

A further note on the biology of *Pancalia schwarzeella* (Fabricius, 1798) (Lepidoptera: Cosmopterigidae) and a consideration of English records

R. J. HECKFORD

67 Newnham Road, Plympton, Plymouth, Devon PL7 4AW, U.K.

S. D. BEAVAN

The Hayes, Zeal Monachorum, Devon EX17 6DF, U.K.

Synopsis

Prior to 2004, when larvae were found at four localities in Scotland in 2004 and 2005, the early stages of *Pancalia schwarzeella* (Fabricius, 1798) appear to have been unknown. Since publication of that discovery in 2006 we are not aware of larvae being found elsewhere in the British Isles. During mid to late July 2008 we found larvae and adults at Braunton Burrows, Devon (V.C. 4), an area of extensive sand dunes. This appears to be a rather late record of the adult, at least at a low elevation, the first county record and apparently the first record from England for over 50 years.

Key words: Lepidoptera, Cosmopterigidae, *Pancalia schwarzeella*, England, Braunton Burrows, sand dunes, *Viola* spp., biology.

Introduction

Adults of both *Pancalia schwarzeella* (Fabricius, 1798) and *P. leuvenhoekella* (Linnaeus, 1761) are very similar and sometimes occur together. The main macroscopic distinguishing character is the antenna; that of both sexes of *P. leuvenhoekella* and the female of *P. schwarzeella* is dark fuscous with a white subapical section whereas that of the male of *P. schwarzeella* lacks the white subapical section. The species are separable on the genitalia. It was probably not until the early part of the last century, at least in the British Isles, that the correct association of the sexes of the two species was made.

Stainton (1854: 168) initially separated the species on the basis that the antennae of *P. schwarzeella*, then known as *P. latreillella* Curtis, 1830, are entirely dark fuscous whereas those of *P. leuvenhoekella* have a broad white ring before the apex. Five years later, however, he states (Stainton, 1859: 361) that the antenna of the male *P. latreillella* is entirely dark fuscous but the female has a broad white ring before the tip and the antennae of both sexes of *P. leuvenhoekella* have a white ring. Later again, in an article entitled '*Pancalia leuvenhoekella* and *latreillella*; are they the sexes of one species?', Stainton (1885: 193–197) refers to his 1854 and 1859 publications and comments on the latter that he now had no recollection where he obtained the notion that the antennae of *P. latreillella* differed according to the sex. He recommended that moths should be obtained in copula to determine the issue. He then sets

out observations made by P. C. T. Snellen in The Netherlands to the effect that *Pancalia leuwenhoekella* and *P. latreillella* are synonyms of *P. nodosella* (Bruand, 1851), a species not known in the British Isles. He also provides a translation of a paper by Snellen published in 1877. This refers to comments of certain other continental European lepidopterists about *Pancalia leuwenhoekella*, *P. latreillella* and *P. nodosella*. From these it is clear that there were various views as to whether they were all good species and if so how they could be reliably separated. It is interesting that Snellen records that Nolcken and Heinemann considered that the antenna of male *P. latreillella* was dark fuscous whereas the female was whitish before the tip.

Meyrick (1895: 676) treated *P. latreillella* as a junior synonym of *P. leuwenhoekella*, stating that, 'Antennae usually with white subapical band'. Just over 30 years later ([1928]: 703) he recognised *P. latreillella* as a good species. The dichotomous key that he gave for separating the two species was:

- 'Antennae ♂ with white band, ♀ simple 1. *leuwenhoekella*.
 " without white band, ♀ rough-scaled in
 middle 2. *latreillella*.'

Neither in this key nor in the text treating these species does he mention that the female of each species has a white subapical band.

As a result of the confusion that existed, records of *Pancalia schwarzeella* prior to 1928 cannot necessarily be assumed to be correct unless either the specimen is available for examination or the written record describes the antenna and then only if it is clear that it does not have a white subapical section, and so is a male *P. schwarzeella*.

For a long time the larva of *Pancalia schwarzeella* remained undetected. It was only a few years ago that Koster (2002: 263–264) and Koster & Sinev (2003: 94–95) stated that the immature stages were insufficiently known but should be similar to those of *P. leuwenhoekella*. They give *Viola canina* L. and *Viola hirta* L. as the host-plants of *P. schwarzeella*. This information appears to be based on the reasonable assumption that the foodplants are likely to be the same as, or similar to, those of the closely related *P. leuwenhoekella* which are stated to be the same, with *Viola tricolor* (L.) Wittr. in addition.

