

## *Zygaena (Mesembrynus) brizae* (ESPER, 1800) in Poland

(Lepidoptera, Zygaenidae)

by

JERZY S. DĄBROWSKI\* & ADAM GÓRNICKI\*\*

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\* JERZY S. DĄBROWSKI, 31-126 Kraków, ul. Grabowskiego No. 8/4; e-mail: dabrowski.contact@gmail.com

\*\* ADAM GÓRNICKI, 37-700 Przemyśl, ul. Przemysława No. 9 b; e-mail: gornicki.adam31@gmail.com

**Abstract:** The authors present their own observations carried out in the years 1999-2014 and an analysis of the population in the newly discovered national localities. They discuss the occurrence of *Z. (M.) brizae* (Esp.) on Polish territory and in the neighbouring countries: the Czech Republic, Slovakia and Ukraine. Proposals for the active protection of this endangered species of the Polish lepidoptero fauna have been submitted.

**Key words:** Burnets, taxonomy, biology, ecology, active protection, parasites. Southern Poland: Pieprzowe Mts., Pieniny National Park, Przemyśl Plateau.

**Introduction:** This Pontic-Mediterranean species reaches in southern Poland the northern limit of the geographical coverage (Fig. 1). In the whole territory of the range of the species (Fig. 2) its localities are very local, scattered and isolated. Nominative subspecies described from the vicinity of Budapest encompasses the southern Poland, Slovakia, the Czech Republic, Hungary, Romania, lower Austria, Ukraine, the Crimea, and probably southern Russia.

Because of the extinction of *Z. (M.) brizae* (Esp.) in well-known rural localities in the Pieprzowe Mts., Pieniny Mts., and Trzciniec, near Przemyśl, it was considered to be possibly extinct in Poland [ExP?] (DĄBROWSKI & KRZYWICKI, 1982; DĄBROWSKI & ŚLIWIŃSKI, 1992).

**Issue:** Individual variability of moths of the *Zygaena* F. species is reflected in the local populations in most species belonging here in a complex of taxonomic characteristics shaped both by the features transmitted by heredity, as well as the effect of reaction to environmental factors (BERGMANN, 1953). This gives lepidopterists opportunities to describe many new intraspecific taxa. The systematics of burnets is incomparable with that of most other groups of Lepidoptera's number of taxa, starting with the so-called. aberration [ab.] and form [f.] to the subspecies [ssp.] (TREMewan, 1967). This issue has not missed the *Z. (M.) brizae* (Esp.) species, where several subspecies have been described as well. Depending on current trends, the authors of the following monographs of Zygaenidae, guided by their own criteria, have accepted a diverse number of them as follows:

### I. HOLIK & SHELJUZHKO (1954/1955):

1. ssp. *brizae* ESPER, 1797. - One taxon throughout the species' range.

### II. REISS & TREMEWAN (1967):

1. ssp. *brizae* ESPER 1797. Hungary, Lower Austria, Moravia, southern Poland, Macedonia, Bosnia.
2. ssp. *ochrida* HOLIK, 1937. Ochrid, Petrin Planina, Macedonia.
3. ssp. *alamuntis* KOCH, 1942. Belkovic, Olmutz, Moravia.

### III. HOFMANN A. & TREMEWAN (1996):

1. ssp. *brizae* (ESPER, 1800). Poland, Czech Republic, Slovakia, Austria, Hungary, Romania, Ukraine (Crimea).
2. ssp. *vesubiana* LE CHARLES, 1933. France (Alpes Maritimes, Alpes-de-Haute Provence, Drome, Hautes Alpes, Isere). Italy (Piedmont, Liguria).
3. ssp. *drvarica* RAUCH, 1977. Bosnia and Herzegovina: Drvar (8 km SW.), 1000 m („Passhöhe“).
4. ssp. *ochrida* HOLIK, 1937. Macedonia (Serbisch - Mazedonien): Petrin Planina (41005°N 20053°E). Ohrid (Ochrid). Albania, Macedonia, northern Greece.
5. ssp. *trikalica* REISS, 1977. Greece: Pelopónnisos (Peloponnes), Trikkala (380 00'N 22026'E), 18 km SW.
6. ssp. *brussensis* REISS, 1929. Turkey: Bursa (Brussa).
7. ssp. *lycaonica* REISS, 1935. Turkey: Icel. NW. of Adana. Bolkar Daglan (Bukghar - Maden).
8. ssp. *corycia* STAUDINGER, 1871. Turkey: Toros Daglan [Lydia (Taurus); Syria]. Turkey (eastern Torsos Dagan).
9. ssp. *staudingeriana* REISS, 1932. Lebanon: Bharre (Bscharre). Syria. Lebanon, Israel.
10. ssp. *araratensis* REISS, 1935. Turkey: Kras, Kazkoparan (Kasikoparan) (40002°N 43026°E). Turkey (Trabzon to Kras), southern Georgia, Armenia, Azerbaijan.
11. ssp. *muchei* ALBERTI, 1971. Russia: Bol'shoy Kavkaz (Caucasus), Kabardino-Balkaria, southern slopes of the Baksan Valley, near Itkol on the Elbrus, 2000-2200 m. Russia (north-western Bol'shoy Kavkaz).
12. ssp. *tibilisica* REISS & REISS 1973. Georgia: Tbilisi.

