

***Eupithecia pulchellata* (STEPHENS, 1831) (Lepidoptera: Geometridae)
– a moth species new to the fauna of Poland**

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ABSTRACT. *Eupithecia pulchellata* (STEPHENS, 1831) is recorded for the first time from Poland on the basis of specimens collected in the Karkonosze Mts. and Izerskie Mts (Sudety Mts.). The species is compared with very similar sympatric *E. pyreneata* (MABILLE, 1871), whose updated records from the region are listed. Diagnostic characters of the moths and their pupae are illustrated and discussed. Data on the biology, habitat requirements and distribution of both species are provided.

KEY WORDS: Lepidoptera, Geometridae, *Eupithecia pulchellata*, diagnostic characters, biology, new localities, Poland.

INTRODUCTION

The genus *Eupithecia*, one of the most species-rich in the Palearctic, is represented in Poland by 67 species (MALKIEWICZ & SOSIŃSKI 2000). They inhabit almost all types of plant communities including these in mountain regions, apart from the highest parts of the Tatra Mts. Together with their allies in tribes Eupitheciini and Perizomini they are known to utilize mainly flowers, fruits and seeds (MIRONOV 2003).

During the field studies in the Izerskie Mts. and Karkonosze Mts. in 2003 - 2005 *Eupithecia pulchellata* (STEPHENS, 1831) was discovered both in larval and imaginal stages. One adult specimen collected earlier had been misidentified (see material examined; MALKIEWICZ 2001), so the species should be treated as recorded for the first time in Poland. This is the result of confusion in the past (up to the sixties of 20th century) with *E. pyreneata* (MABILLE, 1871), a species very close in appearance and of similar biology, that

occurs in the region, too. So, we had a problem how to separate old Polish and German literature records of the two species under the names: *pulchellata* (STEPH.), *pyreneata* (MAB.) and *digitaliaria* Dtze. without voucher specimens. Unfortunately one more species, *E. linariata* (DEN. et SCHIFF.), if collected as adult, might have been mixed, because externally it is also difficult to distinguish. All the three of them are included in the key to Polish Geometrids (BŁESZYŃSKI 1965), but *pulchellata* (STEPH.) and *pyreneata* (MAB.) are treated together under the first name. The illustration of the wings (fig. 634, p. 204) and listed localities suggested that the author might have examined only *E. pyreneata* (MAB.) from Polish collections. He followed ROMANISZYN (1929), who was the first in Poland to confuse the two taxa and use the name *pulchellata* (STEPH.) for records from Western Ukraine (Lwov district) obviously depicting *E. pyreneata* (MAB.). In two historical cases (WOCKE 1872, RAEBEL & TOLL 1962) in the Dolny Śląsk (Lower Silesia) region we can be sure of the proper species (*E. pyreneata*) determination, because these were the records based on caterpillars found on *Digitalis ambigua* MURR. (synonym of *grandiflora* MILL.). One of them came from the same district of Karkonosze (former Riesengebirge) as our present findings of *E. pulchellata* (RAEBEL & TOLL 1962). These were the reasons why this species was excluded from the latest checklists of Geometrid moths in Poland (MALKIEWICZ & SOSIŃSKI 1999, 2000). It is also missing in the faunal inventory of Geometrids from the Karkonosze Mts. (MALKIEWICZ 2001), where it is listed as *E. pyreneata* (MAB.) based on 1 female (det. V. MIRONOV) which is here treated as *E. pulchellata* (STEPH.). This also regarded the only record of *E. pyreneata* in the Dolny Śląsk (Lower Silesia) region after 1960 (MALKIEWICZ & SOSIŃSKI 2000), so in “material examined” below updated records of *E. pyreneata* are included. *Eupithecia pulchellata* was recently recorded from southern parts of Izerskie Mts. (Jizerské hory) in Czech Republic (KRAMPL & MAREK 1999, LAŠTŮVKA & LIŠKA 2005).

