

The Eariadinae and Chloephorinae (Lepidoptera: Noctuoidea, Nolidae) of Israel: distribution, phenology and ecology

Еариадины и Хлоефорины (Lepidoptera: Noctuoidea, Nolidae) Израиля: распределение, фенология и экология

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КЛЮЧЕВЫЕ СЛОВА: Lepidoptera, Израиль, Левант, Nolidae, Eariadinae, Chloephorinae, фенология, экология, кормовые растения.

ABSTRACT: The distribution, flight period and abundance of six Israeli Eariadinae and eight Chloephorinae species (Noctuoidea, Nolidae) are summarized. Seven species are new records for Israel: *Earias biplaga* Walker, 1866, *Earias cupreoviridis* (Walker, 1862), *Acryophora dentula* (Lederer, 1870), *Bryophilopsis roederi* (Standfuss, 1892), *Nycteola revayana* (Scopoli, 1772), *Nycteola columbana* (Turner, 1925) and *Nycteola asiatica* (Krulikovsky, 1904). Three species, *E. biplaga*, *E. cupreoviridis* and *N. revayana*, are recorded for the first time from the Levant. Only one species, *Microxestis wutzdorffi* (Püngeler, 1907), collected some 80 years ago, was not found within the survey of the Israeli-German Lepidoptera Project. The distribution, abundance, phenology and ecology of the 14 species are summarized and discussed and for five species, new host plant records are given.

РЕЗЮМЕ: Приводятся обобщённые данные о распространении, периодах лёта и численности шести видов Еариадины и восьми видов Хлоефорины (Noctuoidea, Nolidae), распространённых в Израиле. Семь видов впервые приводятся для фауны Израиля: *Earias biplaga* Walker, 1866, *Earias cupreoviridis* (Walker, 1862), *Acryophora dentula* (Lederer, 1870), *Bryophilopsis roederi* (Standfuss, 1892), *Nycteola revayana* (Scopoli, 1772), *Nycteola columbana* (Turner, 1925) и *Nycteola asiatica* (Krulikovsky, 1904). Три вида — *E. biplaga*, *E. cupreoviridis* и *N. revayana*, впервые указаны для фауны Леванта. Лишь один

вид, *Microxestis wutzdorffi* (Püngeler, 1907), собранный 80 лет назад, не обнаружен за время работы Израильско-Германского Проекта по изучению Lepidoptera. Для всех видов приводятся данные по численности, распределению, фенологии и экологии. Для пяти видов впервые указаны кормовые растения.

Introduction

The Nolidae is a family that has changed in its coverage several times during the past. Classical Nolidae, which are now systematised as the subfamily Nolinae of the family Nolidae were traditionally placed within the Bombyces, as a family of its own. Some authors have transferred the traditional Nolidae (or Nolidae in the strict sense) to Noctuidae, but this transfer was never clearly established until Speidel et al. [1996] gave 4 autapomorphies for a noctuid group consisting of Camptolominae, Chloephorinae, Sarrorthripinae and Nolinae. The most important characters are the construction of the cocoon with a vertical exit slit and the concordant male genitalic musculature. The monophyly of this group is generally accepted in the literature now, but its placement within the Noctuoidea was subject to considerable disagreement. The group has variously been regarded as a family of its own (Nolidae in the wide sense) separate from the Noctuidae [e.g. Fibiger & Hacker, 2005] or again as a subfamily of Noctuidae, however with the Noctuidae in a very broad