### IV. NAUMANN, TARMANN & TREMEWAN (1999):

1. ssp. *brizae* (ESPER, 1800). Southern Poland, Austria, Slovakia, Hungary, Ukraine and possibly southern Russia.
2. ssp. *corycia* STAUDINGER, 1871. Eastern Torsos, Turkey.
3. ssp. *araratensis* REISS, 1935. North-eastern Turkey, southern Georgia.
4. ssp. *muchei* ALBERTI, 1971. North-western Caucasus.

### V. DE FREINA & WITT (2001):

1. ssp. *brizae* (ESPER, 1800), type locality: Hungary, Buda (Ofen) [= Budapest], Süd-Polen, Tschechien, Österreich, Slovakei, Ungarn und Rumänien bis in die Ukraine.
2. ssp. *vesubiana* LE CHARLES, 1933. SO-Frankreich; NW Italien (Piemont, Liguria).
3. ssp. *drvarica* RAUCH, 1977. Bosnien-Herzegovina.
4. ssp. *ochrida* HOLIK, 1937. Albanien und Kosovo über Makedonien bis Nordgriechenland.
5. ssp. *trikalica* G. REISS, 1977. Griechenland, Peloponnes.
6. ssp. *brussensis* H. REISS, 1929. NW Türkei (Umg. Bursa).
7. ssp. *lycaonica* H. REISS, 1935. Anatolien mit Ausnahme der türkischen Südküste.
8. ssp. *corycia* STAUDINGER & WOCKE, 1871. Südtürkei, östlicher Taurus (Provinzen Adana, Hatay).
9. ssp. *staudingeriana* H. REISS, 1932. Westsyrien, Libanon, Palestina
10. ssp. *araratensis* H. REISS, 1935. Türkische Schwarzmeer-Region (Provinz Trabzon, Zigana-Pass).
11. ssp. *muchei* ALBERTI, 1971. Kaukasus, Elbrus-Region.
12. ssp. *tibilisica* REISS & REISS, 1973. Zentralgeorgien (Tbilisi), 500-600 m. Central Georgia.

An analysis of the taxonomic characteristics of series of moths from around Przemyśl leads to the conclusion that these populations belong to nominative subspecies - *Z. (M.) brizae brizae* (ESPER, 1800), similar to those still preserved in the national collections of specimens from historical Polish localities, in which the species is already extinct. The population from the highlands of Przemyśl shows very little individual variability in drawing and habitus coloration, and the morphology of the male and female genitalia.

In its south-west range in Central Europe, NICKEREL (1897) and JOUKL (1910) believed that this species occurred in the 19<sup>th</sup> century. In the area of the Czech Republic. STERNECT (1929), on the other hand, expressed doubt due to the lack of evidential specimens<sup>1</sup>. Concerning Moravia, SKALA (1912, 1931-1932) stated that it was present in the Olomouc and Mikolov region before 1910, and in Novy Jicin and Bilovec before 1932. In the collection of M. SOLDAT there is a single specimen from Košir distr. Olomouc and one specimen from „Hombok“ Moravia (= Hlubočky u Olomouce) without a year indicated year on the data labels. According to SOLDAT (1987), specimens were collected in the period between 1920-1930. B. STARÝ had in his collection specimens from 1940 and 1942 from the Košir (leg. KUDLA) locality. In the collection of F. FERNANDEZ-RUBIO there is one specimen of Moravia centr., Blansko env., 1998-07-04 (leg. P. VITEC).

