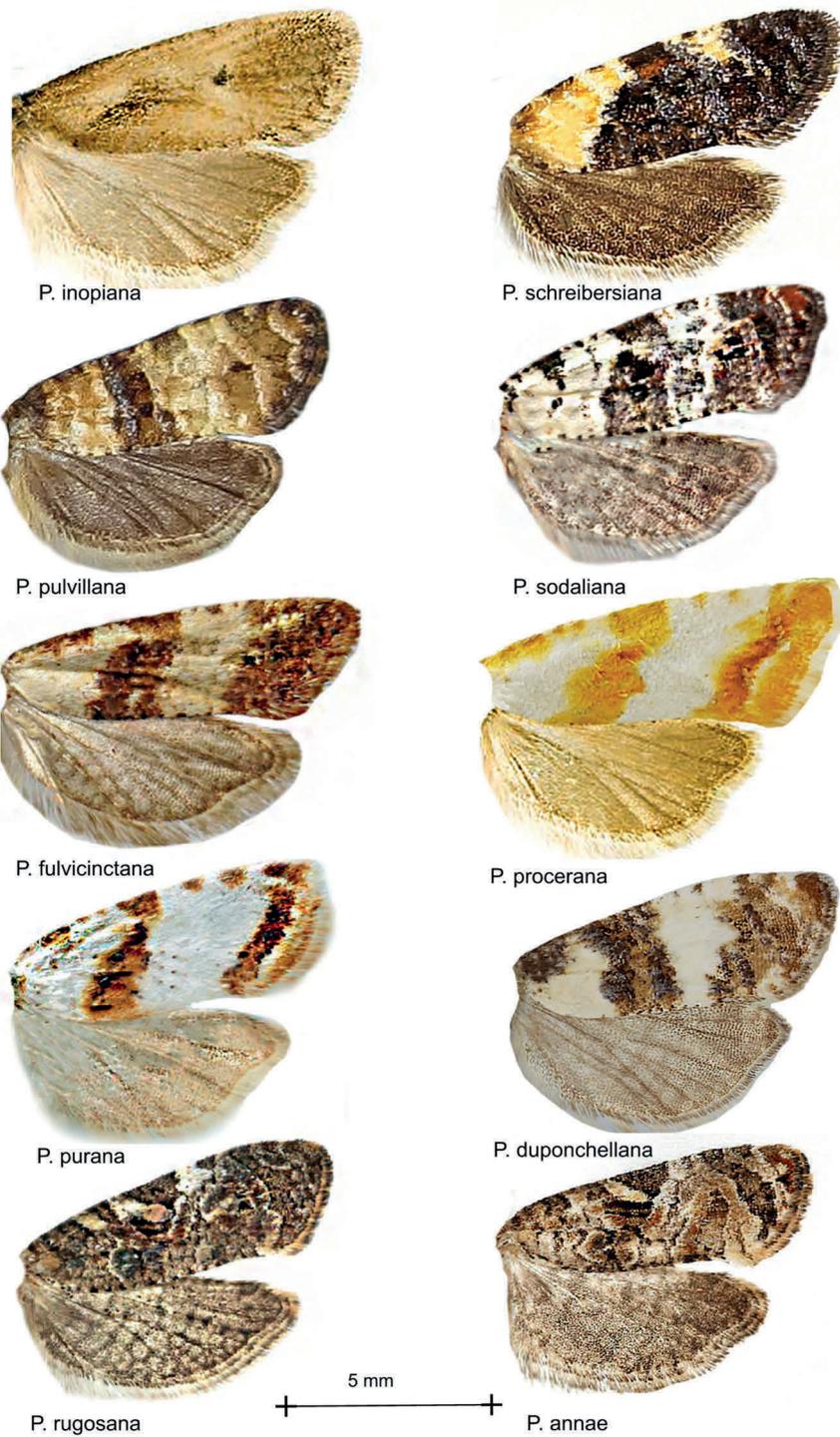
Food plants	<i>P. inopiana</i>	<i>P. schreibersiana</i>	<i>P. pulvillana</i>	<i>P. sodaliana</i>	<i>P. fulvicinctana</i>	<i>P. procerana</i>	<i>P. purana</i>	<i>P. duponchelana</i>	<i>P. rugosana</i>	<i>P. annae</i>
<i>Acanthus spinosus</i>								+		
<i>Artemisia campestris</i>	+									
<i>Asparagus officinalis</i>			+							
<i>Bryonia dioica</i>									+	+
<i>Cephalaria leucantha</i>							+			
<i>Echballium elaterium</i>									+	
<i>Eupatorium cannabinum</i>	+									
<i>Frangula alnus</i>				+						
<i>Limonium gmelinii</i>					+					
<i>Limonium vulgare</i>					+					
<i>Populus nigra</i>		+								
<i>Pulicaria dysenterica</i>	+									
<i>Prunus padus</i>		+								
<i>Rhamnus cathartica</i>				+						
<i>Ulmus minor</i>		+								



**Table 3.** Food plants spectrum and preferred habitat types of *Phtheochroa* species in Hungary. The majority of species live at the grassland level. The following species live in the canopy of trees: *Ph. schreibersiana*, *Ph. sodaliana*.

1. *Asparagus officinalis* - *P. pulvillana*
2. *Acanthus spinosus* - *P. duponchelana*
3. *Artemisia campestre* - *P. inopiana*
4. *Bryonia dioica* - *P. annae*, *P. rugosana*
5. *Cephalaria leucantha* - *P. purana*
6. *Echballium elaterium* - *P. rugosana*
7. *Eupatorium cannabinum* - *P. inopiana*
8. *Frangula alnus* - *P. sodaliana*
9. *Limonium gmelinii* - *P. fulvicinctana*
10. *Limonium vulgare* - *P. fulvicinctana*
11. *Populus nigra* - *P. schreibersiana*
12. *Pulicaria dysenterica* - *P. inopiana*
13. *Prunus padus* - *P. schreibersiana*
14. *Rhamnus cathartica* - *P. sodalina*
15. *Ulmus minor* - *P. schreibersiana*





**Fig. 16.** Diagnostic characters of wings of Hungarian *Phtheochroa* species

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