

# ***Apamea ramonae* n. sp. and *Apamea sphagnicola centralazorensis* n. ssp. — two new noctuid taxa (Lepidoptera, Noctuidae, Xyleninae, Apameini) from the Azores (Portugal) in westernmost Europe**

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**Abstract:** In the present paper two more taxa of *Apamea* OCHSENHEIMER, 1816 are described from the Azorean archipelago. *Apamea ramonae* n. sp. from Flores Island (western Azores) differs from the most recently described *Apamea sphagnicola* WAGNER, 2014 from São Miguel Island (eastern Azores) in some important characters. In larval mandibles, the outer (lower, first) tooth is not distinct, long and pointed as in *A. sphagnicola*, but short and very broadly rounded. The moths are much darker, more uniformly maroon to dark brown with fewer light elements. The stigmata are less rounded, smaller and the reniform stigma is centrally heavily constricted. Also the male genitalia show some clear distinctions: The cornuti of the vesica show less than half the size of those of *A. sphagnicola*, the costal process is less curved and tapered and the apex of uncus broader rounded without prominent tip. The larvae are not as strictly linked with *Sphagnum* mosses as it is the case with *A. sphagnicola*. Despite these points it is obvious that the two taxa descended from a single common ancestor. — *Apamea* larvae from Pico Island (central Azores) resulted in specimens that are indeed very similar to *A. sphagnicola* from São Miguel, but differ in some characters. They are a bit larger, show broader forewings with more white and black colour, a more voluminous body, larger male genitalia and differences in the tip of the uncus. Thus a new subspecies *Apamea sphagnicola centralazorensis* n. ssp. is described from Pico Island.

***Apamea ramonae* n. sp. und *Apamea sphagnicola centralazorensis* n. ssp. — zwei neue *Apamea*-Taxa (Lepidoptera, Noctuidae, Apameini) von den Azoren (Portugal) im westlichsten Europa**

**Zusammenfassung:** In vorliegender Arbeit werden zwei weitere Taxa der Gattung *Apamea* OCHSENHEIMER, 1816 von den Azoren beschrieben. *Apamea ramonae* n. sp. von Flores (westliche Azoren) unterscheidet sich von der erst kürzlich beschriebenen *Apamea sphagnicola* WAGNER, 2014 von São Miguel (östliche Azoren) in einigen wichtigen Punkten. Der erste (äußere) Zahn der Mandibeln der Raupen ist nicht lang und zugespitzt wie bei *A. sphagnicola*, sondern undeutlich, kurz und sehr breit abgerundet. Die Falter sind viel dunkler, einheitlicher dunkelbraun bis kastanienbraun gefärbt mit weniger hellen Elementen. Die Stigmata sind weniger abgerundet, kleiner und die Nierenmakeln sind in der Mitte stark eingeschnürt. Im männlichen Genital sind ebenfalls deutliche Unterschiede vorhanden. Die Cornuti der Vesica sind höchstens halb so groß, der Costalfortsatz ist weniger gebogen und zur Spitze weniger verjüngt. Die Uncusspitze ist breiter abgerundet, ohne den schmal-zipfelförmig abgesetzten Aufsatz bei *A. sphagnicola*. Die Larven sind bei weitem nicht so stark an *Sphagnum*-Moose gebunden wie die von *A. sphagnicola*. Es wird aber trotz der Unterschiede deutlich, daß die beiden Taxa von einem gemeinsamen Vorfahr abstammen. — *Apamea*-Raupen von Pico (zentrale Azoren) ergaben Falter, die *Apamea sphagnicola* WAGNER, 2014 von São Miguel sehr ähnlich sind, aber doch in einigen Punkten leicht abweichen. Sie sind etwas größer, vor allem voluminöser, breitflügeliger sowie noch

kontrastreicher mit mehr weißen und schwarzen Anteilen. Zudem ist die Uncusspitze etwas abweichend gebaut. Daher wird auch eine neue Unterart *Apamea sphagnicola centralazorensis* n. ssp. beschrieben.