From Slovakia localities are mentioned by ALBERTI (1958), HOLIK & SHELJUZHKO (1954/1956), HRUBÝ (1964), REIPRICH (1960) [Slovak Paradise], and others. Our collection includes specimens of *Z. (M.) brizae* (Esp.) from several Slovak localities [coll. DĄBROWSKI, leg. JAN PRUSZYŃSKI (6 ♂♂, 1 ♀ - Červoný convent), and leg. ADOLF RUDOLF (24 ♂♂, 19 ♀♀ from several other Slovak sites], and one ♂ Slovakia mer., Kováčová, mounds, Chlaba, 1976-07-08 [leg. P. VITEC, ex coll. F. FERNANDEZ RUBIO].

In addition, on the eastern Polish border with Ukraine ROMANISZYN & SCHILLE (1929) mentioned: „At the foot of devilish Rocks 1 specimen on 1 July.“ In the area of the then Polish Lviv we have no other data of the presence of *Z. (M.) brizae* (Esp.). They do not mention it in their study, nor even does HOLIK (1932). However, it can be presumed that this could be due to poor investigation of reliable local habitats. In the Crimea it is very local and rare (DĄBROWSKI, 1989).

NOWICKI (1865) mentions it from Poland. ROMANISZYN & SCHILLE (1929), after KARPOWICZ (1930), describe it as a very rare species, reported only from the Sandomierz areas at the end of July, and, as mentioned above, as a single specimen from the vicinity of Lviv. HOLIK (1939 [Taf. I., Abb. 34: ♂]) published a photograph of *Z. (M.) brizae* (Esp.) from the Sandomierz areas (leg. KARPOWICZ), and mentioned the next locality - Trzciniec near Przemyśl (leg. B. OSTROWSKI, 1926-06-25). In summary, OTTO HOLIK stated: „restricted to southern Poland, seems not to differ from the typical race.“ In the Pieniny National Park TADEUSZ MIODOŃSKI discovered in 1947, on the southern slope of the Nowa Góra Mtn., on a mountain mid-forest meadow, a relatively large population of this species (BLESZYŃSKI et al., 1965). Thereafter these burnets were intensively captured by EDWARD PALIK, STANISŁAW SKRABANIA, SERGIUSZ TOLL WILHELM WĘGLARSKI, ROMAN ŻUKOWSKI et al. This locality, however, has been afforested by spruce and, after several years, the local population has been systematically exploited by collectors to extinction. Single specimens were collected in the years 1950/1960 in the meadow below the Szopka mountain pass and on the way to the Trzy Korony, and Macelowa Mts. (leg. MARIAN BIELEWICZ, E. PALIK, R. ŻUKOWSKI et al.). On the right side of the Dunajec, in the area of the Slovak Red Monastery, several specimens have been collected by JAN PRUSZYŃSKI (1963-07-28). In total, within several years at least 150 imagines were caught in the area of the national park, also caterpillars and pupae for breeding<sup>2</sup>. Since the second half of the 1960s it no longer exists in the Polish Pieniny Mts. (DĄBROWSKI, 1965, 1982, 2007; ZARZYCKI & DĄBROWSKI 1986). It ceased to exist much earlier in a locality near Góry Pieprzowe Mts., near Sandomierz. Also its occurrence after the 2<sup>nd</sup> World War has not been confirmed in the locality in Trzciniec<sup>3</sup> near Przemyśl.

**Habitat characteristics:** In July 1997 a new locality of this species was discovered in Poland. In the localities that have been studied, there are two very rare and little known steppe species - indicative of the biotopes of warm xerothermic grasslands: the cicada - *Cicadetta montana* (SCOPOLI, 1772) (Hemiptera: Cicadidae) (Fig. 47) [sometimes mistakenly marked as *Cicadetta podolica* (EICHWALD, 1830)], and the European Preying Mantis - *Mantis religiosa* LINNAEUS, 1758. (Mantidae: Mantidae). In the locality for *Z. (M.) brizae brizae* (Esp.) we have found a cocoon of this mantis with live nymphs (larvae). Both species are listed in the Polish Red Book of Animals (2004). The main threat for burnets' localities in this region is the succession of shrubs and trees on xerothermic grasslands. Invasive plants which overgrow biotopes include maple *Acer campestre* L., Scots pine *Pinus sylvestris* L., shrubs of wild dog rose *Rosa canina* L., and blackthorn *Prunus spinosa* L.