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RESULTS

Material examined***Eupithecia pulchellata* (STEPHENS, 1831)**

Poland: Karkonosze Mts., Szklarska Poręba Śr.[ednia], UTM grid: WS33, alt. 600 m a.s.l., 20 VII 1991, 1 female, leg. A. MALKIEWICZ, det. as *Eupithecia pyreneata* (Mab.) by V. MIRONOV 2000; Karkonosze Mts., Karkonoski P.N., Czeska Ścieżka, UTM: WS32, alt. 750m a.s.l., 27 VII 2005, 2 larvae, leg. M. MATRAJ, K. MISZTAL; Karkonosze Mts., Piechowice-Górzyniec, UTM: WS43, alt. 500m a.s.l., 27 VI 2003, 1 male and 1 female, leg. and coll. A. KOKOT; Izerskie Mts., przeł Babia, UTM: WS33, alt. 650m a.s.l., 20-21 VII 2004, ca. 15 larvae (5 adults emerged, coll. A. MALKIEWICZ), leg. W. GONTARZ, S. KUCZKOWSKI; 17-30 VIII 2004, 8 larvae (4 adults emerged); 29 VII 2005, ca. 15 larvae, leg. W. GONTARZ, A. MALKIEWICZ, M. MATRAJ, K. MISZTAL; 14-18 VIII 2005, 12 larvae (all parasited); Rozdroże Izerskie, UTM: WS33, alt. 770m.a.s.l., 14-18 VIII 2005, 5 larvae (3 pupae alive), leg. W. GONTARZ; Izerskie Mts., Las MIEDZIAŃSKI, UTM: WS05, alt. 300m a.s.l., 24-25 VII 2004, 5 larvae, leg. S. KUCZKOWSKI.

Germany: former DDR – MTB 5342, Sachsen, Hartenstein, Krs. [Kreis] Zwickau, 17.05.1985 e.l., leg. S. & G. WEIB; coll. A. MALKIEWICZ

Great Britain: Anglia, 1 male, 1 female, coll. Mus. Nat. Hist. UW. (ex coll. WISKOTT)

Unknown origin: 1 male “nr” coll. Mus. Nat. Hist. UW. (ex coll. STRECKFUSS et GÄRTNER)

***Eupithecia pyreneata* (MABILLE, 1871)**

Poland: Sudety Mts., Pogórze Kaczawskie, rez. “Wąwóz Lipa” UTM:WS74, alt. 400 m a.s.l., 30 VI 2003, 1 ex. leg. and coll. A. MALKIEWICZ; Góry Kaczawskie, Gorzanowice, UTM: WS74, alt. 400 m. a.s.l., 21 VI 1982, 1 ex., 10 VII 1982, 1 ex., leg. and coll. R. SZPOR; Grudno-Bukowa, UTM: WS74, alt. 430 m a.s.l., 27 VII 2005, 5 larvae (2 pupated) on *Digitalis grandiflora* MILLER, leg. and coll. A. MALKIEWICZ; Góry Bardzkie, Łączna, UTM: XR19, alt. 400 m a.s.l., 15 VII 2003, 3 larvae on *Digitalis grandiflora* MILLER, leg. and coll. A. MALKIEWICZ (2 pupae in coll. A. MALKIEWICZ); Przedgórze Sudeckie, Wzgórze Krzyżowe, Dębowa Góra, UTM: XS22, alt. ca. 350 m a.s.l., 6 VI 1966, 1 ex., leg. R. SZPOR; Pieniny Mts., Kały-Przystań, UTM: DV57, alt. 550 m a.s.l., 22 VI 1998, 1 ex., leg. A. MALKIEWICZ, T. Blaik; Trzy Korony, alt. 800m. a.s.l., 13-14 VII 1998, 5 larvae on *Digitalis grandiflora* MILLER, (3 adults emerged), leg. and coll. A. MALKIEWICZ; Tatra Mts., Tatrzański P.N., Dolina Roztoki, Schr. W. Pola w Roztoce, UTM: DV35, alt. 1040m a.s.l., 24 VI 2000, 1 ex., leg. W. KUBASIK; Puszcza Borecka, UTM: EF70, 19 VII 1991, 1 ex., 10 VII 1994, 2 exx., leg. J. BUSZKO; ex l. 14-24 IV 1995, 12 exx., leg. J. BUSZKO, coll. A. MALKIEWICZ

Discussion on diagnostic descriptions

The diagnostic descriptions for all European species from the *linariata* species group were recently published by MIRONOV (2003). He compared each species to *E. linariata*, but not to each other, so using these remarks (“Similar species”) is not very useful to distinguish between *E. pulchellata* and *E. pyreneata*. We can see some of the diagnostic characters indicated at text figures (p. 88, figs. 27-29), but some of them are dubious (as variable) and some omitted. For example the shape and color of the middle part of postmedial line at forewing is not as diagnostic a character as costal part of this line, which is inward – curved or even indented (nominotypic form) in *E. pulchellata*. More diagnostic seems the continuous, zigzag thin basal line which is distinct in *E. pulchellata* (Figs 1-2) and discontinuous and weakly marked in *E. pyreneata* (Figs 3-4). This character was also omitted by WEIGT (1988). The fringes, pointed with an arrow by the previous author at fig. 28 (*pulchellata*) is another controversial feature, hardly useful in our material studies. On the other hand, medial area of the forewing in this species is usually much darker than ash-grey, not only towards medial line, and the pale ochreous streak under discal spot is not always marked (Fig. 1). These two differences when compared to *E. pyreneata* are only visible in freshly emerged specimens. The hindwings are more contrastingly marked with lines and more blackish compared to *E. pyreneata* that is more uniformly brownish grey (Figs 3-4).