The only literature record they give for the larva of *P. leuwenhoekella* is that of Fletcher (1893: 81–82), and we cannot trace any other. Fletcher states that the larva of *P. leuwenhoekella*, in the early instars, mines the petiole of the leaf in early July but later makes an opaque gallery of silk and detritus between the roots of the plant and eats a large part of the bark from its underground stem. It then pupates in August in a firm cocoon of silk and detritus on the ground.

The biology was more fully understood when Heckford (2006: 209–214) found larvae of *Pancalia schwarzeella* feeding on leaves of *Viola riviniana* Reichb. and also, probably, *Viola palustris* L. between 24 and 27 July 2004 and on 30 June 2005 at one locality in Easternness (V.C. 96) and at three localities in South Aberdeen (V.C. 92).

We can now confirm *Viola canina* and *Viola hirta* as foodplants, as suggested by Koster (2002: 263–264) and Koster & Sinev (2003: 94–95), in addition to the *Viola* species mentioned in the paragraph above.

According to Koster (2002: 264) the adult occurs from the end of April to mid-June and to the end of July at high altitudes but, as will be seen, we found larvae and adults at sea level at Braunton Burrows, Devon, in mid July 2008. This is the first record for the county and, as a result of consideration of prior English records given below, it appears to be the first record from England for over 50 years.

English records

In the British Isles, *Pancalia schwarzeella* is considerably less common than *P. leuvenhoekella* and has been recorded from far fewer vice-counties. According to the map showing the distribution of *P. schwarzeella* in *The Moths and Butterflies of Great Britain and Ireland* volume 4 (1) (Koster, 2002: 264, map 127), it has only been recorded from 26 vice-counties in the British Isles: 14 from England, one from Wales, seven from Scotland and four from Ireland.

The English vice-counties are: 1, 9, 11, 14, 15, 16, 17, 18, 19, 22, 33, 34, 54 and 69. Examination of records from those vice-counties, both published and obtained from relevant county recorders, shows that the inclusion of V.C. 22 in the distribution map is in error, the species has probably not been recorded from V.C. 15 and of the remainder the most recent was just over 50 years ago, from V.C. 1. We have not examined any specimens that form the basis of these records except those mentioned later which are in the British collection of Microlepidoptera at the Natural History Museum (BMNH), London, and which we examined in November 2009 with the considerable assistance of Dr K. Sattler, but some have been examined by others and one literature record shows that Tutt was dealing with this species because reference is made to specimens having dark fuscous unicolorous antennae.

We consider the records from these vice-counties from north to south and east to west as follows.

Westmorland with North Lancashire (V.C. 69). The species was found in the Ambleside area in June 1827 by J. Curtis and J. C. Dale (Brown, 1979: 274). S. M. Hewitt tells us (*in litt.*) that he has checked the Cumbria record cards of Dr N. L. Birkett, who has studied the Lepidoptera and other insect orders in the administrative county of Cumbria, of which V.C. 69 is a part, since the 1940s, and these do not contain any information additional to that given by Brown.

North Lincolnshire (V.C. 54). Several were recorded on 1 June 1891 at Alford by J. E. Mason (Johnson, 1996: 21). C. Smith tells us (*in litt.*) that he knows of no other record.

Essex (V.C.s 18 & 19). The only records given by Goodey (2004: 126) are Epping, V.C. 18, pre-1859, and St Osyth, V.C. 19, pre-1903. These are derived from Stainton (1859: 361) and Harwood (1903: 174) respectively.

Kent (V.C.s 15 & 16). We believe that the indication on map 127 that the species occurs in V.C. 15 is probably in error. The late A. M. Emmet, one of the editors of *The Moths and Butterflies of Great Britain and Ireland* volume 4 (1), produced maps on A4 sheets for every British species of Microlepidoptera. The vice-counties from which a species has been recorded are marked on each map, usually by encircling the vice-county number. The reverse of each A4 sheet usually gives the data in support of the map entry. Following his death, these maps went to Dr J. R.

Langmaid who has continued Emmet's Herculean work. The information on the reverse of each A4 sheet is usually only of the first record from each vice-county known to A. M. Emmet, and latterly to Dr Langmaid.

