

RECENT INTRODUCTIONS OF RIPARIAN NOCTUID
MOTHS FROM THE PALAEARCTIC REGION TO
NORTH AMERICA, WITH THE FIRST REPORT OF
APAMEA UNANIMIS (HÜBNER)
(NOCTUIDAE: AMPHIPYRINAE)

KAURI MIKKOLA

Finnish Museum of Natural History, P.O. Box 17,
FIN-00014 University of Helsinki, Finland

AND

J. DONALD LAFONTAINE

Centre for Land and Biological Resources Research,
Ottawa, Ontario K1A 0C6, Canada

ABSTRACT. The Palearctic moth *Apamea unanimitis* (Hübner) (Noctuidae: Amphipyridae) is reported as new to North America on the basis of a female specimen from the vicinity of Ottawa, Ontario, Canada, collected 11 June 1991. The larva of this species feeds on riparian grasses such as *Phragmites* and *Phalaris* (Poaceae). Two other recent introductions of Noctuidae from the Palearctic to North America, *Apamea ophiogramma* (Esper) and *Rhizedra lutosa* (Hübner) (Amphipyridae), both apparently established in several areas, feed as larvae on these same plants. The apparent synchronous establishment of three Palearctic species with similar ecological associations suggests that they may have arrived by similar means, possibly aided by the modern shipping practices.

Additional key words: *Rhizedra lutosa*, *Apamea ophiogramma*, *Phragmites*, *Phalaris*.

Among the 95 species of Noctuidae recently listed as Holarctic by Mikkola et al. (1991), 26 were considered as probable introductions by man or assisted by man. Thirteen are common European species, probably transported from Europe to the west (or over the Pacific). No corresponding introductions from North America to Europe are known. Possible reasons for this bias are introduced European plants providing host plants in North America, but not vice versa, and the possible saturation of European agroecosystems (Mikkola et al. 1991).

The two most recent introductions differ from earlier ones in that the species are associated with moist habitats (Mikkola et al. 1991). *Rhizedra lutosa* (Hübner) (Figs. 6–8) was reported by McCabe and Schweitzer (1991) from New Jersey, and *Apamea ophiogramma* (Esper) (Figs. 4, 5) by Troubridge et al. (1992) from the Vancouver area, British Columbia. We list several new localities for both of these species from eastern North America.

We would like to draw the attention of North American lepidopterists to these two species and, in particular, to a third amphipyridine species first found in North America in 1991.

Apamea unanimitis (Hübner, 1813)

The first North American specimen was collected in Pinhey Forest Preserve, Nepean, 12 km SW of Ottawa on 11 June, 1991 (J. D. Lafontaine). This female specimen (Fig. 1) was caught at light in a garden at the margin of a mixed forest, in the garden there is a small artificial pond with tall grasses and sedges transported from nearby ditches.

Apamea unanimitis is a small *Apamea* with a wingspan (i.e., distance of forewing outer margins in a well spread specimen) of 29 to 33 mm (mean 30.9 mm♂♂, 31.7 mm♀♀; the difference is significant, Mikkola & Jalas 1979). It is a highly variable species, and the forewing coloration varies from pale luteous gray brown with a darker costal area to unicolorous blackish brown (cf. Figs. 1–3). The median area is weakly marked. The presence of fine white lining on the outer side of the reniform spot is a good specific character.

The species is not closely related to any North American *Apamea* species but is most likely to be misidentified as a dark form of *Apamea remissa indocilis* (Walker). It can be distinguished from *remissa* by its white-lined reniform spot. The most obvious feature distinctive from "*Oligia*" *fractilinea* (Grote), and from the Palaearctic *Mesapamea secalis* (Linnaeus), is the large hindwing discal spot (well visible on the underside of the wing).

