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The Hadeninae of Israel (Lepidoptera: Noctuidae)

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Abstract

Fifty-nine species of Hadeninae were recorded in Israel, four of which are new for the local fauna: *Anarta arenbergeri*, *Hecatera cappa*, *Hadena magnolii* and *Mythimna straminea*. About half of the species (27) are of Mediterranean origin, one third (19) are of eremic origin, and the rest are either Trans-Palearctic (4), Holarctic (1), Afro-Tropical (1) or Irano-Turanian (3). Four species are endemics of the Levant: *Orthosia cypriaca*, *Perigrapha mundoides*, *A. arenbergeri* and *Hadula engedina*. In Israel, some species shift to different biotopes at their southern Distribution border from what is their usual habitat in the center of Distribution.
KEY WORDS: Lepidoptera, Noctuidae, Hadeninae, Israel.

Los Hadeninae de Israel (Lepidoptera: Noctuidae)

Resumen

Cincuenta y nueve especies de Hadeninae fueron registradas en Israel, cuatro de las cuales son nuevas para la fauna local: *Anarta arenbergeri*, *Hecatera cappa*, *Hadena magnolii* y *Mythimna straminea*. Aproximadamente la mitad de las especies (27) son de origen mediterráneo, un tercio (19) son de origen erémico, y el resto son Tras-Paleárticos (4), Holárticos (1), Afro-Tropical (1) o Irano-Turanio (3). Cuatro especies son endémicas del Oriente Próximo: *Orthosia cypriaca*, *Perigrapha mundoides*, *A. arenbergeri* y *Hadula engedina*. Algunas especies en Israel, cambian a un biótopo diferente de lo que es su biótopo habitual en la esquina sur de su distribución, de lo que es su hábitat habitual en el centro de su distribución.
PALABRAS CLAVE: Lepidoptera, Noctuidae, Hadeninae, Israel.

Introduction

Israel is located at the eastern part of the Mediterranean Basin in the northern part of the Syrian East African Rift Valley (PICARD, 1943). The alternating geographical and climatic zones of Israel create a rich fauna and flora with diverse origins and often these flora are at their furthest point of geographical Distribution (FURTH, 1975).

Though Israel is located in the 20º C isotherm of annual temperature (BEAUMONT, BLAKE & WAGSTAFF, 1976; BIEL, 1944), the annual average temperature fluctuates from 17º C in the hills, to 25º C in the Jordan Valley (ASHBEL, 1951). Normally the temperature drops abruptly in November, and reaches a minimum in January or February. In the spring, temperatures rise gradually and peak in the summer at around 40º C (ASHBEL, 1951). The bulk of the annual rainfall (70%) occurs between November and February, with little rain in the spring and a pronounced drought from June to August. The annual rainfall decreases from 1500 mm on Mt Hermon in the north to 15mm near the gulf of Eilat in the south (ASHBEL, 1951).

The plants of Israel belong to five phyto-geographic regions (ZOHARY, 1966), the Mediterranean, Irano-Turanian, Saharo-Arabian, Tragacanth and the Ethiopian penetration zones. Areas receiving more

than 350 mm rainfall annually belong to the Mediterranean or temperate Zone (ZOHARY, 1962) Areas with less than 200-300 mm winter rainfall support only steppes and grassland and belong to the Irano-Turanian Zone. The Saharo-Arabian eremic zone is a true desert with less then 200 mm winter rainfall. The Rift Valley receives even less rain but still supports numerous tropical pockets near springs (ZOHARY & ORSHANSKY, 1949). These oases are penetrated by Ethiopian fauna and flora. Found on the peak of Mt Hermon (above 1900 m) is typical Tragacanth vegetation, which tolerates very low temperatures and snow in winter and hot droughts in summer.

The faunistic data presented here are mainly based on the outcomes of the 18 year, Israeli-German project for the study of Israeli lepidopteran fauna. This project was a joint effort of The Hebrew University, the Tel Aviv University, The Nature Reserves and Park Authority of Israel, the Zoologische Staatssammlung, Munich, Germany and the Museum Witt, Munich, Germany.

Herein, phenology of the Hadeninae is given based on the data obtained during the Israeli-German project as well as information drawn from the literature. Larval host-plants are taken from the literature, the authors' own observations and personal communications by other colleagues.

Subfamily Hadeninae Guenée, 1837

The Hadeninae Guenée, 1837 is a very large subfamily with more than 2400 species worldwide (SPEIDEL *et al.*, 1996a) however, it is probably paraphyletic. In the present scope, this subfamily is mainly characterized by the hairy compound eyes of the adult moths. Tribal systematics is arranged according to FIBIGER & LAFONTAINE (2005). So far, 59 species from 18 genera and 5 tribes have been recorded in Israel, mostly belonging to the tribes Hadenini and Leucaniini.

The bulk of the tribe Orthosiini Guenée, 1837 is univoltine with characteristic early spring phenology. Orthosiini usually prefer forested habitats, including both deciduous and coniferous woodlands. Their larvae are feed on various broad-leaved trees and conifers, pupating and over-wintering in strong cocoons in the soil (RONKAY *et al.*, 2001). So far, five species belonging to three genera (*Orthosia* Ochsenheimer, 1816, *Perigrapha* Lederer, 1857 and *Egira* Duponchel, 1845) have been recorded in Israel.

The tribe Tholerini Beck, 1996 in its present scope includes only three genera. The habitus of the larvae and adults resemble those of the Orthosiini with slight differences in larval morphology. The larvae feed on herbaceous plants rather than bushes and trees. Adults fly in late summer and early autumn (FIBIGER & LAFONTAINE, 2005). Only one species belonging to the genus *Tholera* Hübner, 1821 has so far been recorded in Israel.