## **Introduction**

The Azores constitute the westernmost part of Europe and consist of nine islands in the Atlantic Ocean between Portugal and North America. Flores is the westernmost island of the Azorean Archipelago with some 511 km distance to São Miguel, the easternmost island. The climate is humid year-round (especially in winter and early spring) and temperatures are quite balanced with only exceptional, short night frosts in the uplands (above ca. 400 m elevation) in winter (then about 13° C mean temperature at coast line). Compared to the more eastern islands like São Miguel, precipitation is much higher in Flores with wetter summers (Flores: more than 1500 mm per year near the coast, up to 5000 mm in the mountains, São Miguel: more than 1000 mm per year in Ponta Delgada, up to 3000 mm in the mountains). Flores and the small island of Corvo belong to the western island group of the Azores and are already located on the American tectonic plate. The other islands (central and eastern group) are located on the Eurasian tectonic plate, but moreover at its border zone with the African plate. Thus Flores and Corvo are drifting westwards some centimetres each year with the result of increasing distances. The next island to Flores in the central group is Faial in some 246 km distance.

The island of Flores shows especially three types of landscape elements. The former more extended laurel forests are largely reduced to steep slopes and often have been mixed with allochthonous species like the Australian *Pittosporum undulatum* VENTENANT (Pittosporaceae) at lower altitude. A large part of the island has been converted into cattle pastures of various degrees of intensity. Especially the more intensely used pastures are ecologically almost worthless and can not be used by endemic species of Lepidoptera as reproduction habitat. The third part of the island — especially in higher altitudes — is dominated by Atlantic heath in its local form with much *Juniperus*, mosses, grasses (*Festuca francoi*), *Calluna*, *Erica*, *Frangula azorica*, *Rubus* and others and partially includes relicts of laurel woodland. Higher-growing forests are rare in higher altitudes and mainly consist of allochthonous coniferous trees.

The Lepidoptera fauna of Flores is still not as well-known as that of São Miguel, even though some valuable





**Figs. 1–30: *Apamea ramonae* sp. n.** (all material from Azores, Flores, if not indicated otherwise; larvae found in late III. 2014, adults hatched until late IV. 2014). **Figs. 1–3:** Larvae in last instar (25. III. 2014). **Figs. 4–5:** Larvae in last instar (dorsal/lateral view detail, 25. III. 2014). **Fig. 6:** Comparison of mature larvae, top: *A. sphagnicola*, São Miguel, Serra de Água de Pau, larva in mid-III. 2014, bottom: *A. ramonae*, Flores, 25. III. 2014. **Fig. 7:** Larval head, frontal view. **Fig. 8:** Larval head, ventral view, with mandibles. — **Fig. 9:** Comparison of left mandibles, ventral look, left: *A. sphagnicola* (São Miguel, Serra Devassa, larva in XII. 2013), right: *A. ramonae* (from larval skin after pupation). — **Fig. 10:** Pupa *A. ramonae*. **Fig. 11:** Pupal cremaster, dorsal view. — **Figs. 12–19:** Imagines of *A. ramonae*. **Figs. 12–14:** Live specimens, paratypes. ♂ (12); ♀♀ (13, 14). **Fig. 15:** ♂ holotype. **Figs. 16–18:** Paratypes. ♂ (16); ♀ (17, “allotype”); ♀ (18). **Fig. 19:** Comparison of ♂♂: (left, 19a) *A. sphagnicola* (São Miguel Island, larva in December 2013), (right, 19b): *A. ramonae*.





Figs. 20–25: *Apamea ramonae* sp. n., genitalia. Figs. 20–24: Male genitalia. Fig. 20: Lateral view with cucullus, costal process. Fig. 21: Uncus, clavi, juxta. Fig. 22: Detailed views (22a); uncus enlarged (22b). Fig. 23: Phallus. Fig. 24: Comparison of cornuti of vesica; top (24a): *A. sphagnicola* (São Miguel, larva xii. 2013), bottom (24b): *A. ramonae* (with phallus). Fig. 25: Female genitalia. — Figs. 43–45: *Apamea sphagnicola centralazorensis* ssp. n. (all material from Azores, Pico Island, eastern part, larvae found in mid-xii. 2014, adults hatched until ii. 2015), genitalia. Fig. 43: Male: uncus, saccus, clavi, juxta, ampulla. Fig. 44: Male: detailed view of tip of uncus. Fig. 45: Male: phallus with cornuti of vesica. — Pictures to different scales.