In the Pieniny Mts., the caterpillars feed on woolly (bullhead) thistle *Cirsium eriophorum* (L.) SCOP. In contrast, populations examined at Wyżyna Przemyska feed on *Cirsium decussatum* JANKA (Figs. 5, 6, 7, 12). Older caterpillars can supplement these food-plants by utilising marsh thistle *C. palustre* (L.) SCOP., creeping thistle *C. arvense* (L.) SCOP. (Fig. 8), and dwarf thistle *C. acaule* SCOP.

Imagines feed on the nectar of several species of flowers (Figs. 10, 13, 15, 16). However, they prefer the flowers of scabiouses *Scabiosa* L. and thistles *Cirsium* L. They cannot however use the flowers of woolly (bullhead) thistle and *Cirsium decussatum* JANKA, which bloom a few weeks after their flight.

The flight period of *Z. (M.) brizae brizae* (Esp.) (Figs. 10-15) starts early; sometimes as early as mid-June. Then, on average, within a few days to a week the imagines emerge: *Z. (M.) minos* ([DEN. & SCHIFF.]) (Fig. 16), *Z. (Z.) viciae* ([DEN. & SCHIFF.]) (Fig. 17) and *Z. (A.) loti* ([DEN. & SCHIFF.]) (Fig. 18). Note: during the period of our observations we did not find in these localities burnets that theoretically could have been there expected, especially considering the abundance of their food plants: *Z. (M.) purpuralis* (BRÜNN.), *Z. (Z.) filipendulae* (L.), *Z. (Z.) loniceriae* (SCHEV.) and *Z. (Z.) ephialtes* (L.).

### Conclusions

Of the complex of reasons favouring the extinction of this species the most important are:

1. 1. The disappearance of habitats due to human activity:

a) Forest management: routine afforestation of glades and wastelands, hauling and storage of wood in the burnets' biotopes by using

1) It cannot be ruled out that the voucher specimens from these areas have been destroyed earlier.

2) According to information provided to us by the curator Eng. ROMAN ŻUKOWSKI, 43 of the caterpillars collected on the Nowa Góra Mts. and the ex larva imagines raised from them, were accidentally destroyed in 1965 on the setting boards in the PPN Museum in Krościenko nad Dunajcem.

3) The date of extinction of *Z. (M.) brizae* (Esp.) in this locality could not be established.

heavy equipment (Figs. 3, 4).

- b) Husbandry: positive impact: cleaning and widening of forest - meadow ecotones by cattle grazing; negative impact: flowing (do the authors mean ploughing?) habitats; excessive (several times in the season) mowing of meadows.
- c) Mass tourism: constructing new roads, trampling of biotopes, lighting fires and other fire hazards.
- d) Industrial contamination of habitats, urbanization.
- e) Acquisition of specimens for collections (leading to the extermination of small populations).
- 2. 2. Disappearance and maintenance of burnet biotopes due to natural causes:
  - a) Expansion of the forest, dominant plant formation on steppe habitats and dry xerothermic grassland ecotones (MICHALIK et al., 2004).
  - b) Geological factors slowing down and inhibiting the expansion of the forest: shallow soil substrate with outcrops of limestone rocks hindering rooting and delaying the development of trees and shrubs (KOZŁOWSKA, 1931).
  - c) Climatic and atmospheric anomalies destroying habitats (e.g., hurricanes, torrential rain and hail).
  - d) Specific and non-specific parasites (KAŻMIERCZAK & DĄBROWSKI, 2003), and other natural enemies, which in the case of most burnets species, have a significant indirect impact on their numbers, contributing in cases of small populations to their extinction. This has taken place in several localities on the meadows on the forest slope above Makowa village. It was observed there that a population of approx. 40 specimens died out within two years.
- 3. 3. Active protection:
  - a) Only in partial reserves, where active protection of the habitats, consisting of bush removal and deforestation of overgrown grasslands, is practised to determine the optimal buffer zone boundaries (i.e., the protection zone). Here extensive cattle grazing is advisable.
  - b) Introductions of imagines collected in copula on typical localities by the method tested previously on two endangered species (DĄBROWSKI, 1991), thus promising the survival and development of the population of endangered species (Figs. 1, 2).

Zygaenidae survival, including the species discussed, depends upon the existence of a certain minimum of open spaces at the junction of environments in tarso (contact) - meadow and forest ecotones. They are at the same time refuges of a significant number of thermophilic invertebrate species (DĄBROWSKI & WITKOWSKI, 1990). It is an essential condition, especially on the northern border of its range, where forest ecosystems prevail. In this climate zone in central-eastern Europe forests are the dominant formation, displacing warm xerothermic grasses. Pioneering research on the relics of steppe ecosystems and the need for their active protection in southern Poland has been published by Prof. ANIELA KOZŁOWSKA (1931, 1931). Despite this knowledge, only strict reserve steppe deprived of the protection zone (buffer zone) has been invoked. Their status excluded any interference in the protected ecosystems, which made them liable to destruction. (DĄBROWSKI, 1961, 1962, 1967, 1974, 1977, 1981; MICHALIK et al., 2004).