The Hadenini Guenée, 1837 is a large tribe characterized by the transverse cleft of the larval hypopharynx (FIBIGER & LAFONTAINE, 2005). The generic concepts have been considerably broadened and modified in most recent publications (HACKER *et al.*, 2002; FIBIGER & HACKER, 2005). So far, 35 species belonging to 11 genera have been recorded in Israel.

The tribe Leucaniini Guenée, 1837 is a widely distributed tribe of Noctuidae s.str., one of the few that are well represented in the tropics. Most European species originated from the temperate zones of Asia (HACKER *et al.*, 2002). As well, the habitus of most species is characterized by yellow forewings and grey or whitish hind-wings. So far, 17 species have been recorded in Israel.

The tribe Glottulini Guenée, 1852 has brightly coloured, non-protective larvae which often feed on Amaryllidaceae or Liliaceae. The adults are also conspicuously coloured, which is unusual for noctuids. So far, only one deserticolous species has been recorded in Israel.

Faunistic survey of the Hadeninae

Tribe Orthosiini Guenée, 1837

Orthosia cruda ([Denis & Schiffermüller], 1775)

Distribution: West-Palaearctic. Morocco, Algeria, Tunisia, Europe, Turkey, Levant, Caucasus,

Transcaucasia and Kazakhstan, Israel, Lebanon, Cyprus and Jordan. In Israel in the temperate region, common in the Galilee, the Golan Heights and Mt. Hermon, elsewhere uncommon.

Bionomics: in Israel univoltine, spring, sylvicolous species, flying from January to March. Host plants: larvae feed on deciduous trees, mainly on *Quercus*.

Orthosia cypriaca Hacker, 1996

Distribution: Endemic to the Levant; Israel, Lebanon, Jordan and Cyprus. In Israel in the temperate region, in the Upper Galilee and the foothills of Mt. Hermon. Rare and localized.

Bionomics: in Israel univoltine, spring, sylvicolous species, flying from January to March. Host-plants: unknown, probably deciduous trees like other congeners.

Orthosia cerasi (Fabricius, 1775)

Distribution: Palaearctic. From Europe to Turkey, Israel, Transcaucasia, Eastern Siberia. In Israel in the temperate region, in the Central and Northern Coastal Plain, the Carmel Mountain Ridge and the Upper Galilee. Rare and localized.

Bionomics: in Israel univoltine, spring, sylvicolous species, flying from January to March; in Southern Europe flying from March to April. Host-Plants: polyphagous on deciduous trees, mainly *Quercus*.

Perigrapha mundoides (Boursin, 1940)

Distribution: endemic of the Levant, recorded from Israel, Lebanon and Jordan. In Israel: widespread in the temperate region. Locally common in the Upper Galilee, on the foothills of Mt. Hermon and in the western parts of Jerusalem, elsewhere rare.

Bionomics: in Israel univoltine, spring, sylvicolous species, flying from February to March. Host-Plants: in Israel unknown, FIBIGER *et al.* (1996) suggested *Paliurus spina-christi* or related shrubs for the Near East.

Egira tibori Hreblay, 1994

Distribution: (East-)Mediterranean. The Balkans, Turkey, Israel, Lebanon and Jordan. In Israel: in the temperate region in mountainous areas, in the north especially the Golan Heights, the foothills of Mt. Hermon and the Galilee. Common.

Bionomics: in Israel univoltine, spring, sylvicolous species, flying from February to May with the highest rate of occurrence in March. Host-Plants: unknown, but probably polyphagous on various herbaceous plants and trees like other congeners.

Tribe Tholerini Beck, 1996

Tholera hilaris (Staudinger, 1901)

Distribution: (East-)European-West Asiatic. From the southern part of European Russia to the Caucasus region, Transcaucasia, Turkey and Israel. In Israel: in the temperate or semi-arid region, so far only known from the vicinity of Jerusalem. Not seen since the 1960th.

Bionomics: in Israel so far only collected in October; in Turkey and Iran univoltine, autumn, montane steppe species, flying from September to October. Host-Plants: unknown.

Tribe Hadenini Guenée, 1837

Anarta (*Hadula) sabulorum* (Alphéraky, 1882)

Distribution: Eremic. In most of the eremic parts of the Palaearctic Region. North Africa, the Near and Middle East, Central Asia, Western China and Mongolia. In Israel common in the arid region, rare and localized in the semi-arid region.

Bionomics: in Israel univoltine, spring, deserticolous species, flying from January to April with the highest rate of occurrence in March. Host-Plants: unknown.

Anarta (*Hadula) engedina* Hacker, 1998

Distribution: probably endemic to the Levant (recorded only from Israel). In the arid region in 'En Gedi and in the semi-arid region in the upper elevations of the Judean desert near Alon and Kfar Adumim. Rare and localized.

Bionomics: in Israel univoltine, spring, deserticolous species, flying from January to March. Host-Plants: unknown.

Anarta (*Hadula) arenbergeri* (Pinker, 1974)

New record for the fauna of Israel.

Distribution: Anatolian-Iranian, relict. Recorded only from Turkey and Israel. In the arid and semi-arid region in the Central Negev above 500 m a.s.l. Rare and localized.

Bionomics: in Israel a deserticolous species, so far only collected in March; in Turkey from May to July and in September, probably bivoltine. Host-Plants: unknown.

