DISTRIBUTION AND PLIGHT PERIOD OP Amphipyrinae (Noctuidae: Lepidoptera) SPECIE IN ISRAEL IN 1959-1970

by

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ABSTRACT

In an eleven-year survey throughout Israel, moths of 21 species of Amphipyrinae (Noctuidae: Lepidoptera) were trapped. These include three agricultural pests, Spodoptera littoralis Boisduval, S. exigua Huebner, and Sesamia cretica Lederer; the rest are not known to breed on plants of economic importance.

S. exigua is a definite migrant; Caradrina bodenheimeri Draudt and Autophila cerealis Staudinger show indications of migratory habits. The species not mentioned breed locally, though they too may be reenforced by dispersing individuals from afar. The locally-breeding species include S. littoralis, S. cretica, Hoolodrina ambigua Schiffermiller, Caradrina atriluna Guennee, Spodoptera cilium Ouennee, Apopestes silenides Staudinger, Oria musculosa Huebner, Tatorhynchus exsiccatus Lederer, Stilbina hypaenides Staudinger, Hadjina palaestinensis Staudinger, Caradrina mela- nurina Staudinger, Iegalodes eximia Ferrier, Hypeutina fulgorita Lederer, Luperina dumerilii Duponchel, Trigonophora meticulosa Linnaeus, Phragmitiphila typhae Thunberg, and Autophila libanotica Staudinger.

INTRODUCTION

During 1959-1970 a survey of Noctuidae was conducted at several sites in various parts of Israel. The purpose of this paper Is to present some of the information obtained in the survey, concerning Amphipyrinae species.

The Amphipyrinae that were caught in light traps represent a wide variety in their status and behaviour. Two are notorious polyphagous pests, Spodoptera

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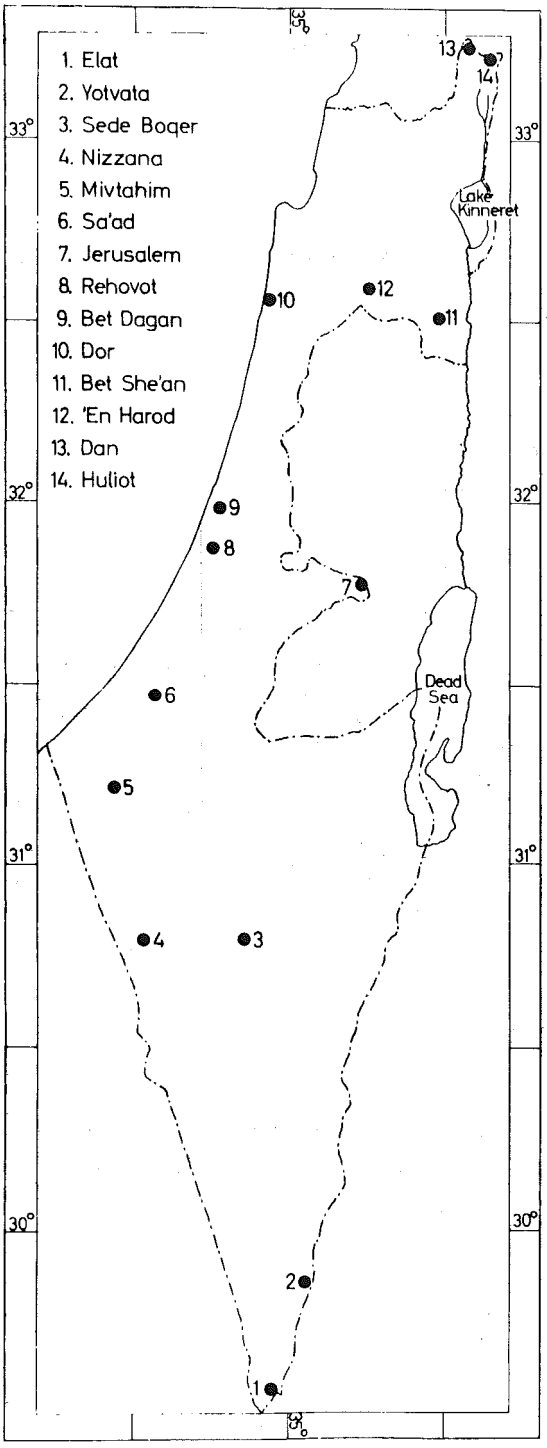

littoralis Boisduval and S. exigua Huebner, while Sesamia cretica Lederer is restricted to summer graminaceous plants.

The majority of the species, however, are not pests of cultivated plants, and presumably feed on wild vegetation, though it is probable that their larvae occasionally feed on cultivated plants and the damage done by them is attributed to other species known to cause damage.

