

Elachista trifasciata (Wollaston, 1879) on St Helena Island (Lepidoptera: Elachistidae: Elachistinae)

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Abstract: The authors give a redescription of the recently rediscovered *Elachista trifasciata* on St Helena Island and provide information about the habitat and biology of this endemic species. For conservation reasons, the area with the food plant of the monophagous larva, *Carex diana*e, should be extended in the Central Ridge area. *Elachista trifasciata* is considered to be sensitive to climate changes.

Key words: Taxonomy, Biology, Elachistidae, Elachistinae, *Elachista trifasciata*, St Helena Island.

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INTRODUCTION

Elachista trifasciata (E. Wollaston, 1879) was discovered by lepidopterist Edith Wollaston (1849–1911) during a stay at St Helena in 1875/76. In her paper she gave an accurate description of the localities and habitats where she found the species: “It was only on the highest portion of the central ridge that I obtained this extremely beautiful *Stagmatophora*; and, indeed, so remarkably circumscribed was it in its range that, although we constantly visited that particular region during our six months' residence on the island, I was never able to meet with it except on the precipitous declivities on the mountain known as Actaeon [Fig. 2]. On the northern slopes it was extremely rare; but on the southern side (overlooking the great Sandy-Bay crater) I found it quite abundantly, especially along a damp and rocky pathway which leads up to the side of the ridge immediately before arriving at the place called Newfoundland; and it was out of the tangled bushes of the common bramble that I principally beat it”.

Elachista trifasciata must have been abundant, because there are more than 30 individuals of this species in the collection of E. Wollaston in The Natural History Museum London.

However, since Wollaston and thus since the 1870s, no further observations of *E. trifasciata* have been reported. There is no mention of this species even in the reports of the extensive Belgian Expeditions in the years 1965–1967. In 1995, the second author visited the island for a week and undertook field work in the central highest ridge

between Mt Actaeon, Diana's Peak and Cuckhold's Point (known as ‘the Peaks’; Figs 1, 2), but was unable to find *E. trifasciata*. Even within the framework of the Peaks project – a project with focus on invertebrates of the Peaks area (Mendel *et al.*, 2008) – no specimens of *E. trifasciata* were seen.

In 2017 and 2018 for the Darwin Plus project DPLUS0040 “Securing the future for St Helena's endemic invertebrates” excursions by day and at night were undertaken. During field work at Diana's Peak (Fig. 2) on 28th February 2017, the entomologists Howard Mendel and David Pryce discovered a beautiful moth with silver bands. Mendel caught the moth and placed it in a tube, whence it was brought to the second author, who was on the island at the same time. Both realised that the little moth was the surprising rediscovery of *E. trifasciata* on St Helena Island, but during subsequent excursions no other specimen was found.

MATERIAL AND METHODS

The moths studied in this paper were collected in March 2017 and March/April 2018 during daytime excursions, using a sweep net and with appropriate consideration for the sensitivity of the cloud forest vegetation. The specimens were spread while still on St Helena Island and taken for further investigation to the laboratory of the second author. They are stored in the collections of the St Helena National Trust and the Museum für Naturkunde und Vorgeschichte Dessau.

The terminology (wing venation, genitalia) follows Traugott-Olsen & Schmidt Nielsen (1977). The wings were scaled, coloured with fuchsin and chlorazol black and placed in Euparal on a slide. The genitalia preparations were done according to Robinson (1976). Scientific plant names are taken from Lambdon (2012).

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Figure 1 – Distribution area of *E. trifasciata* on St Helena Island (violet colour); black rectangle: see detailed map in Fig. 2 (source: Openstreetmap.de).