Anarta (Calocestra) mendax (Staudinger, 1879)

Distribution: (East-)Mediterranean. South-eastern Balkans, Turkey, Israel, Lebanon and Transcaucasia. In Israel: in the temperate region in the area of Jerusalem (not seen since 1910) and rare and localized in the Upper Galilee.

Occurrence in Israel: in the vicinity of Jerusalem, in the Upper Galilee.

Bionomics: in Israel a grassland species, so far only collected in April; in Turkey univoltine, flying from April to May. Host-Plants: unknown.

Anarta (Calocestra) mendica (Staudinger, 1879)

Distribution: Iranian. Turkey, Armenia, Azerbaijan, Israel and Lebanon. In Israel: in the temperate region in the Galilee, on Mt. Hermon and the Upper Golan Heights. Rare and localized.

Bionomics: in Israel a grassland species so far only collected in May; in Turkey and Azerbaijan univoltine, spring species, flying from April to June. Host-Plants: in Israel and elsewhere unknown.

Anarta (Calocestra) *trifolii* (Hufnagel, 1766)

Distribution: Holarctic. Almost through the whole Palearctic region with the exception of the boreal taiga, also widely distributed in the Nearctic region. In Israel: through all the climatological regions all over the country. Abundant in the semi-arid region and the Coastal Plain, common in the temperate region on medium and upper altitudes, in the arid region concentrating in oases often common or abundant.

Bionomics: in Israel multivoltine, ubiquitous species. In the coastal area and the Rift Valley flying all year round with the highest rate of occurrence from March to May and from September to November, on higher elevations absent during the cold months. Host-Plants: generally known to be polyphagous among many others also on *Atriplex halimus*, *Prosopis farcta, Ochradenus baccatus*, *Artemisia sieberi*, *Malva nicaensis*, *Epilobium hirsutum, Convolvulus arvensis* occasionally on salads and vegetables.

Anarta (Calocestra) *stigmosa* (Christoph, 1887)

Distribution: Eurasiatic. From South-eastern Europe, Turkey, Israel and Iran to Central Asia, Southern Siberia, China and Mongolia. In Israel: in the semi-arid region in the Central Negev mainly in Nahal Nizzana and its vicinity. Rare and localized.

Bionomics: in Israel a steppe species, so far only collected from April to May; in Italy bivoltine, flying from May to July and from August to October. Host-Plants: polyphagous on various species of *Atriplex, Salsola* and *Chenopodium* and probably other halophilous shrubs.

Cardepia sociabilis (Graslin, 1850)

Distribution: Eremic. From Morocco to Chad through Southern Europe, Turkey, Israel, Syria, the Arabian Peninsula, to India. In Israel: all over the arid region and in the temperate region along the Southern Coastal Plain. In the arid region locally common, elsewhere uncommon.

Bionomics: in Israel multivoltine, oasis species, flying from March to November with the highest rate of occurrence from April to May and in October, larvae were observed from April to May and in October. Host-Plants: polyphagous on several halophilous plants.

Cardepia affinis Rothschild, 1913

Distribution: Eremic. South-western Europe, North Africa, Israel, Lebanon, Syria, Jordan and Sinai (Egypt), the Arabian Peninsula and Southern Iran. In Israel: widespread in the arid region. Locally common in the Dead Sea area and the Arava valley, rare elsewhere.

Bionomics: in Israel bivoltine, oasis species, flying from November to January and from March to May. Host-Plants: various halophilous herbaceous plants, including *Atriplex* spp.

Thargelia gigantea Rebel, 1909

Distribution: (West-)Eremic. From Morocco to Algeria, Libya, Israel and Sinai (Egypt). In Israel: in the arid region, the Negev, penetrating into the Arava valley. Uncommon and localized in some canyons of the Southern Negev, elsewhere rare and localized.

Bionomics: in Israel univoltine, spring, deserticolous species, flying from January to April with the highest rate of occurrence in March. Host-Plants: unknown.

Odontelia daphnadeparisae Kravchenko, Ronkay, Speidel, Mooser & Müller, 2007

Distribution: Probably endemic of the Levant. Known from Israel and Jordan. In Israel: in the arid region, in the Arava valley, uncommon and localized.

Bionomics: in Israel univoltine, spring, deserticolous species, flying from December to March with the highest rate of occurrence in February. Host-Plants: in Israel and elsewhere unknown.

Lacanobia oleracea (Linnaeus, 1758)

Distribution: Palaearctic. North Africa, Europe, Temperate Asia, the Near and Middle East, Northern India, China, Korea and Japan. In Israel in the temperate region, in the northern part of the Rift Valley from the Sea of Galilee area along the Hula valley up to the medium elevations of Mt. Hermon. Rare and localized.

Bionomics: in Israel bivoltine, wetland species, flying from April to June and in August, larvae were observed in September. Host-Plants: polyphagous on numerous wild herbaceous plants, including *Atriplex*, *Chenopodium*, *Rumex crispus* at least in Southern Europe occasionally an endophagous pest of tomatoes.

Lacanobia softa (Staudinger, 1898)

Distribution: (West-)Eremic. Algeria, Morocco, Israel and Jordan. In Israel: all over the arid and semi-arid regions. Often abundant in the arid region, concentrating in oases, uncommon and localized in the semi-arid region.

Bionomics: in Israel bivoltine, oasis species, flying from October through winter to May with the highest rate of occurrence in November and from March to April, larvae were observed from March to May and in November, overwintering in the pupal stage. Host-Plants: unknown.

Sideridis implexa (Hübner, 1813)

Distribution: (West-)Eremic. From Morocco to Libya, in Spain and from South-eastern Europe, the Balkans, to Turkey, Israel, Lebanon and the Caucasian region. In Israel: in the temperate region along the Southern Coastal Plain and in the semi-arid region in the Northern Negev. Rare and localized.

