

Dryad *Minois dryas* (Lepidoptera, Nymphalidae) in south-eastern Poland: a recent range expansion or oversight of an endangered species?

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ABSTRACT: *Dryad Minois dryas* (Lepidoptera, Nymphalidae) used to be a relatively widespread species in Poland. However recently it has been recorded exclusively in the Cracow-Częstochowa upland, where it thrives on its last natural site and a few others to which it has been successfully introduced. Our new data suggest that the situation of the butterfly is less dramatic. It was found at eight sites in the Bieszczady Mts. and Beskid Niski Mts. (SE Poland) i.e. in a region where it had never been recorded before. The typical habitats of *M. dryas* were south east to south west-facing slopes covered with tall grasses and herbs with some bushes and trees. Other rare and threatened xerothermophilous species i.e. *Iphiclides podalirius*, *Phengaris (Maculinea) arion* and *P. rebeli* were often sympatric. *M. dryas* probably previously inhabited at least a few hardly accessible sites, and its presence was overlooked. Socio-economic changes in the 1970s accompanied by agricultural abandonment might result in the creation of some new sites for the butterfly. Unfortunately very recent intensification of agriculture related to the accession of Poland to the EU and the introduction of a subsidy system may lead very quickly to the reversal of this trend. Sites of *M. dryas* and other threatened xerothermophilous species should be protected and suitably managed.

KEY WORDS: *Minois dryas*, endangered species, Beskid Niski, Bieszczady, Poland, conservation management, *Phengaris (Maculinea) arion*, *P. rebeli*, *Iphiclides podalirius*.

INTRODUCTION

Dryad *Minois dryas* (SCOPOLI, 1763) (Lepidoptera, Nymphalidae) is a Eurosiberian species, found from the Pyrenees across France, central Europe, northern Italy, the northern Balkans, Turkey, southern Russia and temperate Asia to Japan (KUDRNA 2002). In Europe the species was recorded in 26 countries but it is usually local throughout and it is absent from the north and the Mediterranean region. It became extinct in Luxembourg and in nearly half of the countries was estimated as rare, vulnerable or endangered (VAN SWAAY & WARREN 1999).

M. dryas breeds in two main habitats in Europe. Most of the populations can be described as xerothermophilous but they prefer sites with longer sward and some proportion of shrubs and trees (i.e. 'forest-steppes'). They are encountered on dry bushy slopes, in light deciduous forests and their edges or in overgrowing quarries. The second hygrophilous ecotype inhabits wet meadows in river valleys (EBERT & RENNWALD 1991, BENEŠ et al. 2002). In the eastern parts of the distribution range the butterfly is probably less specific, e.g. in northern Mongolia *M. dryas* belongs to the most common butterfly species and is regarded as a generalist (GANTIGMAA 2004).

The ecology and behaviour of *M. dryas* is little known. Butterflies fly slowly, flapping their wings and visit many flowers. Active flight is confined to the morning and to late afternoon. At noon butterflies rather prefer to stay near higher bushes. Colonies can be very numerous and they often form metapopulation systems. Butterflies are rather sedentary, although some individuals were observed over 1 km from the nearest sites. Relatively long-lived imagines are on the wing in one brood from July to September. Males are rather territorial and, as is the case for many other species, the distinct protandry is observed. Copulation lasts a few hours and a disturbed pair will fly away but does not separate. Eggs are scattered among vegetation (BENEŠ et al. 2002, SETTELE et al. 1999).

Some grasses i.e. *Calamagrostis epigejos*, *Festuca rubra*, *Bromus erectus*, *Molinia caerulea* and sedges i.e. *Carex alba* and *C. acutiformis* are used as host plants in Germany. Caterpillars lead a secret life, avoiding light, and pupate on the ground. The egg stage lasts: about 30 days, larval stage: 280-310 days (young larvae overwinter), pupal stage: about 24 days and average life span: 25 (17-34) days (BENEŠ et al. 2002, SETTELE et al. 1999).

Minois dryas is listed among the most threatened butterfly species in Poland. The same category on the national red list, i.e. *critically endangered* (CR) was also applied for *Parnassius apollo*, *Polyommatus ripartii*, *Coenonympha oedippus*, *Pyronia tihonus* and *Chazara briseis* only (BUSZKO & NOWACKI 2002). The evaluation was carried out on the assumption that *M. dryas* remained only on a single natural site. The butterfly is protected by law in Poland (BUSZKO 2004).

