

Additional information about the bionomics of *Apodia bifractella* (Lepidoptera: Gelechiidae)

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Abstract. In early July 2019, some larvae of *Apodia bifractella* (Duponchel, 1843) were found in fresh flowerheads of *Inula montana* in southern France (Department of Gard). Some larvae produced adult moths in August of the same year. Others appeared only after hibernation. Both the host plant and the occurrence of a partial second generation are new data concerning the bionomics of this species.

Samenvatting. Begin juli 2019 werden in Zuid-Frankrijk (Département du Gard) rupsen aangetroffen van *Apodia bifractella* (Duponchel, 1843), heelblaadjespalmot, in verse bloemhoofdjes van *Inula montana*. Enkele rupsen werden al in augustus imago, andere pas na de winter. Zowel de voedselplant als het verschijnen van een partieel tweede generatie zijn nieuwe gegevens inzake de biologie van deze soort.

Résumé. Au début de juillet 2019, plusieurs chenilles d'*Apodia bifractella* (Duponchel, 1843) ont été trouvées dans des capitules frais d'*Inula montana* dans le sud de la France (Département du Gard). En août de la même année, quelques chenilles ont donné des adultes, alors que d'autres ont hiverné. Tant la plante hôte que l'existence d'une seconde génération partielle constituent de nouvelles données biologiques pour cette espèce.

Key words: *Apodia martinii* – France – *Inula montana*.

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Introduction

On 10 July 2019 the author searched for larvae of Lepidoptera in Revens (44°05'20.8"N 3°17'19.4"E Département du Gard), France. This small village is situated in the Western part of the so called 'Causse Noir', one of several limestone plateaux ('Grand Causses') in the highlands of the Massif Central. This particular Causse is a

part of the agro-pastoral cultural landscape 'Les Causses et Les Cévennes' which is a UNESCO World Heritage site (Wikipedia 2019).

Parts of the vegetation on the 'Causse noir' near Revens are, like on other Causses in the area, steppe-like, with different species of grass as well as orchids and other plants which favour calcareous soils (Fig. 1).



Fig. 1. Steppe-like vegetation on the 'Grand Causses', Trèves, France, 14.vii.2019. © Ruben Meert.

Fig. 1. Steppe-achtige vegetatie op de 'Grand Causses', Trèves, Frankrijk, 14.vii.2019. © Ruben Meert.

Very abundant in that particular area is *Inula montana* L. (Fig. 2), a yellow flowered member of the Asteraceae family. While searching for larvae in the fresh flowerheads of this plant, two full-grown Lepidoptera larvae were found at the base in short tunnels amongst the developing fruits and seeds. The feeding pattern, which was similar to those of *Metzneria* and *Apodia* spp., suggested that the larvae belonged to the Gelechiidae Stainton, 1854 family. According to literature the only Gelechiidae species associated with *I. montana* is *Ptocheuusa paupella* (Zeller, 1847) (Bladmineerders.nl 2020).



Fig. 2. *Inula montana* flowerhead, Revens, France, 04.vii.2019. © Ruben Meert.

Fig. 2. Bloemhoofdje van *Inula montana*, Revens, Frankrijk, 04.vii.2019. © Ruben Meert.

To determine the species, the two larvae were put into a glass jar together with 20 other randomly picked flower heads, not knowing whether they contained any larvae or not as no external signs could be observed indicating their presence. Consequently, the author presumed that the larvae were not those of *P. paupella*, as flowerheads that contain larvae of this species mostly show elevated florets.



Fig. 3. *Apodia bifractella*, imago, e.l. 02.viii.2019, bred from a larva in a fresh *Inula montana* flowerhead, Revens, France, 10.vii.2019. © Ruben Meert.

Fig. 3. *Apodia bifractella*, imago, e.l. 02.viii.2019, gekweekt uit een rups in een vers bloemhoofdje van *Inula montana*, Revens, Frankrijk, 10.vii.2019. © Ruben Meert.

Breeding report

Most European, if not all, *Metzneria* and *Apodia* spp. are known to fly in a single generation a year, being in the larval stage from late summer (*Metzneria*) or autumn (*Apodia*) until April (Bland *et al.* 2002). To find those species it is advised to collect dry seedheads of the host plant in winter or early spring.

To prevent the collected flowerheads of *I. montana* from drying out too quickly due to the heat wave occurring in Belgium from 22 to 26 July 2019 (kmi.be 2019), they were kept indoors at about 24–25°C. In late summer they ought to have been placed outdoors to overwinter.

On 2 August 2019 however, an adult moth of *Apodia bifractella* emerged (Fig. 3), followed by another one two days later. These emergences occurred about three weeks after collecting the fresh flower heads, without a larval diapause. On 12 November 2019, 4 larvae were detected within the remaining flower heads. They were placed outdoors to hibernate, and most of them taken indoors again mid-March, producing 5 adults between 10 and 23 May 2020 (Fig. 6). One potted plant with infected seedheads was kept outside in spring, from which 2 adults emerged on 2 and 21 June 2020, giving an idea of the usual flight period under natural circumstances.



Fig. 4. *Apodia bifractella*, cocoon removed from disintegrated seedhead, 12.v.2020, bred from a larva in a fresh *Inula montana* seedhead, Revens, France, 10.vii.2019. © Ruben Meert.