contributions have been made in recent years (e.g., SALDAITIS & IVINSKIS 2006). In general, the fauna is poor in species-numbers due to isolation by long distances. Some Azorean endemics known from other islands (*Phlogophora furnasi* PINKER, 1971, *P. cabrali* PINKER, 1971) are so far unknown from Flores and Corvo (HACKER & SCHMITZ 1996, SOUSA 1991, VIEIRA 2002, BORGES et al. 2005). *Phlogophora interrupta* (WARREN, 1905) is replaced by the closely related *Phlogophora kruegeri* SALDAITIS & IVINSKIS, 2006. Besides *P. kruegeri* only *Noctua carvalhoi* (PINKER, 1983) and *Mesapamea ?storai* (REBEL, 1940) (a single larval record in March 2014 by the author, not reared to imago; thus the identity of this taxon on Flores remains to be confirmed) are found on this island.

Encouraged by the very recent detection of the new species *Apamea sphagnicola* in São Miguel (WAGNER 2014), the author successfully checked possible habitats in Flores Island during a short stay in late March 2014 which primarily aimed at revealing the ecology of *Phlogophora kruegeri* (WAGNER 2015, in preparation). The

new species *Apamea ramonae* sp. n. encountered during this search is described in the following.

#### *Apamea ramonae* sp. n.

**Holotype** ♂: Portugal, Azores, Flores NW, south of Ponta Delgada, 400 m a.s.l., larva 25 iii. 2014, adult in late iv. 2014, WAGNER leg. [ & cult. ] (Fig. 15); SMFL 4684.

**Paratypes** (in total 3 ♂♂, 6 ♀♀): 3 ♂♂, 4 ♀♀, Azores, Flores, south of Ponta Delgada, 400 m, larva 25. iii. 2014, adult in late iv. 2014, WAGNER leg. 1 ♀, Flores, northwestern slopes of Morro Alto Mountain, 500 m, larva on 26. iii. 2013. 1 ♀, Flores, Morro Alto, 850 m, larva on 27. iii. 2013.

**Holotype** ♂ (SMFL 4684) and 5 paratypes (2 ♂♂, SMFL 4685, 4686; 3 ♀♀, SMFL 4687, 5688, 4689) are deposited in the Senckenberg-Museum in Frankfurt am Main, Germany (Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Entomologie II), the remaining 4 specimens are in coll. WAGNER.

**Derivatio nominis:** Named after Ramona BAUR, my former partner, who accompanied many excursions.

All specimens have been collected in larval stage (altogether 11 larvae) and reared to adult (10 imagines).

## Description

Wingspan 34–38 mm; forewing length 15–17 mm.

Quite uniform appearance with only a few white elements.

No major differences in variation of wing pattern and colouration between ♂♂ and ♀♀ (Figs. 12–19), but ♂♂ more often maroon and ♀♀ slightly darker and more often greyish brown in colour.

Individual variability mostly restricted to ground colour (maroon or dark greyish brown) and intensity of white and black elements (especially stigmata).

Forewing base colour maroon to dark greyish brown with a few contrasty white and a few blackish grey elements (veins, claviform stigma). Blackish root streak present, but often only faint. Orbicular stigmata often open towards costa, not clearly rounded, but often elongated and sometimes reaching reniform stigma. Reniform stigmata not rounded, narrow, constricted in the central part, thick whitish bordered towards media, but more yellowish or brownish white towards costa where it is usually open. Dark and sometimes also whitish bordered claviform stigma not always present. Basal field usually with a small white spot. Cross lines usually absent, only subterminal line faint and with darker chevrons on inner side. Terminal field a bit lighter than base colour, especially on veins. Dark terminal spots present, but faint. Media more or less darkish, sometimes also other veins. Fringes of base colour. Hindwings dark grey with dark discal spot (especially clear on underside). Head and breast mainly of base colour. Abdomen greyish brown, posterior abdominal brush conspicuous, triline brush organs present.

## Male genitalia

(Figs. 20–24.)

