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Eupithecia exiguata (Hübner, [1813]) new to the Iberian Peninsula, with notes on other pug moths Eupitheciini in Cantabria, Spain (Lepidoptera: Geometridae)

C. W. Plant, S. J. Petty, T. Farino & M. S. Botham

Abstract

Pug moths recorded in Cantabria, Spain are listed and discussed. Twenty-eight species are currently known. *Eupithecia exiguata* (Hübner, [1813]) is reported as completely new to the Iberian Peninsula. We argue that Cantabria should support approximately 44 species, which is about half of the total Iberian Peninsula fauna.
KEY WORDS: Lepidoptera, Geometridae, Eupitheciini, *Eupithecia*, distribution, Cantabria, Spain.

Primera cita de *Eupithecia exiguata* (Hübner, [1813]) en la Península Ibérica, con notas de otras especies de Eupitheciini en Cantabria, España (Lepidoptera: Geometridae)

Resumen

Se listan y discuten las eupitecias citadas de Cantabria, España. Veintiocho especies se conocen en la actualidad. Se informa de la presencia de *Eupithecia exiguata* (Hübner, [1813]) como nueva especie para la Península Ibérica. Se argumenta que Cantabria debe albergar unas 44 especies, aproximadamente la mitad de la fauna de la Península Ibérica.
PALABRAS CLAVE: Lepidoptera, Geometridae, Eupitheciini, *Eupithecia*, distribución geográfica, Cantabria, España.

Introduction

REDONDO *et al*. (2009) map only 4 species of Eupitheciini (pug moths) for the Spanish province of Cantabria - *Eupithecia cocciferata* Millière, 1864, *E. abbreviata* Stephens, 1831, *E. nanata* (Hübner, [1813]) and *E. icterata* (de Villers, 1789) - each from a single locality. This, without doubt, reflects a simple lack of data from the region rather than an inherently poor fauna. During 1993, TF took up permanent residence in western Cantabria, in the district of Liébana and began, casually, to record the Lepidoptera. In 2003, TF moved to Pesaguero (Pesaguero), Cantabria, at which point recording became regular and still continues. Since 2011, SJP has been a temporary resident at Linares (Peñarrubia), Cantabria and also began moth recording, a process that became regular from 2012 onwards. MSB visits Cantabria annually to help survey Lepidoptera in the area. He has made six trips since 2009 between the months of May and October during which he has surveyed through a combination of day searches and battery-operated portable light traps placed at various sites. Throughout the entire survey period, CWP has made occasional visits to Cantabria to collect Lepidoptera specimens for study and has assisted TF, SJP and MSB with the critical

determination of "difficult" species. As a consequence, we have obtained an extensive data set of Lepidoptera for this part of Cantabria, particularly covering the period from 2005 to 2013. In this present paper we list the pug moths (Eupitheciini) we have recorded in Cantabria and consider how many species of *Eupithecia* are likely to remain undiscovered. One species new to the Iberian Peninsula is also recorded.

Materials and methods

Pesaguero is located in western Cantabria in the municipality of the same name, at 540 metres above sea level in a mosaic of hay meadows and broad-leaved and evergreen forest at N43º 04' 40":W4º 33' 30". The principal tree and shrub species in the immediate area are *Quercus ilex* ssp. *ballota* (Desf.) Samp., *Q. pyrenaica* Willd., *Fraxinus excelsior* L., *Crataegus monogyna* Jacq. and *Corylus avellana* L., with *Populus nigra* L., *Salix caprea* L., *Tilia cordata* Mill., and some *Alnus glutinosa* (L.) Gaertn., in the riverine forest. A static trap fitted with an 80 watt mercury-vapour (mbf) bulb was operated periodically on a balcony, at approximately 540 metres and facing due south up the valley created by the River Vendejo, which joins the River Bullón just below the property, with 40 watt actinic traps in the riverine forest itself. The Sierra de Albas (1600m +), which forms the boundary with the neighbouring province of Palencia (Castilla y León), is visible at the head of the Vendejo river valley, approximately 5 km distant. The bedrock is composed of Devonian shales and sandstones, incorporating monolithic outcrops of Carboniferous limestone.

