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Deserticolous Noctuidae from Israel: New host-plant records and description of larval habitats (Lepidoptera: Noctuidae)

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Abstract

So far, the insect fauna of the deserts and semi-deserts of Israel is poorly investigated. In this paper, 30 host-plant records are presented for 16 deserticolous noctuid species from Israel. For nine species host-plant records are published here for the first time: *Anumeta atrosignata* (WALKER, 1858), *Anumeta asiatica* WILTSHIRE, 1961, *Drasteria kabylaria* (A. BANG-HAAS, 1906), *Gnamptonyx innexa* (WALKER, 1858), *Anydrophila stuebeli* (CALBERLA, 1891), *Cucullia improba muelleri* (HACKER, 2001), *Caradrina casearia* (STAUDINGER, 1900), *Euxoa canariensis diamondi* BOURSIN, 1940, *Agrotis herzogi* REBEL, 1911. Larvae of a new *Odontelia* species were found living subterraneously in unconsolidated sand dunes.

Introduction

Israel is located at the eastern side of the Mediterranean basin, at the northern end of the Syrian - East African Rift valley. In contrast to the more uniform and monotonous landscapes of the Levant, Israel is topographically distinct with a large variety of different habitats (KOSSWIG 1955). The northern part of Israel includes Mt. Hermon, 2.200 m above sea-level, with annual snow and typical Tragacanth vegetation, while the Dead Sea area in the center is about 400 m below sea-level with Ethiopian pockets rich in Afro-tropical fauna and flora surrounded by hyper-arid deserts that stretch to the south (BYTINSKI-SALZ 1961; ZOHARY & ORSHANSKY 1949). The north and center of the country is Mediterranean while the south and east are predominantly arid, with almost two thirds of Israel being semi-desert and desert (ORNI & EFRAT 1980).

The Negev is bordered in the west by the Mediterranean coast, in the south by the Sinai desert and towards the east by the Arava valley. Topographically, the Negev is divided from north to south by a ridge of mountains and hills at heights between 500 m and 600 m, which rise in some cases to above 900 m towards the Egyptian border. The north-western part of the Negev receives sufficient rainfall for wheat production while the rest of the Negev is characterized by mean annual precipitations from 200 mm to less than 50 mm.

The Arava valley is an extreme desert running from the northern tip of the Red Sea to the southern end of the Dead Sea. Geo-morphologically, this alluvial plain forms the northern part of the African Rift valley. Most of the area is below sea level, ranging from minus 400 m up to about 100 m. The Arava is bordered in the East by the Moab mountains in Jordan and in the west by the Negev mountains in Israel. For about 180 days a year the maximum daily temperature exceeds 35˚ C. The annual number of rainy days ranges from 0 to 10 with an annual rainfall of 50 mm (ASHBEL 1939; 1951). Biogeographically, the Rift valley is an important link between the Ethiopian and the Palaearctic region.

Between the temperate and arid region the Irano-Turanian grassland forms a transition zone, which is only several kilometers wide in some areas but nevertheless harbors specific fauna and flora.

In consequence of these alternating geographical and climatic zones, a rich fauna and flora of different origin could establish itself (EIG 1926; LATTIN 1967; ZOHARY 1962; 1966) with many species in their furthest point of geographical distribution (BODENHEIMER 1930; 1935; FURTH 1975; JAFFE 1988).

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Almost 100 species (about 16%) of the presently known Israeli noctuid fauna are deserticolous, occurring exclusively or predominately in arid areas (unpublished data of the authors). The host-plant preferences of most of these species are unknown as are their larval stages.

Although only a few noctuid species from the total of about 35,000 world wide known species (KITCHING & RAWLINS 1999) are well adapted to arid conditions they are nevertheless the dominant group of deserticolous Lepidoptera and provide the bulk of the insect biomass in the desert. (KRAVCHENKO et al. 2006; ALY 1996).

Material & methods

Within the Israeli-German project for the study of the Israeli Lepidoptera fauna (MÜLLER et al. 2005), widespread collecting was conducted from 1986-2004. 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. Adult Lepidoptera were collected during a period of 18 years totaling about 3000 nights of mobile light traps powered by generator (250 Watt bulbs HQL & ML) and about 1500 nights of mobile light trap systems powered by batteries (12Volt 8 Watt & 20Watt, 6 Volt 4 Watt Black light UVB tubes) moved on a daily basis. Additionally a widespread network of permanent light traps (220V 20W Black light UVB & UVC tubes) was maintained. Traps were relocated on an annual basis. From year to year 10-34 traps were operated (MÜLLER et al. 2005). Early stages of Lepidoptera were only collected sporadically in specific habitats without intending to cover the whole of Israel. The collecting methods included beating and shaking larvae from trees and bushes, sweeping herbaceous vegetation, suction of vegetation with power vacs, searching the vegetation with projectors and night vision equipment at night and sieving sand and soil for root-feeding species. Numerous larvae were collected by colleagues and agricultural personal and sent for identification to the authors. Generally, larvae were collected with their host-plants which were identified later by botanists of Tel Aviv University and the Hebrew University. The larvae were reared either out doors under natural conditions on the campus of the Tel Aviv University and the Hebrew University or in the laboratory under standard insectaria conditions.