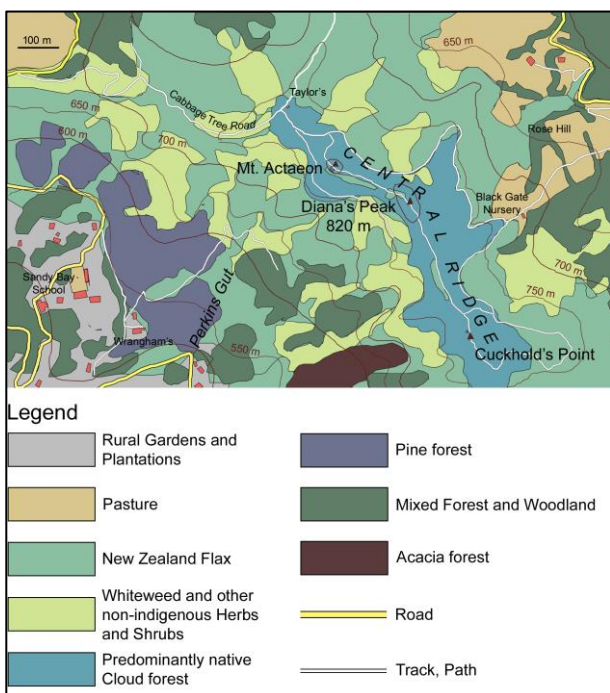


Figure 2 – Detailed habitat map of the central part of St Helena Island. *Elachista trifasciata* is restricted to the cloud forest vegetation zone along the path between Mt Actaeon und Cuckhold's Point.

RESULTS

Biology and habitats

The breakthrough in terms of knowledge of the habitat of the species was achieved by the first author. During the same Darwin Plus project, there were several malaise trap sites at the Peaks (Fowler *et al.*, 2018). One of these was located at Perkin's Gut. A large plant of *Phormium tenax* J. R. Forst. & G. Forst. had fallen away from the upper slope onto the path at some stage of the survey. During her monthly visits, on 16th January 2018 she noted a distinctive movement on this plant – 'dancing' in a circular motion and very similar to that of *Opogona recurva* (Wollaston, 1879) (Tineidae). A dark moth with metallic silver bands across its wings was observed. The specimen was photographed but flew away before it could be

collected (Fig. 3). The photograph was then sent to the second author to confirm the species. Captivated by this find, author one kept a close lookout for this moth on other excursions to the Peaks, and on the 2nd March 2018 whilst sweep netting *Carex diana*e Steud. on Mt Actaeon the species was found again. She searched this plant by hand, and found more moths in between the leaves that indicated a link between *E. trifasciata* and the *C. diana*e. Further observations during excursions to the Peaks revealed that *E. trifasciata* was found quite regularly on or around *C. diana*e especially on the path along the ridge leading from Mt Actaeon along Diana's Peak and Cuckhold's Point. Because of this important observation, and knowledge of the biology of many European species of *Elachista*, it was possible to start a targeted search for *E. trifasciata*.



Figure 3 – Imago of *E. trifasciata* at Diana's Peak (05.iv.2018; photo: Liza Fowler).

This search started on 27th March 2018 in the area between Cuckhold's Point (the easternmost summit) and Diana's Peak. Here we found adults of *E. trifasciata* flying around *C. diana*e along the path, in a thicket of *Dicksonia arborescens* L'Hér. (Fig. 4). Encouraged by this discovery, we started a more careful search on the plant itself to locate the larva, and indeed the larvae were found on this plant, favouring plants slightly sheltered from the sunlight by surrounding vegetation. The larva feeds inside the leaf in a longitudinal mine. The mine is about 2–4 veins broad and starts often near the tip of the leaf. A fresh mine is yellow or yellowish green, and is thickened at the end where the larva is feeding (Fig. 5); the mine often extends as far as the base of the leaf. In old mines the tissue of the leaf is dead and the mines are therefore easier to see because of their brown colour. A single leaf may contain more than one mine, in which case the mines are parallel. *Carex diana*e was found to be the only host plant of the larva of *E. trifasciata*.

*Carex diana*e is a perennial endemic sedge (Cyperaceae) on St Helena Island and occurs on the highest points around Diana's Peak (the Peaks) in the Central Highlands, on High Peak and the Depot in the western parts of the island and in a few specimens at The Barn, Longwood, an imposing rock in the North-East corner of St Helena Island (Lambdon, 2012). The populations from different parts of the island seems to be distinct and were described partially as variations (Lambdon, 2012). Results of the genetic studies are not yet available (Thomas-Williams, pers. comm.). Therefore the status of the populations is not yet resolved. However, the nominate form of

C. diana was described from Diana's Peak (Steudel, 1855).



Figure 4 – Habitat of *E. trifasciata* along the path from Mt Actaeon to Diana's Peak (08.iv.2020; photo: Liza Fowler).