The reverse of the map for this species has a number of manuscript entries. One line reads '14, 15, 19, 83 [vice-county numbers] Stainton Manual'; several entries below this is written '16 [vice-county number] Stainton Man.' Both lines are in the handwriting of A. M. Emmet. In his *Manual of Butterflies and Moths*, Stainton (1859: 361) gives the following localities: 'Lw. Pm. Epping, and near Edinburgh'. His definition of abbreviations (1859: viii–ix) shows that 'Lw.' and 'Pm.' mean Lewes, in East Sussex, and Pembury, in West Kent (V.C. 16). Therefore, although the map entries attribute records from both Kent vice-counties to Stainton's *Manual of Butterflies and Moths*, in fact Stainton only gave one locality in Kent, namely Pembury.

Pembury is also the only locality given by Bower (1908: 205) in *The Victoria History of the County of Kent*. Tutt (1887: 64–66), however, recorded both *P. schwarzeella* (as *P. latreillella*) and *P. leuvenhoekella* from 'the Chalk Downs near Strood' on 4 June 1887. It is clear from his note that he found both species because he states that of the 23 specimens he caught three had dark fuscous unicolorous antennae, and so were male *P. schwarzeella*. There are two places in Kent with the name 'Strood'; one, now part of Rochester, is just within the north-eastern boundary of V.C. 16 and is either on or very close to the extensive chalk of the North Downs, the other is just south-west of Tenterden in V.C. 15 and is not near any chalk downs. Therefore, it seems most likely that Tutt took his specimens in V.C. 16.

We should add that the BMNH has a specimen, standing under *Pancalia schwarzeella*, taken on 30 May 1918 at Halstead, which is in V.C. 16. The initials of the captor are given as 'R.E.E.F.' These are probably those of the Reverend R. E. E. Frampton who lived at Halstead Rectory, Halstead (Dr D. J. L. Agassiz, *in litt.*). The specimen has a dark fuscous antenna with a white subapical section. Examination under a microscope shows that it is a male *P. leuvenhoekella*.

No other records are known from Kent.

East Sussex (V.C. 14). Stainton (1859: 361) gives 'Lw.', namely Lewes, which is on part of the extensive chalk of the South Downs.

The BMNH has five specimens taken by A. C. Vine, two in 1885 with the locality given as 'Brighton', one from the same locality but undated and two dated 1886 with no locality specified. All have dark fuscous unicolorous antennae. Brighton is also on part of the South Downs and is about 10 km south-west of Lewes.

In *The Victoria History of the County of Sussex*, Fletcher (1905: 204) gives 'Brighton Downs'.

J. E. Gardner took a specimen on 30 May 1922 at 'Tilgate', which is now in the BMNH under *Pancalia leuvenhoekella*. It has a dark fuscous unicolorous antenna and so in fact is a male *P. schwarzeella*. Tilgate itself is now within the southern edge of Crawley, with Tilgate Park and Tilgate Forest just to the south. All are just within the western boundary of V.C. 14.

Griffith (1932: 163) states that on 6 June 1931 he took six specimens 'in an open space in a wood in mid-Sussex', which had been submitted to E. Meyrick for determination. Mr D. J. Slade tells us (*in litt.*) that The National Museum of Wales, Cardiff, has seven specimens with dark fuscous unicolorous antennae taken by

Griffith all labelled 'WV', with no date, and next to them is a small label noting that they were determined by Meyrick as *P. latreillella* Curtis, 1830, and that the record was published in *The Entomologist*. 'WV' stands for Wivelsfield, which is just within V.C. 14. We do not know whether six were taken on 6 June 1931 and the seventh on a different date or whether the number given in *The Entomologist* is wrong. C. R. Pratt tells us (*in litt.*) that he does not know of any other Sussex record.

Surrey (V.C. 17). J. W. Douglas took at least one specimen near Mickleham on 18 June 1842 (Brown, 1979: 274). The BMNH has a male specimen, under *Pancalia leuwenhoekella*, from the Tyerman collection, taken at Box Hill on 18 May 1893 but as the antenna is unicolorous dark fuscous it is a male *P. schwarzella*. Mr J. Porter tells us (*in litt.*) that the only other record known to him is one specimen taken by K. G. Blair at Box Hill on 11 May 1935 and now in the Hampshire County Museum, Winchester, Hampshire, and whose identity has been confirmed by Dr J. R. Langmaid.

