

# The Hawk Moths of Israel: Distribution, Phenology and Ecology

(Lepidoptera, Sphingidae)

by

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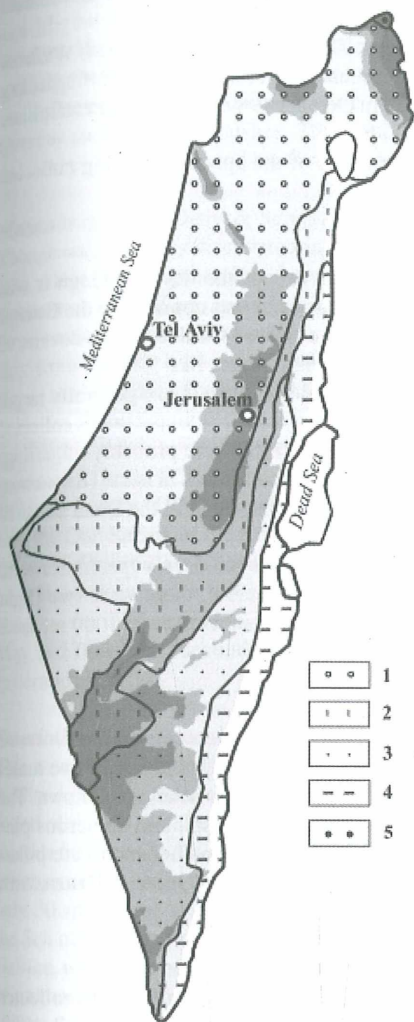
**Abstract:** During an 18-year survey, 21 sphingid species belonging to 17 genera were collected in Israel. Eight species were new records for the country [*Hyloicus pinastri pinastri* (LINNAEUS, 1758), *Akbesia davidi* (OBERTHÜR, 1884), *Hemaris syriaca* (DANIEL, 1939), *Hemaris croatica croatica* (ESPER, 1800), *Pterodonta gorgoniades pfeifferi* (ZERNY, 1933), *Hyles nicaea libanotica* (GEHLEN, 1932) and *Hippotion osiris* (DALMAN, 1823)]. Only one species, *Clarina kotschy* (KOLLAR, 1850), was not found again. The distribution, phenology, ecology, abundance and the association of all species to the main phyto-geographical zones of Israel is discussed.

**Zusammenfassung:** Während eines Untersuchungszeitraumes von 18 Jahren konnten in Israel 21 Schwärmerarten gesammelt werden, die 17 Gattungen repräsentieren. Acht Arten werden erstmals für dieses Land gemeldet [*Hyloicus pinastri pinastri* (LINNAEUS, 1758), *Akbesia davidi* (OBERTHÜR, 1884), *Hemaris syriaca* (DANIEL, 1939), *Hemaris croatica croatica* (ESPER, 1800), *Pterodonta gorgoniades pfeifferi* (ZERNY, 1933), *Hyles nicaea libanotica* (GEHLEN, 1932) und *Hippotion osiris* (DALMAN, 1823)]. Nur die Art *Clarina kotschy* (KOLLAR, 1850) wurde nicht wieder aufgefunden. Die Verbreitung, Phänologie, Ökologie, Häufigkeit und die Zuordnung der Arten zu den phyto-geographischen Großgebieten von Israel wird diskutiert.

**Introduction:** In the context of an Israeli-German project for the study of the Israeli lepidopteran fauna, intensive collecting was carried out from 1986-2004. This project was a joint effort of The Hebrew University, Tel Aviv University, The Nature Reserves and Parks Authority of Israel. The Zoologische Staatssammlung Munich, Germany and Museum WITT, Munich, Germany. Lepidoptera were collected over an 18-year period, totaling about 3000 nights of collecting using mobile light traps powered by generator (250 Watt bulbs HQL & ML) and about 1500

nights using mobile light trap systems powered by batteries (12Volt 8 Watt & 20Watt, 6 Volt 4 Watt Black light UVB tubes) that were moved on a daily basis. Additionally, an intensive 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. Hawk Moth distribution was found to be associated with the five major phyto-geographical zones in Israel (Fig. 1). Terminology of the phyto-geographical zones was developed by EIG (1931-32), modified and adapted by ZOHARY (1973). The major zones are Mediterranean, Irano-Turanian, Saharo-Sindian, Tragacanth and Ethiopian.