sense including also Arctiinae and Lymantriinae which are traditionally separate families [Lafontaine & Fibiger, 2006]. Both systematizations differ, concerning the Nolidae, only in the rank: in the 2005 publication, Nolidae is given the rank of a family, whereas in 2006, it is given subfamily status, and the contained subfamilies are downgraded to the rank of tribes. Both recent systematizations are based on studies of Mitchell et al., the most recent and comprehensive one published in 2006, where the Noctuidae were found to be polyphyletic, and the quadrifine part of them were ostensibly related to Lymantriidae and Arctiidae forming the so called “LAQ”-clade (Lymantriidae-Arctiidae-Quadri-finae). This clade cannot be morphologically substantiated or can only weakly be substantiated, and is in major conflict with most of the traditionally used morphological characters. The polarity of the evolution shown in the phylogenetic trees furnished by Mitchell et al. [2006] is undidactically unclear to the reader, as no out-group has been recorded or determined. Thus, phylogenetic relationships of Noctuoidea are not clearly resolved or demonstrated. We conclude, therefore, that all “new” systematizations seem to be premature. The different approaches to a new system actually create a situation where nobody can know what is meant with terms like “Noctuidae” and “Nolidae”, independent from the fact which phylogenetic hypothesis will finally prove to be most likely. It would have been wise to retain the old classification until a new, well supported, system can be introduced. In systematics, we decided here provisionally to follow the publication of Fibiger & Hacker [2005].

Worldwide, the Nolidae (s. l.) may contain about 1700 species [Heppner, 1991]. In Europe, 35 species are known; 21 species Nolinae, 9 species Chloephorinae, and 5 species Eariadinae [Fibiger & Hacker, 2005]. The most commonly known species of the subfamily are the cotton pests of genus *Earias*, like the Spiny boll-worms: *E. insulana* and *E. biplaga*. The other species are often scarce and localized.

The Israeli Nolidae s.str. (Nolinae) have already been treated [Müller et al., 2005b] and the rest of Nolidae s.lat. is studied here.

Material and Methods

Within the Israeli-German project for the study of the Israeli Lepidoptera fauna, intensive collecting was conducted from 1986–2007. This project was a joint effort of The Hebrew University, Tel Aviv University, the Nature Reserves and Park Authority of Israel, the Zoologische Staatssammlung Munich in Germany and Museum Witt, Munich Germany [Kravchenko et al., 2007a, 2007b]. Lepidoptera were collected during a period of 21 years totaling about 3300 nights of collecting using mobile light traps powered by generator (250 Watt bulbs HQL & ML) and about 1750 nights of collecting using mobile light trap systems powered by batteries (12 Volt 8 Watt & 20 Watt, 6 Volt 4 Watt Black

light UVB tubes). Traps were moved on a daily basis [Müller et al., 2005a]. Additionally an intensive network of permanent light traps (220V 20W Black light UVB & UVC tubes) was maintained. Traps were also relocated on an annual basis. From year to year, 10–34 traps were operated [Müller et al., 2006].

Faunistic survey

Subfamily Eariadinae

1. *Earias insulana* (Boisduval, 1833)

GENERAL DISTRIBUTION PATTERN: Palaeotropical. Wide spread in the Tropics and Subtropics of the Old World.

DISTRIBUTION IN THE LEVANT: Israel, Lebanon, Syria and Jordan.

DISTRIBUTION IN ISRAEL: common and wide spread in all climatological zones. In the semi-arid and arid zones, they are concentrated in oases and settlements.

HABITAT: in Israel generally a ubiquitous species. In the temperate region, they are found in all kinds of open habitats, especially at low and medium elevations, in the semi-arid and arid regions, concentrated in natural and agricultural oases.

PHENOLOGY: in Israel multivoltine, with the highest rate of occurrence from May to June and from August to October.

HOST-PLANTS: mainly Malvaceae. The larvae prefer to feed on buds, flowers and seed pods. In many African countries, they are known as “the spiny boll-worm” — a pest of okra, cotton, hibiscus, and to a smaller extent also rice and maize. In Israel, this is a known pest of cotton and occasionally domesticated hibiscus species. In natural habitats, larvae were so far only observed to feed on Malvaceae like *Malva nicaensis*, *Lavatera punctata* [Avidov & Harpaz, 1969; Rivnay, 1962] and *Malvella sherardiana* (L.) Jaub. & Spach, *Alcea galilaea*, Zohary and *Abutilon hirtum* (Lam.) Sweet (unpublished data of the authors).