The agricultural pests also differ greatly in their habits. S. exigua is a migratory species, enforcements to local populations reaching the country from the south in the spring, whereas S. littoralis has become a well established resident and its population builds up during the summer, reaching a peak in October. This species has no true diapause, while Sesamia cretica enters diapause as a mature larva.

METHODS

Light traps were installed in various parts of the country, at the sites indicated on Map 1. Traps 1-2 were located in the Arava Valley, traps 3-6 in the Negev region, trap 7 in Jerusalem (the Judean Hills), traps 8-10 in the Coastal Plain, traps 11-12 in the Inland Valleys, and traps 13-14 in the Hula Valley. The Negev, and especially the Arava, display typical

eremic biotopes. In the Coastal Plain and Jerusalem Mediterranean zoogeographical features are dominant. The Inland Valleys feature Mediterranean components with intrusions of eremic ones. In the Hula Valley, Mediterranean as well as Palearctic components are found.

The source of light in each trap was a 125-watt mercury vapour bulb, placed over a funnel to which four perpendicular wings were attached to prevent the moths from escaping. A small fan was installed over the funnel to drive the hovering moths into the container. The moths were collected in a jar (containing an insecticide) placed below the funnel.

RESULTS AND DISCUSSION

During the period of study 21 species belonging to the Amphipyrinae were trapped: Spodoptera littoralis Boisduval, S. exigua Huebner, Sesamia cretica Lederer, Hoplodrina ambigua Schiffermiller, Caradrina atriluna Guennee, Spodoptera cilium Guennee, Apopestes silenides Staudinger, Oria musculosa Huebner, Caradrina bodenheimeri Draudt, Tatorhynchus exsiccatus Lederer, Stilbina hypaenides Staudinger, Hadjina palaestinensis Staudinger, Caradrina melanurina Staudinger, Autophila cerealis Staudinger, Megalodes eximia Ferrier, Hypeutina fulgorita Lederer, Luperina dumerilii Duponchel, Trigonophora meticulosa Linnaeus, Phragmitiphila typhae Thunberg, Autophila libanotica Staudinger.

The numbers of moths of each species caught in the different regions are shown in Table 1. The agricultural pests (in particular the polyphagous ones) top the list in their numbers; the other pests were trapped in much smaller populations. We proceed to give some background information and to discuss the results, for each species separately.

Table 1. Number of moths of the Amphipyrinae caught in light traps * in different regions in Israel, 1959-1970 (in parentheses, averages per 100 nights)

Region	Arava	Negev	Coastal Plain	Jerusalem	Inland Valleys	Hula Valley	Total
No. of trapping nights	2210	2565	5989	2853	2166	2855	18638
S. littoralis	1130 (52)	2799 (109)	17957 (300)	15611 (547)	70267 (3244)	96369 (3375)	204133
S. exigua	11362 (514)	13480 (526)	18854 (315)	81761 (2866)	23891 (1103)	41130 (1440)	190478
S. cretica	22 (1)	235 (9)	3277 (55)	312 (11)	6638 (307)	3767 (129)	14160
H. ambigua	1 (0.05)	40 (1.5)	1054 (18)	1585 (56)	1385 (64)	1604 (56)	5669
A. atriluna	7 (0.3)	87 (3)	274 (46)	2753 (96)	1657 (76)	519 (18)	5288
S. cilium	14 (0.6)	43 (2)	84 (1.5)	40 (1.4)	786 (4)	2832 (99)	3765
A. silenides	1 (0.05)	524 (20)	612 (10)	1472 (52)	254 (12)	231 (8)	3094
O. musculosa	0	2 (0.08)	559 (9)	1176 (41)	699 (32)	128 (5)	2564
C. bodenheimeri	828 (38)	845 (33)	1 (0.02)	142 (5)	0	0	1816
T. exicata	84 (4)	21 (1)	110 (2)	9 (0.3)	26 (1)	988 (35)	1238
S. hypaenides			435 (7)	45 (2)	117 (5)	22 (0.7)	619
H. palestinensis					7 (0.3)	437 (15)	444
A. melanurina	307 (14)	84 (3)	7 (0.1)				398
A. cerealis	294 (13)	37 (1)	1 (0.02)	15 (0.5)		17 (0.6)	364
M. eximia			238 (4)	2 (0.07)	4 (0.2)	39 (1)	283
H. fulgorita			22 (0.6)	87 (6)	34 (2)	115 (4)	261
P. dumerilii		3 (0.1)	106 (2)	88 (3)	6 (0.3)	4 (0.1)	207
T. meticulosa		5 (0.2)	8 (0.1)	6 (0.2)	8 (0.4)	14 (0.5)	41
P. typhae	5 (0.2)		4 (0.06)			25 (0.8)	34
A. libanotica	15 (0.7)	15 (0.7)					30

* At sites where traps operated during all seasons.