Legend: Phyto-geographical zones of Israel

- 1 Mediterranean
- 2 Irano-Turanian
- 3 Saharo-Sindian
- 4 Ethiopian
- 5 Tragacanth

Fig. 1: Map of Israel showing phytogeographical zones

## Faunistic survey

### ***Acherontia atropos* (LINNAEUS, 1758)**

This species was uncommon though it was found in all phyto-geographical zones apart from the desert. It was regularly observed only in the coastal plain and the upper Jordan valley. In the south there were mainly single records from villages and oases. Most of the old records were from agriculture where caterpillars and occasionally pupae were found in potato and tomato fields. Adults were reported to occasionally enter bee hives.

The known genera of food-plants in Israel are *Solanum*, *Datura*, *Lycium*, *Nicotiana*, *Withania* (Solanaceae), *Jasminum* (Oleaceae), *Lantana*, *Vitex* (Verbenaceae), *Philadelphus* (Saxifragaceae), *Tecomaria* (Bignoniaceae) (HALPERIN & SAUTER, 1992). In October 1989, several large caterpillars were observed on a *Prosopis farcta* (Chenopodiaceae) bush.

Adults were recorded from late May until December; most of the specimens being collected from July to October.

### ***Agrius convolvuli* (LINNAEUS, 1758)**

This species was common in all phyto-geographical zones except the desert, though it was found in some oases and in irrigated gardens of villages. The species was common in the Coastal Plain, the Hula Valley, the Bet Shean Valley and around the Sea of Galilee where dozens of adults were regularly observed feeding on flowers of ornamental plants like

*Hibiscus* and *Fuchsia*. Specimens from the Golan Heights and Mt Hermon are generally larger and darker than individuals from the rest of the country. A few very small pale specimens collected in the Arava Valley about 25 km north of Eilat in late November 1989 were probably migrating. *Convolvulus* and *Ipomoea* (Convolvulaceae) are known genera of food-plants in Israel (EISENSTEIN, 1984). *Zygophyllum dumosum* (Zygophyllaceae) was the main host-plant in the Dead Sea area where hundreds of caterpillars were seen over several years.

Populations fluctuated greatly from year to year and in some years almost no specimens were observed. Records were from late April through November. In general, there were two flight peaks: one in June; the other, more pronounced, in August to September. Above 1000 m, there was only one peak, from July to August.

### ***Hyloicus pinastri pinastri* (LINNAEUS, 1758)**

This is a new record for the fauna of Israel.

There is only one record from Metula (500 m) the most northern part of Israel where two males were collected by MÜLLER & ORTAL in mid-May 1986. The food-plant in Israel is unknown. The site was a steep and rocky east-facing slope with oak bushes, *Quercus* sp., and numerous pine trees, *Pinus halepensis*, both of which are possibly host-plants. In Turkey and Lebanon, caterpillars were found on different trees of the genera *Pinus*, *Abies*, *Picea*, *Cedrus* and *Quercus* (DERZHAVETS, 1979).

### ***Dolbina elegans* (A. BANG-HAAS, 1912)**

KERNBACH (1959) mentions a female of this species in his collection. MÜLLER & ORTAL collected one ♂ in the Dan Valley near the Baniyas springs of the Jordan River (200 m) in late April, 1989; and KRAVCHENKO found one ♂ on Mt Carmel near Haifa (300 m) in early June, 1998. KRAVCHENKO & MÜLLER collected a third ♂ from Nahal Keziv (150 m) in the western Galilee in mid-May

2000. All the specimens were collected in small canyons with creeks and dense river forest vegetation. The natural host-plant is unknown (DANNER et al., 1998).

***Akbesia davidi* (OBERTHÜR, 1884)**

This is a new record for the fauna of Israel.

There are only three records for Israel. One by MÜLLER & LI from the northern Golan Heights near Migdal Shams (900 m) in late May 1994, and the two others by MÜLLER & KRAVCHENKO, one from the southern slopes of Mt Hermon (1200 m) in early June, 2002; the other from the northern Golan Heights near Quneitra (700 m) in late May 2004.

The collecting sites were either karstic or volcanic, with very sparse vegetation and few small *Quercus* and *Crataegus* bushes. The local host-plant is unknown. In Syria and Lebanon, eggs and caterpillars were found on *Pistacia* trees (DANNER et al., 1998).

