

Annotated checklist and distribution maps of the Hungarian Eupitheciini Fauna (Lepidoptera: Geometridae)

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Abstract. The study is a comprehensive synthesis of information on 80 known Hungarian species of the Eupitheciini (“pug” moths). An updated annotated checklist of pug species in Hungary is presented; data from the list are used to generate distribution maps of the species. This is the first summary work on the geographical distribution of the Hungarian species in this group and is based upon thirty years of collecting examination of museum, institutional and private collections, and writing of Eupitheciini faunistic monographs for several geographic regions. The possible occurrence in Hungary of several additional species, but for which evidence is lacking, is also considered. Species that are misreported in the literature are listed in square brackets. So far, there has been little research in much of the geographical area of Hungary, especially in the regions bordering Romania and Serbia (Tiszántúl).

Keywords. Geometridae, Eupitheciini, distribution maps, Hungary.

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Introduction

The present study aims to gather all the information available on the distribution of Eupitheciini in Hungary in order to provide a starting point for further study on the dynamics of distribution limits. The information was mainly derived from entomological collections and faunistic papers and personal field observations; specimens collected by fellow entomologists also provided much data.

As a consequence of a significant amount of taxonomic uncertainty and confusion, a measure of misidentification affects lists that have appeared in the literature, affecting a period of almost 147 years. These lists are known to include more species reported in error; so that it is clear that these reports have not been overlooked, they are included and annotated here.

Distribution records were obtained from a vast number of taxonomic papers and we have attempted to obtain and check all papers dealing with Eupitheciini species published between 1872 and 2019. Significant older works and a few more recent, were also checked. The accumulated records should enable an initial analysis of the distribution pattern of Eupitheciini Fauna in Hungary.

The maps clearly shown the concentration, by collectors, on the wilderness areas of Hungary’s hills and mountains. Other landscapes, notably the larger part of the Great Plain, are poorly studied in comparison; intensive and organized research is needed there. However, in spite of the uneven coverage, the available records are quite sufficient to demonstrate the approximate limits of range for some species, as well as to assess frequency of occurrences for the majority.

In the past two centuries, Hungary has seen significant economic, social and geopolitical changes that also significantly transformed the land use as well as the relations of urban to rural areas. During this period, human interventions caused signifi-

cant changes in natural potentials, in particular in the water system. Many hygrophilous species are highly rare or have disappeared from many geographical areas.

Forests reach, or even exceed, the same proportion as 200 years ago, but the proportion of grasslands to arable areas has shifted towards the latter everywhere. The proportion of grasslands decreased significantly on higher ground and in middle ranges through expansion of adjacent forest areas. Habitat transformation is very intensive and the original Eupitheciini fauna of Hungary is highly fragmented as a result. The remnants of the original fauna are found mainly along the western border, in the mountains (Mecsek-, Bakony-, Vértes-, Mátra-, Bükk-, Zemplén Mountains and Aggtelek Karst [along the Slovakian border]) and in the steppe fragments of the Great Plain (Danube-Tisza Interfluve and Hortobágy).

According to the MÉTA 11 database, only about 17% of the country is covered with vegetation that are parts of our natural vegetation heritage, i.e. can be considered to be the remnants of the natural vegetation. Looking at the condition of our vegetation heritage, we see that as a result of human utilization over the past millennia, only 0.6% of the territory of the country is covered with a vegetation that can be considered natural, another 5.6% is covered with semi-natural vegetation, while on 8.1% of the area vegetation is degraded and on another 3.0% it is extremely degraded.

The value of creating distribution maps, for a wide range of faunal groups, to facilitate assessments of the wider impacts of these changes upon overall biodiversity over time cannot be over-emphasised. The present maps show the status of the Eupitheciini in Hungary at the beginning of the 21st century; in the coming years, research must continue in eliminate gaps in coverage for every region of the country and so improve the baseline for future comparisons.

Material and methods

Over 40 000 specimens were examined for this study and between 1975–2019, field survey has been concentrated chiefly in the areas that were, at the time, insufficiently investigated or not investigated at all. Additionally, the collections of the following institutions and persons were examined:

Natural History Collection (Kömlő), Hungarian natural History Museum (Budapest), Natural History Museum of Bakony Mountains (Zirc), Mátra Museum (Gyöngyös), Savaria Museum (Szombathely), Pannon Institute (Pécs), Rippl-Rónai Town Museum with county's rights (Kaposvár).

In the case of species or species-pairs posing identification problems, genitalia examinations have been carried on. These were based on the methodology of Robinson (1976), modified by (Fazekas 2018, p. 201, Figs 2–2a). Some genitalia were mounted in Canada balsam or Euparal on glass slides, while others were preserved in micro-vials filled with glycerol.

To plot distributions, the author created a mapping program that works with Corel-Draw software. The basis for the mapping was the large, medium and small landscapes that can be easily distinguished in an ecologically sound manner. These data are retained in an Excel database which is added to on a regular basis. The base maps for distribution were drawn based on Hungary's geographic landscape (Marosi & Somogyi, 1990, Dövényi 2010), who present the most comprehensive and detailed overview of the physical environment of Hungary.

Acknowledgements

We owe thanks to all our colleagues, who in any way have contributed to the construction of the Hungarian Eupitheciini Mapping Database and the publication of this study.

For their kind help in allowing me to study collections and providing me with the specimens and valuable information I would like to express my best thanks to the following persons: Levente Ábrahám (Kaposvár), Zsolt Bálint (Budapest), Imre Balogh [†] (Budapest), Ferenc Buschmann (Jászberény), Béla Herczig. (Tata), József Jablonkay [†] (Gyöngyös), Gergely Katona (Budapest), Vladimir Mironov (St. Petersburg), Károly Petrich [†] (Budapest), Ladislaus Rezbanyai-Reser (Luzern), Kálmán Szeőke (Székesfehérvár), Balázs Tóth (Budapest), Sándor Tóth. (Zirc), Ákos Uherkovich (Pécs), Zoltán Varga (Debrecen), János Wetstein [†] (Budapest). Colin Plant (United Kingdom) and Barry Goater (United Kingdom) is thanked for linguistic corrections.

Annotated checklist of the Hungarian Eupitheciini species

Gymnoscelis Mabille, 1868

1. *Gymnoscelis rufifasciata* (Haworth, 1809) (= *pumilata* (Hübner, 1813))

Note: Older Hungarian literature sources regularly mention it as *pumiliata*

Chloroclystis Hübner, 1825

2. *Chloroclystis v-ata* (Haworth, 1809) (= *coronata* (Hübner, 1813))

Note: Older Hungarian literature sources regularly mention it as *coronata*.
Widespread species in Hungary.

Pasiphila Meyrick, 1883

3. *Pasiphila chloerata* (Mabille, 1870)
4. *Pasiphila rectangulata* (Linnaeus, 1758)
5. *Pasiphila debiliata* (Hübner, 1817)

Eupithecia Curtis, 1825

The *haworthiata* species-group

6. *Eupithecia haworthiata* Doubleday, 1856

The *tenuiata* species-group

7. *Eupithecia tenuiata* (Hübner, 1813)
8. *Eupithecia inturbata* (Hübner, 1817)

The *abietaria* species-group

9. *Eupithecia abietaria* (Goeze, 1781) (= *pini* (Retzius, 1783))

Note: Older Hungarian literature sources regularly mention it as *pini*.

10. *Eupithecia analoga europaea* Lempke, 1969 (= *bilunulata* (Zetterstedt, 1839))

Note: Older Hungarian literature sources regularly mention it as *bilunulata*. According to Mironov (2003) it is represented in Hungary by ssp. *europaea*.

The *linariata* species-group

11. *Eupithecia linariata* (Denis & Schiffermüller, 1775)

12. *Eupithecia pulchellata* Stephens, 1831

Note: The taxonomic status of the taxon is a matter of continuous discussion in Hungary. A recent investigation confirmed the *pulchellata* valid species (Fazekas 2019, Mironov 2003) and that it is very local and rare in Hungary. Several *pulchellata* data have been published in the Hungarian literature, but the specimens were identified only by the pattern of the wings and are certainly misidentified. Only the present author has performed genitalia investigations.