The village of Linares is close to the border with Asturias and approximately 20 km north of Pesaguero. The trap site is a garden at N43º 25' 38", W4º 57' 95", altitude 430 metres. A static trap fitted with a 125 watt mercury vapour (mbf) bulb was operated every 2-3 nights during the period mid-late May until early August, and then again for four weeks during the period October to early December. The habitat surrounding the trapping site comprises hayfields and broad-leaved woodland (deciduous and evergreen) where the main trees species are *Quercus pyrenaica*, *Q. ilex* ssp. *ballota*, *Fagus sylvatica*, *Castanea sativa* and *Populus nigra*. The topography is low montane and the bedrock predominantly limestone and other sedimentary rocks.

Occasional forays were made with lamps to places away from these two main trapping bases. These other sites include Vendejo (Pesaguero), Aliezo (Cillorigo de Liébana) from 1998-2000, Barrio (Vega de Liébana) from 1993-2002, Pido and Espinama (Camaleño), and the Embalse de Enterrías (Vega de Liébana).

Whilst a great many moths were released after identification, species requiring critical examination were collected. Such determinations were performed in England by CWP, after extracting genitalia from specimens by digestion of detached abdomens in 10% heated KOH. For some species, where the identifications were surprising, confirmation was sought from Dr Vladimir Mironov (St Petersburg, Russia), to whom we are most grateful.

Results

From 2003 to the end of 2013, we recorded 27 species of Eupitheciini in Cantabria; these are summarised below. To our 27 species must also be added *E. icterata* (de Villers), which is shown in the maps by REDONDO *et al*. (2009); we have included it in the list below so that the inventory is complete. The total of recorded pugs in Cantabria is, therefore, 28 species. Our following assessments of frequency and abundance are necessarily subjective, because light trapping has been the only significant recording methodology. Species that are weakly attracted to light will be poorly represented in the sample, whilst some species without doubt remain to be detected.

Gymnoscelis rufifasciata (Haworth, 1809)

69 records. Common and presumed resident, taken regularly at light from 20-III to 10-XI, in

every month. Apparently continuously-brooded, but with a clear peak of adults in the first week of June.

Chloroclystis v-ata (Haworth, 1809)

182 records. Frequently caught and numerically common presumed resident, recorded in every month from 1-IV- to 16-XI. A graph of numbers of moths versus date shows a small peak of adults in late May / early June and a larger peak in the first week of July, but there are also records into the late autumn, perhaps suggesting that this species may be continuously-brooded here.

Pasiphila rectangulata (Linnaeus, 1758)

38 records from 2005 to 2013. Presumed to be resident. The adults fly from 22-V to 15-VII at Linares, and from 15-V to 22-IX at Pesaguero, but overall showing two generations, with adults flying from mid-May to mid-June and from the third week of August to the third week of September. Smaller numbers of adults in July probably represent a protracted first generation.

Eupithecia abbreviata Stephens, 1831

36 records in the years 1993 to 2013. Common resident, with adults flying continuously, apparently in a single generation, from 20-III to 12-VII.

Eupithecia assimilata Doubleday, 1856

Single example only, Pesaguero, 1 ♀, 2-VIII-2013.

Eupithecia breviculata (Donzel, 1837)

56 records, from 2008 to 2013. Regular and numerically abundant presumed resident, recorded from 31-V to 9-VIII as a single generation.

Eupithecia centaureata ([Denis & Schiffermüller], 1775)

56 records, from 1998 to 2013. A presumed resident that is a regular and numerically common attendee at light traps, from 13-V to 20-IX. The data show adults attending the lights in all weeks between the first and last dates with no peaks in this flight period.

Eupithecia cocciferata Millière, 1864

5 records of only 6 moths: Linares, 1 ♂, 13-V-2013 and Pesaguero, 2 ♀♀, 6-IV-2010, 1 unsexed (abdomen lost), 16-III-2012, 1 ♂, 25-III-2012 and 1 ♀, 12-IV-2013.