Figure 5 – Mines of *E. trifasciata* in a leaf of *C. diana* (above with larva, below an old mine) (Diana's Peak, 27.iii.2018; photo: Timm Karisch).

During our search we found occupied leaf mines in March and April, but judging from the observations of the first author it is probable that the larva develops during a longer period of the year. The moth is recorded throughout the whole year but with more individuals seen in August and March/April. A standardised, targeted monthly survey would help to determine if this species displays seasonality.

Pupation occurs outside the leaf mine on the underside of the blade. Here the larva produces a flat, rather dense silky web of crossing filaments (Fig. 6), under which it pupates. The pupa itself is blackish brown and rather slender, with two broad sclerotized bands with some protuberances dorsally on the thorax, and with two rows of teeth on abdominal segments 1–6 (Figs 7–9).

It is not yet known how long the larval and pupal stages last. The habitat of *E. trifasciata* is very humid, and often the summits are swathed in clouds. So far, it has not been possible to breed the species from an early instar, because of the difficulty of keeping the leaves of the *C. diana* in such a way that the early stages are able to develop. When leaves were brought to lower and less humid altitudes, they soon started to wither, and the larvae or pupae were damaged and died. Keeping the foliage in boxes or plastic bags, or even transplanting a whole plant were equally unsuccessful. However, from a pupa collected on 27th

March 2018 by the first author, the moth hatched on 3rd April 2018, indicating the pupal stage lasts at least seven days.



Figure 6 – Silky web on leaf with larva before pupation beneath (Diana's Peak, 27.iii.2018; photo: Timm Karisch).



Figures 7, 8, 9 – Exuvia of *E. trifasciata*: 7 – ventral, 8 – dorsal, 9 – lateral.

The adults of *E. trifasciata* are to be found only around the food plant of the larva. The species is restricted to the Central Peaks around Diana's Peak (Fig. 2) and has never been found at High Peak or the Barn. The moths like to rest on the *C. diana* leaves or near the ground on leaves of other plants in the *D. arborescens* thicket. They fly only short distances of a few metres, before they alight on the next plant. In sunlight they often rest just a short time before they fly again. The moth is strictly diurnal.

Morphology

The external appearance of the imago (Fig. 3) was described by Wollaston (1879) in an excellent way, and her description is given verbatim here: "Expanse 31/2–4 lines [7–8.5 mm]. With the labial palpi divergent, somewhat arched and having the terminal joint longer than the second one; head covered with coarse imbricated coppery scales. The fore wings are of a rich velvety brown, with three large, conspicuous, transverse fasciae; formed of brilliant metallic scales (in which silvery or coppery tints prevail); the first fascia is at the base, the second (which is straight and much more elevated or gibbose) just before the middle, and the third one (which is more arcuated or internally scooped out) parallel with and near to the outer (truncated) margin. Even the dark portion of the wing between the fasciae; is dusted with a few coarse metallic and more or less coppery scales. Hind wings of a dull, smoky, blackish brown and quite free

from metallic lustre. Thorax of the same dark metallic hue as the upper wings. Body smoky black, but more or less sprinkled with paler scales. Antennae long and black, the extreme apex being of a pure white.”

Wing venation

The wing venation of *E. trifasciata* (Figs 10, 11) is quite interesting and is more like that of former *Cosmiotes* Clemens, 1860 than *Elachista* Treitschke, 1833 (after illustrations in Traugott-Olsen & Schmidt Nielsen, 1977). On the forewing R3 is lacking, R4 and R5 are not stalked and M1 arises from the branch with R5. M2 is absent. In hindwing, only M1 is developed and CuA1 and CuA2 are stalked and divide just before the margin of the wing.

Genitalia

♂ genitalia (gen. slide BM 28553) (Fig. 12): Uncus lobes very small like a pustule, with shorter setae; gnathos prominent, ovoid; tegumen broad; valva rather narrow, costa of valva strong, hump at 2/3 of the costa; digitate process absent; juxta with two protrusions towards saccus; vinculum delicate, elongate, triangular, tapering into a longer, stout saccus. Aedeagus slightly curved, narrow, with a tapering apical end; vesica without cornuti.