Morphology and habitus of the larvae are not subjects of this paper and will be treated in subsequent publications. This publication shall strictly be focussed on host-plant relationships, habitats and occurrence in Israel.

Systematic account

Subfamily Catocalinae BOISDUVAL, 1828

Anumeta spilota ERSHOV, 1874

Abundance and distribution in Israel: Generally rare and rather local in the arid region of the country, in the northern part of the Arava valley especially near ‘Iddan and in Shezaf Nature Reserve.

Habitat: On loessial deposits and silty alluvial soils along the bottom of the Arava valley with sparse vegetation cover in impoverished semi-shrub communities dominated by *Calligonum comosum*.

Phenology: Multivoltine, probably with a facultative diapause, flying from March to September with peaks of abundance from March to May, larvae were observed in May.

New host-plant record: *Calligonum comosum* L’HERIT (Polygonaceae).

One larva was found feeding at night on the foliage of *C. comosum* in the northern Arava valley, in Shezaf Nature Reserve in an impoverished semi-shrub community dominated by *Calligonum comosum* in mid-May; the larva was reared to adulthood under insectaria conditions, the adult hatched in late June of

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the same year. In Turkmenia, young larvae of this species were observed on *Calligonum* sp. during morning hours, from the third instar on the larvae fed at night (SHETKIN 1965).

Anumeta atrosignata (WALKER, 1858)

Abundance and distribution in Israel: In the arid region widespread in the Arava valley and the Dead Sea area, fairly common in the northern Arava valley and the Dead Sea area, elsewhere rare and local.

Habitat: In wide wadis, shallow depressions and water catchments in plains, on silty alluvial soils in contracted shrub and semi-shrub thickets, especially if dominated by *Calligonum comosum* (Fig. 1).

Phenology: Multivoltine, probably with a facultative diapause, flying from March to July with peaks of abundance from March to May, larvae were observed in March and May.

New host-plant records: *Calligonum comosum* L'HERIT and *Rumex vesicarius* L. (Polygonaceae).

Two larvae were found feeding in the early morning on the foliage of *R. vesicarius* south of Neot Hakikar in a water catchment of a shallow wadi in mid-March; the larvae were reared to adulthood under insectaria conditions and hatched late April and early May. Nine larvae were found feeding at night on the foliage of *C. comosum* in the northern Arava valley, in Shezaf Nature Reserve in an impoverished semi-shrub community dominated by *C. comosum* in mid-May; the larvae were reared to adulthood under insectaria conditions, the adults hatched from early to mid-July in the same year.

Anumeta asiatica WILTSHIRE, 1961

Abundance and distribution in Israel: In the arid region widespread along the Arava valley but always rare.

Habitat: Mainly in sandy areas and depressions with silty alluvial soils and along seasonal waterways with contracted shrub and semi-shrub thickets often dominated by *Atriplex* ssp., *Calligonum comosum* and *Ochradenus baccatus*.

Phenology: Multivoltine, summer species, probably with a facultative diapause, flying from May to August with peaks of abundance in May, larvae were observed in May.

New host-plant record: *Calligonum comosum* L'HERIT (Polygonaceae).

Three larvae were found feeding in the early morning on the foliage of *C. comosum* in the northern Arava valley, in Shezaf Nature Reserve in an impoverished semi-shrub community dominated by *C. comosum* in mid-May; the larvae were reared to adulthood under insectaria conditions, the adults hatched in mid-June of the same year.

Scodionyx mysticus STAUDINGER, 1900

Abundance and distribution in Israel: Widespread in the arid region, in the Arava valley and the Dead Sea area common, locally even abundant.

Habitat: Almost an obligatory component of all the *Acacia* stands in the arid and semi-arid regions of Israel but especially common in wide wadis and depressions with well watered *A. raddiana* forests and in *Acacia* stands in the periphery of large oases (Fig. 2).

Phenology: Univoltine, winter species, flying from October to April with peaks of abundance from January to March, larvae were observed from March to May.

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New host-plant records: In nature *Acacia tortilis* (FORSSK.), *Acacia raddiana* SAVI, *Acacia pachyceras* SCHWARTZ and *Acacia laeta* R. BR. (Mimosaceae); in captivity *Prosopis farcta* (BANKS et SOL.) (Mimosaceae). In Egypt, larvae were recorded on *Acacia raddiana* (WILTSHIRE 1948).

Several larvae were found on *A. tortilis* in the central Arava valley in early March, hundreds of larvae on *A. raddiana* in a small canyon near Elat in mid-March, one larva on *A. pachyceras* in the central Negev in the upper Nahal Paran in early April, numerous larvae on *A. laeta* in a dry wadi south of Neot Hakikar in mid-May.