***Marumba quercus* (DENIS & SCHIFFERMÜLLER, 1775)**

Though only recently discovered in Israel, this species was fairly common in the Mediterranean hills while it was generally absent in the costal plain (BYTINSKI-SALZ, 1966). It was found throughout the Galilee, including the costal forests, Samaria, Judean Mts., the Dan Valley, the forests around the Jordan springs, the Golan Heights and Mt Hermon up to 2000 m. Habitats vary from ranging between narrow, shady and rather cool canyons, oak shrubs on south facing slopes to single dwarf oak bushes on Mt. Hermon. There are no records for the costal plain south of Haifa. The most southern record in Israel is from Jerusalem. Altogether, 215 specimens were recorded in this survey. All specimens were of a very light beige color with not a single dark specimen as known from the northern distribution area (KUMAKOV & KORSHUNOV, 1972; AJBASOV, 1974; DE LATTIN, 1967). Larvae were observed in July on mature shady *Quercus ithaburensis* near the Dan Spring of the River Jordan and in the western Galilee in June on small bushes of *Q. boissieri*. Caterpillars that pupated in spring and early summer hatched in autumn of the same year. Records of adults were from late April until early October. On Mt. Hermon and the Golan Heights, the flight period is from July to August. In the rest of the area, there was one peak in May and June and a second in August and early September. The species is seen in Israel in two generations.

***Smerinthus kindermanni kindermanni* (LEDERER, 1853)**

This rare and rather local species was limited to the northern Mediterranean part of the country. Additionally, it penetrated into the Irano-Turanian zone along rivers and creeks. It was exclusively found along river valleys and springs with thickets of poplar trees and willows. There are no records from oases or valleys with streamlets in the south even though poplar trees and willows are common in some of these areas. The most southern record is from Jerusalem. In this survey, only 30 specimens were collected, the majority from along the Jordan River from its springs to the Sea of Galilee. Probably, the species is also found along the Jordan River south of the Sea of Galilee, which is a border area and therefore not easily accessible. Yathom collected one specimen of unknown location in the south of the country in May 1959.

In Israel, the species feeds on *Populus euphratica* (HALPERIN & SAUTER, 1992). In this survey several larvae were found in the Jordan Delta on a *Salix alba* bush in early May and mid-September. Adults were recorded from March to early October, the peak being July to August.

The data suggest that along the Jordan River the species flies in two, probably three generations,

***Hemaris (Hemaris) syriaca* (DANIEL, 1939)**

This is a new record for the fauna of Israel.

This is the first record of the species in the Eastern Mediterranean south of Turkey. A single was collected by MÜLLER & LI, of a single ♀ in the southern Golan Heights (500 m) in late May 1997. The specimen was caught at noon on the south facing slopes of the Yarmuk River feeding on flowers of Fabaceae. The host-plant is unknown. It is noteworthy that *Lonicera* (Caprifoliaceae) species were abundant near the collecting site, which are known to be host-plants of some other species of this genus (PITTAWAY, 1993).

***Hemaris (Cochrania) croatica croatica* (ESPER, 1779)**

This is a new record for the fauna of Israel.

There are two records of this species, both from the Golan Heights. One specimen was collected by MÜLLER & LI in mid-May 1996, in a sparse oak forest on the southern Golan Heights (600 m). The second specimen was collected by MÜLLER & KRAVCHENKO in early May 2003, where the southern slopes of Mt. Hermon connect to the Golan Heights near Migdal Shams (1200 m). In Israel, the host-plant is unknown. In Southern Europe, the preferred host-plants are *Cephalaria* (Dipsacaceae) species (EFETOV & BUDASHKIN, 1990), which are very common on the Golan Heights and Mt. Hermon near the collecting areas.

***Clarina syriaca* (LINNAEUS, 1758)**

This species was rare and confined to the Mediterranean part of the country. Records were from the Dan Valley, Jordan springs (150 m), the Hula Valley (100m), the western Galilee in Nahal Keziv (100 m), Mt Carmel (400m), the Lower Galilee, Mt. Meron (800 m) and Samaria near Shechem (600 m). The most southern record was from Jerusalem (800 m). All the specimens were collected in rather shady and wet habitats often with springs and streamlets nearby. The species was absent from the Mediterranean Coastal Plain south of Haifa and from the other phyto-geographical zones of the country.

In Israel *Vitis* (Vitaceae) is the known host-plant (EISENSTEIN, 1984).

Records of adults are from late May until late September with a clear peak in June to July. The number of generations in Israel is not clear.

***Clarina kotschy* (KOLLAR, 1850)**

This species was published by AMSEL (1933) for the Judean Mountains. Since then there have been no further records for Israel. It is not clear if the species vanished or is still a rare and probably local element of the fauna. In Iran, caterpillars feed on *Vitis vinifera*, *Parthenocissus* spp. and *Ampelopsis* spp. Habitats are park forests, vineyards and cultivated areas in mountainous regions. The species flies in three overlapping generations from early May to end of August (PITTAWAY, 1982).