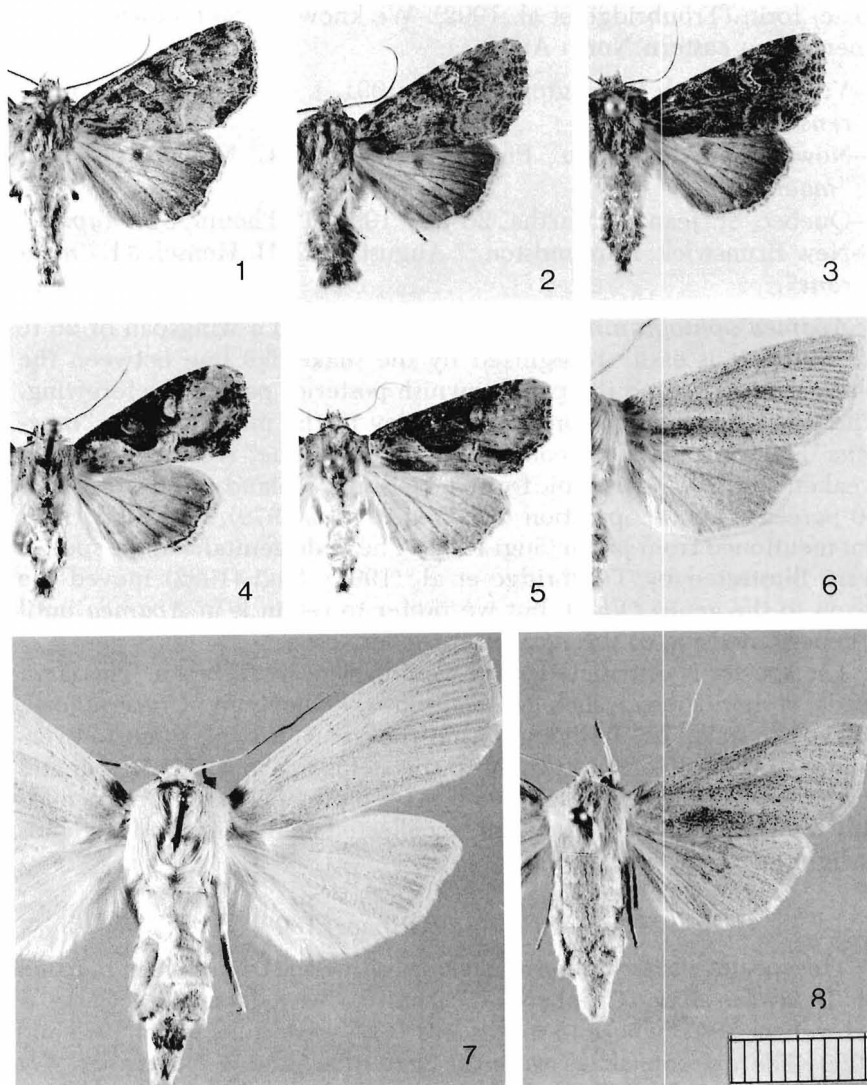
The determination of male specimens of *A. unanimitis* may be easily confirmed by brushing the valva. The cucullus is upright as in most *Apameas*, and a large sclerotized, coiled digitus is present at the anterior lower corner.

Apamea unanimitis occurs from the Pyrenees and northern Italy to the central parts of Fennoscandia (about the 63rd parallel) in Europe, and from there the distribution extends through Russia, Caucasus, and Siberia to the Amur River. The species is mainly rare and localized. However, in suitable habitats, such as rocky sea-shores, the species may be abundant in June and early July. It can be collected most easily by sugaring.

The larva feeds between the leaves of riparian grasses such as *Phragmites*, *Phalaris*, and *Glyceria* overwintering fully grown and pupating in the spring inside broken stems (Mikkola & Jalas 1979). The larva overwinters in grass tussocks, under loose bark, and in rotten wood, and pupates in the early spring in a compact cocoon in the soil (Bretherton et al. 1983).

Apamea ophiogramma (Esper, 1793)

Apamea ophiogramma was first reported from Langley, British Columbia; 4 specimens were collected at light in 1989, 19 in 1990 and 38 in 1991, between late June and late August, all of them of the typical



FIGS. 1-8. Specimens of *Apamea unanimitis* (Hübner), *A. ophiogramma* (Esper) and *Rhizedra lutosa* (Hübner) from North America and Europe. 1-3, *A. unanimitis*—1, female, Canada, Ontario, Ottawa 12 km SW, Pinhey Forest, 11 June 1991, leg. J. D. Lafontaine; 2, male, Finland, U: Porvoo, 8 June 1930, leg. E. Suomalainen; 3, female, Finland, U: Hanko, 18 June 1983, leg. Nupponen; 4-5, *A. ophiogramma*—4, female, Canada, B.C., 5 km E Langley, 24-30 June 1990, leg. J. Troubridge; 5, male form "maerens", U: Tvärminne, 9 August 1981, leg. A. Järvelä; 6-8, *R. lutosa*—6, male, Finland, U: Espoo, 16 September 1960, leg. P. Utrio; 7, female, U.S.A., N.J., Cumberland Co., Port Norris, salt marsh, 30 September 1988, leg. D. Schweitzer; 8, female, England, 6 September 1892, leg. T. Tunstall.

(pale) form (Troubridge et al. 1992). We know of the following specimens from eastern North America:

- Vermont, South Burlington, 28 July 1991, J. R. Graham, ♀ f. “*maerens*”
- New York, Albany Co., Pinebush, 1991, T. L. McCabe, 1 ex. f. “*maerens*”
- Quebec, St.-Jean de Martha, 26 July 1992, T. Thouin, ♂ f. “*typica*”
- New Brunswick, Edmundston, 7 August 1992, H. Hensel, ♂ f. “*maerens*”.