Identical errors have been committed, e.g., in the Swiss reserves („Naturschutz“), where in 1972 we observed the effects on the steppe grasslands after several years of their operation.

In Poland a depopulation of burnets (Zygaenidae) has been observed since the mid-20<sup>th</sup> century, having been reported in the literature from the sites where their occurrence had been noted. Up to the first half of the 1950s most of the species occurred almost en masse - for example, in Jura Krakowsko-Częstochowska, Wyżyna Miechowska, Góry Pieprzowe Mts. (DĄBROWSKI, 1965; HOLIK, 1939), or in Pieniny Mts. (DĄBROWSKI, 1982 2007; HOLIK, 1939; ZARZYCKI & DĄBROWSKI, 1986). In the region of Zachodnie Bieszczady Mts. and Pogórze Przemyskie (Tab. I) they were already less numerous (BIELEWICZ, 1973; HOLIK, 1939; SCHEFFNER, 1925; SCHRAMM, 1946). However, in the Polish Tatra Mts. they were rare, only single examples being recorded (DĄBROWSKI, 1956 2007; HOLIK, 1939; NIESIOŁOWSKI, 1929). In the second half of the twentieth century, there was further regression and extinction of most burnets species in the above-mentioned regions, although sometimes with some local exceptions and significant fluctuations in the number of imagines (DĄBROWSKI, 2007).

At the same time the period of incubation and the flight periods of most Polish burnets species became shortened. This problem has become especially visible since the 1980s up to the present and requires further research.

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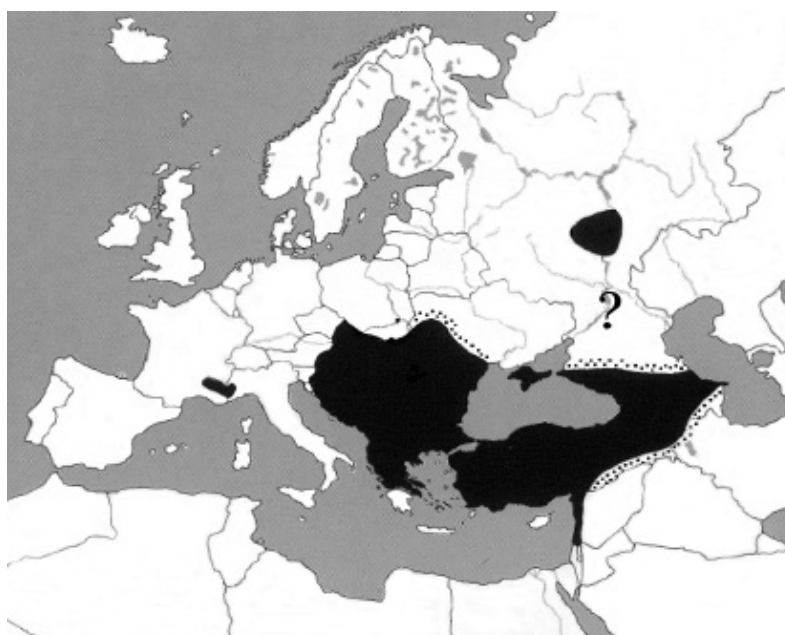


Fig. A: Distribution map of *Zygaena (M.) brizae* (ESPER, 1800) According to de FREINA & WITT (2001), partly changed.