Bionomics: in Israel univoltine, spring, steppe species, flying from March to April. Host-Plants: in Europe *Dianthus* spp. (Cariophyllaceae).

Dicerogastra chersotoides (Wiltshire, 1956)

Distribution: (Central-)Eremic. Israel, Jordan, Saudi Arabia and Oman. In Israel: in the Semi-arid and temperate region, mainly along the Rift Valley. Rare and localized.

Bionomics: in Israel steppe species, possibly bivoltine, in the semi-arid region flying from September to November, in the temperate region from June to July. Host-Plants: in Israel and elsewhere unknown.

Saragossa siccanorum (Staudinger, 1870)

Distribution: West-Palaearctic. South-eastern Europe, Turkey, Lebanon, Israel, Iraq, Azerbaijan, Ukraine, Southern Russia, Central Asia, Western Mongolia and North-western China. In Israel: in the semi-arid region in the Central Negev especially in Nahal Nizzana and Nahal HaRoa. Rare and localized.

Bionomics: in Israel univoltine, steppe species, flying from October to January with the highest rate of occurrence in November. Host-Plants: in Israel and elsewhere unknown.

Hecatera bicolorata (Hufnagel, 1766)

Distribution: West-Palaearctic. From almost all Europe and Turkey, Iran, Israel, Lebanon, Syria, to Kirghizia, Tajikistan, Western Siberia and China. In Israel: in the temperate region along the northern part of the Rift Valley from the Sea of Galilee area (-200 m b.s.l.), along the Hula valley (200 m a.s.l.) as far north as the Banyas Nature Reserve (300 m a.s.l.), so far only recorded from low lands. Rare and localized.

Bionomics: in Israel possibly univoltine, spring, grassland species flying from April to May; in Southern Europe bivoltine, flying in spring and again from July to early autumn. Host-Plants: polyphagous on flowers of *Hieracium*, *Prenanthes*, *Eupatorium*, *Sonchus* and *Lactuca*.

Hecatera weissi (Boursin, 1952)

Distribution: Mediterranean. Southern Europe, North Africa, Turkey, Israel, Jordan and Saudi Arabia. In Israel: all over the arid and semi-arid regions and in the temperate region along the southern part of the Coastal Plain. Common in the semi-arid region in the Judean desert and the Jordan Valley, elsewhere uncommon.

Bionomics: in Israel univoltine, spring, steppe species, in the arid and semi-arid region from January to April with the highest rate of occurrence in March, in the temperate region from March to May with the highest rate of occurrence in April. Host-Plants: in Israel and elsewhere unknown.

Hecatera dysodea ([Denis & Schiffermüller], 1775)

Distribution: West-Palaearctic. From Central and Southern Europe and North Africa to Israel, Lebanon, Jordan and Egypt (Sinai), Turkey, Iraq, Iran to Central Asia Northern India and China. In Israel all over the country in all the climatological regions. Uncommon in the temperate region, common in semi-arid region, fairly common in the arid region but concentrating in oases.

Bionomics: in Israel bivoltine, ubiquitous species, flying from March to May and from October to November. Host-Plants: flowers and seeds of Asteraceae (Compositae) also on wild and cultivated *Lactuca* spp.

Hecatera cappa (Hübner, 1809)

New record for the fauna of Israel.

Distribution: West-Palaearctic. Morocco, Algeria, Central and South-eastern Europe, Turkey, Transcaucasia, Israel, Lebanon, Jordan, Iran and Central Asia. In Israel: in the temperate region on Mt. Hermon on medium and upper elevations. Rare and localized.

Bionomics: in Israel univoltine, spring, montane steppe species, flying from April to May; in Central Europe bivoltine, flying at the beginning and end of summer. Host-Plants: flowers and seeds of Scropulariae, and *Delphinium* spp. (Ranunculaceae).

Hecatera fixseni (Christoph, 1883)

Distribution: (East-) Eremic. Egypt, Israel, Armenia, Iran, Turkmenistan, Afghanistan and Pakistan. In Israel: in the arid region in the Dead Sea area. Rare and localized.

Bionomics: in Israel an oases species, so far only observed from March to April, generally bivoltine, flying in spring and autumn. Host-Plants: unknown.

Enterpia laudeti (Boisduval, 1840)

Distribution: West-Palaearctic. Southern Europe, Ukraine, European part of South-eastern Russia, Kazakhstan, Turkmenistan, Iran, Iraq, Israel, Lebanon, Syria, Jordan and Egypt (Sinai), Egypt and the Arabian Peninsula. In Israel: in the semi-arid region in the Judean desert, the Dead Sea area and the lower Jordan Valley. Uncommon in the Judean desert on medium and upper elevations, rare elsewhere.

Bionomics: in Israel univoltine, spring, steppe species, flying from March to May, larvae were observed in May. Host-Plants: *Silene* spp. and *Gypsophila* spp.

Hadena magnolii (Boisduval, 1829)

New record for the fauna of Israel.

Distribution: Mediterranean-Central Asian. Morocco, Algeria, South-eastern Europe, Turkey, Israel and Lebanon, Iran, Turkmenistan, Uzbekistan and Kirghizia. In Israel: in the temperate region on Mt. Hermon, the Upper Golan Heights and Mt. Meron. Rare and localized.

Bionomics: in Israel univoltine, summer, sylvicolous species, flying from May to June. Host-Plants: flowers and seeds of *Silene nutans* and other *Silene* species.