Apamea ophiogramma is a small noctuid with a wingspan of 26 to 32.5 mm. It is easily recognized by the snake-like line between the blackish anterior and the pale brownish posterior part of the forewing. The forewing groundcolor is smoky gray in the melanic form “*maerens*” Staudinger, and the contrast of the “snake line” is correspondingly weaker (Fig. 5). The melanic form in Helsinki, Finland constitutes about 40 percent of the population (Mikkola & Jalas 1979), but this form is not mentioned from Japan (Sugi 1982). The male genitalia of the species were illustrated by Troubridge et al. (1992). Sugi (1982) moved the taxon to the genus *Oligia*, but we prefer to retain it in *Apamea* until a generic revision of the Apameini is completed.

The species is distributed from western Europe to Japan. The larva feeds on shore grasses, such as *Phragmites*, *Phalaris* and *Glyceria* (e.g., Mikkola & Jalas 1979), living within the stems, leaving them to overwinter in the soil, and returning to the stems in the spring. It pupates in the soil (Bretherton et al. 1983). The moths fly mainly from mid-July to mid-August, and they can be collected near shores and wetlands at light or by sugaring.

Rhizedra lutosa (Hübner, 1803)

This species was first reported in North America from the salt marshes of Delaware Bay, Cumberland County, New Jersey (McCabe & Schweitzer 1991) where 18 moths (5♂♂ 13♀♀) were collected in 1988 and 1989. The extreme dates were 30 September and 4 November. We now report two additional collections:

- New York, Albany Co., Pinebush, 1991, T. L. McCabe
- New York, Catskill, West Shokan, 1991, J. G. Franclemont.

This is a bulky fall-flying species that can be recognized easily from the straw-colored, apically sharp forewing. The groundcolor may have a reddish-brown hue. The wingspan varies in Finland from 34 to 52.5 mm, the females being on average larger than the males, and the forewing is “almost always characteristically irrorate with black scales”

(Mikkola & Jalas 1979). The specimen from New Jersey (Fig. 7) is uncharacteristically large and pale. The handbooks from Central Europe illustrate similar unicolorously pale moths (e.g., Bretherton et al. 1983). The male genitalia were illustrated by McCabe and Schweitzer (1991).

The species is distributed from western Europe to Tibet and Japan. In Europe, *R. lutosa* is thought to be monophagous on *Phragmites australis*. The larva lives inside the stem bases and rhizomes of reeds that grow on dry land, causing blanching of the leaves; it pupates in the reed-humus amongst the rhizomes; the egg overwinters (Mikkola & Jalas 1977, Bretherton et al. 1983). The moths fly mainly from late August to early October, in and near reeds but, as in many other noctuids of this habitat, the females may disperse far from suitable habitat. The moths are attracted to light but rarely come to sugar baits.

DISCUSSION

The Canadian record of *Apamea unanimis* fits well with the European flight time because in Europe the species is one of the earliest *Apameas* to appear in late spring and early summer. The around 5 yards long garden pond hardly supports a permanent population of *A. unanimis*, but the species could be established along the shores of Ottawa and Rideau rivers, the latter two miles away, where *Phragmites* grows. The other two introduced riparian species seem to be relatively widespread, but the sudden accumulation of new observations suggests that they are newcomers.

The external appearance of the moths, combined with geographical factors, permits some inferences about the possible sources of the founder individuals. The monomorphic population of *Apamea ophiogramma* in western North America evidently has been imported from the Far-East or Japan where the melanic form seems not to occur (there occur wild type females in eastern North America, too, but importation from there seems improbable). As expected, the eastern population might have originated in the industrialized areas of Western Europe (the founder could have been a single heterozygous female which would have produced both pale and melanic forms). The very pale appearance of the American specimens of *Rhizedra lutosa* points to an origin in Great Britain or in continental Central Europe.

It is curious that three species associated with riparian grasses should appear in North America in such a short period. It seems possible that modern shipping practices may have contributed to the spread of these species. Because one of the species may overwinter as a pupa within *Phragmites* stems or close to them, the other probably lays overwintering eggs on *Phragmites*, and the third spends the winter as a medium-