Clavus with dark, heavily sclerotised apical square corner with rounded tip and small spines, basal process quite long. Uncus relatively broad, considerably expanded towards the heavily haired tip, tip (apex) broadly rounded with two tips (Fig. 22b). Cucullus relatively small, with heavily sclerotised pollex. Costal process broad, only slightly curved and only weakly tapered towards tip. Not forked. Ampulla quite long and slender.

Juxta basis anchor-shaped, upper end with two quite small lobe-like bulges.

Phallus long, curved towards opening (juxta-side), compact vesica with two small cornuti.

## Female genitalia

(Fig. 25.)

Papillae medium-long, quite broad. Appendices posteriores broad, curved inwards at first and then outwards near rounded and slightly widened tip. Appendices anteriores broad, more or less straight, dilating near tip. Duc-

tus bursae very short and wide, terminating into a very compact, heavily sclerotized central part and a terminal slender soft bag.

## Caterpillar

Full-fed 33–38 mm long (Figs. 1–6). Head (Figs. 7–8) light orange-brown, reticulate pattern most often well developed, also the coronal stripes. Bristle points on body with quite large pinacula. Body surface medium glossy and wrinkled. White dorsal line broad (0,4–0,5× the width of the neighboured zone) and conspicuous, subdorsal lines weaker, but still clearly visible, all three lines irregularly confined. Dorsal zone greyish brown, not contrasting. Spiracles creamy beige (not contrasting to bordering colour), with black border. Thoracic shield dark except for the light dorsal and subdorsal lines.

Mandibles (Fig. 9) compact, with the first outer tooth being short and very broadly rounded and the other two being longer, more pointed and robust. Inner area beyond the first tooth rounded and hardly differentiated any more.

Hypopharynx with comparatively small spines, spinneret long, tapered, clearly longer than labial palps with its setae (compare BECK 1999 or AHOLA & SILVONEN 2008 for larval traits of *Apamea*).

## Pupa

18–19 mm long, redbrown (Fig. 10), dorsal side a bit darker, more or less rounded cremaster with original, typical stiff bristle: four distally hooked bristles in row inserting on small bumps near the ventral tip of the cremaster, the inner two much thicker than the outer ones, and two additional bristles (comparable to the outer ones) inserting a bit more away from the tip on the dorsal side (Fig. 11).

## Distribution

Azores, Flores: northwestern quarter, Morro Alto to Ponta Delgada. Above 400 m elevation.

## Diagnosis

The adults differ from the similar taxon *Apamea sphagnicola* in following details and are thus easily recognised: smaller, base colour much darker, more uniform with less white elements (no distinct lines), stigmata much less rounded, more elongate and reniform stigma clearly constricted in central part (Fig. 19).

In ♂ genitalia, the most striking difference is that the two cornuti of vesica are much smaller: only about half the size of *A. sphagnicola* and thus comparable to *A. sordens* (HUFNAGEL, 1766), see ZILLI et al. (2005). Further the costal process is less curved and less tapering towards the tip. The tip of uncus is broader rounded and thus differs clearly from the small and distinct pointed tip of the otherwise also rounded apex in *A. sphagnicola*.

Finally the proportions of the juxta are slightly different. The distal part towards the phallus shows relatively smaller lobes, but the anchor-shaped lower part is more voluminous.

The ♀ genitalia are very similar to *A. sphagnicola*. The ductus bursae is shorter and wider and the adjacent white, more sclerotized part between ductus bursae and terminal soft bag of bursa copulatrix is more compact (other proportions).

The larvae are smaller (Fig. 6) with smaller head capsule, more uniform in colouration and less glossy with on average smaller pinacula. The spiracles are not light orange-brown as in most *A. sphagnicola* where they often contrast to the neighbouring colour, but creamy beige (apart from a black border which is the same in both species). The thoracic shield is darker between dorsal and subdorsal lines, without the light orange brown suffusion near the dorsal line in *A. sphagnicola*. Another striking difference is the outer, third tooth of mandibles which is not clearly differentiated, short, very broad rounded in the new species (in all 11 individuals), but comparatively long and pointed in all *A. sphagnicola*. The other two teeth are not as triangular as in *A. sphagnicola*, but a bit more rounded especially in inner angles. The area beyond (inner side) the first tooth is more or less simply rounded in the new species whereas it is differentiated into two or three very short tips (small teeth) in *A. sphagnicola*. Finally, the inner ridges of the mandibles are different, probably also due to the different tooth pattern.