2. *Earias syriacana* Bartel, 1903

GENERAL DISTRIBUTION PATTERN: endemic of the Levant.

DISTRIBUTION IN THE LEVANT: Israel, Lebanon, Syria and Jordan.

DISTRIBUTION IN ISRAEL: rare, restricted to the northern part of the Temperate zone especially the Upper Galilee and the Golan Heights.

HABITAT: in Israel this is a sylvicolous species, mainly in scattered park forests, especially if dominated by *Quercus* sp., to a smaller extent also in forest clearings, along forest edges and in forested grasslands.

PHENOLOGY: in Israel probably bivoltine, with the highest occurrence in May and October.

HOST-PLANTS: in Israel, larvae were observed in early June on flowers of *M. nicaensis* (Malvaceae) and *Atractylis comosa* Cass. Compositae (Asteraceae) (unpublished data of the authors), elsewhere unknown.

3. *Earias chlorophyllana* Staudinger, 1892

GENERAL DISTRIBUTION PATTERN: Pan-Eremic. In northern Africa, they are distributed from Morocco to Libya, from Southeastern Turkey and the Levant to Turkmenistan, the Arabian Peninsula and Sudan.

DISTRIBUTION IN THE LEVANT: Israel, Lebanon and Jordan.

DISTRIBUTION IN ISRAEL: rare, restricted to the northern part of the Temperate zone especially the Upper Galilee and the Golan Heights.

HABITAT: in Israel, this is a steppe-dwelling species, mainly found in xerotherm grassland, especially on slopes with outcrops of hard fissured limestone and dolomite, less common in forested grassland and forest clearings.

PHENOLOGY: in Israel, this species is probably bivoltine with the highest rate of occurrence in May and October.

HOST-PLANTS: in Israel, the larvae were observed in October in seed buds of *Alcea setosa* (Malvaceae) (Boiss.) Alef. (unpublished data of the authors), elsewhere unknown.

4. *Earias vittella* (Fabricius, 1794)

GENERAL DISTRIBUTION PATTERN: Asiatic-Tropical; from Indo-Australia to the Southern Arab Peninsula and the Levant.

DISTRIBUTION IN THE LEVANT: known only from Israel.

DISTRIBUTION IN ISRAEL: rare, restricted to the southern and central coastal plain, from Ashdod to Haifa.

HABITAT: in Israel, this is a wetland-dwelling species, in seasonally flooded grasslands, lush herbaceous vegetation near springs and streamlets and reed beds.

PHENOLOGY: in the tropics multivoltine, in Israel at least bivoltine but mainly found from August to September.

HOST-PLANTS: in Israel unknown. In the tropics, they are occasionally a pest of Malvaceae including okra and hibiscus.

5. *Earias biplaga* Walker, 1866

First record for Israel and the Levant.

GENERAL DISTRIBUTION PATTERN: Afro-Tropical. Found throughout tropical Africa and India, local in some oases of the Arab Peninsula and in the Levant.

DISTRIBUTION IN THE LEVANT: so far only known from Israel.

DISTRIBUTION IN ISRAEL: rare, restricted to the central coastal plain near Tel Aviv.

HABITAT: in Israel, this is a wetland-dwelling species, so far only observed in a seasonally flooded reed bed of a drained swamp area. It is not clear if this is an isolated relict population or if the species was introduced into the country in the last decades with agricultural products.

PHENOLOGY: in the tropics multivoltine, in Israel so far only collected in December.

HOST-PLANTS: in Israel unknown. In Africa, this is a major cotton pest and a minor pest of Malvaceae and cacao.

6. *Earias cupreoviridis* (Walker, 1862)

First record for Israel and the Levant.

GENERAL DISTRIBUTION PATTERN: Afro-Tropical. Found throughout tropical Africa, in the Oriental tropics as far east as the Maluku.

DISTRIBUTION IN THE LEVANT: known only from Israel.