Hadena compta ([Denis & Schiffermüller], 1775)

Distribution: Trans-Palaearctic. Morocco, Algeria, Europe, Turkey, Israel, Lebanon, Iraq, Iran, Central Asia, Southern Russia, China and Japan. In Israel there are two isolated populations: in the temperate region on Mt. Hermon above 1200m a.s.l. and in the semi-arid region in the Central Negev near Nahal Nizzana, the two populations show constant distinctive colour patterns. Fairly common on Mt. Hermon, rare in the Negev.

Bionomics: in Israel univoltine, summer, montane steppe species, on Mt. Hermon flying from May to July, in the Central Negev so far only collected in October. Host-Plants: seeds of Caryophyllaceae, usually *Dianthus carthusianorum*.

Hadena adriana (Schawerda, 1921)

Distribution: Mediterranean. Tunisia, Southern France, Italy, the Balkans, Turkey, Israel, Lebanon. In Israel: in the temperate region on Mt. Hermon at medium and upper elevations. Rare and localized.

Bionomics: in Israel univoltine, summer, montane steppe, so far only collected in May. Host-Plants: unknown, probably capsules of Caryophyllaceae, like other congeners.

Hadena gueneei (Staudinger, 1901)

Distribution: Mediterranean-Iranian. Italy, the Balkans, Turkey, Israel, Transcaucasia, Iran and Turkmenistan. In Israel: in the temperate region on Mt. Hermon at medium and upper elevations. Rare and very localized.

Bionomics: in Israel univoltine, summer, steppe species, flying from May to August. Host-Plants: unknown; probably capsules of Caryophyllaceae, like other congeners.

Hadena clara (Staudinger, 1901)

Distribution: Mediterranean-Iranian. Morocco, Southern Europe, Turkey, Armenia, Azerbaijan,

the Caucasus region, Israel, Lebanon, Syria and Iran. In Israel in the temperate region, on Mt. Hermon above 1800 m a.s.l. Rare and very localized.

Bionomics: in Israel univoltine, summer, tragacanth species, flying from May to June. Host-Plants: unknown; probably capsules of Caryophyllaceae, like other congeners.

Hadena persimilis Hacker, 1996

Distribution: (East-)Mediterranean-Turanian. The Balkans, the European part of South-eastern Russia, Ukraine, Turkey, Israel, Armenia, Azerbaijan, Iran, Turkmenistan and Kazakhstan. In Israel: in the temperate region on Mt. Hermon above 1200 m a.s.l. On Mt. Hermon at 1200 m a.s.l. rare and localized, above 1800 m uncommon and localized.

Bionomics: in Israel univoltine, summer, tragacanth species, flying from June to July. Host-Plants: unknown; probably capsules of Caryophyllaceae like other congeners.

Hadena drenowskii (Rebel, 1930)

Distribution: (East-)Mediterranean-Iranian. The Balkans, Ukraine, Turkey, Armenia, Israel, the Caucasus region, Iran and Turkmenistan. In Israel: in the Temperate region on Mt. Hermon above 1800 m a.s.l. Common.

Bionomics: in Israel univoltine, summer, tragacanth species, flying from June to August. Host-Plants: unknown; probably capsules of Caryophyllaceae, like other congeners.

Hadena syriaca (Osthelder, 1933)

Distribution: (East-)Mediterranean-Iranian. Italy, the Balkans, South-eastern Europe, Turkey, Transcaucasia, Israel, Syria and Jordan, Iran, Pakistan and Egypt. In Israel widespread in the temperate and semi-arid regions. Locally common in the temperate region in the northern part of the Rift Valley, rare elsewhere.

Bionomics: in Israel univoltine, spring, grassland species, flying from February to May with the highest rate of occurrence in March; in Southern Europe from April to June. Host-Plants: unknown; probably capsules of Caryophyllaceae, like other congeners.

Hadena perplexa ([Denis & Schiffermüller], 1775)

Distribution: West-Palaearctic. Morocco, Algeria, Tunisia, Europe, Turkey, Israel, Lebanon, Syria, Jordan, Iran, Iraq, Northern and Central Asia, Northern India and Western China. In Israel in the temperate region in the northern part of the Rift Valley. Locally common.

Bionomics: in Israel univoltine, spring, grassland species, flying from February to May with the highest rate of occurrence in April; in Europe flying from April to June, depending on the micro climate of the habitat locally bivoltine, flying from April to June and from August to September. Host-Plants: flowers and seeds of *Dianthus*, *Lychnis* and *Silene*.

Hadena silenes (Hübner, 1822)

Distribution: (East-)Mediterranean-Iranian. Europe, Turkey, Israel, Iran and Turkmenistan. In Israel widespread in the temperate region. In the temperate region, fairly common in the area of the Sea of Galilee especially in Delta of the river Jordan, elsewhere only rare and localized.

Bionomics: in Israel univoltine, spring, grassland species, so far only collected in April; also in the Near East univoltine but flying from March to June. Host-Plants: in Israel unknown, in Europe larvae of the nominate form feed on seeds of *Silene* spp., *Cucubalus* spp. (Caryophyllaceae).

Hadena sancta (Staudinger, 1859)

Distribution: Mediterranean. Spain, Corsica, Sardinia, Malta, North Africa, Israel, Lebanon, Syria, Jordan, Cyprus, Turkey, Saudi Arabia and Yemen. In Israel in the semi-arid region, from the southern part of the Judean Mts. through the Judean desert to the Lower Jordan Valley. Rare and localized.

Bionomics: in Israel univoltine, spring, steppe species, flying from March to May. Host-Plants: seeds of *Silene* spp.