Fig. 4. *Apodia bifractella*, cocon uit ontbindend zaadhoofdje, 12.v.2020, gekweekt uit een rups in een vers bloemhoofdje van *Inula montana*, Revens, Frankrijk, 10.vii.2019. © Ruben Meert.

Regarding these observations, *A. bifractella* appears to be (partially) bivoltine in the mentioned region in southern France. As adults of the first generation probably lay their eggs by the end of May and in June, this second generation needs only two months or even less to complete its development.

Taxonomy

On Lepiforum.de 2019, Erwin Rennwald discussed the unclear status of *Apodia martinii* Petry, 1911 that was described as a separate species in Germany. The description from A. Petry is based on a few morphological differences from *A. bifractella*, a bigger size and much

darker wings with less pattern being the most important ones (Petry 1911). None of these characteristics seem to apply to the bred specimens from France.

Petry also states that the flight period starts a few weeks earlier (from late June onwards) than in *A. bifractella* (starting in the second half of July). Finally, he mentions *Inula hirta* (and possibly *I. salicina*, but this remains unconfirmed) as the host plant of *A. martinii*, while *A. bifractella* was, at that time, only known to feed on *Inula conyzae* and *Pulicaria dysenterica*.

In recent decades, most authors have treated *A. bifractella* and *A. martinii* as synonyms, but to be 100% sure, DNA sequencing was necessary. DNA barcoding was done by Peter Huemer and Ole Karsholt and the results, perhaps surprisingly, fully support the species status of both taxa. In their 'Commented Checklist of European Gelechiidae', they reinstate *Apodia martinii* as a valid species, with the remark that morphological differences between *A. martinii* and *A. bifractella* require detailed study in the future (Huemer & Karsholt 2020, Lepiforum 2020).

For this reason, the collected specimens from the mentioned locality in Revens will be kept as study material, as *Inula montana* is unknown to be a host plant of either species. Also, the flight period of the first generation must have been a lot earlier (May–June) than what is usual for *A. bifractella*. Nevertheless, in this article it is assumed that the recorded observations in Revens refer to *A. bifractella*.



Fig. 5. *Apodia bifractella*, pupa in opened cocoon, 12.v.2020, bred from a larva in a fresh *Inula montana* flower head, Revens, France, 10.vii.2019. © Ruben Meert.

Fig. 5. *Apodia bifractella*, pop in geopende cocon, 12.v.2020, gekweekt uit een rups in een vers bloemhoofdje van *Inula montana*, Revens, Frankrijk, 10.vii.2019. © Ruben Meert.

Distribution and biology

Apodia bifractella occurs in most of Europe (Karsholt 2017), but according to Bland *et al.* 2002 records from northern and eastern Europe should be attributed to *A. martinii* if it is confirmed as a distinct species, which is now the case.

The larvae of *A. bifractella* feed on *Pulicaria dysenterica* (L.) Gaertn., *Inula conyzae* (Griess.) Meikle, *I. helvetica* Grauer (Lepiforum.de 2019), *Aster tripolium* L.

(Bland *et al.* 2002) and *Inula montana* L. (pers. obs). The eggs are possibly laid on the flowerheads (Bland *et al.* 2002). By spinning together the developing fruits, the larva creates a tube at the base of the disc florets (Fig. 3). It feeds on the fruits or developing seeds within. There are no external signs indicating the larval presence. Overwintering larvae can be found until the following spring.

To pupate, the larva constructs a tough cocoon in which seed fragments and sometimes other flower parts are incorporated (Fig. 4–5). This cocoon is firmly attached onto the dry receptacle of the seedhead. Winter and spring are the best seasons to look for overwintering larvae or pupae, as often most fruits and pappus bristles are blown away by the wind, while the larval cocoon remains attached. If not, one can also brush off the pappus and fruits by hand to look whether some parts stick to the receptacle. As infected fresh flowerheads are not recognizable, larvae preceding the second generation are quite difficult to find in late spring or early summer. Splitting the fresh flowerheads to look for larvae seems the only option here.



Fig. 6. *Apodia bifractella*, imago, e.l. 12.v.2020, bred from a larva in a fresh *Inula montana* flower head, Revens, France, 10.vii.2019. © Ruben Meert.

Fig. 6. *Apodia bifractella*, imago, e.l. 12.v.2020, gekweekt uit een rups in een vers bloemhoofdje van *Inula montana*, Revens, Frankrijk, 10.vii.2019. © Ruben Meert.

Discussion

The occurrence of a partial second generation of *Apodia bifractella* has not been described before. The specific climatological conditions at the finding location in Southern France, with warm and sunny summers and mild winters (Meteofrance.com 2019), seem to be a good reason to explain why this species has a second generation here.

Without denying that this might actually be the case, the use of *Inula montana* as a host plant might also have an influence. As the females of *A. bifractella* probably lay their eggs on the flower heads of the host plant (Bland *et al.* 2002) and the larvae feed on the developing seeds within, the flight period of the moth needs to match with the plant's phenology. Other host plants such as *Pulicaria dysenterica* and *Inula conyzae* mainly flower in full summer and early autumn. *Inula montana* starts flowering

by the end of May and goes on until the end of July, (FloreAlpes.com 2019), possibly creating the right conditions for an early flight period and allowing a second generation of *A. bifractella*. If that is the case indeed, the appearance of an early first generation does not seem likely in areas where *P. dysenterica* and *I. conyzae* are used as host plants.

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