Eupithecia dodoneata Guenée, 1858

43 records. A regular and often abundant presumed resident. Of the total of 43 records, 42 refer to the period from 12-IV to 22-VI, with most examples flying in May and June; one single record was made outside this period on the unusually early date of 14-III-2007.

Eupithecia egenaria Herrich-Schäffer, 1848

4 records - one from Pesaguero (1 ♀ on 15-VI-2012) and three from Linares (1 ♀ on 20-V-2013, 1 ♀ on 5-VI-2013 and 1 ♀ on 18-X-2013). This species is normally univoltine and the adults typically fly from mid May to early July across Europe (MIRONOV, 2003). For Iberian Peninsula, REDONDO *et al*. (2009) give May and June. Discussion suggests (Vladimir Mironov, personal communication) that our October record represents the first evidence of a bivoltine situation for this species. The presumed larval foodplant, *Tilia cordata*, is present in the area around both trap sites.

Eupithecia exiguata (Hübner, [1813])

We have a single record, from Pesaguero, 1 ♀ on 6-IV-2010. A surprising discovery, confirmed by genitalia dissection. The adult moth is similar in gross morphology to *E. druentiata* Dietze,

1902. That latter species has, within the female genitalia, a small patch of spines on the ductus bursae just posterior to the point where the ductus seminalis arises; this is absent in *E. exiguata*. In addition, sternite 8 in *E. druentiata* is distinctly notched (concave) on the posterior edge, but in *E. exiguata* the posterior edge of the abdominal sternite is more or less straight (both in 3-dimensions when suspended in fluid and also when compressed under a glass cover-slip). The European distribution pattern of *E. exiguata* is not hugely different from that of *E. valerianata*, below. **New to the Iberian Peninsula**.

Eupithecia extraversaria Herrich-Schäffer, 1852

2 records - Pesaguero, 1 ♀ on 31-VII-2013 and Linares, 1 ♀ on 5-VIII-2013, together representing a westwards expansion of the known range in Iberian Peninsula.

Eupithecia haworthiata Doubleday, 1856

5 records. An infrequently captured, numerically uncommon, presumed resident at Linares, from where we have records from 16-VI to 15-VII. At Pesaguero, we have only a single record of 1 ♀ on 1-VI-2013. These minimal data suggest that it is univoltine.

Eupithecia icterata (de Villers, 1789)

Recorded for Cantabria in REDONDO *et al*., 2009, but so far not encountered by us.

Eupithecia innotata (Hufnagel, 1767)

Single record - Linares, 1 ♂, 12-VIII-2012.

Eupithecia irriguata (Hübner, [1813])

Single record - Linares, one on 13-V-2013.

Eupithecia nanata (Hübner, [1813])

4 records - Pesaguero, 1 ♀ on 31-VIII-2012 and 1 ♀ on 24-VIII-2013 and Linares, 2 ♀♀ on 1-VIII-2012 and 1 ♀ on 10-X-2013. These sparse data suggest a possible bivoltine situation, which would not be unexpected.

Eupithecia ochridata Schütze & Pinker, 1968

3 records - Pesaguero, 1 ♀, 25-V-2012 and Linares, 1 ♂, 5-VI-2012 and 1 ♂, 31-V-2013.

Eupithecia oxycedrata (Rambur, 1833)

3 records. Surprisingly uncommon at our lights, with a single record from Linares, 1 ♀, 31-X-2013 and two from Pesaguero, 1 ♀ on 1-VI-2013 and 1 ♀ on 21-XI-2007.

Eupithecia pantellata Millière, 1875

8 records. Recorded by us only from Linares, in 2012 and 2013, from 31-V to 28-VI as follows: 1 ♂ on 7-VI-2013; 1 ♀ on 15-VI-2013; 1 ♂ on 26-VI-2013 and 1 ♂, 1 ♀ on 28-VI-2013 (and in 2012, 4 ♂♂ on 31-V, 3-VI, 8-VI and 10-VI). Presumed resident.