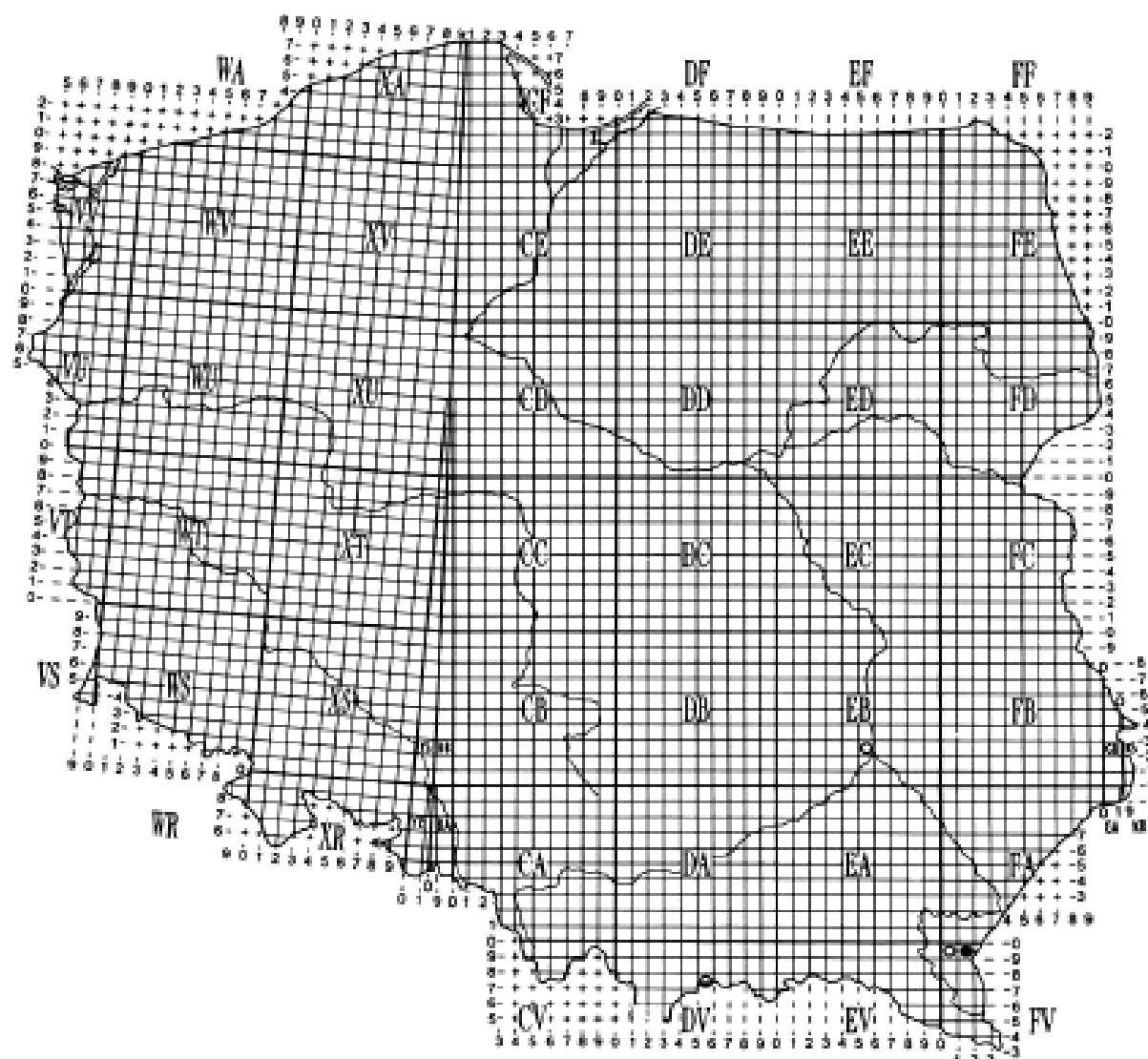


Fig. B: Occurrence of *Zygaena (M.) brizae* (ESPER, 1800) in Poland.

Found until the year: ○ - 1939; ◐ - 1960; ● - 2015.

| Nr | Species                                   | SCHEFFNER (1925) | SCHRAMM (1946) | BIELEWICZ (1973) | Author's observations, 2000-2015 |
|----|-------------------------------------------|------------------|----------------|------------------|----------------------------------|
| 1  | <i>Procris (P.) statice</i> (L.)          | ●                | ●              | ●                | ●                                |
| 2  | <i>Zygaena (M.) cynarae</i> (ESP.)        |                  | ●              |                  | ■                                |
| 3  | <i>Z. (M.) brizae</i> (ESP.)              |                  |                |                  | ●                                |
| 4  | <i>Z. (M.) minos</i> ([DEN. & SCHIFF.])*) |                  |                | ●★               | ●                                |
| 5  | <i>Z. (M.) purpuralis</i> (BRÜNN.)        |                  |                |                  | ■ ?                              |
| 6  | <i>Z. (Z.) loti</i> ([DEN. & SCHIFF.])    |                  |                | ●                | ●                                |
| 7  | <i>Z. (Z.) osterodensis</i> REISS         |                  | ●              |                  | ■                                |
| 8  | <i>Z. (Z.) viciae</i> ([DEN. & SCHIFF.])  |                  |                | ●                | ●                                |
| 9  | <i>Z. (Z.) ephialtes</i> (L.)             |                  |                | ●                | ■                                |
| 10 | <i>Z. (Z.) angelicae</i> OCHS.            |                  |                | ●                | ■ ?                              |
| 11 | <i>Z. (Z.) filipendulae</i> (L.)          |                  |                | ●                | ●                                |
| 12 | <i>Z. (Z.) trifolii</i> (ESP.)            |                  | ●              | ■                | ■                                |
| 13 | <i>Z. (Z.) lonicerae</i> (SCHEV.)         |                  |                |                  | ●                                |