Among neighbouring countries *M. dryas* is threatened by extinction in the Czech Republic (BENEŠ et al. 2002), Germany (SETTELE et al. 1999) and Belarus where it was found at a single site (DOVGAILO et al. 2003). However in Slovakia and Ukraine the species is not threatened at all (VAN SWAAY & WARREN 1999).

HISTORICAL DATA ON THE OCCURRENCE OF *M. DRYAS* IN POLAND

Minois dryas used to be relatively widespread in Poland. It was recorded in western Pomerania, and the Noteć valley as well as in scattered sites near Warsaw, Poznań, Wrocław, Kielce, Cracow and Przemyśl (DĄBROWSKI & KRZYWICKI 1982). In the north west-ern part of the country *M. dryas* inhabited wet *Molinion* meadows and river valleys, how-ever in central and southern Poland it was observed in xerothermal habitats, especially in light deciduous forests on hill slopes (BUSZKO 2004).

The "Skołczanka" nature reserve (UTM DA 14) near Cracow was regarded as the last natural site of the butterfly (BUSZKO 2004). In 1973 the butterfly was successfully intro-duced to another nearby nature reserve "Kajasówka" (DA 04) by transfer of fertilised fe-males collected at "Skołczanka" (DĄBROWSKI 1994). Later *M. dryas* was also introduced to subsequent, far more distant, sites (DĄBROWSKI 2004). Ten females per site were released in the area of Bolechowice and Kobylany (DA 15 and 16) in 1997, and in the area of Klucze near Olkusz (CA 97). Four sites (two per area) were recognised as permanently settled (Fig. 1).

The causes of the extinction of *M. dryas* in western Poland are unclear and perhaps it resulted from the intensification of grassland management (BUSZKO 2004). Dry habitats are threatened by the excessive overgrowing of open patches; the low number of individuals and isolation of existing colonies are also important negative factors. According to DĄBROWSKI (2004), populations from "Kajasówka" and "Skołczanka" were rescued at the last moment thanks to conservation management, i.e. removal of some bushes and trees.

NEW SITES OF *M. DRYAS*

Minois dryas was recorded in eight squares of a UTM grid (100 km² each) localised in the Bieszczady Mts. and Beskid Niski Mts., i.e. EV 75, EV 76, EV 85, EV 87, EV 98, FV 15, FV 16, FV 17 (Fig. 1). The sites turned out to be quite diverse, as regards both the area and number of observed adults, but detailed studies were not performed.

The characteristic biotopes of the butterfly were dry overgrowing (but not overgrown) slopes of south-eastern to south-western exposure. All sites were not managed at the time and were densely covered by tall grasses and herbs. Scattered juniper bushes *Juniperus communis* and blackthorn *Prunus spinosa* were also present. Plant communities can be classified as later seral stages of xerothermic grasslands *Adonido-Brachypodietum pinnati* mixed with *Origanetalia* and *Prunetalia* or vegetation of intermediate characteristics with *Arrhenatheretum* meadows.

The flight period of the butterfly usually started towards the end of July and lasted to the end of August. In cool summers it extended to the beginning of September. Butterflies mainly visited violet and pink flowers, especially *Scabiosa columbaria*, *Centaurea jacea*, *Coronilla varia*, and *Clinopodium vulgare*. *Carlina acaulis* was also frequently used, and males were occasionally recorded on *Hypericum perforatum* and *Achillea* sp.