Hadena pumila (Staudinger, 1879)

Distribution: Iranian. Greece, Turkey, Transcaucasia, Israel, Lebanon, Jordan, Syria and Iran. In Israel in the temperate region on Mt. Hermon above 1800m a.s.l. Rare and very localized.

Bionomics: in Israel univoltine, summer, tragacanth species, flying from May to July. Host-Plants: unknown.

Hadena silenides (Staudinger, 1895)

Distribution: (West-)Eremic. Portugal, Spain, from Mauretania to Egypt, Israel, Lebanon, Syria, Jordan, Egypt (Sinai), the Arabian Peninsula, Iraq and Iran. In Israel all over the arid and semi-arid regions and in the temperate region along the Southern Coastal Plain. Common, locally even abundant in the arid part of the Rift Valley, uncommon elsewhere.

Bionomics: in Israel univoltine, spring, deserticolous species, flying from January to April with the highest rate of occurrence in March. Host-Plants: unknown.

Tribe Leucaniini Guenée, 1837

Mythimna (Hyphilare) ferrago (Fabricius, 1787)

Distribution: West Palearctic. Morocco, Algeria, Europe, Turkey, Israel, Lebanon, Iraq, Iran, Central Asia and Western Temperate Asia. In Israel in the temperate region on medium elevations, especially the western Judean Mts., the Galilee, the Golan Heights and Mt. Hermon. Fairly common.

Bionomics: in Israel univoltine, spring, wetland species, flying from March to May, in Northern Europe flying from July to August; in Southern Europe from May to June and from July to September. Host-Plants: polyphagous on various Gramineae, *Plantago* spp. and *Taraxacum* spp.

Mythimna (Mythimna) vitellina (Hübner, 1808)

Distribution: West-Palaearctic. North Africa, Southern Europe, the Near and Middle East, Central Asia and Western China, especially in the subtropical parts of the Western Palearctic. In Israel through all the climatological regions all over the country. Abundant in the temperate region, common but localized in the Semi-arid and arid regions.

Bionomics: in Israel multivoltine, ubiquitous species, flying from March to November with the highest rate of occurrence in April, May and in October. Host-Plants: polyphagous on Gramineae and low plants like *Rumex crispus*.

Mythimna (Mythimna) straminea (Treitschke, 1825)

New record for the fauna of Israel.

Distribution: West-Palaearctic. Morocco, Europe, Turkey, the Caucasus, Israel and Lebanon. In Israel in the temperate region, in the Northern Hula valley, near the Jordan springs in Tel Dan Nature Reserve. Rare and very localized.

Bionomics: in Israel probably a wetland species, so far only collected in May; in Southern Europe bivoltine, flying from June to August and from September to October. Host-Plants: mainly *Phragmites,* to a smaller extent *Pharalis*, *Carex* and *Typha*.

Mythimna (Hyphilare) congrua (Hübner, 1817)

Distribution: Mediterranean-Iranian. Algeria, Southern Europe, Turkey, Israel, Syria, the Caucasian and Transcaucasian region, Azerbaijan, Iraq and Turkmenistan. In Israel in the temperate region, in the northern part of the Rift Valley, the Sea of Galilee area, the Hula valley and the foothills of Mt. Hermon, at the Northern Coastal Plain. Fairly common.

Bionomics: in Israel possibly univoltine, spring, wetland species, so far only collected from

January to May with the highest rate of occurrence in April, in Europe bivoltine, flying from March to June and from August to October. Host-Plants: various Gramineae.

Mythimna (Morphopoliana) languida (Walker, 1858)

Distribution: Paleotropical. Almost all parts of tropical and subtropical Africa, Asia and the Mediterranean basin. In Israel all over the temperate region, penetrating into the Semi-arid and arid region. Common, locally even abundant.

Bionomics: in Israel multivoltine, grassland species, flying all year round with the highest rate of occurrence in January, April and September, in oases in the Rift Valley also in December. Host-Plants: in Italy *Arundo phraguntes* in Egypt *Lavathera* spp.

Mythimna (Hyphilare) l-album (Linnaeus, 1767)

Distribution: West-Palaearctic. Wide spread in the Western and Central parts of the Palearctic region, including North Africa from Morocco to Tunisia, the Levant, missing in the far North and from the Arabian Peninsula. In Israel in the temperate region mainly on medium elevations especially on the Upper Galilee, the Golan Heights and Mt. Hermon. Uncommon.

Bionomics: in Israel multivoltine, wetland species, flying round the year with the highest rate of occurrence from March to June and in August. Host-Plants: various Gramineae (*Poa*, *Festuca*, *Dactylis*, ets).

Mythimna (Sablia) sicula (Treitschke, 1835)

Distribution: Mediterranean-Turanian. From Morocco to Libya, Central and Southern Europe, Turkey, Israel, Iran and Turkmenistan. In Israel all over the semi-arid region, penetrating the arid region towards the northern Arava valley and the temperate region towards the Coastal Plain. Common, locally abundant.

Bionomics: in Israel multivoltine, steppe species, flying all year round with the highest rate of occurrence in January, April and September. Host-Plants: different species of Gramineae.

Mythimna (Sablia) alopecuri (Boisduval, 1840)

Distribution: Mediterranean-Turanian. Southern Europe, Turkey, the Caucasus region, Israel, Jordan, Iraq, Iran, the European part of Southern Russia, Ukraine, Kazakhstan and Turkmenistan. In Israel through all the climatological regions along the Rift Valley and the neighbouring mountain ranges, from the northern part of the Arava valley, the Dead Sea area, the Jordan Valley to the Golan Heights and Mt. Hermon up to medium elevations. Common in the Judean desert at upper elevations and the northern Jordan Valley, elsewhere rare and localized.