13. *Eupithecia pyreneata* Mabilles, 1871
 14. *Eupithecia laquaearia* Herrich-Schäffer, 1848

The plumbeolata species-group

15. *Eupithecia plumbeolata* (Haworth, 1809)
 16. *Eupithecia pygmaeata* (Hübner, 1799) (= *pygmaearia* (Boisduval, 1840))
 Note: Older Hungarian literature sources regularly mention it as *pygmaearia*.

The silenata species-group

17. *Eupithecia silenata* Assmann, 1848

The silenata species-group

18. *Eupithecia venosata* (Fabricius, 1787)
 19. [*Eupithecia schiefereri* Bohatsch, 1893]
 Note: The author confutes the *schiefereri* records suggesting the occurrence of the species in Hungary. All publications are either groundless or based on misidentifications. The occurrence of the species in Hungary is possible, but these are no known voucher specimens (Fazekas 2017). It is known from Burgenland and western Slovakia, and so may occur in the western Hungarian borderland. Habitats in this area are quite suitable; nature reserves are significant.
 20. *Eupithecia silenicolata* Mabilles, 1867
 Note: *Silenicolata* is one polytypic species. Several subspecies are known in the Mediterranean landscapes. The populations from the Hungary (Mecsek Mountains) were described as ssp. *zengoensis* Fazekas, 1979. The name *zengoensis* would be the available name of this subspecies of the Central Europe populations. The ssp. *zengoensis* is valid at subspecific rank (Mironov 2003).
 21. *Eupithecia alliararia* Staudinger, 1870
 Note: This species described from Hungary (Locus typicus: Budapest [„Ofen“]).

The abbreviata species-group

22. *Eupithecia abbreviata* Stephens, 1831
 23. *Eupithecia dodoneata* Guenée, 1857
 24. *Eupithecia extremata* (Fabricius, 1787)
 25. *Eupithecia pusillata* (Denis & Schiffermüller, 1775) (= *sobrinata* (Hübner, 1817))
 Note: Older Hungarian literature sources regularly mention it as *sobrinata*.
 26. *Eupithecia ericeata* (Rambur, 1833)
 27. *Eupithecia oxycedrata* (Rambur, 1833)
 Note: The occurrence of *oxycedrata* in North Hungary (Zemplén Mountains, Telkibánya) is highly unexpected, because this area is completely different from all habitats known for this species in the Mediterranean region. In addition, the primary host plant *Juniperus oxycedrus* is not known to occur in Hungary (Tóth 2018). So far four examples have been found in 1963, but since then the species has not been caught in Hungary. All specimens are deposited in HNHM. Possibly, the species was introduced in Hungary, but no resident population is known.

The tripunctaria species-group

28. *Eupithecia tripunctaria* Herrich-Schäffer, 1852

The virgaureata species-group

30. *Eupithecia virgaureata* Doubleday, 1861

The tantillaria species-group

30. *Eupithecia tantillaria* Boisduval, 1840

The lariciata species-group

31. *Eupithecia lariciata* (Freyer, 1841)

The lanceata species-group

32. *Eupithecia lanceata* (Hübner, 1825)

The egenaria species-group

33. *Eupithecia selinata* Herrich-Schäffer, 1861

34. *Eupithecia actaeata* Walderdorff, 1869

Note: Protected species in Hungary and listed in the Hungarian Red Data Book.

It is very rare and local in North Hungary (Bükk and Mátra Mountains).

35. *Eupithecia egenaria* Herrich-Schäffer, 1848

36. *Eupithecia pimpinellata* (Hübner, 1813)

37. *Eupithecia simpliciatata* (Haworth, 1809) (= *subnotata* (Hübner, 1813))

Note: Older Hungarian literature sources regularly mention it as *subnotata*.

The sinuosaria species-group

38. *Eupithecia sinuosaria* (Eversmann, 1848)

Note: It has only been known in Hungary for a few decades; it spreads slowly, but gradually.

The innotata species-group

39. *Eupithecia nanata* (Hübner, 1813)

40. *Eupithecia innotata* (Hufnagel, 1767)

41. *Eupithecia ochridata* Schütze & Pinker, 1968 (= *szelenyii* (Vojnits, 1969))

Note. The taxon "*szelenyii*" is described from Hungary (Locus typicus: Mátra Mountains) as junior synonym for *ochridata*.

42. [*Eupithecia unedonata* (Mabille, 1868)]

Note: Specimens reported (Vojnits, 1973) as *E. unedonata*, from North Hungary (Szécsény) were misidentified and are *E. ochridata*. Further observations are needed to confirm the occurrence of the species in Hungary.

The graphata species-group

43. *Eupithecia graphata* (Treitschke, 1828)

Note: The species described from Hungary (Locus typicus: Budapest [„Ofen“]). Protected species in Hungary and listed in the Hungarian Red Data Book.

44. *Eupithecia gemellata* Herrich-Schäffer, 1861

Note: There are very old Hungarian data from the Transdanubia (Fazekas 1977, Uherkovich 1978), but the specimens are lost. No records of the species are known from the last several decades.

The breviculata species-group

45. *Eupithecia breviculata* (Donzel, 1837)

The irriguata species-group

46. *Eupithecia irriguata* (Hübner, 1813)

47. *Eupithecia indigata* (Hübner, 1813)

The *distinctaria* species-group

48. *Eupithecia distinctaria* Herrich-Schäffer, 1848

The *centaureata* species-group

49. *Eupithecia extraversaria* Herrich-Schäffer, 1852
 50. *Eupithecia centaureata* (Denis & Schiffermüller, 1775) (= *oblongata* (Thunberg, 1784))
 Note: Older Hungarian literature sources regularly mention it as *oblongata*.

The *insigniata* species-group

51. *Eupithecia insigniata* (Hübner, 1790)

The *gueneata* species-group

52. *Eupithecia trisignaria* Herrich-Schäffer, 1848
 53. *Eupithecia gueneata* Millière, 1862
 54. *Eupithecia veratraria* Herrich-Schäffer, 1850
 55. [*Eupithecia cretacea fenestrata* Millière, 1874]
 Note: Known from Burgenland (Austria), therefore it may occur in the western Hungarian borderland (surroundings Kőszeg and Sopron). Habitats in this area are eminently suitable and nature reserves are significant. For the present, however, no confirmed occurrence or voucher specimen of this species is known from Hungary.

The *satyrata* species-group

56. *Eupithecia intricata* (Zetterstedt, 1839)
 57. *Eupithecia satyrata* (Hübner, 1813)
 58. *Eupithecia cauchiata* (Duponchel, 1831)
 59. *Eupithecia pernotata* Guenée, 1858 (= *aggregata* (Guenée, 1857))
 Note: There is only one published record (Mironov 2003) of the species *E. pernotata* based on a single specimen collected in the Northern part of the country (Bükk Mountains). The voucher cannot be found; it was originally identified and published as *E. cauchiata* (Vojnits et al. 1993). All material in the Hungarian collections identified as *Eupithecia cauchiata/pernotata* need revision.
 60. *Eupithecia absinthiata* (Clerck, 1759) (= *catharinae* Vojnits, 1969)
 Note: The author examined the holotype and paratype specimens of *Eupithecia catharinae* Vojnits, 1969 deposited in the Hungarian Natural History Museum. Additionally, more than 800 specimens were studied, all curated hitherto either as *E. catharinae* or *E. absinthiata* (Clerck, 1759). It has been found that *E. absinthiata* is a polytypic species, and the species-group name *catharinae* indicates a widely distributed intraspecific form; consequently *E. catharinae* is not a valid species, but a synonym of *E. absinthiata* (see Fazekas 2016).
 61. *Eupithecia expallidata* Doubleday, 1856
 Note: Due to earlier taxonomical problems, the exact geographical distribution of the *E. expallidata/absinthiata* species pair is only partially known in Hungary. *E. expallidata* appears to be restricted to very isolated colline and mountain populations e.g. in Mecsek Mountains, Bakony Mountains, West Hungarian Borderland, Mátra Mountains and Bükk Mountains, with very few localities on the Great Hungarian Plain (see on 61 maps). The distribution area of the species is static or perhaps regressive. *E. expallidata* is a k-strategist, adapted to constant environmental conditions. Conservation status in Hungary: species known only in nature reserves, vulnerable and gene flow is uncertain (Fazekas 2012).
 62. *Eupithecia valerianata* (Hübner, 1813)

The *assimilata* species-group

63. *Eupithecia assimilata* Doubleday, 1856
 64. *Eupithecia vulgata* (Haworth, 1809)
 65. *Eupithecia immundata* (Lienig & Zeller, 1846)

The *addictata* species-group

66. *Eupithecia addictata* Dietze, 1908

Note: The author notes that the voucher specimen of *E. addictata* known from the literature (Mironov 2003; Bátorliget, Eastern Hungary) cannot be located (Fazekas 2017). At the same time a new record for the occurrence of the species in Nagybjom (Fazekas 2017; County Somogy), in the south-western part of the country, has been provided (see on 66 maps). The species is very fragmented in the Western Palaearctic Region (see Fazekas 2017; Fig. 2). Only two specimens are known in Hungary so far, from 1987 and 1988. Since then, there are no new observations.