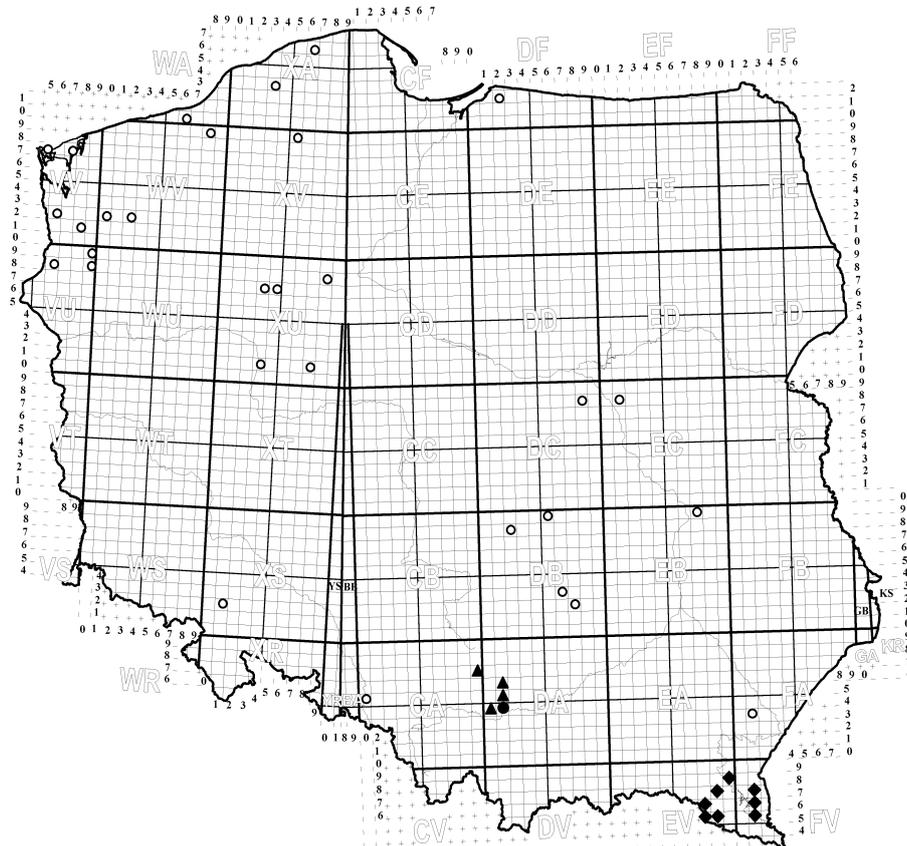


Fig. 1. Occurrence of *Dryad Minois dryas* in Poland: ○ - localities before 1986 (BUSZKO 2004, DĄBROWSKI 2004); ● - the "Skolczanka" nature reserve near Cracow, considered until now as the only natural site; ▲ – sites of successful introductions between 1973-1999 (DĄBROWSKI 2004); ◆ - newly discovered sites in the Bieszczady Mts. and Beskid Niski Mts.

Females oviposited during flight or hovering above grasses and touching blades. At some sites observations of preimaginal stages were also performed. Caterpillars fed at dusk and in the night on various grasses e.g. *Arrhenatherum elatius* and *Lolium perenne*. They pupated hidden among tussocks of grasses on the ground or near the surface.

M. dryas typically co-occurred with at least one of the three other xerothermophilous species threatened in Poland i.e. *Iphiclides podalirius*, *Phengaris (Maculinea) arion*,

P. rebeli. *Colias erate*, a migrant rarely recorded in the country, was also observed almost everywhere.

Description of sites

Łupków (EV 75, about 550 m a.s.l., south-facing slope). The site at the moment is small (about 0.5 ha) with scattered *Pinus spinosa*. Sympatric species: *P. rebeli*, nearby *P. arion* and *I. podalirius*. The site was discovered in the late 1970s. (AW). Part of the site bordered on a road and a track, where *M. dryas* is now the most numerous, which have been practically unchanged for 30 years. From that refuge the butterfly probably colonised neighbouring abandoned grasslands. Intensive mowing introduced in 2004 caused an 85-90% reduction of favourable habitat. However population density is still relatively high.

Radoszyce (EV 76, about 500 m a.s.l., south west-facing slope). The site encompasses an area of about 1 ha. Sympatric species: *I. podalirius* and *P. rebeli*. The site was discovered in 2002 (AW).

Smolnik/Mików (EV 85, 400 - 650 m a.s.l. west-facing slope). A broad area of a few dozen hectares. However, a relatively small number of individuals i.e. a few dozen, was observed, which might be caused by partial mowing. Sympatric species: *I. podalirius*. and *P. rebeli*. The site was discovered in 2002 (AW).

Szczawne (EV 87, 500-550 m a.s.l., south-facing slope). A very small area, less than 1 ha, inhabited by a relatively numerous population. Sympatric species: *I. podalirius* and *P. rebeli*. The site was discovered in 2004 (AW).

Zagórz (EV 98, about 380 m a.s.l., south west-facing slope). A small area of a few hectares. Just several individuals were observed daily. Sympatric species: *P. arion* and *P. rebeli*. The site was discovered in 2005 (AW).

Krywe (FV 15, about 500 m a.s.l., flat terrain with small hillocks). A broad area of a few dozen hectares at the foot of Mt. Otryt. Single individuals of *M. dryas* were locally encountered. Probably local populations in a metapopulation system. Sympatric species: *I. podalirius*. There is reliable information that *M. dryas* was present there as early as before World War II (P. Kutiak, personal comm.).