***Daphnis nerii* (LINNAEUS, 1758)**

This species is common all over Israel. Only in the desert, is it limited to villages with irrigated gardens or to oases where Oleander is present. The species is most common in the Mediterranean

and in the Irano-Turanian grassland along streamlets and valleys with thickets of Oleander. In the Mediterranean Hills, the Golan Heights, Mt. Hermon and the Lower Jordan Valley it is uncommon. Nevertheless, even in the most remote desert areas single specimens were collected probably in migration. Known genera of food-plants in Israel are *Verium* (Apocynaceae) and occasionally *Ipomoea* (Convolvulaceae) (EISENSTEIN, 1984). The species was present during the whole survey, but there were huge annual fluctuations. At least, it is a resident in the coastal plain, the larger valleys and most of the oases. Some cooler parts of the country might get re-colonized on an annual basis (RIVNAY & YATHOM, 1967). Records in the south are from March to December and in the north from April to November. The species is most common from June to September.

***Pterodonta gorgoniades pfeifferi* (ZERNY, 1933)**

This is a new record for the fauna of Israel.

This uncommon species was first discovered by KRAVCHENKO & MÜLLER near Yagur in the northern part of Mt Carmel (200 m) in mid-April 1999. In the following years, it was regularly found on the northern slopes of Mt. Meron (600 – 1100 m) in the Lower Galilee (500 – 700 m), Mt. Hermon from the foothills (300 m) to 2000 m, with most records from the southern slopes of Mt. Hermon north of Migdal Shamsh (1300 m) and the Hula Valley near the Jordan spring at Banias (200 m). Records are from late May to late June and from early August to mid-September. The known host-plant of the nominate subspecies in Turkey is *Galium verum* (DANNER et al., 1998). In Israel, the host-plant is unknown but 14 species of *Galium* are known from the area of the Jordan springs and Mt. Hermon (ZOHARY, 1972). The data suggest that there are two generations.

***Proserpinus proserpina proserpina* (PALLAS, 1772)**

All existing records are from northern Israel in the Mediterranean zone of the Hula Valley, around the Sea of Galilee, the northern Golan and the lower parts of Mt. Hermon. The species is uncommon. Unlike in Europe, the species was not collected or observed in disturbed secondary biotopes (ERNST, 1994). The habitats are southern and south-eastern slopes covered with rocks and sparse vegetation without or almost no bushes and no grazing. There are river banks, water holes or springs close by. Adults were observed over several years at exactly the same locations, hovering over flowers around sunset. The species had already been collected at two of the locations in the Hula Valley by Shoham and Yathom in the 1960's (BYTINSKI-SALZ, 1966). In Israel, the host-plant is unknown. In Europe, caterpillars feed on *Epilobium*, *Oenothera* (Onagraceae) and *Lythrum* (Lythraceae) (ERNST, 1994; ZOLOTUHIN, 1997). It is worth mentioning that wherever the species was found, *Lythrum salicaria*, a known host-plant in Europe, was rather common. There are six specimens from the Hula Valley in the local museum collections that were caught in the 1960's from March to May. In this survey 11 specimens were obtained from late March to late June. The species was most common from late April to late May. Remarkably, all specimens collected in Israel are on average larger and stronger colored than the European material (DE FREINA & WITT, 1987).

***Macroglossum stellatarum* (LINNAEUS, 1758)**

It is abundant in all phytogeographical zones in all habitats. The species is common and often observed during daytime hovering around flowers in cultivated and uncultivated areas. Most of the observations were accidental during daytime. Only a few specimens were collected with light traps. Few specimens are kept in local museum collections, probably owing to the abundance of the species. The species is known for its migratory behavior in the Middle East (LARSEN, 1976). Two migrations were observed in Israel during the last 20 years. The first of about one thousand specimens moving within one hour in the Judean Desert in a north-westerly direction in mid-August 1994. In late April 1989, about 300 specimens were observed flying in the Central Negev near Nizzana in a north-easterly direction over a 3-hour period.

In Israel *Centranthus* (Valerianaceae) is known as a host-plant (EISENSTEIN, 1984). The species was seen all year around with peaks from March to May and August to September. Strangely, this moth was collected in light traps in the cold winter months sometimes more often than during spring and summer.

***Hyles conspicua* (ROTHSCHILD & JORDAN, 1903)**

This taxon was raised to species level by DANNER et al. (1998).

RIVNAY & YATHOM (1967) collected *Deilephila euphorbiae* L. at all sites in Israel where they put light traps in various numbers. All specimens in local collections, including the Yathom collection in Volcani Center, Bet Dagan, labelled *D. euphorbiae* (L.), were identified as vicariant *Hyles conspicua* (R. & J.).