Pupae are slightly smaller and show on average thicker and more prominent spines on cremaster, but are in general hardly distinguishable.

### Bionomics

Larvae of *Apamea ramonae* n. sp. inhabit very wet embankments, slopes or more rarely also plain areas in open heathland between 400 and 900 m. These places (Figs. 26–30) usually show a mix of mosses (*Sphagnum*, but also many others) and grass tussocks (mainly *Festuca francoi*, for *Festuca* systematics see PRIETO et al. 2008). They can be both partly sun-exposed or in quite shady northern exposition, with the latter being more frequent. In the lower part of its occurrence, the nine larvae have been recorded in a several metres high, more or less vertically orientated, rocky embankment which was waterlogged and north exposed. The larvae rested there in various mosses and in grass tussocks. *Sphagnum* occurred only partially and only three of the nine larvae rested in *Sphagnum*. Altogether three had already constructed their cocoon for pupation (prepupae).

In rearing, most moths emerged after a pupal phase of about 21 to 25 days (18–19°C) in the second half of April and early May 2014.

## Discussion

### Bionomics, distribution

*Apamea ramonae* is a hygrophilous species of medium to higher altitudes (400–900 m) and obviously shows a narrow ecological ennicement in undisturbed, mostly ungrazed habitats as it is the case with its sister taxon *Apamea sphagnicola*. But it is much less restricted to *Sphagnum* mosses and shade and larvae even rest in grass tussocks and not always in mosses. Only three out of 11 larvae rested in *Sphagnum*, another five in other mosses and three in grass tussocks. In *A. sphagnicola*, all so far recorded 39 larvae have been found in *Sphagnum*.

This may be explained with the even more humid climate in Flores where rainfall is common even in summer. Thus there is no need to concentrate only on the wettest spots.

The species is quite rare in Flores according to present knowledge and has only been found in the northwestern quarter of the island around Morro Alto and northward in direction to Ponta Delgada. Though it is not impossible that the species may be detected in some other parts of the island (e.g. in and around craters) in future, it is obvious that suitable habitats are rare due to the topography of the island and large-scale cattle pastures. So the species depends on the remaining habitats which should be protected from cattle and other disturbances in future.

The species is restricted to Flores Island according to present knowledge. It is possible that a small population exists at the crater slopes of neighbouring small Corvo island.

As in *A. sphagnicola*, the species most probably has only one generation per year. According to own observations, larvae are mature in March. Thus the moths should be on the wing between late April and June, almost simultaneously with those of the other taxon in São Miguel Island.