Berkshire (V.C. 22). We believe that the indication on map 127 that the species occurs in Berkshire is in error. The reverse of the map for this species has the following manuscript entry by A. M. Emmet for Berkshire 'North Unhill Bank 25.v.91 (B. R. Baker) *J. Br. Ent. nat. Hist.* 5: 59.' Unfortunately this entry appears to be an entirely understandable mistaken transposition of a record of *P. leuwenhoekella*. According to the report of the 1991 Annual Exhibition of the British Entomological and Natural History Society, published in the *British Journal of Entomology and Natural History*, B. R. Baker showed various species of Microlepidoptera from Berkshire in 1991, including one or more specimens of *P. leuwenhoekella* from North Unhill Bank collected on 25 May 1991, but he did not exhibit *P. schwarzella* (Baker, 1992: 59). Further, in *The Butterflies and Moths of Berkshire*, written by Baker and published in 1994, the most recent records of *P. leuwenhoekella* are given as 'North Unhill Bank, 4.vi.88, 25.v.91 (BRB)' (Baker, 1994: 90). *Pancalia schwarzella* is not mentioned as occurring in Berkshire.

South Hampshire (V.C. 11). There is an unconfirmed record from Hampshire, from sand hills at Hayling Island (V.C. 11), in *The Victoria History of the County of Hampshire and Isle of Wight* published in 1900 (Goater, 1974: 113). The BMNH has a specimen, standing under *P. leuwenhoekella*, from the F. G. Whittle collection, labelled Brockenhurst and taken on 20 May 1916. This has a dark fuscous unicolorous antenna and hence is a male *P. schwarzella*. This appears to be the first confirmed, and previously unpublished, record from Hampshire. Whittle lived at Southend-on-Sea, Essex. He spent the period from May to September 1916 in Hampshire, based at Brockenhurst, and produced a note of some of his entomological records for that period (Whittle, 1917: 14–16), but makes no mention of any *Pancalia* species. Dr J. R. Langmaid tells us (*in litt.*) that he knows of no other Hampshire record.

We should add that the BMNH has three specimens, standing under *Pancalia schwarzella*, taken on 30 May 1938 at Farley Mount by W. Fassnidge. All have dark fuscous antennae with a white subapical section. Examination under a microscope shows that they are all male and so are *P. leuwenhoekella*. It would appear that Fassnidge correctly identified them as *P. leuwenhoekella* because Goater (1974: 112), under that species, gives 'Farley Mount, c. [common] (WF ms.)' and in the introduction to his book states that some of the records are derived from a manuscript List of Hampshire Tineidae which was being prepared by Fassnidge but never published.

Gloucestershire (V.C.s 33 & 34). Fletcher (1935: 82–83) records the species from Rodborough Hill in April and May 1935. The BMNH has three specimens with dark fuscous unicolorous antennae, and so are male *P. schwarzeella*, taken on 20 May 1935 by Fletcher with the locality given as ‘Stroud’. ‘Rodborough Hill’ is not a name that appears on the current Ordnance Survey map for the Stroud area, but an area called ‘Rodborough Common’ (V.C. 34) is just to the south of Stroud and we assume that Fletcher’s specimens came from there. Fletcher & Clutterbuck (1940: 104) provide one record from Haresfield (V.C. 33), on 4 May 1937, and several from ‘Rodborough’ between 28 April 1935 and 19 May 1939, commenting that it was locally common there in 1935, less common in 1936, was not seen in 1937 and apparently scarce since. Although in different vice-counties, Haresfield and Rodborough Common are less than 8 km apart. Newton (1985), in a supplement to the Microlepidoptera records of Gloucestershire since those published by Fletcher & Clutterbuck, does not list the species and so presumably did not know of any subsequent record. R. G. Gaunt tells us (*in litt.*) that he does not know of any other record.

Dorset (V.C. 9). The only known records were made by E. R. Bankes. On 30 May 1891 he took a specimen at Ballard Down, the identification being confirmed by H. T. Stainton (Richardson, 1913: 74). This specimen is in the BMNH with the locality given as ‘Swan.’ [Swanage]. Ballard Down is a chalk downland situated between Swanage and Studland. The BMNH also has a specimen taken on 27 May 1907 at Lytchett Minster. Both specimens have dark fuscous unicolorous antennae. Dr P. H. Sterling tells us (*in litt.*) that he does not know of any other record.