Some of the larvae were reared to adulthood under insectaria conditions on the deciduous shrub *P. farcta*; and hatched from late September to mid-December in the same year. The larvae were feeding on the flowers and foliage of *P. farcta* and the *Acacia* spp. The F1 generation of the specimens which hatched in September pupated in the laboratory during November and hatched from late September to late October of the following year.

Subfamily Melipotini GROTE, 1895

Drasteria kabylaria (A. BANG-HAAS, 1906)

Abundance and distribution in Israel: Widespread in the arid region in the Arava valley and the Dead Sea area common, elsewhere rare.

Habitat: Mainly along rocky seasonal water ways and in canyons to a much smaller extent in shallow wadis with loessial or sandy deposits, in contracted vegetation and dense shrub and semi-shrubs thickets dominated by *Atriplex*, *Suaeda* and *Haloxylon*, rare or absent in depressions with solonchak soils and wet salinas.

Phenology: In Israel bivoltine, flying from March to May and from October to November, larvae were observed in May.

New host-plant records: In nature *Haloxylon persicum* BUNGE (Chenopodiaceae); in captivity *Atriplex halimus* L. (Chenopodiaceae). RUNGS (1948) and HACKER (2001) suggested *Tamarix*.

Eight larvae were found feeding in the morning on the foliage of *Haloxylon persicum* on semi-consolidated sands in the central Negev near Dimona in early May; the larvae were reared, with a high mortality, to adulthood on *A. halimus* under insectaria conditions and only a single adult hatched in late September of the same year.

Subfamily Ophiusini GUENÉE, 1837

Heteropalpia acrosticta (PÜNGELER, 1904)

Abundance and distribution in Israel: Widespread in the arid region, common in the Arava valley, in the Dead Sea area even locally abundant, fairly common but more local in the Negev. This species is especially common after rainy winters.

Habitat: Ubiquitous in all kind of larger *Acacia* stands, including settlements with planted *Acacia* spp., to a smaller extent in the dry periphery of oases and in wadis with *Prosopis farcta* thicket (Fig. 3).

Phenology: In Israel multivoltine, flying throughout the year with peaks of abundance in May and from October to November, larvae were so far only observed in June.

New host-plant records: In nature foliage of *Prosopis farcta* (BANKS et SOL.), *Acacia tortilis* (FORSSK.), and *Acacia raddiana* SAVI (Mimosaceae). In the past, this species was found in Israel on *Acacia horrida*

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(BYTINSKY-SALZ 1954; 1957; HALPERIN & SAUTER, 1992). In Morocco, larvae were observed on *Acacia raddiana* and *A. gummifera* (WILTSHIRE 1990).

Numerous larvae were found feeding at night on the foliage and flowers of *P. farcta* and to a smaller extent on the foliage of small *A. tortilis* trees at the northern part of the Dead Sea, near Jericho in an irrigated area in early June. Seven larvae were found during day time on the foliage of large *A. raddiana* trees near Yotvatah. Some larvae from both locations were reared on *P. farcta* under insectaria conditions to adulthood, adults hatched from mid-August to early September of the same year.

Tytroca dispar (PÜNGELER, 1904)

Abundance and distribution in Israel: Widespread in the arid region, abundant in the Arava valley and the Dead Sea area.

Habitat: Ubiquitous in all kind of larger *Acacia* stands and in settlements with planted *Acacia*, common in the dry periphery of oases, in water-catchments and in wadis with *Prosopis farcta* thickets.

Phenology: Multivoltine, flying throughout the year with peaks of abundance in January, March, May and November, larvae were observed in May and June.

New host-plant records: In nature *Prosopis farcta* (BANKS et SOL.), and *Acacia raddiana* SAVI (Mimosaceae).

Several larvae were found during day time on the foliage of *Prosopis farcta* at the central part of the Dead Sea near En Gedi in a natural date plantation in mid-May. The larvae were reared on their natural host-plant under insectaria conditions to adulthood, adults hatched from mid-June to early July of the same year.

Ten larvae were found on the foliage of large *Acacia raddiana* trees in the southern part of the Arava valley in a dry rocky wadi in late June; the larvae were reared on *P. farcta* under insectaria conditions to adulthood, adults hatched from early August to early September of the same year.

Gnamptonyx innexa (WALKER, 1858)

Abundance and distribution in Israel: Widespread in the arid region, generally rare but occasionally after rainy winters in the northern Arava valley more common.

Habitat: So far only found in *Acacia* stands, mainly in hot and dry areas with *Acacia tortilis*.

Phenology: Multivoltine, so far only collected as adults in February, June and October, larvae were observed in April and November.

New host-plant records: In nature *Acacia raddiana* SAVI, and *Acacia tortilis* (FORSSK.) (Mimosaceae); in captivity *Prosopis farcta* (BANKS et SOL.) (Mimosaceae).