### Morphology and systematics

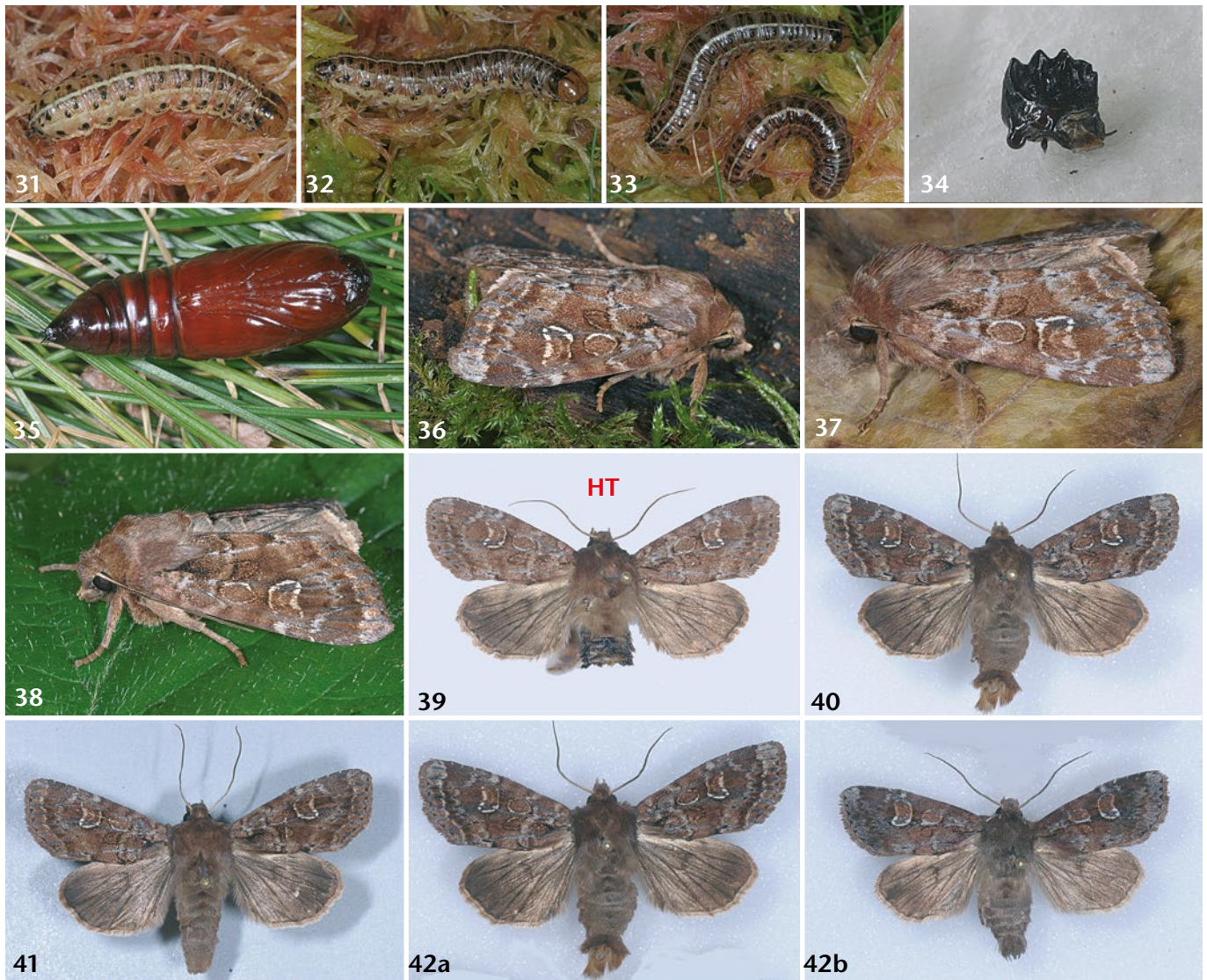
Details of morphology and systematics of *A. sphagnicola* can be found in WAGNER (2014). Thus I concentrate here on the relationship and the differences between the two taxa.

Similarities in life cycle, larvae and moths show that the two taxa are very closely related and certainly derived from a common ancestor. But due to increasing distance to other islands and long-term isolation, there are also several differences. The most striking ones are the different mandibles in larval stage and the wing pattern and male genitalia in the adults. It is easy to recognize each so far obtained moth even if only focusing on the forewing stigmata. Besides that, there are also more subtle differences (size, extent of glossiness of larval surface, ground colour, spiracles, thoracic shield).









Figs. 26–30: Larval habitats of *A. ramonae* on Flores Island. Fig. 26: *Festuca* pad below center, NW slopes Morro Alto, ca. 600 m, 25. III. 2014. Figs. 27–28: S Ponta Delgada, 400 m, 25. III. 2014. Fig. 29: Same area, 27. III. 2014. Fig. 30: Morro Alto, 850 m, 27. III. 2014. — Figs. 46–48: Larval habitats of *A. sphagnicola centralazorensis* on Pico Island. Fig. 46: *Sphagnum* mosses in nearly vertical embankment. Fig. 47: Embankment in center of photo: *Sphagnum* only exists in the embankment. All area below and above is already trivialized through cattle grazing. Fig. 48: Threat: cattle gradually destroy endemic vegetation.