67. [*Eupithecia thalictрата* (Püngeler, 1902)]

Note: Known from Burgenland (Austria), therefore it may occur in the western Hungarian borderland (surroundings Kőszeg and Sopron). Habitats in this area are very suitable and nature reserves are significant. No confirmed occurrence or voucher specimen of this species is known from Hungary.

The *exiguata* species-group

68. *Eupithecia exiguata* (Hübner, 1813)
 69. *Eupithecia denotata* (Hübner, 1813)

The *millefoliata* species-group

70. *Eupithecia pauxillaria* Boisduval, 1840 (= *euphrasiata* (Herrich-Schäffer, 1861))

Note: Older Hungarian literature sources regularly mention it as *euphrasiata*.

71. *Eupithecia millefoliata* Rössler, 1866 (= *wettsteini* Vojnits, 1974)

Note: The taxonomic status of the species *Eupithecia wettsetini* Vojnits, 1974, described based on a single female specimen, remained unclarified for a long period. In the original description the habitus of the holotype specimen was not documented by any figure. It can be stated that the drawing provided for the original description does not correctly illustrate the dissected genitalia. Critical examination of the genitalia demonstrates with certainty that *E. wettsteini* is only an individual form of *Eupithecia millefoliata* Rössler, 1866 (see Fazekas 2017).

72. *Eupithecia spadiceata* Zerny, 1933

Note: The species is very local and rare in Hungary (Fazekas 2007, Mironov 2003). The voucher specimens were collected on the Fót (east of Budapest) and Kisvaszar (South Hungary, Mecsek Mountains). The species lives in the riverine willow-poplar of the Kisvaszar and in Fót in the rock steppe and slope steppes (see on 72 maps). Only very old data from the 1950s and 1953 are known; it has not been recorded from our country in the last few decades.

The *semigraphata* species-group

73. *Eupithecia icterata* (Villers, 1789)
 74. *Eupithecia succenturiata* (Linnaeus, 1758)
 75. *Eupithecia semigraphata* Bruand, 1850
 76. *Eupithecia impurata* (Hübner, 1813)

Note: The species *impurata* in Hungary is threatened and is in need of protection. During the revisionary work, all the specimens representing the data from

various Hungarian locations published by the literature turned out to be *E. semi-graphata*. Further studies are necessary to clarify the distribution of both species in Hungary.

77. *Eupithecia denticulata* (Treitschke, 1828)

Note: The species described from Hungary (Locus typicus: Budapest [„Ofen“]). It is a protected species in Hungary and is listed in the Hungarian Red Data Book. Very local and rare in Hungary (see on 77 maps).

78. *Eupithecia subumbrata* (Denis & Schiffermüller, 1775) (= *scabiosata* Borkhausen, 1784)

79. *Eupithecia orphnata* W. Petersen, 1909

80. *Eupithecia subfuscata* (Haworth, 1809) (= *castigata* (Hübner, 1813))

Note: The older Hungarian literature sources regularly mention it as *castigata*.

Distribution maps of the Hungarian Eupitheciini species (Tables 1-10)

Map information on the geographical distribution of species:

- black spot = a widespread, sometimes common species;
- grey spot = sporadic, or highly volatile populations;
- black circle = local or very rare, in the population abundance is low;
- white spot: no proven data or little information, no material examined.
- P= probable occurrence. These species are expected in the region, but they have not yet been found there;
- ? = uncertain publications the identified specimen is missing. Erroneous record. Published records that have been deemed incorrect, either because they have been documented as incorrect in a reliable publication or the specimens in question have been re-determined as another species by an expert.

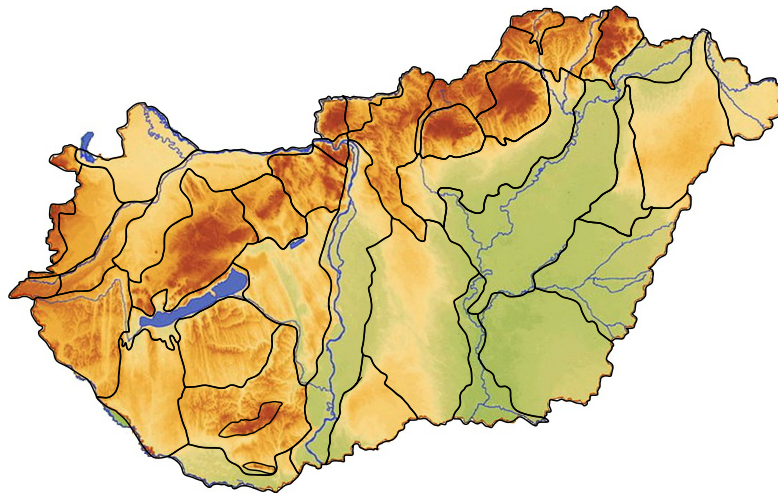


Fig 1. The 33 meso-regions of Hungary (made up of 230 micro-regions) differentiated into plains, hilly and mountainous landscape. The species maps clearly showed the concentration, by collectors, on the wilderness areas of Hungary's hills and mountains. Other landscapes, notably the larger part of the Great Plain, are poorly studied in comparison.

(© Fazekas I. | 2020 | sketchy representation)