RIVNAY & YATHOM (1967) noticed high variations in frequency and flight periods during their survey from 1959-1964. In some years, the species was collected in hundreds in some of the automatic light traps with a total of several thousands during the whole survey (YATHOM, personal communication). The species is present in all local collections from a few specimens up to one dozen. In this survey, the species was never common and often absent for 1-2 years. Apparently, the species became increasingly uncommon during the last decades. More than 80% were collected in the Mediterranean and the Irano-Turanian grassland with the most numerous catches in the Coastal Plain and the Mid-Jordan Valley. It was uncommon in the Mediterranean Hills, the Golan Heights and Mt. Hermon. In the Negev and in the Arava Valley as far south as Eilat only occasional single specimens were collected. Like RIVNAY & YATHOM (1967) we are not sure whether the species is a rare resident in the south or only dispersion and/or migration was encountered. Larvae were observed on a *Euphorbia* sp. (Euphorbiaceae) in the Coastal Plain. Records are from late March to early November with the highest numbers during late June to mid-September.

***Hyles nicaea libanotica* (GEHLEN, 1932)**

This is a new record for the fauna of Israel.

All records were from high altitude in the Tragacanth zone on Mt. Hermon from 1200 to 2200 m and on the southern slopes of the mountain north of Migdal Shamsh (1300 m). No specimen was ever collected below 1200 m. Several mature larvae were found in mid-August 2000 on *Euphorbia oxydonta* BOISS. & HAUSSKN. growing on the southern slopes of the mountain (1700 m). The larval habitat was extremely karstic with a few patches of the food-plants between the rocks and some bushes of *Prunus*, *Rosa* and *Crateagus* (Rosaceae). The whole area was generally heavily

grazed by cows, sheep and goats. Three of the six caterpillars collected pupated after four days and hatched in early June of the following year. Two specimens were found in the Bet Ussishkin Museum that had been collected on Mt. Hermon (2000 m) in July and August during the 1990s. In our survey, we collected 79 specimens on Mt. Hermon mainly above 2000 m from early June until early September with a clear peak in July.

### *Hyles livornica* (ESPER, 1779)

This species was abundant all over the country. During this survey, many thousands of specimens were found. The highest numbers were collected in the Jordan Valley, the Arava, the Negev and the Coastal Plain. In Israel, multiple mass developments of larvae were only observed in the Irano-Turanian, Saharo-Arabian zone and in the southern part of the Coastal Plain during spring. After the natural food-plants like *Rumex*, *Emex* and *Euphorbia* were finished, masses of caterpillars were observed invading nearby vegetation like *Genista*, *Vitis*, *Olea*, *Gossypium*, *Solanum*, *Zea*, *Prosopis*, *Atriplex* and Cruciferae. On several occasions, so many caterpillars were killed by traffic while crossing roads that the roads turned slippery for several hundred meters. Gradations seem to occur locally in intervals of about 5-7 years. We observed mass developments of many hundred thousands of larvae stripping complete wadis of their vegetation. Outbreaks seem to coincide with previous strong winter rains. Consequently, extremely high population fluctuations of adults (up to 100 fold) were the rule. Records are from all year round with a strong peak from March until May. As stated by RIVNAY & YATHOM (1967), the species is clearly a resident with a high tendency to migrate and apparently is reinforced regularly by immigrations from Jordan and Egypt.

### *Choerocampa suellus* (STAUDINGER, 1878) subsp.?

One specimen was collected by BYTINSKI-SALZ (17.V.1957) at the Dan Spring of the Jordan. Another specimen was found in the Tel Aviv University collection labeled Jerusalem. Considering the label, the specimen was probably collected in the 1940s or 1950s. Recently, in early June 2004, a specimen was caught by MÜLLER & KRAVCHENKO near Beit Lehem (750 m) in an old neglected olive grove. Only the two specimens from Jerusalem, with their distinct grayish-brown color, resembled the nominate subspecies found in Turkey and Iran. More material is needed to decide definitively to which subspecies the local population belongs. In Turkey, the species is found from May to June in one generation and the suspected host-plant is *Galium* sp. (DANNER et al., 1998). BYTINSKI-SALZ (1966) suggested *Galium* sp. and *Epilobium* sp. as possible host-plants in Israel.

### *Hippotion celerio* (LINNAEUS, 1758)

This migratory species is very common all over the country but only seemed to be a permanent resident in the Irano-Turanian and Saharo-Arabian zone. The first stages are not able to withstand low temperatures; consequently the Mediterranean Hills and the Golan Heights have to be recolonized on an annual basis. The highest numbers were observed regularly in the Jordan Valley, the Arava and the Negev. During our survey several thousand individuals were recorded. Known host-plants in Israel are *Ampelopsis* (Vitaceae), *Fuchsia* (Onagraceae) and *Hedera* (Araliaceae) (EISENSTEIN, 1984; HALPERIN & SAUTER, 1991). Caterpillars were observed in the Negev repeatedly on *Emex spinosa*, *Rumex cyprius* (Polygonaceae) and in the Jordan Valley on



*Vitis vinifera*. Adults were found all year round with a well pronounced peak in April and May. Populations fluctuated highly from year to year (up to 20 fold) and, as already stated by RIVNAY & YATHOM (1967), are probably enforced regularly by southern immigrations.