Bionomics: in Israel bivoltine, steppe species, flying from April to May and from September to October. Host-Plants: probably Gramineae species.

Mythimna (Anapoma) riparia (Rambur, 1829)

Distribution: Mediterranean-Turanian. Morocco, Southern Europe, Turkey, Israel, Syria and Turkmenistan. In Israel along the Rift Valley, through all the climatological regions, from the northern part of the Arava valley to the Golan Heights and Mt. Hermon at medium elevations, also along the Southern Coastal Plain. Common in the area of the Sea of Galilee and the Hula valley, elsewhere rare and localized.

Bionomics: in Israel bivoltine, grassland species, flying from March to May and from September to October, larvae were observed in April. Host-Plants: polyphagous on grasses including *Calamagrostis* and low herbaceous plants like *Vicia* and *Trifolium*.

Mythimna (*Pseudaletia) unipuncta* (Haworth, 1809)

Distribution: Cosmopolitan. Cosmopolitan apart from the Eastern Palearctic and the Oriental and Australian Regions. In North Africa from Morocco to Tunisia, in Europe a resident up to the 45th degree of

latitude, Turkey and the Levant absent from the arid parts of the Arabian Peninsula but recorded from Yemen and Oman, otherwise widespread in the Near and Middle East. In Europe migrating as far north as Iceland and Scandinavia. In Israel through all the climatological regions all over the country. Abundant in lowlands, common on medium and upper altitude, locally common or abundant in the arid region in oases.

Bionomics: in Israel multivoltine, ubiquitous species, flying all year round, with 3-4 overlapping generations, with the highest rate of occurrence from January to March, in May and from September to November, in the Tropics up to six generations per year. Host-Plants: in Israel *Arundo donax* and *Picnomon acarna* L., occasionally on wheat and barley, but so far not registered as a pest; elsewhere known from Gramineae and cereals; in Europe *Rumex crispus*, *Rumex obtusifolius*.

Leucania putrescens (Hübner, 1824)

Distribution: Mediterranean. Southern Europe, North Africa, Turkey, Israel, Lebanon and In Israel widespread in the arid region, penetrating the semi-arid region in the northern Rift Valley and the Judean desert. In the Arava valley locally common, elsewhere rare.

Bionomics: in Israel univoltine, autumn, ubiquitous species, flying from October to November, larvae were observed in September. Host-Plants: in Europe undefined Gramineae species.

Leucania (Leucania) punctosa (Treitschke, 1825)

Distribution: Mediterranean-Iranian. From Morocco to Libya, Southern Europe, Turkey, Armenia, Israel, Lebanon, Jordan, Egypt (Sinai), Iran, Iraq and Turkmenistan. In Israel in the arid region in the Northern Negev and in the temperate region along the Coastal Plain. Rare and localized.

Bionomics: in Israel univoltine, autumn, steppe species, flying from October to November. Host-Plants: in Europe undefined Gramineae species.

Leucania (Leucania) herrichii Herrich-Schäffer, 1849

Distribution: (East-)Mediterranean-Iranian. Bulgaria, Greece, Turkey, Israel, Lebanon, Syria, Jordan the Levant, Iran and Turkmenistan. In Israel widespread in the Temperate region. Common and widespread on medium and higher altitudes, especially in the Judean mountains, the Golan Heights, the Upper Galilee and Mt. Hermon, rare and localized on the Coastal Plain (Tel Aviv).

Bionomics: in Israel univoltine, autumn, grassland species, flying from August to November with the highest rate of occurrence in October. Host-Plants: in Israel and elsewhere unknown, probably Gramineae like other congeners.

Leucania (Leucania) palaestinae Staudinger, 1897

Distribution: Mediterranean-Iranian. From Algeria to Egypt, Sicily, Cyprus, Greece, Turkey, Israel, Syria, Jordan, Sinai (Egypt), Iran, Iraq and Turkmenistan. In Israel through all the climatological regions, along the Rift Valley, mainly from the Northern Arava valley to the Hula valley. Common or abundant in the Hula valley, elsewhere rare and often localized.

Bionomics: in Israel bivoltine, wetland species, flying from April to June and from October to December. Host-Plants: in Europe on *Arundo phraguntes* and Gramineae (Gramineae).

Leucania (Leucania) joannisi Boursin & Rungs, 1952

Distribution: Afrotropical. Tropical and Subtropical Africa, Morocco, Portugal, Spain, Southern Italy, Greece, Israel and Saudi Arabia. In Israel in the temperate region in the Hula valley. Rare and localized.

Bionomics: in Israel bivoltine, wetland species, flying from April to October with the highest rate of occurrence from April to May and from September to October. Host-Plants: in Israel and elsewhere unknown.

Leucania (Leucania) zeae (Duponchel, 1827)

Distribution: Mediterranean-Turanian. North Africa, Southern Europe, Turkey, Israel, Iran, Iraq,

Saudi Arabia, Central Asia and Western China. In Israel in the temperate region in the Hula valley. Fairly common.

Bionomics: in Israel multivoltine, wetland species flying from March to November with the highest rate of occurrence from April to May, July and from September to November. Host-Plants: in Europe *Arundo donax*, *Zea mays* and other Gramineae including cereals, occasionally a minor pest.

Leucania (*Acantholeucania) loreyi* (Duponchel, 1827)

Distribution: Paleotropical. Widespread, migratory species. Most of Africa, the Indo-Australian subtropics and tropics, the eastern Palearctic region and the Near and Middle East. In Israel all over the country, in all climatological regions, in the arid region concentrating in oases, only avoiding high elevations (Mt. Hermon) and arid deserts. Common, occasionally even abundant.