DISTRIBUTION IN ISRAEL: rare, restricted to the central coastal plain, north of Tel Aviv.

HABITAT: in Israel, this is a wetland-dwelling species, in seasonally flooded grassland and sedges along a small streamlet.

PHENOLOGY: in the tropics multivoltine, in Israel so far collected only in June.

HOST-PLANTS: in Israel unknown. In the tropics, this is a known pest of cotton, a minor pest on Malvaceae (*Abelmo-*

schus, *Hibiscus*, *Kydia*, *Malvastrum*, *Sida*, *Corchorus* and *Grewia*) and some Tiliaceae.

Subfamily Chloephorinae

7. *Bena bicolorana* (Fuessly, 1775)

GENERAL DISTRIBUTION PATTERN: Mediterranean. From Europe (except its most northern parts) to Turkey, the Levant and eastwards to Iran.

DISTRIBUTION IN THE LEVANT: Israel, Lebanon, Syria and Jordan.

DISTRIBUTION IN ISRAEL: wide spread in the Temperate zone, in the Upper Galilee especially the Hula Valley, and to a smaller extent the Golan Heights but generally uncommon, often rare.

HABITAT: in Israel, this is a sylvicolous species, mainly in deciduous forests along streamlets, in shady canyons, on north facing slopes, and in some natural parkland in settlements.

PHENOLOGY: in Israel probably bivoltine, found from April to May and from September to early November with the highest rate of occurrence in May and October.

HOST-PLANTS: in Israel *Quercus libani* Olivier (Fagaceae) (unpublished data of the authors); in Europe monophagous on *Quercus* sp.

8. *Arcyophora dentula* (Lederer, 1870)

First record for Israel.

GENERAL DISTRIBUTION PATTERN: Iranian. Mainly from Iran to Iraq, Afghanistan and Pakistan, northwards as far as Turkmenistan, eastwards to India, in the south-west reaching the Levant.

DISTRIBUTION IN THE LEVANT: Israel and Jordan.

DISTRIBUTION IN ISRAEL: rare. Presently known only from the Golan Heights.

HABITAT: in Israel, this is a sylvicolous, probably a riverine species, so far only observed in shady deciduous forests and bush-land surrounding springs and creeks.

PHENOLOGY: in the Middle East, probably multivoltine, in Israel so far only collected in December; in Jordan only in January.

HOST-PLANTS: unknown. Wiltshire [1952] suggested fruit-tree foliage.

9. *Microxestis wutzdorffi* (Püngeler, 1907)

GENERAL DISTRIBUTION PATTERN: probably East Eremic. A wide spread but rare species. Presently only known from Israel and Jordan (Jordan Valley), Northern Egypt (Nile Delta and Alexandria), and Saudi Arabia (Asir Mountains).

DISTRIBUTION IN THE LEVANT: known from Israel, Jordan and Egypt.

DISTRIBUTION IN ISRAEL: the two type specimens were collected in 1930 in Wadi Kelt (Georgskloster), since that time, no new records.

HABITAT: in Israel no data is available on habitat preferences, but the type locality and the general distribution pattern suggests an oasis dwelling species.

PHENOLOGY: in Israel the type specimens were collected in April and May; in Egypt specimens were collected in September; in Saudi Arabia in April; the species is possibly bivoltine, maybe even multivoltine;

HOST-PLANTS: unknown.

10. *Bryophilopsis roederi* (Standfuss, 1892)

First record for Israel and the Levante.

GENERAL DISTRIBUTION PATTERN: Irano-Turanian. From Southeast Turkey to the Levant, Iraq, Iran,

Afghanistan, Turkmenistan and Kirghizia.

DISTRIBUTION IN THE LEVANT: only known from Israel.

DISTRIBUTION IN ISRAEL: rare. Presently known only from the Golan Heights.

HABITAT: in Israel, this is a grassland species, in xerotherm un-forested and forested grassland, along forest fringes and in forest clearings with annual precipitation above 500mm.