***Hippotion osiris* (DALMAN, 1823)**

This is a new record for the fauna of Israel.

This species is of African origin and is a southern Saharan resident. This migrating species had already been recorded from North Africa and Spain (PITTAWAY, 1993). In Israel, one specimen was found near Eilat (100 m) in mid-June 2001, two specimens near Jericho (-250 m) in September 2004 and another in Neot Hakikar (-400 m) in late July 1994. It is not clear if the species only migrates to Israel, occasionally breeds in the Rift Valley, or is even a permanent element of the fauna.

***Theretra alecto cretica* (BOISDUVAL, 1827)**

It is common in the Coastal Plain, the Mediterranean Hills and the Irano-Turanian grassland, but absent or only occasionally found in the south of the country. Caterpillars were often observed in vineyards where they occasionally became pests (BODENHEIMER, 1930; AVIDOV & HARPAZ, 1969). The majority of specimens were collected in the Hula Valley and the Coastal Plain. Records are from late March until December, depending on the year, with an occasional spring peak but a regular well-pronounced summer peak. Spring peaks, when observed, occurred in May and summer peaks from June to September.

**Discussion:** Twenty-one Sphingidae species belonging to 17 genera were collected during this 18-year project. Seven are being published for the first time as members of the fauna of Israel. Only *Clarina kotschyi* (KOLL.), one of the previously found species, was not encountered in this study.

Sphingidae are known for their migratory behavior and high dispersal in Israel (RIVNAY & YATHOM, 1967; EISENSTEIN, 1983). Consequently, adults are often found far from their breeding habitats though the first stages of many species depend on specific habitats and climate (WILLIAMS et al., 1942; WILLIAMS, 1958). It is, therefore, difficult to decide whether single records indicate migration or small residential populations (WILLIAMS, 1930). Almost half (9/21) of the records were rare and seven of them were documented in Israel for the first time.

The new records of *Hemaris syriaca* (DANIEL) and *Hyloicus p. pinastris* (L.) were found only in one location and of *Hemaris croatica* (ESP.) and *Akbesia davidi* (OBERTH.) in two or three places each.

The single record of *Dolbina elegans* (A. BANG-HAAS) by KERNBACH (1959) was confirmed. *D. elegans* (A. BANG-HAAS) is not known for long distance migration. Therefore we believe that this species can be regarded as a rare element of the fauna of Israel.

*Choerocampa suellus* (STGR.) was observed twice in the vicinity of Jerusalem within the last 50 years and once in northern Israel. The specimen BYTINSKI-SALZ (1966) collected was described by him in the following way: "This specimen shows a decided pinkish suffusion. On the body especially the patagia of the pronotum and abdomen are pink." It belongs therefore to the subspecies *C. suellus rosea* (ZERNY, 1933) which is endemic to the Cedar Mts. of Lebanon. It

Tab. 1: The distribution and abundance of Hawk moths (Sphingidae) in Israel associated with the major phyto-geographical zones

Species distribution & abundance				Major Phyto-geographical Zones				
				Mediterranean	Irano-Turanian	Saharo-Sindian	Ethiopian	Tragacant
<i>A. atropos</i>			+	XXX	XXX	X	XX	X
<i>A. convolvuli</i>			+++	XXX	XX	X	X	X
<i>H. pinastri</i>	N	L	R	XXX				
<i>D. elegans</i>	N	L	R	XXX				
<i>A. davidi</i>	N	L	R	XXX				
<i>M. quercus</i>			++	XXX				XX
<i>S. kindermanni</i>			R	XXX	XX			
<i>H. syriaca</i>	N	L	R	XXX				
<i>H. croatica</i>	N	L	R	XXX				
<i>D. nerii</i>			+++	XXX	XX	X	XX	X
<i>C. syriaca</i>			R	XXX				
<i>C. kotschy</i>			old record	?	?			
<i>P. gorgoniades pfeifferi</i>	N		+	XXX				
<i>P. proserpina</i>			+	XXX				
<i>M. stellatarum</i>			++++	XXX	XXX	XX	XX	XX
<i>H. conspicua</i>			++	XXX	XXX	X	X	X
<i>H. nicaea libanotica</i>	N	L	++	X				XXX
<i>H. livornica</i>			++++	XXX	XXX	XXX	XXX	XX
<i>C. suellus</i>	N	L	R	XXX				
<i>H. celerio</i>			++++	XX	XXX	XXX	XXX	X
<i>H. osiris</i>	N		R				XXX	
<i>T. alecto cretica</i>			+++	XXX	XXX	X	X	X