Eupithecia phoeniceata (Rambur, 1834)

7 records in the years 2010, 2011 and 2013. An infrequent and numerically uncommon species in light trap samples, though doubtless resident locally. Recorded (six records) in the autumn from 16-X to 22-XI, but with a single earlier example, 1 ♂, 1-VI-2012 at Pesaguero.

Eupithecia pulchellata Stephens, 1831

7 records - one in 1999 and six in the years 2012 and 2013. An occasional visitor to our light traps in low number and a presumed resident, which we recorded from 20-V to 5-VIII.

Eupithecia pyreneata Mabille, 1871

Single record - Pesaguero, 1 ♂, VI-2012, photographed by Matthew Gandy. Our own identification of this species was most kindly confirmed by Vladimir Mironov from the photograph.

Eupithecia scopariata (Rambur, 1833)

Single record - Pesaguero, 1 ♂, 1-VI-2013.

Eupithecia subfuscata (Haworth, 1809)

17 records - a regular and not uncommon presumed resident, recorded in the adult stage from 11-VI to 15-VII in a single generation.

Eupithecia valerianata (Hübner, [1813])

5 records - Linares, several, ♂♂ and ♀♀, 31-V-2012 to 1-VII-2012 and then 6-VII-2013. All records confirmed by genitalia examination.

Eupithecia venosata (Fabricius, 1787)

5 records - recorded as singletons on five occasions, from 21-V to 2-VII.

Eupithecia virgaureata Doubleday, 1861

Single record - Pesaguero, 1 ♀, 1-IX-2012.

Discussion and conclusions

Species of particular interest

The addition of *E. exiguata* (Hübner, [1813]) to the Iberian Peninsula fauna is of some interest and may be discussed in parallel with the recent confirmation of *E. valerianata* (Hübner, [1813]) by REDONDO *et al*. (2010), since both are components of the Eurasian fauna. Whilst it is true that, in general, species in the northern hemisphere are expanding northwards with the warming climate, so that one might expect areas to the south to offer the greatest source of 'new' species, the Eurasian fauna is also a potential source. Their confirmation of *E. valerianata* was based on a female from Mirantes de Luna (León) on 3-VII-2009, as a result of which discovery a previously rejected record from Mataró (Barcelona) in 1870 was readmitted to the Spanish list. It is exciting that our present results may indicate that this species is resident and breeding in Cantabria. Conversely, *Eupithecia exiguata* is recorded only as a single example. It is a distinctive species that is unlikely to have been overlooked by any experienced English lepidopterist and we are confident that earlier specimens have not escaped our attention. It seems possible that both of these species may be overlooked residents in this poorly studied area of northern Spain.

Eupithecia ochridata Schütze & Pinker, 1968 has a scattered distribution in the Iberian Peninsula which REDONDO *et al*. (2009) interpret as a consequence of it being a fairly recent addition to fauna. The implication in their text that it will be found across a wider area is supported by our single example from Linares in May 2013. According to MIRONOV (2003), the larvae feed on the leaves, flowers and seeds of *Artemisia* species, including *A. alba* (Macedonia), *A. campestris* (Germany), *A. scoparia* and *A. schmidtiana* (Austria and Italy).

The distribution map given by MIRONOV (2003) for *E. pantellata* Millière suggests that this moth is a Maghrebian faunal element (Morocco, Algeria and Tunisia with the southern Iberian Peninsula) and thus a surprising addition to the fauna of Cantabria. However, it is now known to be widely distributed across the entire Portugal, from south to north (Martin CORLEY, personal communication, February 2014) and the map by MIRONOV (2003) is more likely, therefore, to reflect the severely under-recorded nature of the Eupitheciini in the Iberian Peninsula at that date.