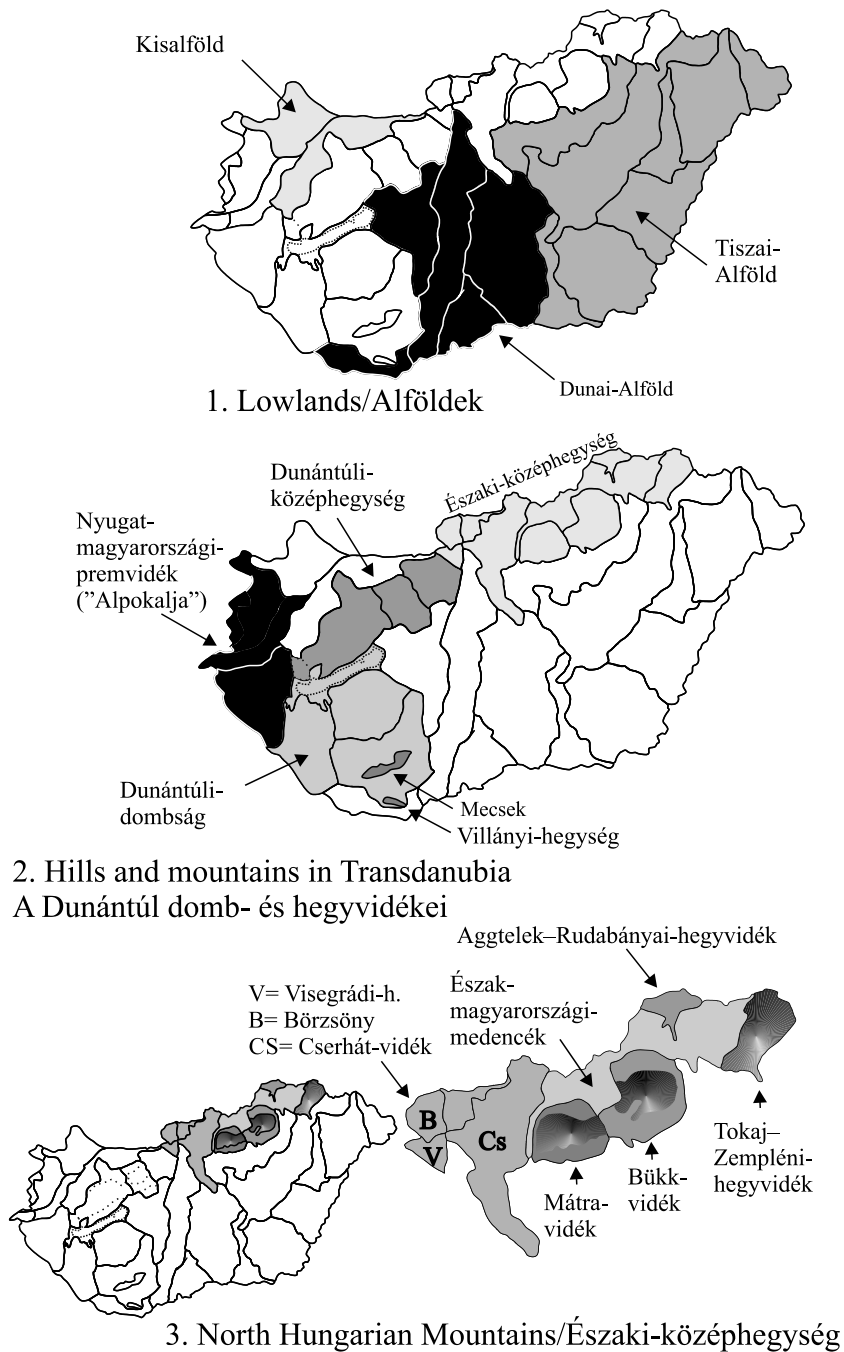


Fig. 2. Hungarian names of the examined geographical regions

Table 1.
Maps 1–8.

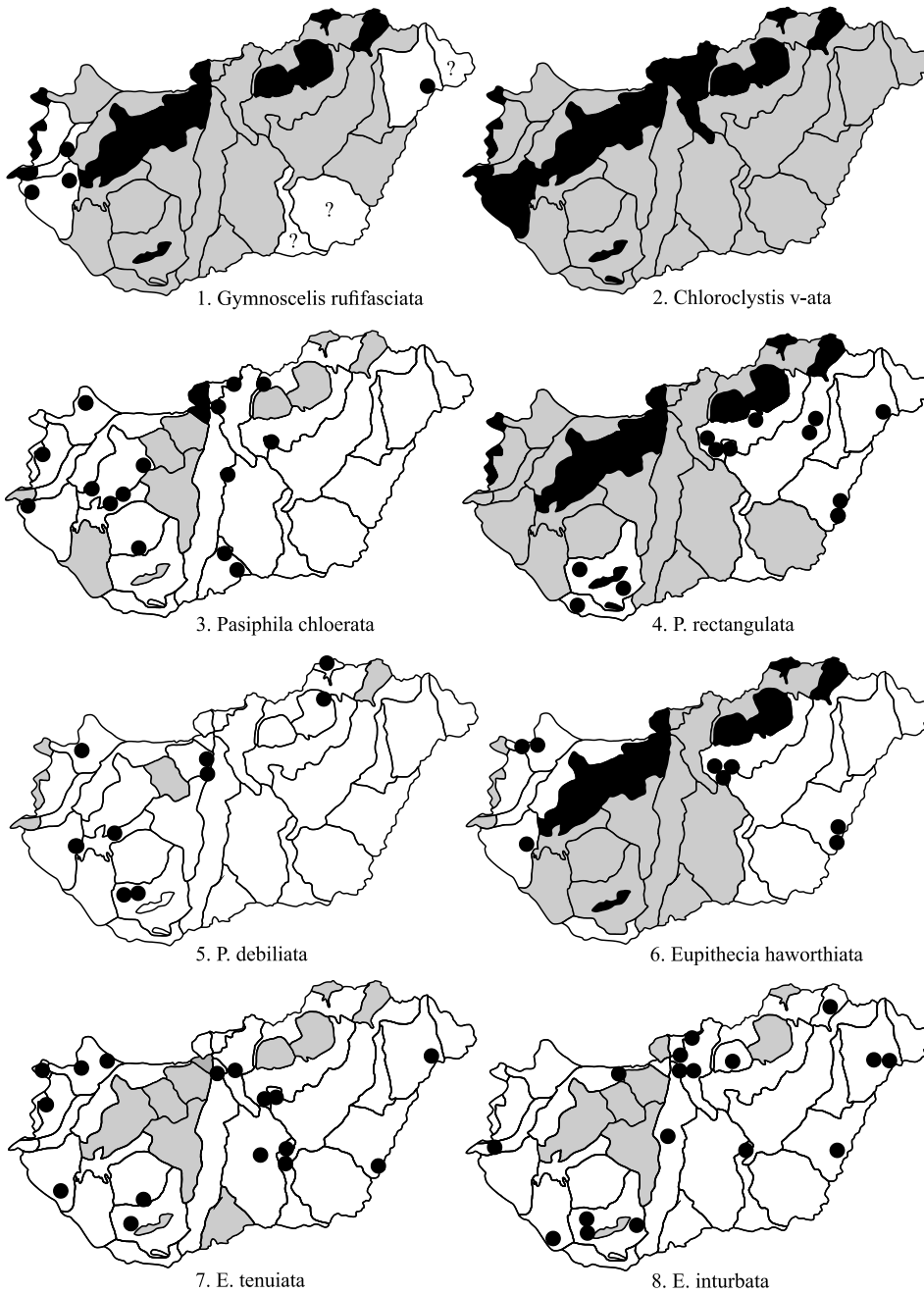


Table 2.
Maps 9–16.

