GEOMETRIDAE

1678 (8017) Blair's Mocha *Cyclophora puppillaria* (Hübner, 1799) — Immigrant, possibly now resident
1678a (8018) Jersey Mocha *Cyclophora ruficiliaria* (Herrich-Schäffer, 1855) — Immigrant, resident
1679 (8019) False Mocha *Cyclophora porata* (Linnaeus, 1767)
UK Biodiversity Action Plan Priority, Nationally Scarce B
1680 (8022) Maiden's Blush *Cyclophora punctaria* (Linnaeus, 1758) — Common
1681 (8024) Clay Triple-lines *Cyclophora linearia* (Hübner, 1799) — Local

Diagnostic external characters

These species are very closely related and the difficulties they present should not be under-estimated. Hybrids (which may have intermediate genitalia) between some species in this genus are easily obtained in captivity and have repeatedly been reported in the wild, suggesting that the barriers between species are low and speciation occurred relatively recently (Hausmann, 2004).

The adults are variable in colour and markings, even in some cases between spring and summer generations. Diagnostic features as provided by Waring *et al*. (2009) and Skinner (2009) can successfully identify most examples, but should be used with caution as the relevant features (such as discal spots and the forewing apex) are often small and easily lost or modified with wear and in any case are prone to variability. For example, although *ruficiliaria* is stated to have white, un-ringed discal spots on fore- and hindwing, Hausmann (2004) notes that sometimes it is thinly ringed on the hindwing. This could, for example, cause confusion with *puppillaria*, in which the discal spots may be very small and only weakly ringed. Chainey (2001) and Chainey and Spence (2004), also discuss diagnostic features in this group.

With care the majority can be identified, either by external features or genitalia or a combination of these, depending on the species, the sex and condition of the specimen. In the case of males (with narrowly pectinate antennae), genitalia should be checked if there is any doubt. As described below, females can be very difficult to separate using genitalia, and as pointed out by Chainey and Spence (2004), often the easiest and most sensible solution is to allow the moth to lay some eggs, rear the larvae and identify the offspring, when the genitalia of the males can be examined. The larvae are not difficult to rear.

Key to diagnostic morphological characters of the males

Terminology follows that of Hausmann (2004). It may be possible to view the valvae *in situ* by extruding them if the abdomen is soft.

1. Valva without broad ventral projection, but with long, narrow fibula (Figs. 1-2, A)……2

– Valva with broad ventral projection (Figs. 3-5, A)……3

2. Fibula very long, broad at base, sharply bent and sickle-like (Fig. 1, A)……*puppillaria**

– Fibula shorter, fairly straight. Narrow at base; apex broadened, club-like (Fig. 2, A)……*ruficiliaria**

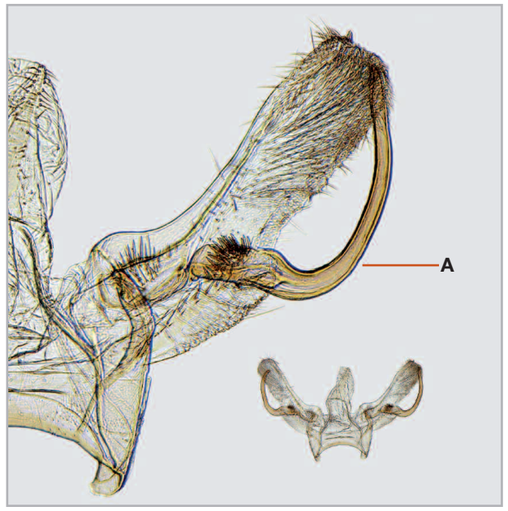
*(see also *quercimontaria*, below under *Other similar species*).

3. Ventral projection lacking long spines, very broad, tapering to beak-like extension (Fig. 3, A)……*porata*

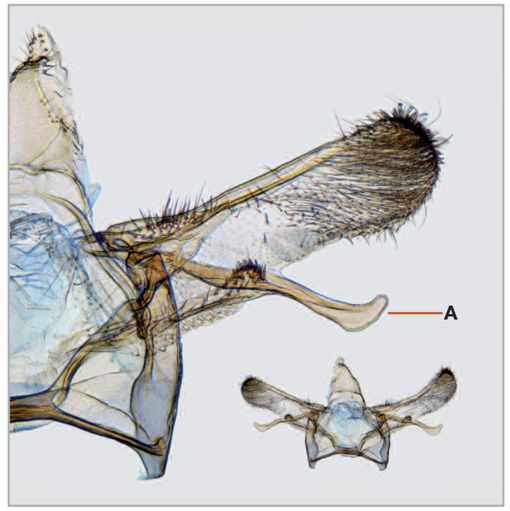
– Ventral projection thickly clothed with long spines in apical third……4

4. Ventral projection sub-rectangular (Fig. 4, A); short basal extension clothed with spines (B). Fibula (C) long, slightly bent……*punctaria*