Eupithecia pyreneata Mabille, 1871 is a Euro-Turanian species, well-established in the Pyrenean Mountains, but also resident in Spain's southern coastal zone and in the Sistema Central, in the southern part of Castilla y León. Its presence at Pesaguero perhaps suggests that there may be undiscovered populations affecting the wider area of the montane zone in Spain, including the Cordillera Cantábrica.

Eupithecia egenaria Herrich-Schäffer, 1848 is represented in the Iberian Peninsula at only four localities, all listed by REDONDO *et al*. (2009). As for the previous species, the present record is the first for Cantabria and represents a significant westwards range expansion. Of particular interest is the evidence for a second generation of adults during 2013. As far as we are able to ascertain this is the first such report for the whole of Europe.

Eupithecia extraversaria Herrich-Schäffer, 1852 has a rather strange apparent Iberian Peninsula distribution. Most known localities lie within the Pyrenees, in Aragón and Cataluña, but it is also noted throughout the remainder of Cataluña and in the south of Aragón, with a single record from the Sierra Nevada, in Andalucía. This presents a somewhat easterly distribution, but that impression is confused by the fact that the species has been noted from the central Portuguese region of Alto Alentejo (MIRONOV, 2003) and more recently in that country's provinces of Minho and Trás-os-Montes (CORLEY *et al*., 2013). Our Cantabrian locality is relatively isolated, but may indicate, simply, that this species is more widely distributed than current information suggests.

Eupithecia phoeniceata (Rambur, 1834) is evidently widespread in the north-eastern quadrant of the Iberian Peninsula and there are also localities known in the south in Andalucía and in southern Portugal in the Algarve and Bajo Alentejo (CORLEY *at al*., 2013). The larval foodplants of both *E. phoeniceata* and of *E. oxycedrata* require elucidation in our area. In Portugal, *E. phoeniceata* is restricted to the south of the country, where the larval pabulum is *Juniperus phoenicea*, but it appears to be absent from places such as the Douro Valley, where *J. oxycedrus* is plentiful and *E. oxycedrata* is abundant (Martin Corley, personal communication, February 2014). *Juniperus* is a native element of the local flora in the area surrounding our two primary recording stations at Pesaguero and Linares, but is only sparsely distributed and *J. phoenicea* has yet to be encountered here. *Juniperus oxycedrus* grows much further down the valley in the hot, dry habitats around Potes - a distance much greater than that over which a pug moth might be expected to travel. Planted *Cupressus* appear to be largely absent, although clearly we are not able to examine many private areas.

Our Cantabrian records appear to suggest a possible bivoltine life history. MIRONOV (2003) considers *E. phoeniceata* to be univoltine, with adults on the wing from late August to early December across Europe, but GOATER & SKINNER (1981) note that in southern England it is recorded from May to October. More recently, BARNETT *et al*. (2008) present a histogram showing adult records from late July to the end of September in the Bristol area of south-west England, with a significant population peak in late August.

Eupithecia virgaureata Doubleday, 1861 is supposedly a species of damp, montane woodland in Spain. It is evidently widespread in the Pyrenees, but reaches its western limits, according to the distribution maps in REDONDO *et al*. (2009) in the País Vasco. Our record suggests that the true distribution may extend further.

The wider fauna of Eupitheciini

The Iberian Peninsula supports an extremely rich fauna of Lepidoptera (vide, e.g., KARSHOLT & RAZOWSKI, 1996). However, available information is very widely scattered across the entomological literature, published in several different countries and therefore, languages. For the Geometridae, the important works of REDONDO *et al*. (2009, 2010) have updated and compiled available data. REDONDO *et al*. (2009) included, for the first time, distribution maps of Iberian Peninsula species of Geometridae and has been a major source of

reference in our wider researches; it lists 87 Eupitheciini for the Iberian Peninsula (excluding the Balearic Islands). The more recent REDONDO *et al*. (2010) adds *Eupithecia valerianata* and with the present addition of *E. exiguata*, the total for the Iberian Peninsula stands at 89. Of these, we now know of a total of 28 species in Cantabria, which represents a mere 32% of the Iberian Peninsula fauna.