PHENOLOGY: in Israel univoltine, so far only collected in May.

HOST-PLANTS: unknown.

Remarks: not mentioned by Hacker and Schreier [2001] but mentioned by Hacker [2001] as a new record for the fauna of the Levant (Israel/ Palestine) in the same volume of Esperiana (without giving any location and data, a pictured specimen is from Turkey) referring on Hacker and Schreier [2001]. No material was found in the ZSM where the material collected by "Muller and colleagues", the basis for the publication of Hacker and Schreier [2001], was deposited. See also *Nycteola revayana*.

11. *Nycteola revayana* (Scopoli, 1772)

First record for Israel.

GENERAL DISTRIBUTION PATTERN: Mediterranean. From Northern Africa (Morocco and Tunisia) and Europe to Turkey, the Levant and Iran.

DISTRIBUTION IN THE LEVANT: Israel, Lebanon and Cyprus.

DISTRIBUTION IN ISRAEL: rare and localized in the Upper Galilee, and the Golan Heights.

HABITAT: in Israel, is a sylvicolous species so far only recorded from Mt. Meron in a mature, rather shady forest up to 12 m in height and dominated by *Quercus calliprinous*, *Q. boissieri* and *Arbutus andrachne* with scarce undergrowth.

PHENOLOGY: in Israel, probably bivoltine, with the highest rate of occurrence in May and October.

HOST-PLANTS: in Israel unknown. Elsewhere known to be monophagous on oak (*Quercus*).

Remarks: not mentioned by Hacker and Schreier [2001] for the fauna of Israel/ Palestine, but in the same volume of Esperiana mentioned by Hacker [2001] for Lebanon and Palestine without giving any location and data for this species. No material was found in the ZSM where the material collected by "Müller and colleagues", the basis for the publication of Hacker and Schreier [2001], was deposited. See also *B. roederi*.

12. *Nycteola columbana* Turner, 1925

First record for Israel.

GENERAL DISTRIBUTION PATTERN: Mediterranean. From Central and South-East Europe, to Turkey and the Levant, in Northern Africa from Morocco to Tunisia.

DISTRIBUTION IN THE LEVANT: Israel, Lebanon and Cyprus.

DISTRIBUTION IN ISRAEL: rare and very local in the Upper Galilee.

HABITAT: in Israel a sylvicolous species, so far only recorded from Mt. Meron in a mature, rather shady forest dominated by *Quercus calliprinous*, *Q. boissieri* and *Arbutus andrachne* with scarce undergrowth.

PHENOLOGY: in Israel probably bivoltine, with the highest rate of occurrence in May and October. On the Balkans flying from June to September.

HOST-PLANTS: in Israel unknown; in Europe monophagous on *Quercus* sp.

13. *Nycteola asiatica* (Krulikovsky, 1904)

First record for Israel.

GENERAL DISTRIBUTION PATTERN: Palearctic. This species is found from temperate and southern Europe, throughout temperate Asia as far east as Japan. In the Near and Middle East, it is found from Turkey to the Levant, Iraq, Iran, Afghanistan and Pakistan.

DISTRIBUTION IN THE LEVANT: Israel and Jordan.

DISTRIBUTION IN ISRAEL: rare and localized in the northern part of the temperate zone.

HABITAT: in Israel, this is a wetland-dwelling species, in shady, lush herbaceous vegetation around the springs of the River Jordan (Banyas and Tel Dan nature reserves), in the Hula swamp in bush-clad wet meadows and seasonally flooded *Salix albida* thickets.

PHENOLOGY: in Israel, bivoltine with the highest rate of occurrence in May and from September to October. In Europe, the highest rate of occurrence is in midsummer and late autumn.

HOST-PLANTS: in Israel unknown; in Europe *Populus* spp. and *Salix* spp.

14. *Characoma nilotica* (Rogenhofer, 1882)

GENERAL DISTRIBUTION PATTERN: Paleotropical. Found throughout the Tropics of the Old World, less common in the Subtropics. In Europe, known from Greece, Crete and Italy, possibly only as a migrant.