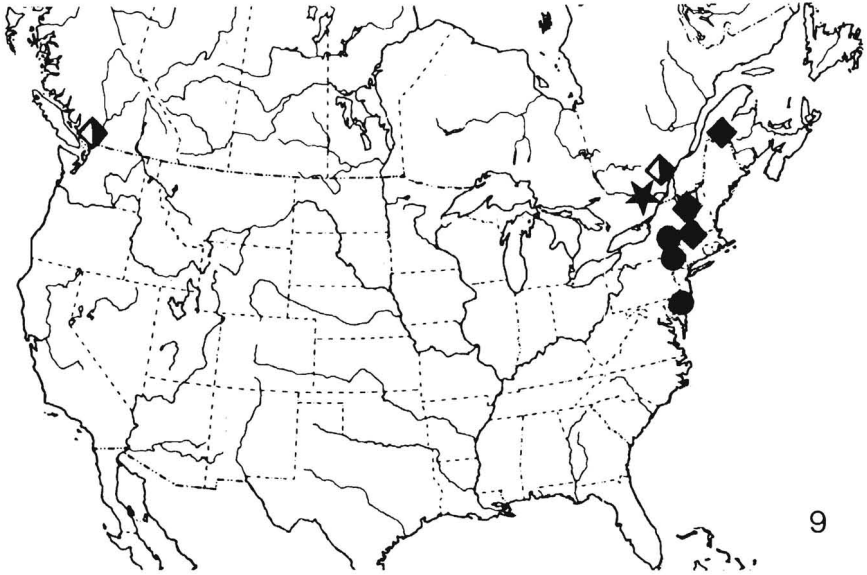


FIG. 9. Distribution of collecting localities of the three European Apameini moths in North America. ★ = *Apamea unanimitis*; ◆ = *Apamea ophiogramma*, half-filled = typical form, filled = melanic form; ● = *Rhizedra lutosa*.

sized larva associated with riparian grasses, it is possible that all three species have been transported with *Phragmites*, or with other riparian vegetation.

Soils are no longer used as ship ballast, but new shipping techniques may provide clues. Containers are kept in large storage yards in shore areas, and when they are transported into the ships, grass turfs may enter the ships. On the other hand, the reproductive strategy of *Phragmites* may enhance introduction. The plant mainly reproduces asexually from the rhizomes, and these often form dense mats along the shore. In the winter, the ice movements remove such mats, and rafts several meters in length can be seen on or near the shores. Pieces of them may enter ships through the open gates. Thus, container ships may transport reed material across the ocean, both from Europe to eastern North America, and from eastern Asia to the west coast of North America.

If the appearance of these three riparian species reflects a similar history of introduction, other Palaearctic riparian species could be expected to appear in North America, including the following species

feeding on *Phragmites* as larvae: *Archanara* spp., *Chilodes maritima* (Tauscher), *Arenostola phragmitidis* (Hübner), *Photedes brevilinea* (Fenn), *Mythimna pudorina* (Denis & Schiffermüller), *M. straminea* (Treitschke), *M. obsoleta* (Hübner) and *Senta flammea* (Curtis). Species of other lepidopteran families living as larvae on *Phragmites* or on other riparian grasses also may be introduced.

ACKNOWLEDGMENTS

We thank J. G. Franclemont (Ithaca, New York), J. R. Graham (South Burlington, Vermont), H. Hensel (Edmundston, New Brunswick), T. L. McCabe (Albany, New York), D. F. Schweitzer (Port Norris, New Jersey), and T. Thouin (St.-Jean de Martha, Quebec) for unpublished observations, and B. Landry, A. Pucut, and R. A. Bracken (Ottawa, Ontario) for commenting on the manuscript.

LITERATURE CITED

- BRETHERTON, R. F., B. GOATER & R. I. LORIMER. 1983. Noctuidae: Cuculliinae to Hypeninae, pp. 36–413. In Heath, J. & A. Maitland Emmet (eds.), *The moths and butterflies of Great Britain and Ireland*. Harley Books, Colchester, England. 459 pp.
- MCCABE, T. & D. SCHWEITZER. 1991. *Rhizedra lutosa* (Lepidoptera: Noctuidae) newly introduced to North America. *Entomol. News* 102:130–132.
- MIKKOLA, K. & I. JALAS. 1979. Suomen perhoset. Yökköset 2. (Finnish Lepidoptera. Noctuidae 2.). Otava, Helsinki, Finland. 304 pp.
- MIKKOLA, K., J. D. LAFONTAINE & V. S. KONONENKO. 1991. Zoogeography of the Holarctic species of the Noctuidae (Lepidoptera): Importance of the Beringian refuge. *Entomol. Fennica* 2:157–173.
- SUGI, S. 1982. Noctuidae. In Inoue, H., S. Sugi, H. Kuroko, S. Moriuti & A. Kawabe (eds.), *Moths of Japan*. Kodansha, Tokyo. 966 + 552 pp.
- TROUBRIDGE, J. T., S. M. FITZPATRICK & J. D. LAFONTAINE. 1992. *Apamea ophiogramma* (Esper), a palearctic cutworm new to North America (Lepidoptera: Noctuidae). *Canad. Entomol.* 124:109–112.

Received for publication 6 June 1993; revised and accepted 1 October 1993.