West Cornwall (V.C. 1). There are two records. The first was from somewhere on the Lizard peninsula on 31 May 1858 (Boyd, 1858: 144). The second was on 25 May 1956 at Park Shady (Tremewan, 1961: 139), but the species probably no longer occurs there because when revisited in 1991 the biotope was found to have been completely destroyed by attempted cultivation (Smith, 1997: 105). This appears to have been the last English record before the discovery of the species in July 2008 at Braunton Burrows, Devon, mentioned later in this paper.

In the course of our research we noted that the following are not shown on map 127 (Koster, 2002: 264).

J. H. Wood recorded the species in 1892 in the Tarrington district, Herefordshire (V.C. 36), and it was included in *The Victoria History of the County of Herefordshire* (Harper & Simpson, 2003: 170). It has not been recorded since according to those authors, who state that it is an ‘Extinct resident’.

Palmer (2001: 115) refers to a record of, apparently, one specimen in 1872 from Rabley, Wiltshire (V.C. 7), but states that this requires confirmation.

It is no doubt for these reasons that map 127 does not include V.C.s 7 and 36 in the distribution of the species.

We cannot trace any subsequent record of *Panccalia schwarzeella* from any additional vice-county in England since *The Moths and Butterflies of Great Britain and Ireland* volume 4 (1) was published in 2002.

In summary, therefore, it appears that in England during the 100 years prior to 12 July 2008, the species has only been recorded from seven localities in the following six vice-counties: West Cornwall (V.C. 1) (1956), South Hampshire (V.C. 11) (1916), East Sussex (V.C. 14) (1922, 1931), Surrey (V.C. 17) (1935), East Gloucester (V.C. 33) (1937) and West Gloucester (V.C. 34) (1935 to 1939).

Discovery of *Pancalia schwarzeella* in Devon

On 12 July 2008 we visited Braunton Burrows, Devon, an extensive sand dune system on the north Devon coast. It is an area that is comparatively well known entomologically and which both authors have visited on a number of occasions since the mid 1980s. It was a rather windy day and we were on our hands and knees closely searching the comparatively short turf growing on compacted sand immediately to the east of the main sand dunes. We found a leaf of *Viola hirta* L. almost touching the substrate, whose underside was partially eaten, resulting in the uneaten upper surface of the area showing white and from the underside of which slight silken threads lead to a silken tube that was spun amongst moss. Careful examination showed that this tube was inhabited by a larva that appeared to RJH to be similar to those of *Pancalia schwarzeella* that he had collected in Scotland in 2004 and 2005. Further examination of the area produced two more larvae, each in a silken tube amongst the same moss with strands leading to leaves of *Viola canina* L. We also found several empty tubes amongst the same moss and leading to the same *Viola* species in this area.

SDB returned to the same small area on 16 July 2008 and whilst carefully searching the turf for further larvae, disturbed a female *P. schwarzeella*. During a visit on 18 July, again whilst on her hands and knees, but this time in the pouring rain, a male *P. schwarzeella* 'jumped' out onto her hand. Also one larva was noted on each of these visits. On 26 July, a less windy day, we returned to the site and smoked out two adults, both female. We also saw two larvae there but failed to find them in what seemed to be similar areas nearby. During the late afternoon we caught one adult flying about 250 m from the original site.

Biology

The larvae ranged in length from between about 4–10 mm and the colour and markings appeared to agree, except in two respects, with the larvae of *P. schwarzeella* which RJH had found in Scotland in 2004 and 2005. The differences between the larvae found in Scotland and those at Braunton Burrows being that the larvae in Scotland had dull purplish brown bodies with dull creamy white dorsal, subdorsal, lateral and lateroventral lines, from thoracic segment 3, which became fainter, interrupted or obsolete from about abdominal segments 4 and 5, but the bodies of the larvae found at Braunton Burrows were only slightly tinged purplish brown and the dorsal, subdorsal, lateral and lateroventral lines extended to abdominal segment 9. As a full description of the final instar has already been provided by RJH (Heckford, 2006: 211–213), it is not repeated here. That paper had two monochrome photographs of the larva. We take this opportunity to provide two colour photographs (Figs 1, 2) of the larva, one within the silken tube mentioned below.

As in 2004 and 2005, the larvae were not easy to find because none was feeding on the leaves. All the larvae were in silken tubes that were spun amongst the moss *Homalothecium lutescens* (Hedw.) H. Rob., which also had



Fig. 1. Larva of *Pancalia schwarzeella* (Fabricius, 1798).