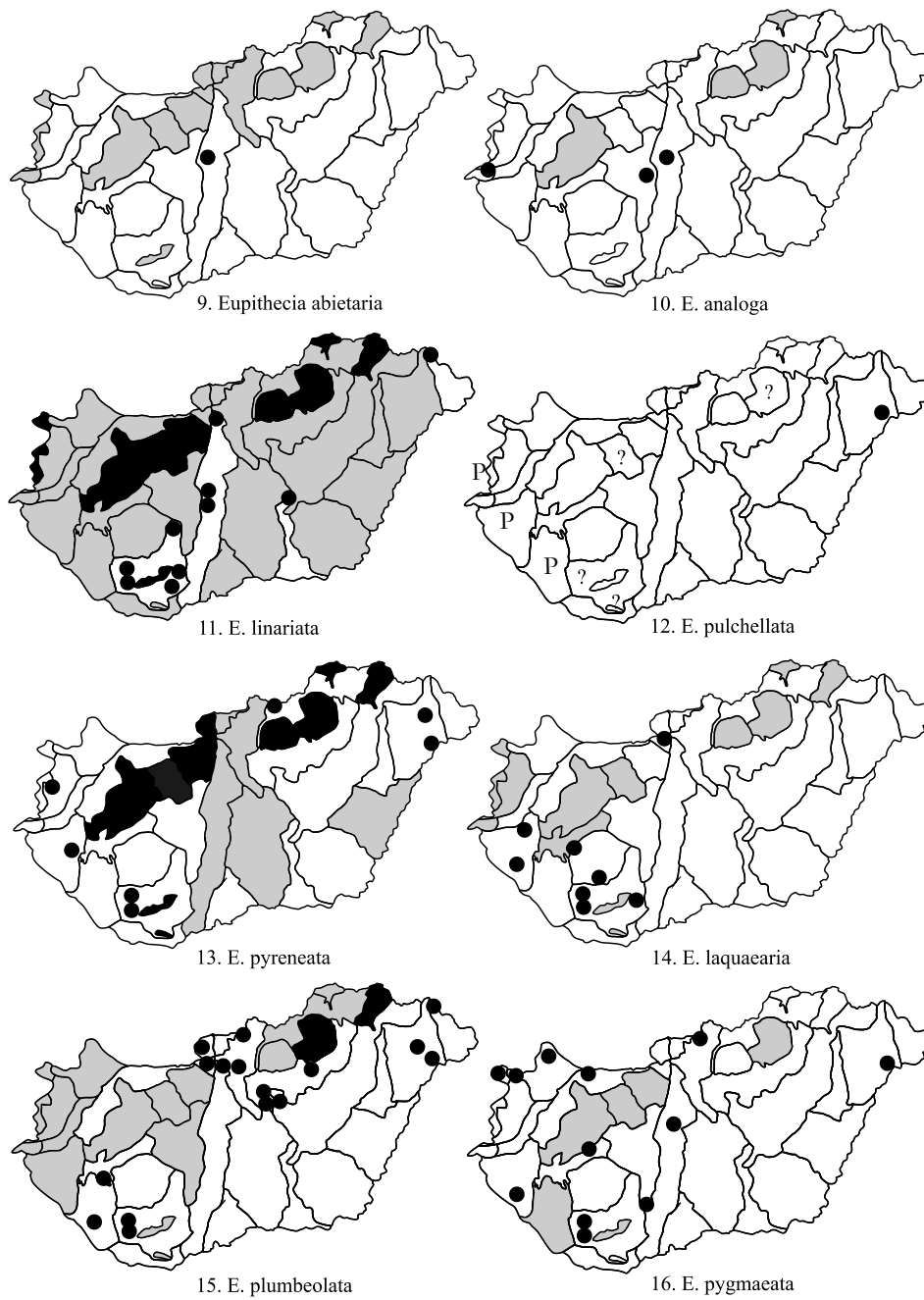


Table 3.
Maps 17–24.

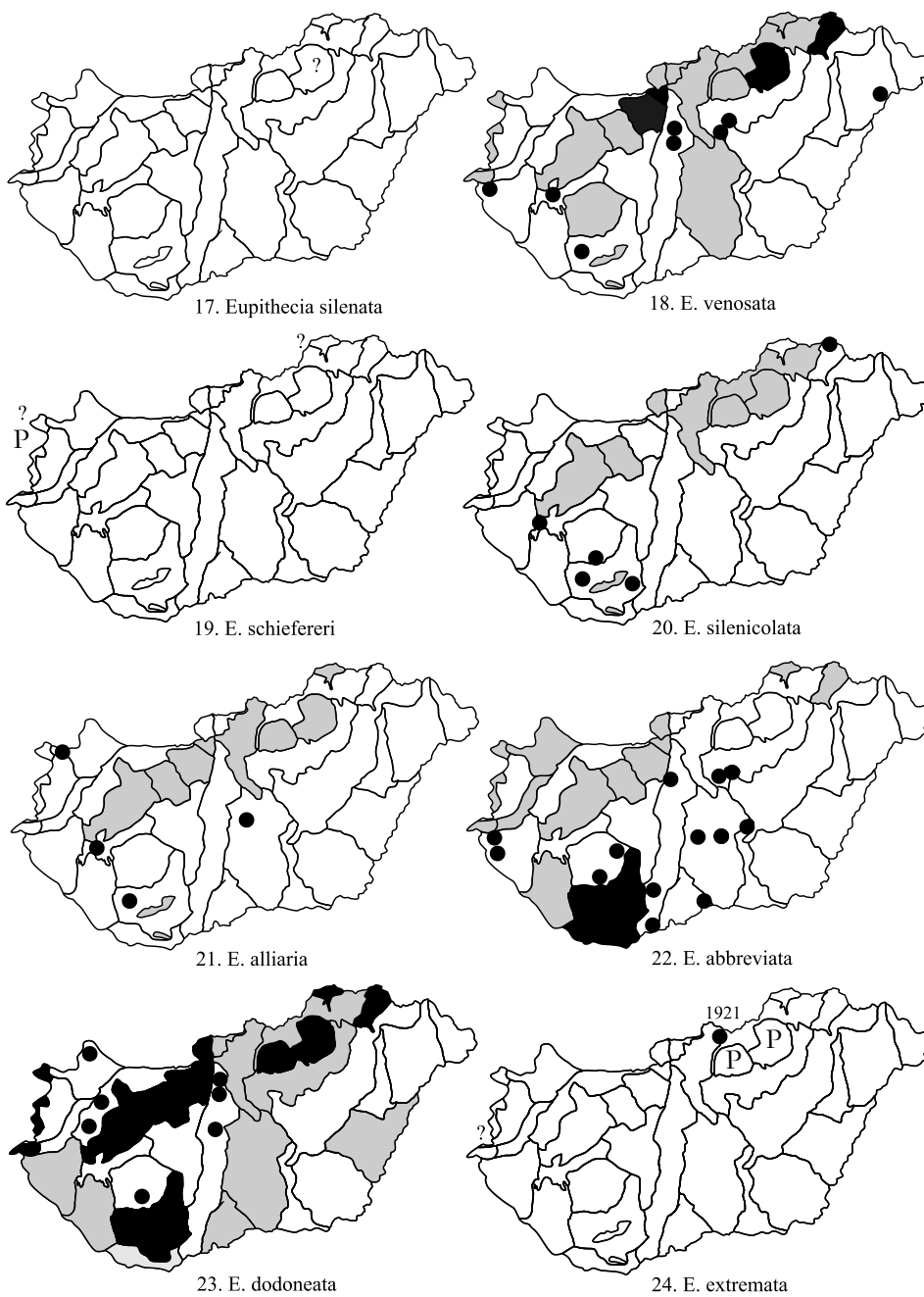


Table 4.
Maps 25–32.

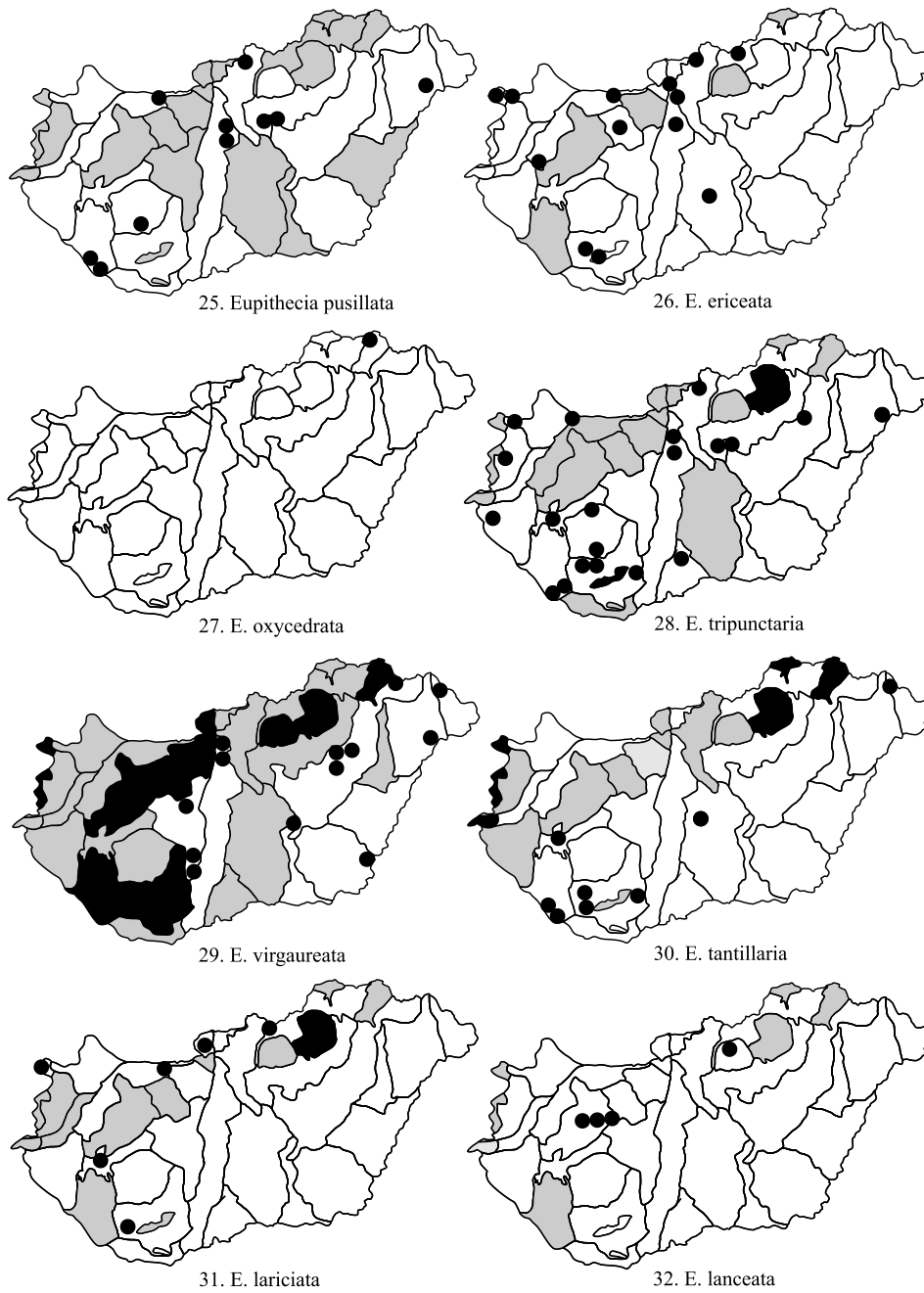


Table 5.
Maps 33–40..