However, it is not at all likely that all 89 Iberian Peninsula pugs will be present either in Cantabria or, for that matter, anywhere else within the Orocantabrican biogeographical region. This physical zone incorporates the Colline and Montane bioclimatic regions (vide RIVAS-MARTÍNEZ, 1987) and extends from Galicia to the Pyrenees, encompassing northern Portugal, Galicia, Asturias, northern Castilla y León, Cantabria, La Rioja, the País Vasco and north-western Navarra. Overall, we would expect the northern Iberian Peninsula fauna to be dominated by Eurasian elements.

In an attempt to estimate what the actual fauna of Cantabria might comprise, we compared the species recorded in the present study with those recorded by REDONDO *et al*. (2009) for the regions to the east (País Vasco) and west (Asturias) of Cantabria. The latter two regions appear to have been given more attention by lepidopterists in the past than Cantabria. Thirty-one species were recorded in the País Vasco and Asturias (Table 1) and of these, 11 species (shaded rows in Table 1), were not recorded in our present study or by REDONDO *et al*. (2009) in Cantabria; these species might be found in Cantabria in the future. To these 39 species could be added another five (*Pasiphila debiliata* (Hübner, [1817]), *E. plumbeolata* (Haworth, 1809), *E. alliaria* Staudinger, 1870, *E. pimpinellata* (Hübner, [1813]) and *E. distinctaria* Herrich-Schäffer, 1848), that have been recorded just over the southern borders of Cantabria, the País Vasco and Asturias, in Castilla y León. This makes a total of 44 species of which we now record 28 (64%). In view of our own fairly sedentary nature as recorders, this is a figure we do not find surprising; we would welcome data from other visitors to this area.

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Table 1.– Presence (yes) or absence (no) of pug moths in the present study, and from distribution maps in REDONDO *et al.* (2009) for Cantabria alone and Asturias and País Vasco together. Shaded rows denote those species that are most likely to be recorded in Cantabria in the future (based on their occurrence in Asturias and the País Vasco).

Species	Present study	Cantabria (REDONDO *et al*., 2009)	Asturias & País Vasco (REDONDO *et al*., 2009
Chloroclystis v-ata	yes	no	yes
Gymnoscelis rufifasciata	yes	no	yes
Pasiphila rectangulata	yes	no	yes
Eupithecia abbreviata	yes	yes	yes
Eupithecia absinthiata	no	no	yes
Eupithecia assimiliata	yes	no	yes
Eupithecia breviculata	yes	no	yes
Eupithecia centaureata	yes	no	yes
Eupithecia cocciferata	yes	yes	yes
Eupithecia dodoneata	yes	no	yes
Eupithecia egenaria	yes	no	no
Eupithecia exiguata	yes	no	no
Eupithecia extraversaria	yes	no	no
Eupithecia haworthiata	yes	no	yes
Eupithecia icterata	no	yes	yes
Eupithecia indigata	no	no	yes
Eupithecia innotata	yes	no	yes
Eupithecia irriguata	yes	no	yes
Eupithecia lariciata	no	no	yes
Eupithecia massiliata	no	no	yes
Eupithecia nanata	yes	yes	yes
Eupithecia ochridata	yes	no	no
Eupithecia oxycedrata	yes	no	yes
Eupithecia pantellata	yes	no	no
Eupithecia pauxillaria	no	no	yes
Eupithecia phoeniceata	yes	no	no
Eupithecia pulchellata	yes	no	yes
Eupithecia pusillata	no	no	yes
Eupithecia pyreneata	yes	no	no
Eupithecia scopariata	yes	no	yes
Eupithecia selinata	no	no	yes
Eupithecia subfuscata	yes	no	yes
Eupithecia ultimaria	no	no	yes
Eupithecia valerianata	yes	no	no
Eupithecia variostrigata	no	no	yes
Eupithecia venosata	yes	no	yes
Eupithecia virgaureata	yes	no	yes
Eupithecia vulgata	no	no	yes
Eupithecia weissi	no	no	yes
Total	**27**	**4**	**31**