Photo: R. J. Heckford



Fig. 2. Larval tube, with larva, of *Pancalia schwarzeella* (Fabricius, 1798).

Photo: R. J. Heckford

Hypnum lacunosum (Brid.) Hoffm. ex Brid. var. *lacunosum* growing amongst it. Where we found the larvae, the moss was about 10–15 mm deep, with *Viola hirta*, *Viola canina* and other plants growing through it, forming a comparatively short, soft sward. Each tube extended from several millimetres below the surface, usually more or less at the base of the moss where it met the compacted sand substrate, and then meandered up through the moss resulting in each tube not being attached just to one stem of the moss but amongst and over several stems. Each tube was made of comparatively thick, white silk and usually did not touch the leaf of the foodplant but had some silken strands leading from the end of the tube where it reached the surface of the moss to the underside of a leaf of the foodplant. Unlike RJH's observations in Scotland, where the presence of larvae was obvious from brownish 'windows' in the lower surface of basal leaves of *Viola* species caused by the larvae eating (but not mining) part of the lower surface, most of the leaves at Braunton Burrows to which silken strands were attached did not have any 'windows', but had areas completely eaten away. Like those in Scotland, all the affected leaves were very close to the surface of the ground. Also, it would appear, in line with the observations in Scotland, that no more than one larva fed on any one plant. Had we not found the first leaf with its white uneaten area we doubt that we would have noticed the eaten leaves, nor searched for tubes amongst the moss.

Although the *Viola* species also grew in areas without *Homalothecium lutescens*, sometimes amongst other moss and sometimes without any association with moss, we only found larvae where the *Viola* species grew amongst this moss.

All the larvae spun cocoons by mid August and moths emerged between 12 and 14 March 2009.

This is not the first time that *P. schwarzella* has been recorded from a sand dune area in the British Isles. It appears that the first record of *Pancalia schwarzella* from sand dunes in the British Isles was provided by Beirne (1938: 229–230). He states that on 14 May 1932, A. W. Stelfox, of the Natural History Museum, Dublin, noticed a moth that was common on the sand hills at Ballyteige Bay, Kilmore, Co. Wexford (H. 12). He caught a specimen that was identified as this species at the Natural History Museum, London, then the British Museum (Natural History). On 19 May 1934, Stelfox visited the locality with J. N. Halbert when again *Pancalia* species were found to be common. Halbert took a specimen that he gave to Beirne and this proved to be *P. leuwenhoekella*, the first Irish record. Beirne went there on 22 May 1936 and found both species to be common in the hollows of the sand hills, with *P. schwarzella* the more common.

Also, Dr J. R. Langmaid tells us (pers. comm.) that he has found the species at two sand dune areas in South Aberdeen, one of which may be threatened by a proposed golf course development.

The species has recently been found in a similar situation on the islands of Terschelling and Ameland in The Netherlands (J. C. Koster, *in litt.*).

Pancalia nodosella occurs on sand dunes in continental Europe. It has been reared on *Viola tricolor* ssp. *curtisii* (E. Forster) Syme (J. C. Koster, *in litt.*), a plant that occurs at Braunton Burrows although not where we found moths

and larvae. Partly for this reason and partly because of the difference in the larvae between those from Scotland and those from Braunton Burrows, genitalic preparations were made of one of the moths collected in July 2008 as well as one of the moths reared in 2009, both females, to confirm identification.

Discussion

It was very surprising to discover *Pancalia schwarzeella* at Braunton Burrows in July 2008, not only because of the late date for the adult at low elevation but also because of the lack of records from England since 1956 and the absence of records in England from sand dunes, apart from the unconfirmed one from Hayling Island, Hampshire, given in *The Victoria History of the County of Hampshire and Isle of Wight*, and so it would be worth making further searches there.

It is difficult to know whether there has been a genuine decline in the species in England or whether the lack of recent records is simply an indication that it has been overlooked. We know from what we have been told by some recorders that they have made a particular point of checking for this species, without success, where *P. leuvenhoekella* is known to occur.

On the basis of our present observations it appears that the species has a very specific microhabitat requirement at Braunton Burrows involving one species of moss, but is likely to be more widespread at this locality than we have so far had time to investigate.