Two larvae were found on the foliage of a small *Acacia raddiana* tree in the central part of the Arava valley in a shallow depression in mid-April. One larva was collected on the foliage of a large A. tortilis tree in a steep canyon near Eilat; the larvae of both locations were reared on *P. farcta* under insectaria conditions to adulthood, the adults from the first location hatched early and mid-July of the same year, the adult of the second place in early February of the following year.

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Subfamily Anydrophilini WILTSHIRE, 1977

Anydrophila stuebeli (CALBERLA, 1891)

Abundance and distribution in Israel: In the arid region, locally fairly common in the northern Arava valley especially in Shezaf Nature Reserve and Hazeva.

Habitat: Probably psammophilous, mainly found on sandy deposits on the bottom of the Rift valley and in water catchment areas of large wadis with patches of annuals and semi-shrubs.

Phenology: Univoltine, spring species, flying from March to May, larvae were observed in April.

New host-plant records: In nature *Rumex cyprius* MURB., *Rumex vesicarius* L. and *Calligonum comosum* L'HER. (Polygonaceae); in captivity *Rumex maritimus* L. (Polygonaceae).

Several larvae were found in a water catchment in a small wadi in Shezaf Nature Reserve in the northern Arava valley feeding at night on the foliage of *R. cyprius*, *R. vesicarius* and *C. comosum* in early April, the larvae were reared on *R. maritimus* L. under insectaria conditions to adulthood, adults hatched from mid-February to early March of the following year.

Subfamily Acontiinae GUENÉE, 1841

Armada panaceorum (MÉNÉTRIÉS, 1849)

Abundance and distribution in Israel: In the arid region, along the arid part of the Rift valley locally common in the southern part of the Arava valley, elsewhere rare.

Habitat: Mainly in large depressions and shallow wadis in water catchments, on different types of soil, in contracted shrub and semi-shrub communities with patches of annuals.

Phenology: Univoltine, spring species, flying from March to April larvae were observed in April.

New host-plant records: In nature *Arnebia tinctoria* FORSSK., and *Lappula spinocarpos* (FORSSK.) Asch. (Boraginaceae). In Uzbekistan, larvae were found on *Arnebia decumbens*, *Heterocaryum rigidum* and *Lappula ceratophora* (SHETKIN 1965) (all Boraginaceae).

Several larvae were found in a partially flooded water catchment along a road near Yotvatah Nature Reserve in the southern Arava valley feeding at night on the foliage of *A. tinctoria* and *L. spinocarpos* in late April, the larvae were reared on their natural host-plants under insectaria conditions to adulthood, adults hatched from early to mid-March of the following year.

Subfamily Cuculliinae HERRICH-SCHÄFFER, 1850

Cucullia improba muelleri (HACKER, 2001)

Abundance and distribution in Israel: In the arid region, rare and local in the Negev.
Habitat: In the proximal parts of the larger canyons draining into the Arava valley often in areas almost bare of any vegetation, in the Ramon crater in wadis with sparse scattered semi-shrubs and small patches of annuals, in xerotherm mountainous desert-steppes with *Artemisia sieberi* and *Helianthemum* plant societies, in shallow rocky valleys with contracted vegetation dominated by various *Artemisia* species (Fig. 4).

Phenology: Univoltine, spring species, flying from March to April, larvae were observed in April and May.

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New host-plant record: In nature *Aaronsohnia factorovskyi* WARB. & EIG (Cucurbitaceae). RONKAY & RONKAY (1994) state the host-plant to be unknown but speculate about "*Anthemis* and/or *Artemisia*" as possible hosts for the nominate subspecies.

Several larvae were found on some *A. factorovskyi* plants in the central Negev near Mizpe Ramon in a water catchment of a stony wadi with patches of sparse steppe vegetation in late April and later at the same place in early May, the larvae were reared on their natural host-plant under insectaria conditions to adulthood, two adults hatched in late March of the following year.

Subfamily Xyleninae GUENÉE, 1837

Caradrina (*Eremodrina) casearia* (STAUDINGER, 1900)

Abundance and distribution in Israel: Widespread in the arid and temperate regions along the southern Coastal Plain, locally common in the Arava valley and along the southern Coastal Plain, elsewhere rare. Type locality Enot Zuqim, Dead Sea.

Habitat: Mainly along seasonal water courses, large depressions and wide shallow wadis, on different types of soft sediment soils, often in contracted thickets of different shrubs and semi-shrubs, especially in thickets dominated by *Atriplex* ssp. and *Ochradenus baccatus*, in the dry periphery of oases in shrub communities dominated by *Prosopis farcta*, *Atriplex* and *Nitraria*, along the Coastal Plain in semi-consolidated and consolidated sand dunes in different types of shrub and semi-shrub communities (Fig. 5).

Phenology: Univoltine, autumn species, flying from October to December, larvae were observed in February.

New host-plant records: In nature *Atriplex halimus* L., and *Atriplex glauca* L. (Chenopodiaceae).

Numerous larvae were found feeding at night on the foliage of *A. halimus* and *A. glauca* in a shallow seasonally flooded wadi in the northern Negev near Beer Sheva in mid-February; some of the larvae were reared on *A. halimus* under insectaria conditions to adulthood, the adults hatched from late September to mid-October of the same year.