Bionomics: in Israel multivoltine, grassland species, with a few overlapping generations, flying throughout the year with the highest rate of occurrence in May and from August to November. Host-Plants: in Israel *Phragmites australis*, *Sacharum ravennae* Gramineae, occasionally on ornamental bamboo and once in an experimental rice field, a pest of winter cereals (wheat, barley) and summer cereals (corn, sorghum, sugar cane) AVIDOV & HARPAZ (1969).

Tribe Glottulini Guenée, 1852

Polytela cliens (Felder & Rogenhofer, 1874)

Distribution: (West-)Eremic. Through North Africa and the Sahara to Israel, Jordan, the Arabian Peninsula and to Southern Iran. In Israel in the arid region, in the Negev, the Arava valley and the Dead Sea area. Uncommon and localized.

Bionomics: in Israel univoltine, spring, deserticolous species, flying from February to March, part of the pupae diapause up to several years.

Host-plants: in Israel unknown; in Europe on the flowers and seeds of *Dipcadi serotinum* and *Pancratium tortuosum*.

Results and discussion

To date, in Israel 59 species of the subfamily Hadeninae (belonging to 5 tribes and 18 genera) are found. The two tribes Hadenini and Leucaniini include the bulk (52) of these species. About half (28) range from abundant (1) to common (22), to fairly common (5). There are 17 rare species and six which are localized and rare. Six localized species are common or even abundant.

About half of the species (30) fly at their highest rate of occurrence from March to May, while another 25 species fly twice in April/ May and again in September/ October. Only four species (*Tholera hilaris*, *Saragossa siccanorum*, *Leucania putrescens* and *Leucania herrichi*) are clearly autumnal.

Most of the species herein are Mediterranean (21) and Palearctic (17) elements. Nine species are Eremic; four species (*P. mundoides*, *O. daphnadeparisae*, *A. engedina*, *O. cypriaca*) are endemics of the Levant; two species (*A. mendica* and *H. pumila*) are Iranian; two species (*M. languida* and *L. loreyi*) are Paleotropical. *T. hilaris* is a (East-)European-West Asiatic species; *L. joannisi* is Afrotropical; *A. arenbergeri* is an Anatolian-Iranian, relic and *M. unipuncta* is a cosmopolitan species.

Only four mulitvoltine, ubiquitous species are widely distributed throughout Israel (*Hadula trifolii*, *Hecatera dysodea*, *Mythimna vitellina* and *Pseudaletia unipuncta*). Others are restricted to one or two of the three climatic regions of Israel (Temperate, Semi-Arid, Arid), or much localized. Most species (32) are found in the Temperate region including the 11 species inhabiting the Mt. Hermon area. Twelve species are typically found in the semi-arid region, but locally penetrate the Temperate and Arid regions, while eleven species are centered in the arid region.

In terms of habitat preference, most species were found in wetlands (38), grasslands (19) and steppes (including montane steppes and tragacanth) on the upper part of Mt. Hermon (19). The low-

land wetlands and oases are typical habitats for most species of the tropical tribe Leucaniini (genera *Mythimna* and *Leucania*). Populations of *Leucania joannisi* found throughout the eastern Mediterranean basin are in Israel restricted to the Hula valley. Species of genus *Hadena* prefer steppes. Four species (*Hadena clara*, *H. persimilis*, *H. drenowskii* and *H. pumila*) were recorded only in the tragacanth and two species (*H. adriana* and *H. gueneei*) were found on the surrounding montane steppes of Mt. Hermon. *H. compta* was found in two isolated populations; one in the montane steppes of Mt. Hermon and another in the steppes of highland (central) Negev.

Species of tribe Orthosiini (genera *Orthosia*, *Perigrapha* and *Egira*) fly during early spring in forests, mainly on medium and upper altitudes in northern part of Israel. Most of the species are characteristic of the Arid region and occur exclusively in oases, or in their vicinity, developing on different Chenopodiaceae, especially on species of genus *Atriples*. Two species of the genus *Cardepia* (*C. sociabilis* and *C. affinis*) are halophilous species that prefer saline oases. Probably the only true desert species is *Polytela cliens* which localizes on different types of soft sediment soils in the Arava and Negev. *Odontelia margiana* are found only on moving sand dunes of the Arava valley.

Some species change their biotopes in Israel compared with their main area of Distribution. For example *Hecatera cappa* typically inhabits open lowland forest habitats in Europe (NOWACKI, 1998; HACKER, 2001) but in Israel, they are found only on montane steppes of Mt. Hermon not below ~ 1.000 m. As well, *Hadena magnolii* in central Europe a xerophilous species found in dry, warm open habitats such as steppes, forest-steppes and limestone slopes (NOWACKI, 1998) but in Israel, they are found only in dense montane forest not below ~ 800 m of Mt. Hermon and Mt. Meron.

Biotypes	*Hadena*	*Mythimna*	*Hadula*	*Laucania*	*Hecatera*	*Orthosia*	*Cardepia*	*Lacanobia*	Other genera	Total:
Ubiquitous		1	1		1				1	4
Sylviculous	1					3			2	6
Wetlands and grasslands	3	6	2	4	1			1	2	19
Steppes and tragacanth	8	2	1	2	2				4	19
Deserticolous	1		2						4	7
Oases					1		2	1		4
Total:	13	9	6	6	5	3	2	2	13	59

Table 1. Distribution of number of species of the main genera and their ecological preferences. Other genera – genera with single species.

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