Although the species appears to be regarded as univoltine, with a long emergence period, the discovery of adults and larvae at the same time in July 2008 with moths resulting from those larvae in March 2009 suggests that it may be bivoltine, at least at Braunton Burrows.

Finally we should mention that *P. leuvenhoekella* has never been recorded in Devon and so we did not have to consider whether any old records of that species might have been misidentifications of *P. schwarzeella*.

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NOTES AND OBSERVATIONS

A previously unrecognised Scottish record of *Pancalia schwarzeella* (Fabricius, 1798) (Lepidoptera: Cosmopterigidae), which extends the known range of the species in Britain

Heckford & Beavan (2010, *Entomologist's Gazette* 61: 159–170) have offered a consideration of the English records of *Pancalia schwarzeella* (Fabricius, 1798). During the research for that paper the opportunity was taken to examine specimens held at the Natural History Museum, London.

Standing under the name *Pancalia leuvenhoekella* (Linnaeus, 1761) are 22 specimens from the F. G. Whittle collection taken between 1916 and 1921 from five localities. In fact 17 of these specimens, and at least one from each location, are male *Pancalia schwarzeella*, because they have dark fuscous unicolorous antennae. The distinguishing features separating the two species were not fully understood at that time. Whilst four of the five hand-written data labels detail entomologically well-established localities, the fifth is not easy to decipher and no known place name was convincing (Fig. 1). There are eight specimens standing under this label taken between 8 May and 2 June 1921.

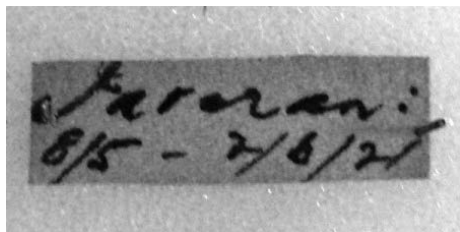


Photo: S. D. Beavan

Fig. 1. Label from the F. G. Whittle collection attributing location of specimens of *Pancalia schwarzeella*.

Research into the life of Francis George Whittle revealed that it ended when, sitting on the seafront at Southend-on-Sea and attended only by his faithful fox terrier, he died suddenly in October 1921 at the age of 68 (1921, *The Entomologist* 54: 302–303). W. G. Sheldon, who had written his obituary, also ensured that the notes of his final Scottish trip were published posthumously the following year (Whittle, 1922, *The Entomologist* 55: 10–11). In those notes Whittle states that early in May 1921 he ‘arrived at Invershin for Inveran, just above the junction of the rivers Oykel and Shin.’ On seeing the name Inveran it became clear that this is indeed the name on the data label and the dates would support this view. Inveran is situated to the north-east of the river Oykel and hence is in East Sutherland, V.C. 107 (Dandy, 1969, *Watsonian Vice-Counties of Great Britain* 35 and North Sheet).

This is the only known record of *Pancalia schwarzeella* from that vice county and is the most northerly record in the British Isles. It is published here apparently for the first time. It is ironic that, despite reporting that 'I did not find my visit unprofitable. Several interesting species occurred in moderate numbers.', Whittle failed to include any *Pancalia* species in the list of those interesting species!

S. D. BEAVAN
The Hayes,
Zeal Monachorum,
Devon EX17 6DF, U.K.

R. J. HECKFORD
67 Newnham Road,
Plympton, Plymouth,
Devon PL7 4AW, U.K.

A further note on the biology of *Panacalia schwarzeella* (Fabricius, 1798) (Lepidoptera: Cosmopterigidae) and a consideration of English records. Article. Jul 2010. R.J. Heckford. S.D. Beavan. Prior to 2004, when larvae were found at four localities in Scotland in 2004 and 2005, the early stages of *Panacalia schwarzeella* (Fabricius, 1798) appear to have been unknown. Since publication of that discovery in 2006 we are not aware of larvae being found elsewhere in the British Isles. During mid to late July 2008 we found larvae and adults at Braunton Burrows, Devon (VC. 4), an area of extensive sand dunes. Lepidoptera are characterized by, and named after, their dense covering of chitinous scales on bodies, legs, and wings. A search for further Mesozoic wing-scale records is needed to fully assess the potential of the palynological microfossils as a useful source of evolutionary and ecological information, but it seems safe to conclude that our Rhaetian-Hettangian data already offer a new window on the timing of basal lepidopteran divergences. The reproductive biology of *Kauri* (*Agathis australis*). I. Pollination and prefertilization development. Int.