Caradrina (*Eremodrina) melanurina* (STAUDINGER, 1901)

Abundance and distribution in Israel: In the arid region along the Rift valley, abundant in the Dead Sea area, elsewhere only locally common.

Habitat: Along shallow wadis and even small erosion canyons in different types of soft sediment soils, in contracted shrub and semi-shrubs thickets, especially if dominated by *Anabasis* ssp. and *Atriplex* ssp., and in the dry periphery of oases in shrub thickets dominated by *Prosopis farcta*, *Atriplex* and *Suaeda* (Fig. 6).

Phenology: Univoltine, autumn species, flying from October to November, only occasionally in spring, larvae were observed in December.

New host-plant records: In nature *Anabasis articulata* (FORSSK.) Moq., *Anabasis setifera* MOQ., and *Atriplex suberecta* VERD. (Chenopodiaceae); in captivity *Atriplex halimus* L. (Chenopodiaceae). According to WILTSHIRE (1948), this species is polyphagous, feeding on different low plants, even grasses.

Some dozens of larvae were found on *A. suberecta A. articulata* and *A. setifera* near a disturbed road site in the vicinity of Jericho in late December (after the first winter rains); some of the larvae were reared on *A. halimus* under insectaria conditions to adulthood, the adults hatched in the following year in spring from mid-March to early April and later in autumn from late September to early October.

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Caradrina (*Levantrina) bodenheimeri* (DRAUDT, 1934)

Abundance and distribution in Israel: Widespread in the Arid and semi-arid regions and in the temperate region along the southern and central Coastal Plains. Common, or even abundant in the arid and semi-arid region, less common and more local in the Coastal Plain.

Habitat: Mainly along wide and shallow wadis and in large depressions with different types of soft sediment soils, in shrub and semi-shrubs thickets especially if dominated by *Atriplex* ssp., in the dry periphery of oases in shrub communities especially if dominated by *Prosopis farcta*, *Atriplex* spp. and *Nitraria retusa* (Fig. 7), along the Coastal Plain on semi-consolidated and consolidated sand dunes and sandy plains, in all kind of shrub and semi-shrub communities and sparse grassland.

Phenology: Bivoltine, flying from October to December and from February to April, the flight period in autumn can be occasionally reduced or even absent, larvae were observed in December.

New host-plant records: In nature *Echinops philistaeus* Feinbrun & Zohary (Asteraceae (Compositae)). Larvae were bred in captivity on *Calendula* spp. (WILTSHIRE 1957) (Asteraceae (Compositae)).

Four larvae were found in Israel feeding during day time on the foliage of *E. philistaeus* in Wadi Kelt in early December; the larvae were reared on their natural host-plant under insectaria conditions to adulthood, two adults hatched in the following year in early March.

Subfamily Hadeninae GUENÉE, 1837

Odontelia spec.

The new species was previously confused with *Odontelia margiana* PÜNGELER, 1901 (HACKER et al. 2004) and is presently described as a new species (KRAVCHENKO, RONKAY & MÜLLER 2006). Taxonomic revision of the genus *Odontelia*: VARGA & RONKAY (1998)

Abundance and distribution in Israel: This uncommon and local species is so far only known from the arid region in the Arava valley.

Habitat: Unconsolidated mobile sand dunes with *Haloxylon persicum* plant communities (Fig. 8).

Phenology: Univoltine, spring species, flying from December to March with the highest rate of occurrence in February.

Larval habitat: Ten larvae, in different stages, were found buried in sand dunes near Grofit as deep as 0.5 m below the surface in late April. The larvae were offered foliage of *Haloxylon persicum, H. salicornium, Calligonum comosum* and *Tamarix aphylla*, shrubs and trees growing in the direct proximity where the larvae were collected. The earlier stages perished after several days without accepting the offered plants. Only one larva in the final stage pupated in the thin layer of added sandy soil without feeding on one of the offered plants. The moth hatched in mid February of the following year.