Chrewt/Olchowiec (FV 16, 350-500 m a.s.l., south east-facing slopes). A broad site of about 50 ha, 1.5 km long and 300-400 m wide. Diverse vegetation, besides junipers and blackthorns some alders *Alnus glutinosa* are also present. The site was discovered in 2004 (AW).

Ustrzyki Dolne (FV 17, about 650 m a.s.l., south west-facing slope). The site encompasses a dozen or so hectares and is inhabited by a rather sparse population. Sympatric species: *I. podalirius*. The site was discovered in 2005 (AW).

DISCUSSION

Records of *M. dryas* in south-eastern Poland indicate that the butterfly is much more widespread in the country than was previously estimated. Therefore its conservational status (*critically endangered* - CR) should perhaps be verified. The Beskid Niski Mts. and especially Bieszczady Mts. are attractive areas as regards nature and they were not completely abandoned as a region of butterfly observations (BIELEWICZ 1973, BUSZKO 1997 & 2004). A similar situation applies to *P. rebeli*, which was recorded from that region just a few years ago (SIELEZNIOW et al. 2003). For that reason we do not exclude the possibility of new future findings of *M. dryas*.

The lack of previous records of *M. dryas* from the Beskid Niski Mts. and Bieszczady Mts. possibly does not reflect a simple inventory deficiency but may also be a result of the recent range expansion of the species. Some sites might be colonised from Slovakia, Ukraine or more likely from Polish refuges. We cannot exclude the possibility that colonisation of new sites could be facilitated by climate changes reflecting global warming. Geographical ranges of many butterflies have showed latitudinal and altitudinal shifts northwards during recent decades (PARMESAN et al. 1999). Xerothermophilous populations of *M. dryas* reach the northern edge of their European distribution in Poland (KUDRNA 2002).

Another explanation of our findings may be related to the fundamental social-economic transformations which the south-eastern limits of Poland have undergone in the last few decades. The first stage started just after World War Two and involved the intensification of agriculture based on PGRs (state-owned farms) and RSPs (farming cooperatives). It seriously influenced some potential habitats of *M. dryas*, and we suppose that the butterfly disappeared then from many meadows and pastures due to regular mowing, intensive grazing and fertilizers. In the 1970s *M. dryas* hypothetically thrived only in localities hardly accessible to socialist agriculture, like steep slopes (e.g. Łupków, EV 75) or the vicinities of railway lines (e.g. Chrewt/Olchowiec, FV 16).

Further political and economic changes at the end of the 20th century led to the collapse of PGRs and RSPs. Vast areas were abandoned and plant communities appropriate for many rare butterfly species developed in adequately exposed places. It may be assumed that refuges where *M. dryas* survived a period of intensive agriculture enabled the colonisation of neighbouring fallow lands. Populations of other butterflies which are rare or threatened in Poland might also be subject to similar processes.

Unfortunately the accession of Poland to the European Union in 2004 probably caused a renewed decline of the species range, because of intensive mowing of vast areas carried out rather to obtain subsidies than for the real needs of animal production. *M. dryas* has been driven back to inaccessible places such as Łupków (EV 75) and Smolnik/Mików (EV 85). On the other hand some localities are threatened with the slow acting succession of bushes and trees. Intensive grazing, spring fires and afforestation are also observed as negative factors elsewhere.

The sites of *M. dryas* should be protected by law as nature reserves or ecological areas and their plans of conservation management should take into consideration the require-

ments of the butterfly. *M. dryas* is a relatively big butterfly and probably needs considerable land areas to support viable populations. Hence the species is condemned to extinction when sites become too small and too isolated. Maintenance of a network of warm grasslands and 'forest-steppe'-like vegetation in areas where *M. dryas* still occurs is vital and may be achieved by occasional mowing, light grazing and periodical removal of shrub regrowth. Restoration of coppicing in forests bordering on xerothermal grasslands and the promotion of the conservation of wide forest edges without management are also important. *M. dryas* in general probably does not need sophisticated actions, but detailed studies on ecology and behaviour are desirable (BENEŠ et al. 2002).

The next challenge is the reconciliation of the requirements of *M. dryas* and other species e.g. *P. arion* and *P. rebeli*, which need a shorter sward. It might be achieved by rotational mosaic mowing or light grazing. On the scale of the whole area of the Bieszczady Mts. and Beskid Niski Mts, local conservation priorities should be specified precisely, to save butterfly diversity.

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