Figs. 31–42: *Apamea sphagnicola centralazorensis* ssp. n. Figs. 31–32: Larva, last instar. Fig. 33: Comparison of mature larvae: top: *A. sphagnicola centralazorensis*, bottom: *A. sphagnicola sphagnicola*, São Miguel, Serra de Água de Pau, larva in mid-December 2014. Fig. 34: Larval mandible (from larva after pupation). Fig. 35: Pupa. Figs. 36–37: Male PT. Fig. 38: Female PT. Fig. 39: Male holotype. Fig. 40: Male PT. Fig. 41: Female PT ("allotype"). Figs. 42a, b: Comparison of adults. Fig. 42a (left): *A. sphagnicola centralazorensis* male; Fig. 42b (right): *Apamea sphagnicola sphagnicola* (São Miguel Island, larva in XII. 2014). — All preparations made and photos taken by the author.

Regarding these subtle differences it would have been sufficient to describe the new taxon as a subspecies of *Apamea sphagnicola*. Usually, I am more conservative and think that the modern upranking of many subspecies to full species status is at least in some cases exaggerated. But due to the above mentioned major differences it is surely justified to classify the taxon *ramonae* as a species of its own. There is another similar example in Flores island. *Phlogophora kruegeri* is very close to *P. interrupta*. Its stage of differentiation and speciation is comparable (genitalia differences see FIBIGER & HACKER 2007, ecological and larval characters WAGNER 2015, in preparation) with that of the two *Apamea* taxa. The western island group with Flores is most probably the most isolated one, because of distances and the fact that eastern winds which would promote genetic flow from

more eastern islands are quite rare and the predominating west winds even strengthen this barrier.

### New *Apamea* subspecies from the central islands

After the discovery of *A. ramonae* sp. n. the genus *Apamea* had been known from the eastern and western Azores, but still not from the central group of islands. Thus I visited Pico Island in December 2014. With precise knowledge of typical larval habitats, I was able to find my first larva within the first hours on the island.

Pico is the second largest Azorean island and located in the central group of islands with distances of 246 km to São Miguel and some 265 km to Flores. Distance to neighbouring islands of central group, however, is only low (e.g. 19 km to São Jorge). Pico is dominated by Mount

Pico in the western part. This highest peak of Portugal reaches an elevation of 2351 m. Another mountain range is found in the eastern part of the island, reaching approximately 1000 m. While Mount Pico exceeds the main fog region (approx. 400–1100 m) and is thus drier in its upper regions, the eastern mountains are totally located within the fog zone and thus are much more humid. Total annual humidity is lower than in Flores, but a bit higher than in São Miguel.

Though human population is low, really undisturbed habitats are comparatively scarce on this island because there is no separation of *Calluna* heathlands and laurel woodlands on one side and cattle pastures on the other side as it is the case, for example, in São Miguel. Thus EU-funded cattle grazing affects almost any places, only except for higher regions of Mount Pico and a few woodlands. In the eastern highlands substantially only the few steepest inner embankments of craters escape from cattle grazing. Unfortunately endemic Azorean vegetation is very sensitive to grazing with heavy animals and degenerates quickly to trivialized grasslands with substantially European mainland plant species.

### *Apamea sphagnicola centralazorensis* n. ssp.

**Holotype** ♂: Portugal, Azores, Pico Island, eastern part, Caveiro, 900 m a.s.l., larva found in mid-XII. 2014, adult reared e.l. in early to mid-II. 2015, WAGNER leg. [& cult.] (Fig. 39); SMFL 4690.

**Paratypes:** in total 3 ♂♂, 2 ♀♀, with same data.

Holotype ♂ (SMFL 4690) and 3 paratypes (2 ♂♂, SMFL 4691, 4692, 1 ♀, SMFL 4693) are deposited in the Senckenberg-Museum in Frankfurt am Main, Germany (Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Entomologie II), the remaining 2 specimens are in coll. WAGNER.

**Derivatio nominis:** Occurring in central group of the Azorean islands, thus named *centralazorensis*.

All specimens have been collected in larval stage (altogether 9 larvae) and reared to adult (6 moths).

### Description and diagnosis

For general description of the species see WAGNER (2014).

Wingspan 39–43 mm; forewing length 18–20 mm.

Large, voluminous subspecies with broad forewings with contrasty colouration (Figs. 36–42). White and black elements are often stronger than in nominotypical subspecies. Ground colour less reddish brown. Subterminal and wavy lines often better developed, with more white. Black root streak broad, claviform stigma well developed, black with whitish border.