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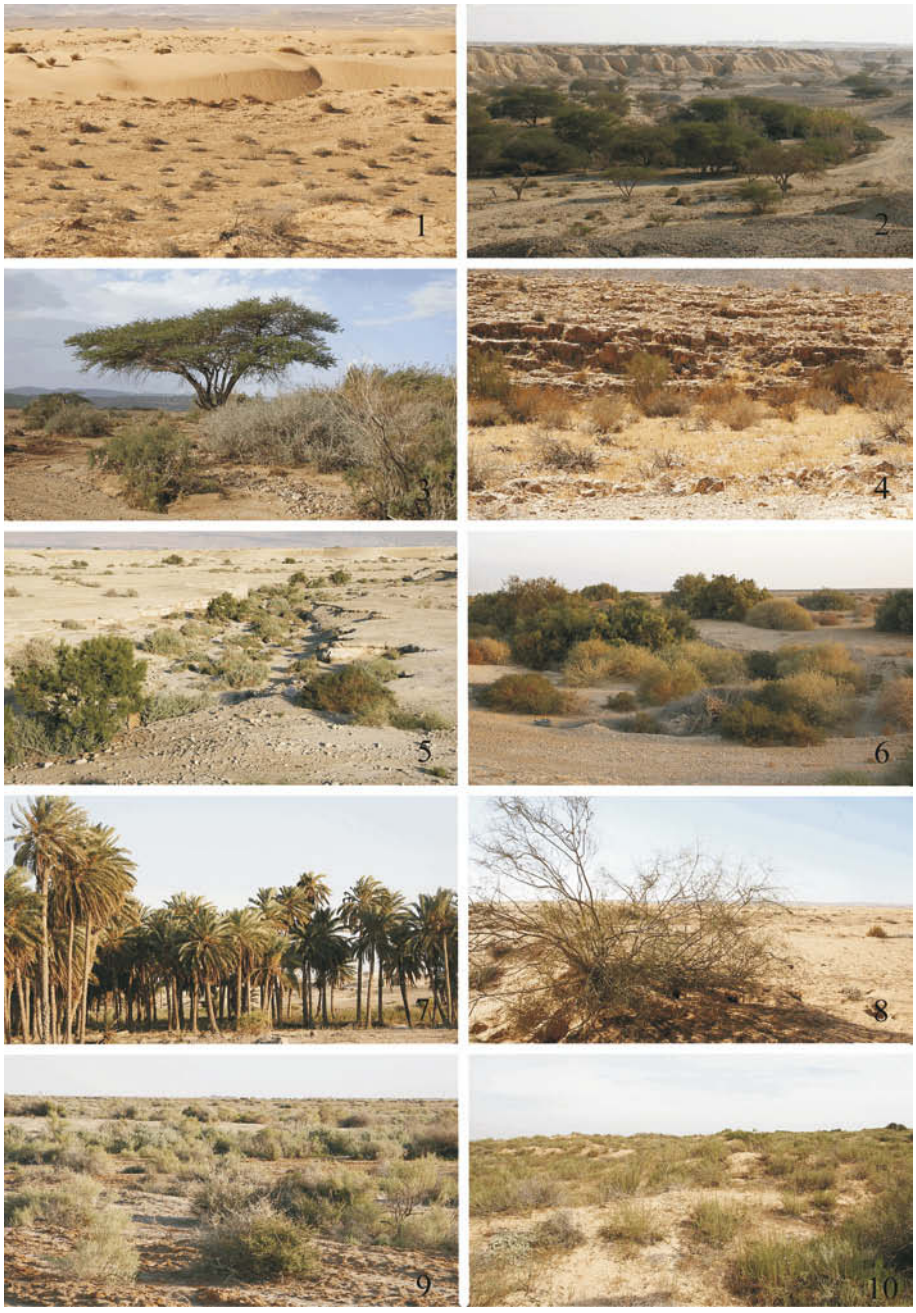

Figs 1-10. Israeli habitats. **1,** Arava valley, habitat of *Anumeta atrosignata* (WALKER, 1858). **2,** *Acacia* stands near Hazeva, habitat of *Scodionyx mysticus* STAUDINGER, 1900. **3,** periphery of a small oasis in the northern Arava valley with *Atriplex* sp. and *Prosopis farcta* thicket, habitat of *Heteropalpia acrosticta* (PÜNGELER, 1904). **4,** northern Negev, north of Arad, with vegetation dominated by various *Artemisia* species, habitat of *Cucullia improba muelleri* (HACKER, 2001). **5,** seasonal water course near Jericho, habitat of *Caradrina* (*Eremodrina) casearia* (STAUDINGER, 1900). **6,** Dead Sea area, near Kibbutz Kalia, shrub thickets dominated by *Prosopis farcta*, *Atriplex* and *Suaeda*, habitat of *Caradrina* (*Eremodrina) melanurina* (STAUDINGER, 1901). **7,** small oasis south of Jericho, with shrub communities dominated by *Prosopis farcta*, *Atriplex* spp. and *Nitraria retusa*, habitat of *Caradrina* (*Levantrina) bodenheimeri* (DRAUDT, 1934). **8,** Arava valley, near Grofit, unconsolidated mobile sand dunes with *Haloxylon persicum* plant communities, habitat of *Odontelia* spec. **9,** lower Jordan valley, north of Jericho, shrub steppe dominated by *Atriplex* and *Suaeda* on silty alluvial soils, habitat of *Euxoa canariensis diamondi* BOURSIN, 1940. **10,** Coastal Plain, south of Tel Aviv, semi-consolidated sand dunes covered with semi-shrubs, perennial grasses and annuals, habitat of *Agrotis herzogi* REBEL, 1911.

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Subfamily Noctuinae LATREILLE, 1809

Euxoa canariensis diamondi BOURSIN, 1940

Abundance and distribution in Israel: Widespread in the arid region and normally common.