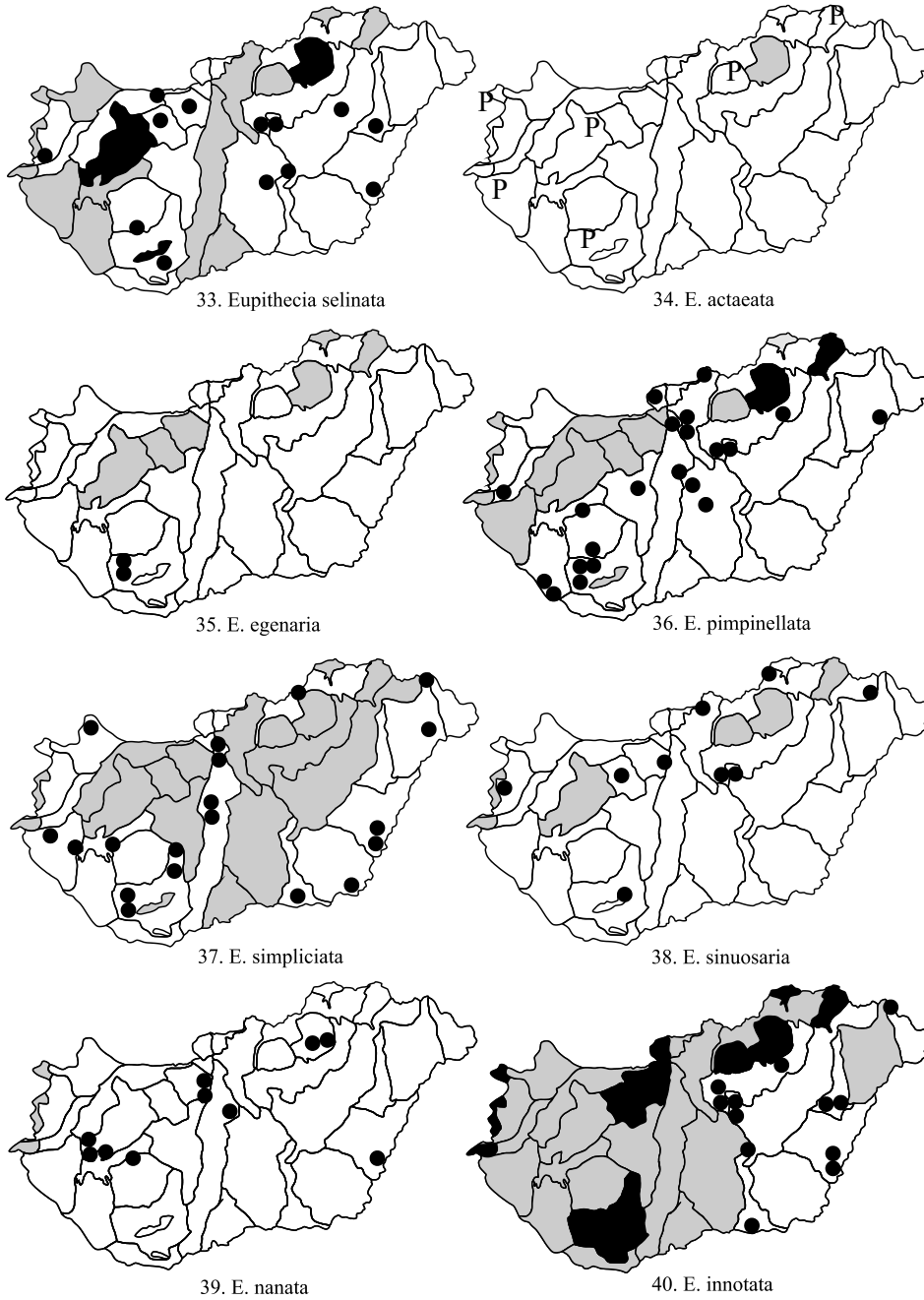


Table 6.
Maps 41–48.

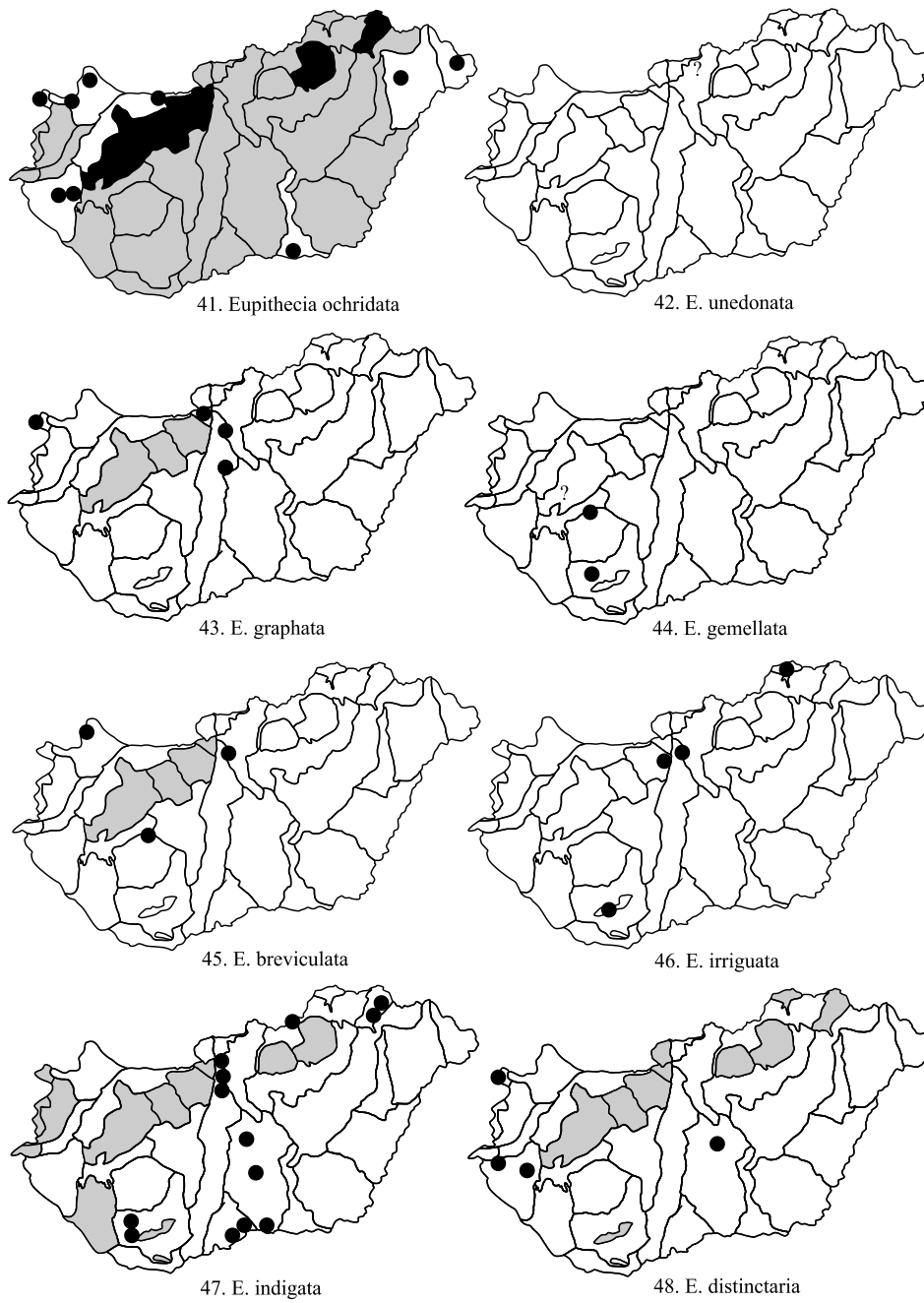


Table 7.
Maps 49–56.