The male and female genitalia are not clearly different from those of other *linariata* group species as shown by MIRONOV (2003) and other authors before. The first impression may be misleading when looking at figs. 29-31 (female genitalia plates, p. 405) where some differences in the shape of bursa copulatrix and tergum A8 were shown, but not commented on. These are clearly caused by illustrating specimens in different (pre-, or postcopulation) states. The males of *E. linariata* can be distinguished by little shorter cornutus (sclerotized tube) in aedeagus.

Some information on coloration and body patterns of larvae are given by WEIGT (1988) and PORTER (1997). They both accent variable coloration, dependent on pigments eaten and adopted from the foodplant, particularly external parts of the flower, like petals. This explains why caterpillars of *E. pulchellata* are often purple (Fig. 5) after the last moulting, when earlier most of them are green (Fig. 6), yellow or brownish. Brown dorsal markings of variable shape along the segments A1-A6 in contrastingly coloured forms (Fig. 7) don't help to distinguish them from some other *Eupithecia* larvae. Pupae were recently described by PATOČKA (1996). He gave some small differential characters, but unfortunately they are in the opposite order in diagnoses and on illustrations by mistake. The only one confirmed in our studies is the form of labrum: round in *E. pyreneata* and broader (and trapezoid acc. to PATOČKA) in *E. pulchellata* (Figs. 9-10). The rest of characters were not clearly differential and turned out useless as diagnostic.



Fig. 1. *Eupithecia pulchellata* (STEPH.), female with diagnostic characters pointed; Izerskie Mts., przeł. Babia, UTM: WS33, alt. 650 m a.s.l., larva: 20-21 VII 2004 (*Digitalis purpurea*), leg. S. KUCZKOWSKI (coll. A. MALKIEWICZ).



Fig. 2. *Eupithecia pulchellata* (STEPH.), male with diagnostic characters pointed; Izerskie Mts., przeł. Babia, UTM: WS33, alt. 650m a.s.l., larva: 20-21 VII 2004 (*Digitalis purpurea*), leg. S. KUCZKOWSKI; (coll. A. MALKIEWICZ).



Fig. 3. *Eupithecia pyreneata* (Mab.), female; Puszcza Borecka, UTM: EF70, ex l. 14.04.1995 (*Digitalis grandiflora*), leg. J. BUSZKO; (coll. A. MALKIEWICZ).



Fig. 4. *Eupithecia pyreneata* (Mab.), male; Puszcza Borecka, UTM: EF70, ex l. 16.04.1995 (*Digitalis grandiflora*), leg. J. BUSZKO; (coll. A. MALKIEWICZ).



Fig. 5. Caterpillar (green form) of *E. pulchellata* (STEPH.); Izerskie Mts., przeł. Babia, UTM: WS33, alt. 650m a.s.l., 29 VII 2005, leg. & photo A. MALKIEWICZ.



Fig. 6. Caterpillar (purple form) of *E. pulchellata* (STEPH.); Izerskie Mts., przeł. Babia, UTM: WS33, alt. 650m a.s.l., 29 VII 2005, leg. & photo A. MALKIEWICZ.



Fig. 7. Caterpillar (contrast form) of *E. pulchellata* (STEPH.); Izerskie Mts., przeł. Babia, UTM: WS33, alt. 650m a.s.l., 20-21 VII 2004, leg. S. KUCZKOWSKI, photo A. MALKIEWICZ.



Fig. 8. *Eupithecia pulchellata* (STEPH.). Breeding site of the caterpillar hidden inside the flower of *Digitalis purpurea* L. (pointed), Izerskie Mts., przeł. Babia, UTM: WS33, alt. 650m a.s.l., 20-21 VII 2004. Photo S. KUCZKOWSKI.