Habitat: In desert plains with savannoid vegetation dominated by *Acacia tortilis* and *A. raddiana* and in shallow wadis and large depressions with silty alluvial soils (Fig. 9) especially in water catchment areas with dense shrub and semi-shrub thickets and large patches of perennial grasses and annuals, less common in saline areas, in the north-eastern Negev on consolidated and semi-consolidated sand dunes in *Anabasis articulata* and *Artemisia sieberi* plant communities.

Phenology: In Israel univoltine spring species, flying from March to May.

New host-plant record: In nature *Atriplex halimus* L. (Chenopodiaceae).

Several larvae were found feeding subterraneously on the roots of *A. halimus* growing on soft alluvial soils at the northern end of the Dead Sea near Qualia village (Fig. 9); the larvae were reared on young foliage of *A. halimus* under insectaria conditions to adulthood, six adults hatched in the following year from mid-March to early April in the following year.

Agrotis herzogi REBEL, 1911

Abundance and distribution in Israel: Widespread in the arid region abundant in the Arava valley and the Dead Sea area, much less common and more local in the semi-arid region, in the temperate region along the Coastal Plain rare and local.

Habitat: Along wide shallow wadis and in large depressions with soft sediment soils, in shrub and semi-shrub thickets especially if dominated by *Atriplex* ssp., to a smaller extent in water catchments large patches of annuals, this species is generally avoiding hard soils, stony and hyper-arid deserts, dry and wet salinas, along the Coastal Plain on consolidated and semi-consolidated sand dunes covered with shrubs, semi-shrubs, perennial grasses and annuals (Fig. 10).

Phenology: Probably bivoltine, flying from October to April with peaks of abundance in November and March.

New host-plant record: In nature *Atriplex leucoclada* BOISS. (Chenopodiaceae).

Numerous larvae were found feeding subterraneously on the roots of *A. leucoclada* bushes growing on semi-consolidated sand dunes on the southern Coastal Plain in mid-November; the larvae were reared to adulthood on young foliage of *A. halimus* under insectaria conditions, with a rather high mortality, two adults hatched in the following year in early March.

Summary and discussion

In this study we present 30 host-plant records for 16 deserticolous noctuid species from Israel. All these data refer to observations in nature. For nine species there were no previous host-plant records in literature. In captivity eleven species were bred on the same plants as they had been found in nature. Five species were reared on other plants. *Prosopis farcta* (Mimosaceae) revealed to be a good substitute for most *Acacia* (Mimosaceae) feeders, *Atriplex halimus* (Chenopodiaceae) for feeders on Chenopodiaceae species (Tab. 1).

Of the almost 100 Israeli deserticolous species host-plants of only four species were known from Israel, so far: Larvae of *Cleonymia chabordis* (OBERTHÜR, 1876) were recorded by HALPERIN & SAUTER (1992) in the northern Negev on foliage of *Helianthemum stipulatum* and larvae of *Polytela cliens*

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(FELDER & ROGENHOFER, 1874) were observed by YATOM (1989) in the northern Negev and the Arava on *Dipcadi serotinum* and *Pancratium tortuosum*. BYTINSKY-SALZ (1954) mentioned unspecified *Acacia* spp. for *Heteropalpia acrosticta* and *Scodionyx mysticus* as host-plants for southern Israel. For *Heteropalpia acrosticta*, foliage of *Acacia horrida* was recorded by HALPERIN & SAUTER (1992)

Generally, host-plants records of deserticolous species seem to be rather scarce compared to other ecological groups and only few further host-plant associations are known from Noctuidae of the eremic belt. Host-plants of six additional species, occurring also in Israel, have been recorded from neighbouring countries: In Saudi Arabia, WILTSHIRE (1962) found larvae of *Acantholipes circumdata* (WALKER, 1858) on *Taverniera spartea* (Fabaceae), the larvae of *Drasteria oranensis* ROTHSCHILD 1920 were observed by WILTSHIRE (1990) in North Africa and Saudi Arabia on *Calligonum comosum* shrubs (Polygonaceae), in Central Asia FALKOVICH (1968) found larvae of *Tarachephia hueberi* (ERSHOV, 1874) on *Arnebia decumbens* (Boraginaceae), in North Africa DUMONT (1927) collected larvae of *Rhabinopteryx subtilis* (MABILLE, 1888) on *Plantago albicans* (Plantaginaceae), in Saudi Arabia WILSHIRE (1948) found larvae of *Boursinia deceptrix* (STAUDINGER, 1900) on the foliage of *Lycium barbareum* (Solanaceae), while the larvae of *Agrotis boetica* (BOISDUVAL, 1837) revealed to be rather polyphagous in Spain feeding on a variety of plants including *Lithospermum*, *Echinops* and *Astragalus* (FIBIGER, 1997). Other records in literature seem to be breeding records in captivity such as *Euxoa anarmodia* (STAUDINGER, 1897) which larvae were successfully reared in captivity on *Hyosyamus muticus* (Solanaceae) (WILTSHIRE 1948) and sophisticated guesses based on the knowledge of the ecology of congeners and observations in habitats without actually having recorded larvae on host-plants in nature, often resulting in general remarks such as "on low plants" (cf FIBIGER 1997; FALKOVICH 1968; HACKER 2001).