DISTRIBUTION IN THE LEVANT: Israel and Lebanon.

DISTRIBUTION IN ISRAEL: wide spread along the arid parts of the Rift Valley, but only common in the Dead Sea area.

HABITAT: in Israel an oasis-dwelling species living in any kind of *Tamarix* thicket including wet Salinas.

PHENOLOGY: in Israel, multivoltine with the highest rate of occurrence in May and from September to October.

HOST-PLANTS: in Israel, the larvae were observed inside unidentified galls on old *T. nilotica* (Ehrenb.) Bunge trees (Tamaricaceae) during June and October (unpublished data of the authors). In Saudi Arabia, in galls on *T. aphylla* caused by acarid mites [Wiltshire, 1990].

Results and Discussion

During the last 20 years of the Israeli-German Lepidoptera Project, six Eariadinae and eight Chloephorinae (Noctuoidea, Nolidae) species were recorded for the fauna of Israel. Seven species are new records for Israel (*E. biplaga*, *E. cupreoviridis*, *A. dentula*, *B. roederi*, *N. revayana*, *N. columbana* and *N. asiatica*). Three species, *E. biplaga*, *E. cupreoviridis* and *N. revayana*, are recorded for the first time for the area of the Levante. Only one species, *M. wutzdorffi*, collected some 80 years ago, was not found within the survey.

The most commonly known species of this group are the cotton pests of genus *Earias*, like the spiny bollworms *E. insulana* and *E. biplaga*. Though *E. biplaga* is a well known pest, in Israel it is rare and it is questionable if it is an isolated relic population or possibly an introduced species. Only three species are wide spread in Israel. *E. insulana*, is common and wide spread in all climatological zones, *B. bicolorana* is wide spread in the Temperate zone but generally uncommon and

C. nilotica is wide spread along the arid parts of the Rift Valley, especially in the Dead Sea area but most of the time uncommon. The other species are all localized and often rare. Seven of the species *E. syriacana*, *E. chlorophyllana*, *A. dentula*, *B. roederi*, *N. revayana*, *N. columbana* and *N. asiatica* are restricted to the northern parts of the temperate zone and most (5 of 7) to the most northern parts, often 700 m a.s.l. Three species are restricted to the lowlands of the coastal plain. Two, *E. cupreoviridis* and *E. biplaga* are restricted to a small area in the central part, while, *E. vittella* spreads from the central to the southern coastal plain. *M. wutzdorffi*, to date, was only collected once 80 years ago near Jericho, an oasis 300m below sea level. Four species (*E. vittella*, *E. biplaga*, *E. cupreoviridis* and *B. roederi*) are presently known within the Levante only from Israel. This probably reflects the present degree of research and not an actual distribution pattern. In fact, most of the species found in Israel show a large distribution area. Five species are of a Tropical distribution pattern, one species is Palearctic, three are Mediterranean, two are Iranian/ Irano-Turanian and only one, *E. syriacana*, is endemic for the Levante. Nevertheless, only one species, *E. insulana*, is ubiquitous, the other species are rather stenobiotic. Five species are sylviculous (*E. syriacana*, *B. bicolorana*, *A. dentula*, *N. revayana* and *N. columbana*), four species are wetland dwelling (*E. vittella*, *E. biplaga*, *E. cupreoviridis* and *N. asiatica*), two (*M. wutzdorffi* and *C. nilotica*) are oasis dwelling and two (*E. chlorophyllana* and *B. roederi*) are grassland species. None of the recorded species are deserticulous and the few species which are occasionally found in the arid areas of Israel are restricted to natural or agricultural oases. Apart from pest species and their host plant relations, little is known about what Eariadinae and Chloephorinae larvae feed on in natural habitats. Within the last 20 years for five species, new host plants were recorded in Israel. For the two species *E. chlorophyllana* and *E. syriacana* these are the first host plant records in nature.

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