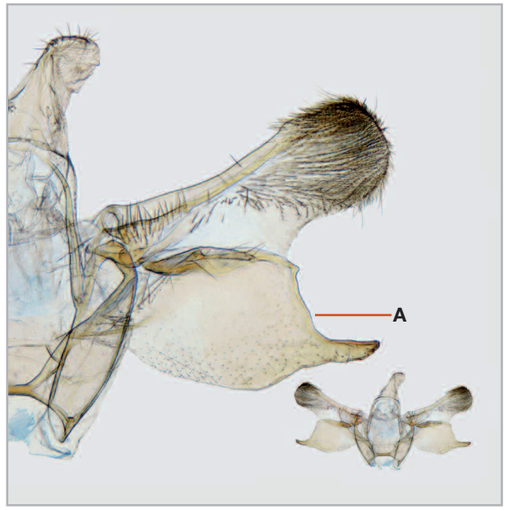
– Ventral projection rounded sub-quadrate (Fig. 5, A). Basal extension absent. Fibula (B) strongly elbowed……*linearia*



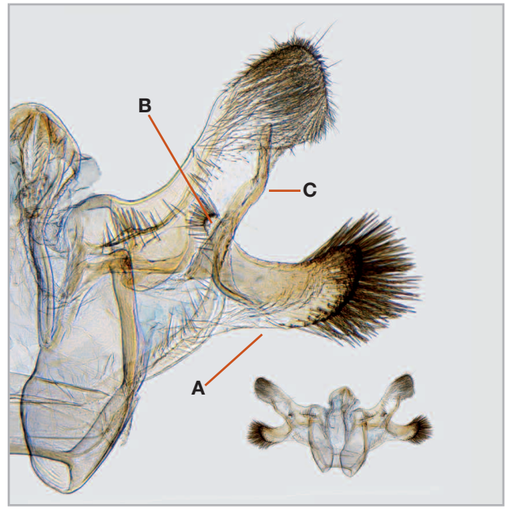
1. *Cyclophora puppillaria*



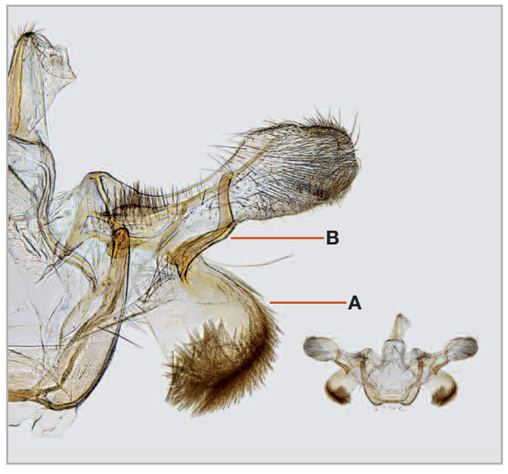
2. *Cyclophora ruficiliaria*



3. *Cyclophora porata*



4. *Cyclophora punctaria*



5. *Cyclophora linearia*

Plate 1. Genitalia of male *Cyclophora* species (aedeagus not shown).

Diagnostic morphological characters of the females

In the female, positive identification from the genitalia is difficult and in some cases will not be possible as the differences are slight and difficult to interpret. The shape of the ductus bursae and its length relative to the bursa copulatrix are the only useful characters. Even here the differences are comparative and slight with intra-specific variation and overlap between species. Moreover, these are fragile structures, which can easily become misshapen. It is important that the ductus bursae is not twisted or damaged in the dissection or slide preparation. Experience in dissection techniques, a number of specimens, and a graduated eyepiece lens are needed, and great caution should be exercised in making a determination. For these reasons, it is not considered appropriate to present a key in this case. However, illustrations and notes are included here as a guide, as they may be of use in cases where some species can be safely eliminated using other features. It would be advisable to dissect confirmed examples of the various species before attempting a determination.

In all five species, the ductus bursae (Figs. 6-10, A) is dilated at the ostium end. The apparent degree of dilation can depend on how the genitalia come to rest in the final preparation, and may also show intra-specific variation. Therefore the shape of this area may be deceptive. Also, the degree of curvature of the ductus varies from specimen to specimen, again depending on its orientation on the slide. Dimensions are from Hausmann (2004), who provides further detail.

Ductus bursae (Fig. 6, A) 0.7-0.9 mm long and relatively broad.....*puppillaria*

Ductus bursae (Fig. 7, A) 0.85-1.3 mm long.....*ruficiliaria*

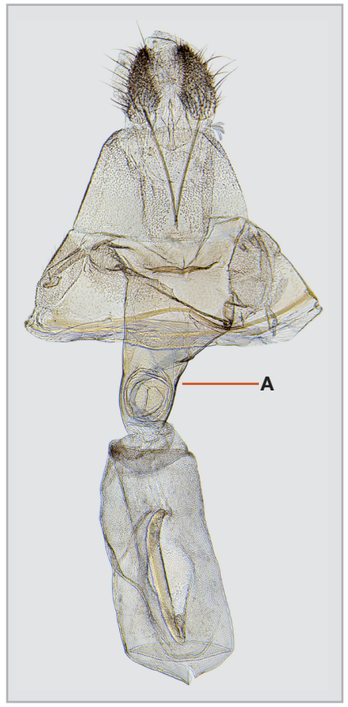
Ductus bursae (Fig. 8, A) 1.3-1.6 mm long (usually 0.55-0.7 times length of bursa copulatrix).
Broad, fairly straight and moderately tapered.....*punctaria*