♂ genitalia (Figs. 43–45) large, with tip of uncus being more rounded with less narrow and prominent tip, thus more similar to *Apamea ramonae* and less to *A. sphagnicola* (intermediate between the two taxa). Other characters like *A. sphagnicola* from São Miguel. The two cornuti of the vesica are of the same shape as in the nominotypical subspecies from São Miguel and are only slightly smaller (in relation to genitalia size), but still distinctly larger than in *Apamea ramonae* from Flores.

♀ genitalia have not been examined and supposedly show no big differences to nominotypical subspecies.

### Caterpillar, pupa

The larva (Figs. 31–33) is similar to the nominotypical subspecies from São Miguel, but a bit larger (39–45 mm long). Mandibles (Fig. 34) show the typical pattern of the species with three large teeth and thus differ clearly from *A. ramonae*. But slight differences to the nominotypical subspecies exist: for example, the tips of teeth are a bit less pointed in the new subspecies.

Pupa (Fig. 35) as in nominotypical subspecies, slightly larger (23–25 mm).

### Distribution

Azores, Pico: eastern highlands between 800 and 1000 m altitude between Lagoa do Caiado in the west and Mount Laje in the east.

### Bionomics

The larvae inhabit *Sphagnum* mosses in steep embankments (Figs. 46, 47), mainly along streets and especially in inner slopes of small craters. They feed at night on *Festuca franconi*. They tend to be mature earlier than the nominotypical subspecies. All but one larva had already reached the last instar by mid-December 2014. In rearing, pupation occurred in January and moths emerged in February. No obvious other differences to bionomics of the nominotypical subspecies.

**Note** regarding WAGNER (2014): The types of *Apamea sphagnicola* WAGNER, 2014 deposited in Senckenberg Frankfurt am Main have received the following SMFL numbers: holotype ♂ SMFL 4675; paratypes ♂♂: SMFL 4677, 4678, 4682; paratypes ♀♀: SMFL 4676 (“allotype”), 4679, 4680, 4681.

### Discussion

#### Morphology

Differences to the nominotypical subspecies in São Miguel are only slight and mainly refer to larger size, more white and black colouration, different tip of uncus and a few other minor details of male genitalia. Differences to *A. ramonae* from Flores are much more striking (general colouration, reniform stigma, cornuti of vesica, larval mandibles). Thus subspecific rank within *A. sphagnicola* fits best to describe relationship within the *Apamea sphagnicola* complex of the Azorean islands. Occurring in distinct forms of various degrees (according to isolation) in different groups of islands indicates that the species complexes of both *Apamea sphagnicola* and *Phlogophora interrupta* are most probably quite old endemics of the Azores.

#### Bionomics, distribution, threat

The new subspecies shows the same ecological limitation as the nominotypical subspecies and obviously only



occurs in steep, mainly shady places with *Sphagnum* mosses. The moths are supposed to be on the wing between March or April and early June in nature.

This subspecies is so far only known from Pico Island. But it can probably be expected also in other islands of the central group. Thus the distribution pattern of all Azorean *Apamea* may be characterized as follows: *A. sphagnicola sphagnicola* in São Miguel, *A. sphagnicola centralazorensis* in Pico Island and probably also some other islands of the central group, *A. ramonae* in Flores and possibly also in Corvo Island. Santa Maria is too dry with too low mountains, probably also Graciosa.

In Pico Island, the new subspecies misses in the west around Mount Pico (too dry above 1200 m, too wooded or used as cattle pastures below 1200 m, no *Sphagnum*). In the east, the population must be classified as highly endangered due to cattle grazing (Figs. 47, 48). Cattle destroy lower embankments with *Sphagnum* through their weight ("cattle erosion"). Thus only a few of the steepest slopes bear adequate habitats. Unfortunately the natural morphology of the mountains provides only a few steep embankments. As a conclusion, the new subspecies is one of the rarest and most threatened moths of Pico Island. Conservation measures should be established urgently and mainly consist of excluding cattle from the most vulnerable and highest parts of the eastern highlands. For the same reasons, possible populations in neighbouring islands probably share this poor conservation state, especially in São Jorge. At the moment, the nominotypical subspecies is much more secure in São Miguel because of a separation of natural reserves around the summits and cattle pastures below.

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