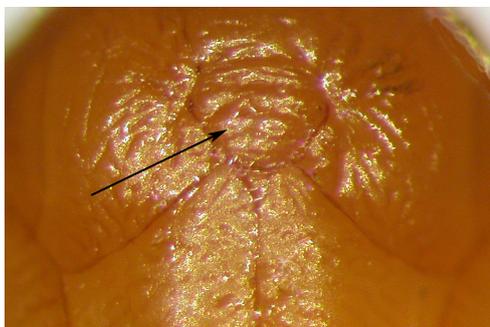


Fig. 9. Head region of the pupa (ventral view) of *E. pulchellata* (STEPH.) with labrum pointed; Izerskie Mts., przeł Babia, UTM: WS33, alt. 650m a.s.l., 20-21 VII 2004, leg. S. KUCZKOWSKI, cult. A. MALKIEWICZ & photo R. STELMASZCZYK.

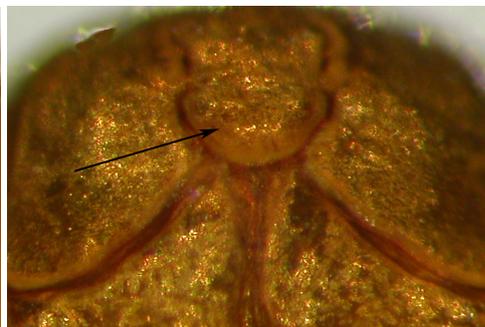


Fig. 10. Head region of the pupa (ventral view) of *E. pyreneata* (MAB.) with labrum pointed; Pieniny Mts., Trzy Korony, alt. 800m. a.s.l., larva 13-14 VII 1998, leg. & cult. A. MALKIEWICZ, photo R. STELMASZCZYK.

Biology

Both species reported here seem monofagous in Polish natural conditions. *Eupithecia pyreneata* is known to utilize yellow flowering species of *Digitalis*, in Poland only *D. grandiflora* Mill. In some other European countries it was reported to feed on other species like *D. lutea* L. (EBERT 2003, MIRONOV 2003), a plant cultivated in gardens and recorded in Poland as introduced to Pomorze region (SZAFER et al. 1986). There is also one documented case of occurrence of its caterpillars on *D. purpurea* L. in the wild from Land Brandenburg (RICHERT 2004). *Eupithecia pulchellata* caterpillars live on *Digitalis purpurea* L., the only known foodplant in nature. There are some old literature (and probably breeding) data stating *D. grandiflora* as alternative food (after MIRONOV 2003). The habits of both species in larval stage are similar: they come into the flower and close its edges with silk, which changes the flower's form like in flower bud (Fig. 8). This behavior secures them against parasitoids. After consuming generative organs like stamens and pistils with ovary, they have to leave the flower through the hole in the side and enter the next one. During this passage the larva is endangered by natural enemies, particularly Ichneumonidae, so according to EBERT (2003) it is suspected to change the breeding place at night. The same author discusses the question if this species can feed on fruit of the foodplant. In our breeding (2005) from Izerskie Mts., caterpillars of the last instar utilized also unripe seeds by biting in the seed capsule (Fig. 5), but such observation was not made in natural habitat. Development period of caterpillars in Baden – Württemberg (SW Germany)

is from the end of June to the end of August, maximum to the beginning of September and is synchronic with flowering of the foodplant. Our observations coincide with this. This period varies depending on microclimatic factors, the weather and altitude. The last one spreads in Germany from 200 to 1300 m a.s.l., so we can expect the moth up to the timberline in the Sudety Mts. At the Polish localities the caterpillars listed above were collected along the ways and paths in spruce forests, but only in semishadowy places. All attempts to find them on the foodplants growing in open places have failed. The plant likes acidic soils, contrary to *D. grandiflora*, which prefers alkaline soils. Degree of parasitization exceeded 90% in 2005 breeding, so this also coincides with the cases reported from Germany (EBERT 2003). The pupa overwinters in loose cocoon in soil, occasionally twice according to MIRONOV (2003). Flight period of moths lasts from the very end of May to the middle of August and is longer than of *E. pyreneata* and begins a little earlier on average.

Distribution

Eupithecia pulchellata distribution area extends more to the west and northwest in Europe than *E. pyreneata*. It doesn't occur in higher Alps, but is recorded from high Pyrenees (up to ab. 2,400 m. a.s.l.). According to data from Czech Republic (Jizerské hory Mts.) the species is spreading east in the mountains (KRAMPL & MAREK 1999). The second species is distributed widely from Portugal to southern Urals and Caucasus, but has not been recorded in the northwestern part of the continent (MIRONOV 2003).

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