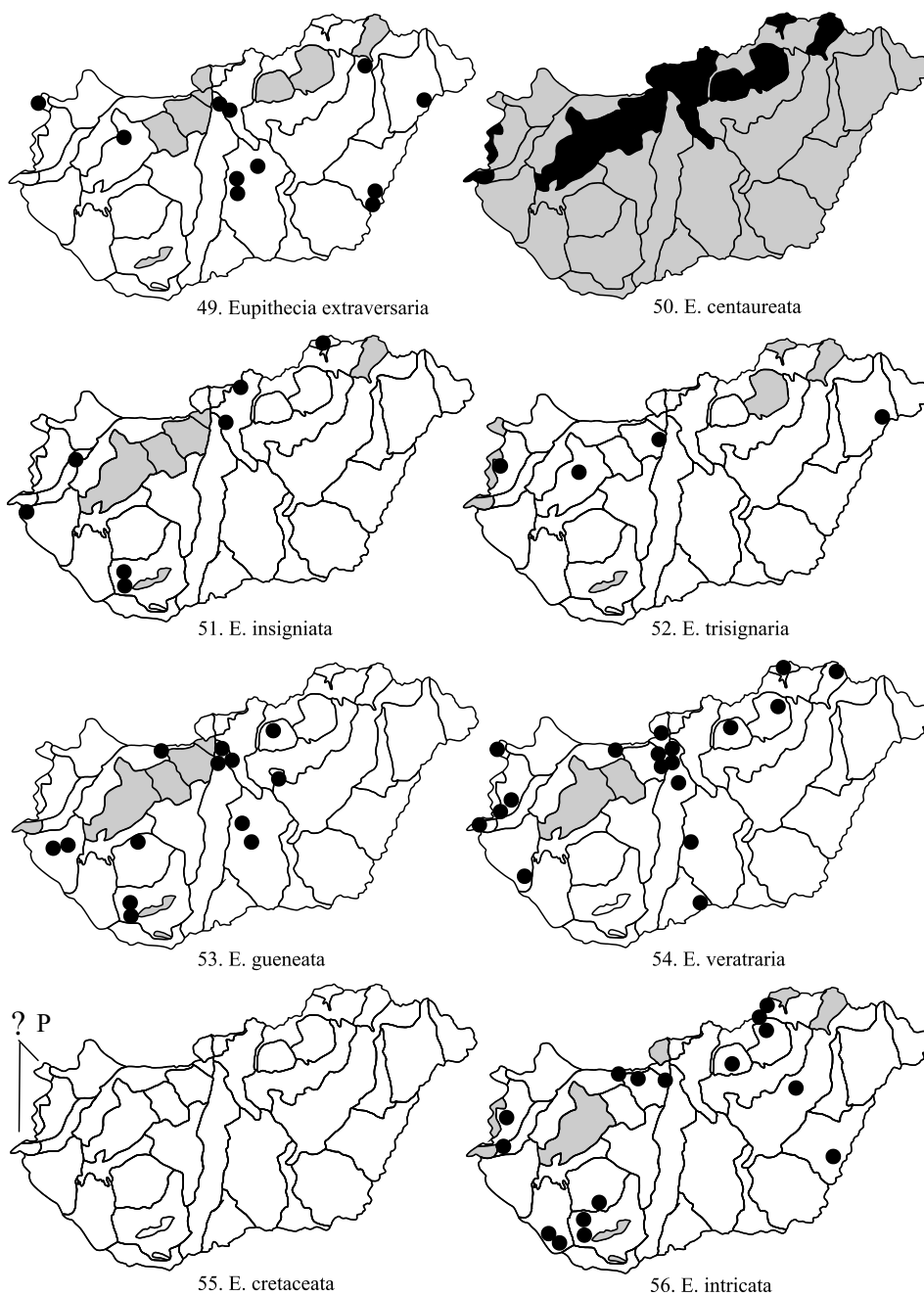


Table 8.
Maps 57–64.

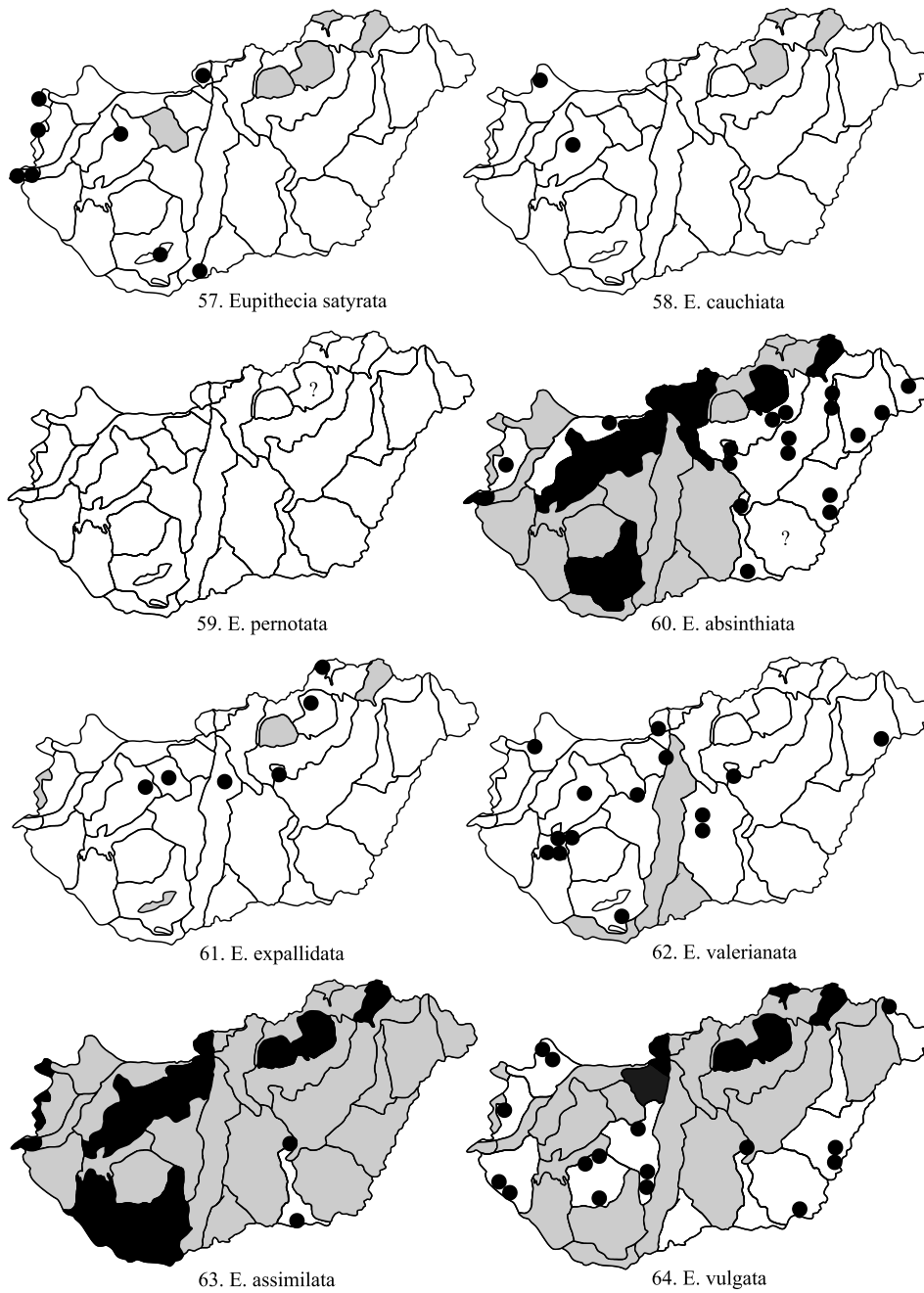


Table 9.
Maps 65–72.