Ductus bursae (Fig. 9, A) 1.45-1.7 mm long (0.7-0.9 times length of bursa copulatrix).....*porata*

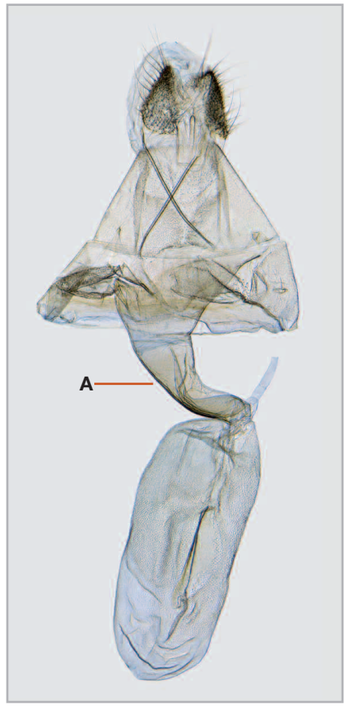
Ductus bursae (Fig. 10, A) 1.35-1.75 mm long (0.6-0.9 times length of bursa copulatrix).....*linearia*

Other similar species

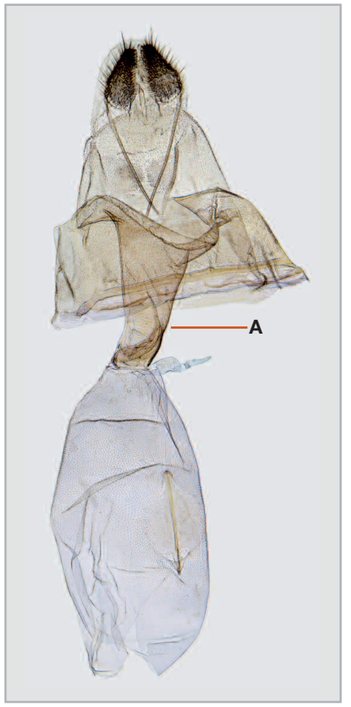
In addition, several species occur in Europe which are very similar to one or more of those found in Britain. These include *Cyclophora quercimontaria* (Bastelberger, 1897), which occurs on the near continent and could in the future be found in Britain or Ireland as an immigrant. It is very similar, especially to *ruficiliaria*, has a white, un-ringed discal spot on fore- and hindwing and is finely speckled or suffused with darker scales, and median line reddish-brown. In the male, the valva resembles that of *puppillaria* and *ruficiliaria* in having no large ventral projection. The fibula is most similar to that of *puppillaria*, being very long, strongly curved and slender. However, it is of more or less even thickness, with only a slightly broader base. The valva is narrower, and constricted towards the base. In the female, the ductus bursae is 1.2-1.5 mm long (after Hausmann, 2004).



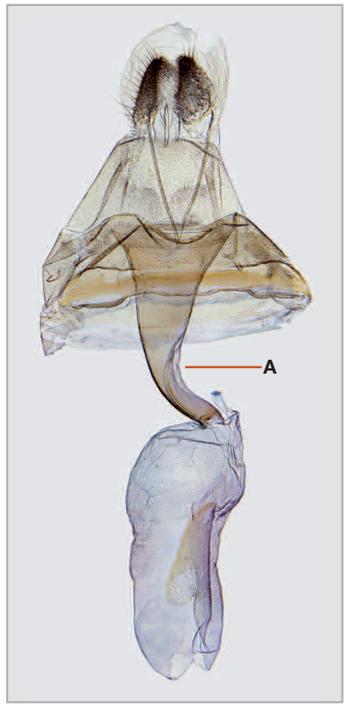
6. *Cyclophora puppillaria*



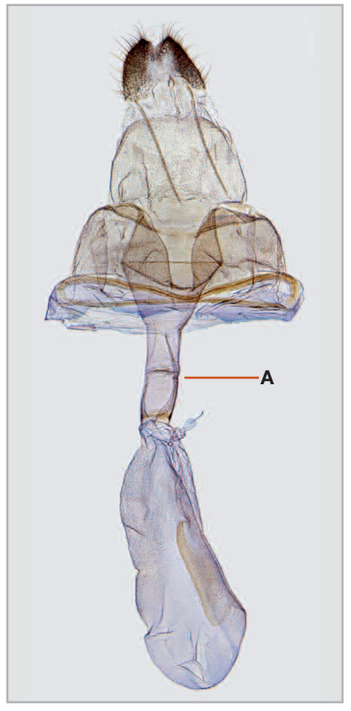
7. *Cyclophora ruficiliaria*



8. *Cyclophora punctaria*



9. *Cyclophora porata*



10. *Cyclophora linearia*

Plate 2. Genitalia of female *Cyclophora* species.