New record for Israel

N

Distribution within phyto-geogr. Zones

XXX Main area of distribution

XX Area of penetration

X Sporadic records

Abundance &amp; Distribution

++++ Abundant (more than 500 specimens recorded per year)

+++ common (100 to 500 specimens recorded per year)

++ Fairly common (20 to 100 specimens recorded per year)

+ Uncommon (5 to 20 specimens recorded per year)

R Rare (less than 5 specimens recorded per year)

L Local (only in one Zone and there in 3 or less locations collected)

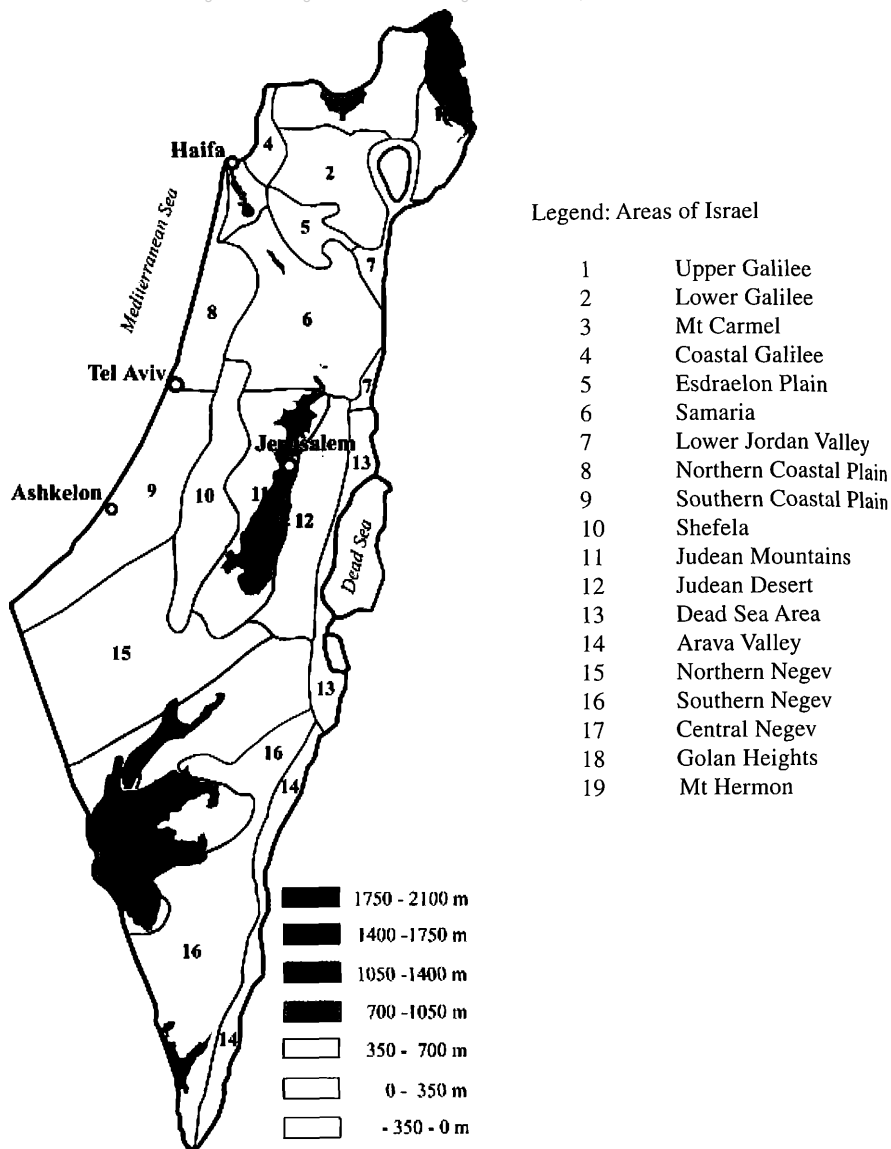


Fig. 2: Map of Israel showing altitudes and areas

is noteworthy that the population in Lebanon from the Cedar Mountains is regarded to be a different subspecies endemic for this area (PITTAWAY, 1993). The specimens from Jerusalem with their distinct grayish-brown color closely resemble the nominate species known from Turkey and Syria. The specimens from Israel query whether the Lebanese specimens are an isolated subspecies or color variation. Intrasubspecific status is supported by the fact that, occasionally, in Iran and Turkey specimens are collected that match the Lebanese form closely (unpublished data of the authors).