Tab. 1. The disappearance of burnet species (Zygaenidae) in the Zachodnie Bieszczady Mts. and Pogórze Przemyskie: ● - species recognized; ■ - species no longer found; ★ - at that time species were not distinguished..



Fig. 1: Collection of *Zygaena (Mesembrynus) brizae* (ESPER, 1800) in copula for resettlement

Fig. 2: Releasing *Zygaena (Mesembrynus) brizae* (ESPER, 1800) in a selected habitat.

Fig. 3: Devastation of a *Zygaena (Mesembrynus) brizae* (ESPER, 1800) locality including its food-plant - *Cirsium desudatum* JANKA by locating a timber yard on it.

Fig. 4: The second part of a timber yard on a devastated *Zygaena (Mesembrynus) brizae* (ESPER, 1800) biotope.

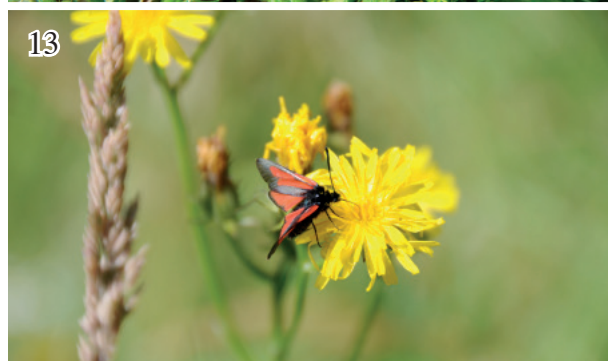


Fig. 5-13: *Zygaena (Mesembryus) brizae* (ESPER, 1800)

Fig. 5: Caterpillars feeding on the leaf of *Cirsium dessudatum* JANKA.

Fig. 6: Caterpillars on *Cirsium dessudatum* JANKA.

Fig. 7: Caterpillar feeding on *Cirsium dessudatum* JANKA.

Fig. 8: Adult caterpillar feeding before pupation on *Cirsium arvense* L.

Fig. 9.: Exited pupa in the cocoon.

Fig. 10: ♂ nectaring on a *Scabiosa* L., flower.

Fig. 11: ♀ on a *Cirsium dessudatum* JANKA leaf.

Fig. 12: ♀ on a *Cirsium dessudatum* JANKA leaf.

Fig. 13: ♂ nectaring.

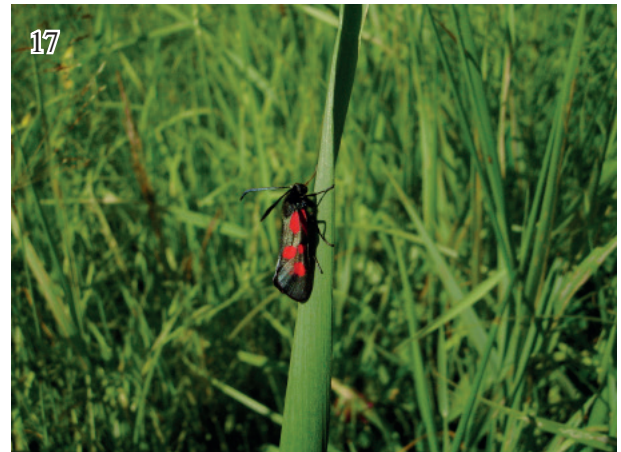


Fig. 14: *Zygaena (Mesembrynus) brizae* (ESPER, 1800) ♀.

Fig. 15: *Zygaena (Mesembrynus) brizae* (ESPER, 1800) ♂.

Fig. 16: *Zygaena (Mesembrynus) minos* ([DENIS & SCHIFFERMÜLLER], 1775) ♂.

Fig. 17: *Zygaena (Zygaena) viciae* ([DENIS & SCHIFFERMÜLLER], 1775) ♂.