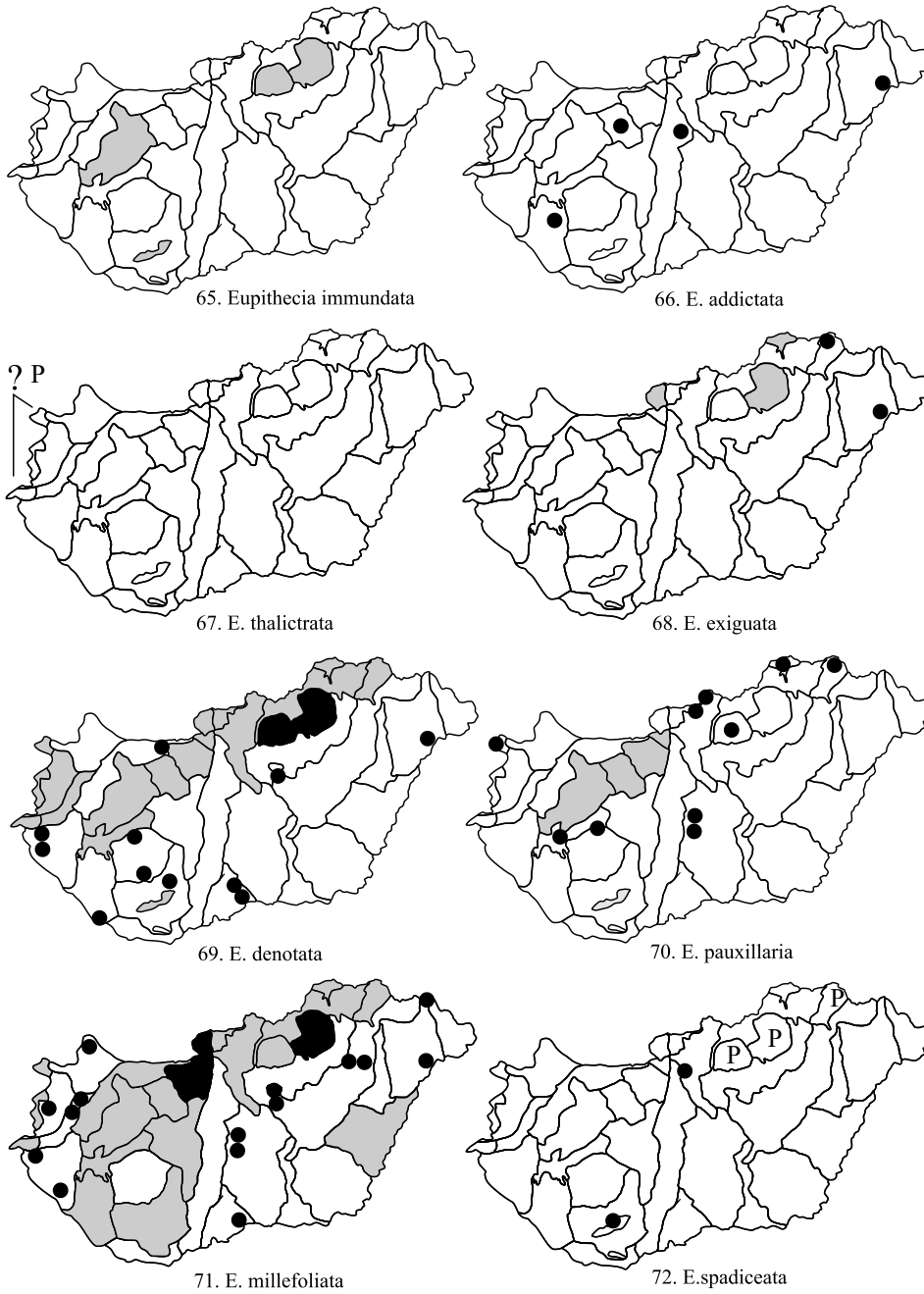
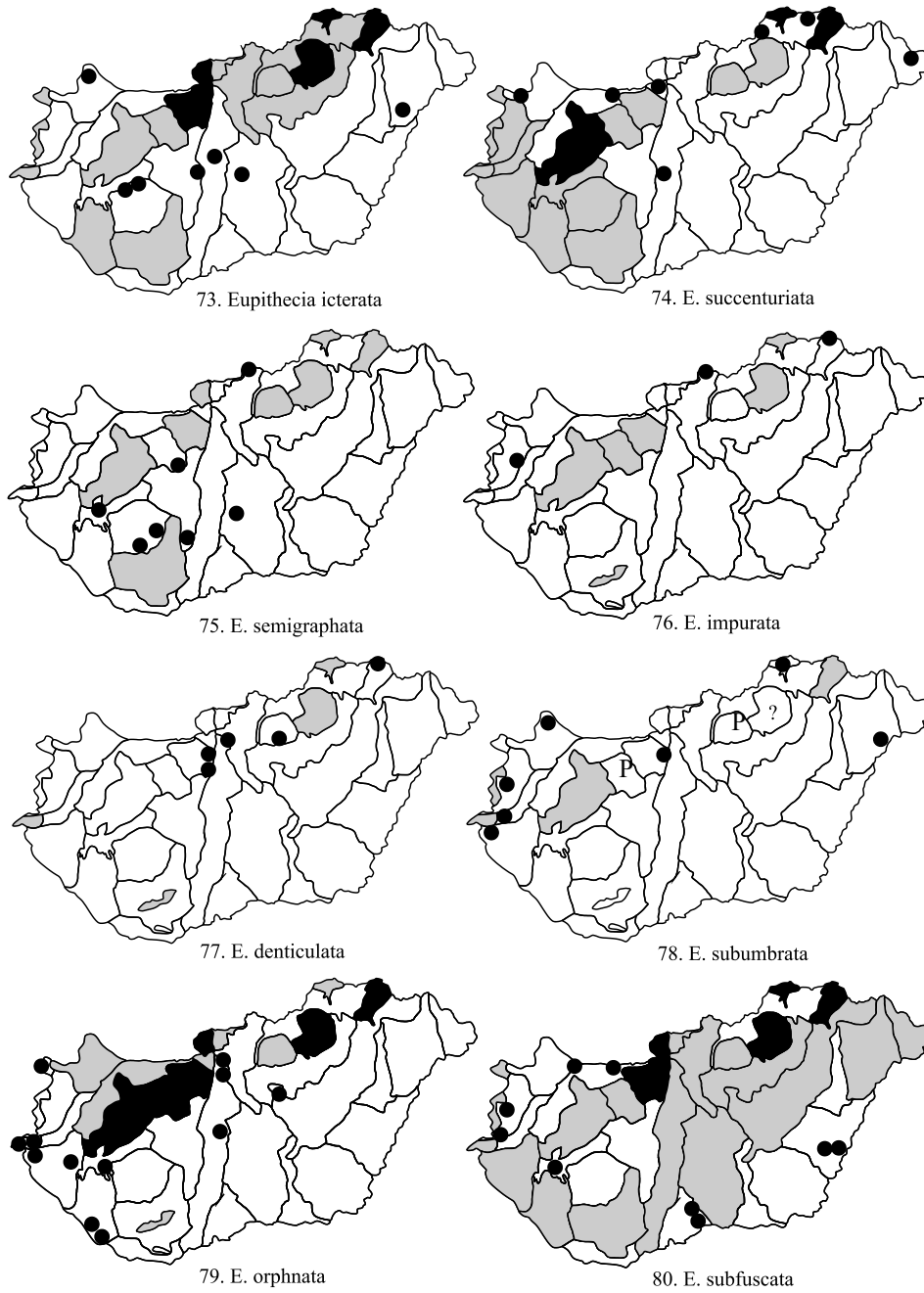


Table 10.
Maps 73–80.



Selected references

The list of references is by no means comprehensive but has been provided should the reader wish to enquire further into the various aspect of Hungarian Eupitheciini fauna.

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