Only little is published on the bionomics of Lepidoptera of the Middle East especially the Levant and Israel. Most of the publications are based on sporadic collections resulting in check lists without solid ecological remarks or in the case of agricultural publications in monographs of a few pest species (MÜLLER et al. 2005). This is a direct result of the virtual absence of entomologist working on Lepidoptera in eremic areas and the difficulty to observe early stages of deserticolous species. Because of the extreme high temperatures and the low humidity during day time most of the larvae of desert Lepidoptera are nocturnal. In summer they can typically only be found for a short time in the early morning, during the most humid and cool hours, or in winter during the whole night. The hot hours they spend below layers of decaying plant matter in the shade of their host-plants, just above the soil or in deep burros in the soil. The larvae of numerous species develop on the roots of plants never coming up to the surface and hiding occasionally as deep as 1-1.5 m below the surface (FALKOVITCH 1968; 1979; KRAVCHENKO & MÜLLER, 2005).

The detection of larvae of a new *Odontelia* species living subterraneously in unconsolidated sand dunes was not a single, occasional finding, but was accompanied by the record of several other Lepidopterous larvae, e.g. *Idaea inclinata* (LEDERER, 1855) (Geometridae, Sterrhinae). These psammophilous larvae in sand dunes arise several questions that are actually addressed in ongoing research projects: Host-plants are investigated by analysing the gut content of the larvae through DNA barcoding (MILLER et al. in press; MATHESON et al. in press), additional field studies are performed to get precise information on activity patterns, daily and seasonal rhythms and ecological niches.

Zusammenfassung

Die Insektenfauna der Wüsten und Halbwüsten Israels ist bisher nur sehr unzureichend erforscht. In der vorliegenden Veröffentlichung werden für 16 wüstenbewohnende israelische Noctuidenarten 30 Futterpflanzennachweise aus dem Freiland vorgestellt. Bei neun dieser Arten handelt es sich um die ersten Wirtspflanzennachweise überhaupt: *Anumeta atrosignata* (WALKER, 1858), *Anumeta asiatica* WILTSHIRE, 1961, *Drasteria kabylaria* (A. BANG-HAAS, 1906), *Gnamptonyx innexa* (WALKER, 1858), *Anydrophila stuebeli* (CALBERLA, 1891), *Cucullia improba muelleri* (HACKER, 2001), *Caradrina casearia* (STAUDINGER, 1900), *Euxoa canariensis diamondi* BOURSIN, 1940, *Agrotis herzogi* REBEL, 1911. Raupen einer neuen *Odontelia* Art wurden unterirdisch in Sanddünen lebend gefunden.

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Tab. 1. Synopsis of noctuids with new host-plant records and old records

noctuid species	new host-plant record		previous host-plant records
	in nature	in captivity	
Anumeta spilota	*Calligonum comosum*	id.	*Calligonum griseum* (Tajikistan)
Anumeta atrosignata	*Calligonum comosum, Rumex vesicarius*	id.	no previous records
Anumeta asiatica	*Calligonum comosum*	id.	no previous records
Scodionyx mysticus	*Acacia tortilis, A. raddiana, A. pachyceras, A. laeta.*	*Prosopis farcta*	Undefined *Acacia* sp. (Israel); *A. raddiana* (Egypt)
Drasteria kabylaria	*Haloxylon persicum*	*Atriplex halimus*	no previous records
Heteropalpia acrosticta	*Prosopis farcta, Acacia tortilis, A. raddiana*	id.	*Acacia horrida* (Israel); *A. raddiana* and *A. gummifera* (Morocco)
Tytroca dispar	*Prosopis farcta , Acacia raddiana*	id.	*Acacia* sp.
Gnamptonyx innexa	*Acacia raddiana , Acacia tortilis*	*Prosopis farcta*	no previous records
Anydrophila stuebeli	*Rumex cyprius, R. vesicarius, Calligonum comosum*	id.	no previous records
Armada panaceorum	*Arnebia tinctoria, Lappula spinocarpos*	id.	*Arnebia decumbens*, *Heterocaryum rigidum* and *Lappula ceratophora* (Uzbekistan)
Cucullia improba muelleri	*Aaronsohnia factorovskyi*	id.	no previous records
Caradrina casearia	*Atriplex halimus, A. glauca*	id.	no previous records
Caradrina melanurina	*Anabasis articulata, A. setifera, Atriplex suberecta*	*Atriplex halimus*	polyphagous on various low plants
Caradrina bodenheimeri	*Echinops philistaeus*	id.e	*Calendula* sp. in captivity
Euxoa canariensis	*Atriplex halimus*	id.	no previous records
Agrotis herzogi	*Atriplex leucoclada*	*A. halimus*	no previous records

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