Fig. 18: *Zygaena (Zygaena) loti* ([DENIS & SCHIFFERMÜLLER], 1775) ♂ x ♀ in copula.

Fig. 47: Cicada *Cicadetta montana* (SCOP.) in the habitat of *Zygaena (Mesembrynus) brizae* (ESPER, 1800).

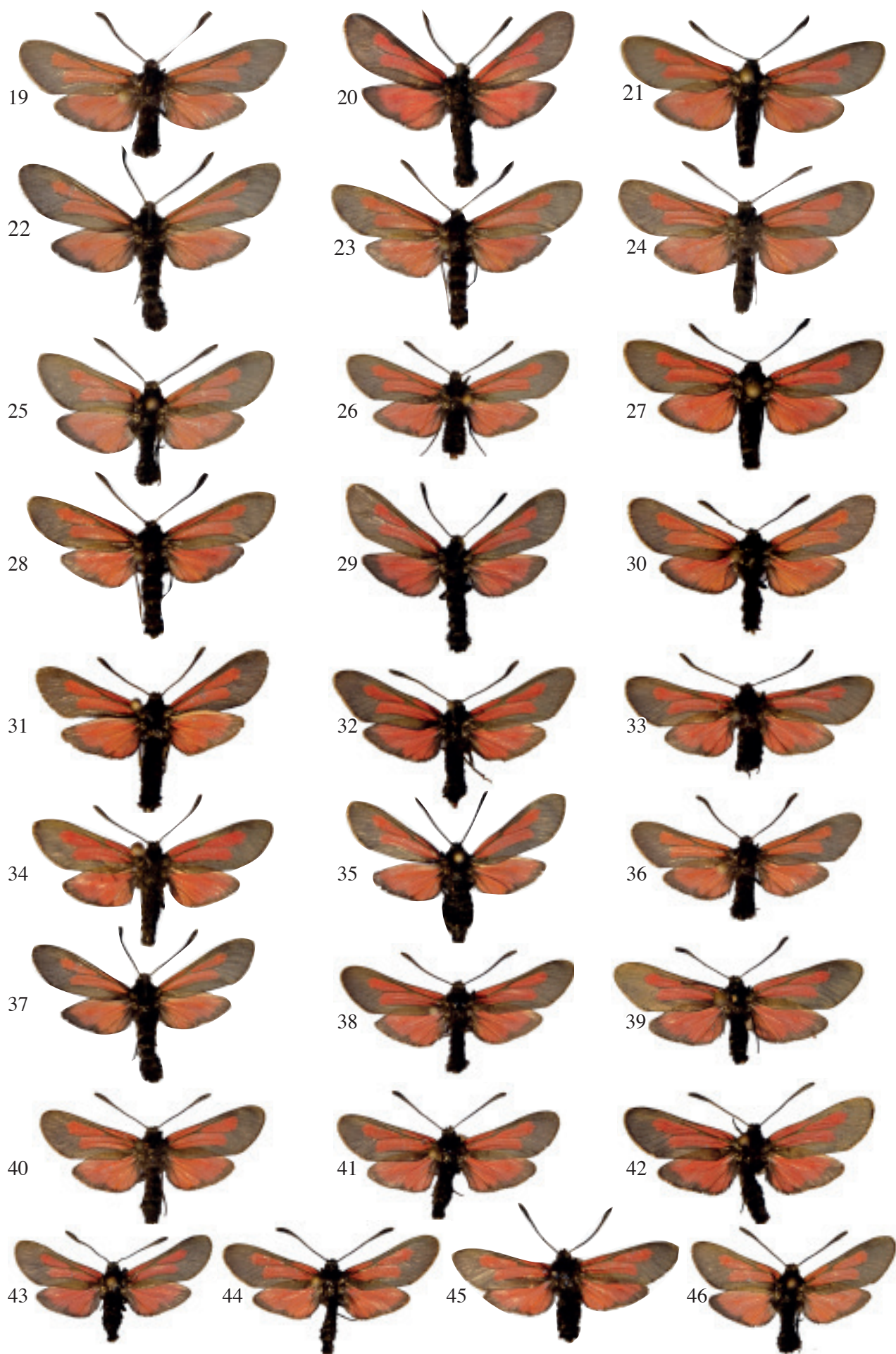


Fig. 19-46: Individual variability of *Zygaena (Mesembrynus) brizae* (ESPER, 1800) at Wyżyna Przemyska in the years 1997-2012.

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