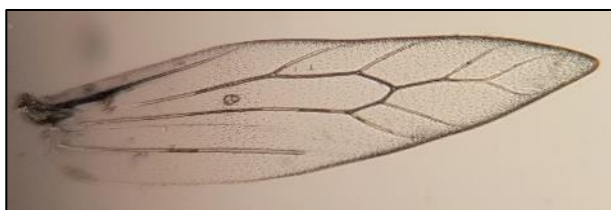


Figure 10 – *Elachista trifasciata* forewing venation.

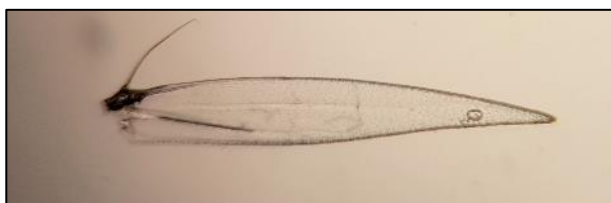


Figure 11 – *Elachista trifasciata* hindwing venation.



Figure 12 – *Elachista trifasciata* male genitalia.

♀ genitalia (gen. slides 3115, 3116, Karisch) (Fig. 13): Apophyses of about the same length; antrum bowl-shaped, membranous, ventral margin curved anteriorly; colliculum narrow, about as long as the apophyses; corpus bursae saccate, membranous, without signum.



Figure 13 – *Elachista trifasciata* female genitalia.

DISCUSSION

Systematics

Judging from Traugott-Olsen & Schmidt Nielsen (1977) the wing venation with M1 arising from R5 in forewing, the absence of M2 in forewing (Fig. 10) and only one M in hindwing (Fig. 11) it is hypothesised that *E. trifasciata* is positioned nearer to *Cosmiotes*. This is strengthened by the fact that pupation is under a rather dense silky web and the pupa is not fixed with a girdle or under a flimsy cocoon (Fig. 6). However, *Elachista trifasciata* is different from *Cosmiotes* in other respects. There are no claw-like uncus lobes in the male genitalia and there are no labides from the transtilla. *E. trifasciata* differs from both *Cosmiotes* and *Elachista* in the absence of a digitate process of the juxta. An apomorphic character of *E. trifasciata* seems to be the double protrusion at the end of the juxta towards the saccus.

Kaila (2019) treated *Cosmiotes* Clemens, 1860 as a junior synonym of *Elachista* Treitschke, 1833. He placed *E. trifasciata* in the *Elachista praelineata* group. This group is closely related to the *Elachista bifasciella* group (Kaila [2000]) and within the transition zone towards species formerly placed in *Cosmiotes*. Some characters of members of the *E. praelineata* group were given by Kaila (1999). However, apart from the above-mentioned characters, *E. trifasciata* differs in the comparatively short cucullus and the bowl-shaped antrum. Consequently, we suppose that *E. trifasciata* should form a separate line within the genus *Elachista*, consequent perhaps from a longer separation of the species on St Helena Island.

Conservation

Elachista trifasciata is an endemic element of the invertebrate fauna of St Helena Island and associated with an endemic plant. The area of the habitats on the Central Peaks is very small (probably not more than 5 ha, Figs 1, 2). Although there have been many attempts to establish the former cloud forest vegetation (*Melanodendron integrifolium*-*Dicksonia arborescens* thicket) in large areas on the Peaks, *E. trifasciata* remains highly endangered. It is considered that an attempt should be made to extend the area of occurrence by planting more

*C. diana*e of the indigenous form along the path from Diana's Peak to the stairs of Mt Actaeon and along Cabbage Tree Road from Taylors to the Black Gate Nursery. This could help to balance unwanted disturbances at one place.

There are no records of *E. trifasciata* from High Peak and The Barn. This indicates a strong relationship to the special population cluster of the nominate form of *C. diana*e on the main Central Ridge. Therefore the authors do not recommend a relocation of specimens of *E. trifasciata* to other places on the island with populations of the *C. diana*e.

Finally, we want to point out that global warming could play an unwanted role and affect the efforts for conservation in a negative way. The possible consequences of climate change for St Helena Island are yet to be investigated, but a longer duration of dry periods in the mountains, a reduced coverage of cloud and higher temperatures could influence *C. diana*e. It is hoped that by trying to extend the present range of *C. diana*e might enable it to become adapted to some changes in climate.

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