The definitive status of *Hyloicus pinastri* (L.) in Israel is not clear; this species is found in nearby Lebanon but in a different habitat, the Cedar Mountains. It is known to migrate occasionally, but breeding habitats in Turkey are strikingly similar to the Mediterranean forests of Israel, which might suggest that it is probably a rare resident.

According to PITTAWAY (1982), *C. kotschy* (KOLL.) and *C. syriaca* (L.) are the same species with an intermediate zone of hybridization, while EBERT (1976) and DANNER et al. (1998) regard them as two separate species because of several distinct morphological differences of the adult and the caterpillar. At the time AMSEL published, there was no doubt about the status of the two species and their characteristic wing shapes made identification fairly easy. Until now, *Clarina kotschy* (KOLL.) was only observed by Amsel (1933) in Israel in the Judean Mountains. All other records so far are from eastern Turkey, north Iraq and Iran. Many lepidopteran species were collected in this region once only or are extremely rare (BYTINSKI-SALZ & STERNLICHT, 1967; BODENHEIMER, 1939; ELLISON & WILTSHIRE, 1939). Also, in our survey, more than a quarter of all the sphingids follow this pattern. Additionally, quite a few species found in Iran or eastern Turkey suddenly also appear in Israel without any records from countries in between. We assume that *C. kotschy* (KOLL.) was actually collected by AMSEL. It is not clear if the species finally vanished over the last decades or is still a rare local element.

The new record of *Hemaris syriaca* (DANIEL) is especially interesting. Until now, only two ♂♂ were collected in the Taurus Mountains (1000 m), in 1939 in Marasch, Turkey (DANIEL, 1939; DANNER et al., 1998). This is the first ♀ of this extremely rare and elusive species ever collected.

The situation for *Pterodonta gorgoniades pfeifferi* (ZERNY) and *H. niceaa libanotica* (GEHLEN) is different. The first was uncommon but was observed over years in many locations in northern Israel. The other was restricted to the higher parts of Mt Hermon but it was fairly common and observed annually for more than ten years. These data firmly suggest that both species are residents.

Nine of the known species are migrants, among them all the common species of Israel *Agrius convolvuli* (L.), *Daphnis nerii* (L.), *Macroglossum stellatarum* (L.), *Hyles livornica* (ESP.), *Hippotion celerio* (L.), *Theretra alecto cretica* (Bdv.), and also the less common ones *Hyles conspicua* (R. & J.), *Acherontia atropos* (L.), and *Hippotion osiris* (DALMAN). Only one species, *Hyles conspicua* (R. & J.), showed a drastic reduction in numbers over the last decades (personal communication Dr. S. YATHOM), though its distribution area did not change. There is no obvious reason for this phenomenon. All the other species maintained stable populations except for annual fluctuations.

All the rare and local non-migratory species *Hyloicus p. pinastri* (L.), *Dolbina elegans* (A. BANG-HAAS), *Akbesia davidi*, *Marumba quercus* (D. & S.), *Smerinthus k. kindermanni* (LED.), *Hemaris syriaca* (DANIEL), *Hemaris croatica* (ESP.), *Clarina syriaca* (L.), *Pterodonta*

*gorgoniades pfeifferi* (ZERNY) *Proserpinus p. proserpina* (PALLAS), *Hyles nicaea libanotica* (GEHLEN), and *Choerocampa suellus* (STGR.) are restricted to the Mediterranean zone. Quite remarkably, there is no distinctive zonal distribution. Towards the south there is a gradual but considerable disappearance of species. Half of these species were not recorded south of Haifa while no species was absent from the north.

South of the Mediterranean zone even fewer species were recorded and no species was exclusively centered in the Irano-Turanian grassland, although six species were commonly found and three more penetrated into this zone.

In the high altitude Tragacanth zone, *Hyles nicaea libanotica* (GEHLEN) was centered and fairly common. Apart from *Marumba quercus* (D. & S.), which penetrated from the Mediterranean zone, the eight other recorded species were migrants.

No species was centered in the desert and only three of the ubiquitous species [*Macroglossum stellatarum* (L.), *Hyles livornica* (Esp.) and *Hippotion celerio* (L.)] were encountered in abundant numbers and five more were observed only occasionally in small numbers.

Only *Hippotion osiris* (DALMAN), was recorded in the Ethiopian zone. This species is a known long distance migrant and the Rift Valley is a known migration route to the north for many African species (BYTINSKI-SALZ, 1961; FURTH, 1975; DE LATTIN, 1967). Nevertheless the three records from Ethiopian pockets, could indicate that it could be a potential resident.

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