Spodoptera littoralis Boisduval (Prodenia litura Herrier)

S. littoralis Boisd. is a Holotropic species widely distributed in tropical and subtropical zones, and a well known pest, as it is multivoltine and polyphagous (13, 14). In our region it has been a known pest of cotton and clover since 1884 (2). In Israel, S. littoralis has been known as a potential polyphagous pest for a long time (3).

At present it is a pest of primary importance in Israel, far more than it was up to the early 1950s. This has occurred due to the increase in irrigated area which provided suitable oviposition sites and favoured feeding conditions for longer periods of the year. These extended periods of activity of the pest caused overlapping of generations and inevitably a build up of the population toward the end of the season, especially in years with favourable weather conditions, as happened in 1967.

Fig. 1

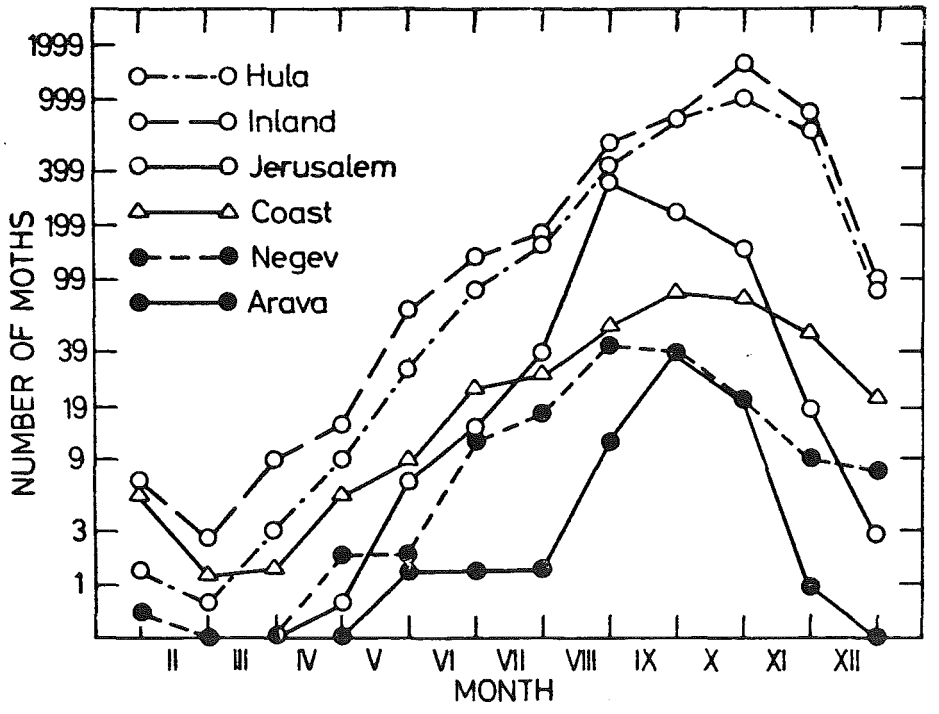

Fig. 1. Number of S. littoralis moths caught in light traps in various regions of Israel. (Averages per 10 nights for each month).

Light trap catches were begun in 1959 and used to follow infestation ever since. S. littoralis populations were low in the desert, as shown in Table 1 and Fig. 1, confirming Wiltshire's statement that in the desert this species is a stray (15). The highest populations were trapped, as expected, in agricultural areas (9), where individuals could be trapped all year round; in the desert and in Jerusalem, very few were present before April-May.

Populations were not uniform throughout the years. Some years very high numbers were trapped, as shown in Table 2 and Fig. 2, while in other years they were low. The high adult populations trapped in agricultural areas coincided with high larval infestations especially marked in 1967 (9); this points to the local origin of the population.

Table 2. Number of S. littoralis moths caught annually at four sites in 1960-1970 (averages per 100 nights)

Year / Site	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Jerusalem	1072	24	24	410	49	63	626	2684	694	90	-
Dor	219	92	168	223	80	154	177	970	178	139	77
'En Harod					1555	2009	6274	13131	717	1096	924
Huliot	3840	-	-	7603	3329	3248	10895	2438	701	759	737

Individual moths were present throughout the year, but populations started to build up with the onset of warm weather in May-June, reaching a peak in October (9). In November, populations were still high, but starting to drop. The lowest point was reached in February, and afterwards the numbers trapped began to increase.

Fig. 2.

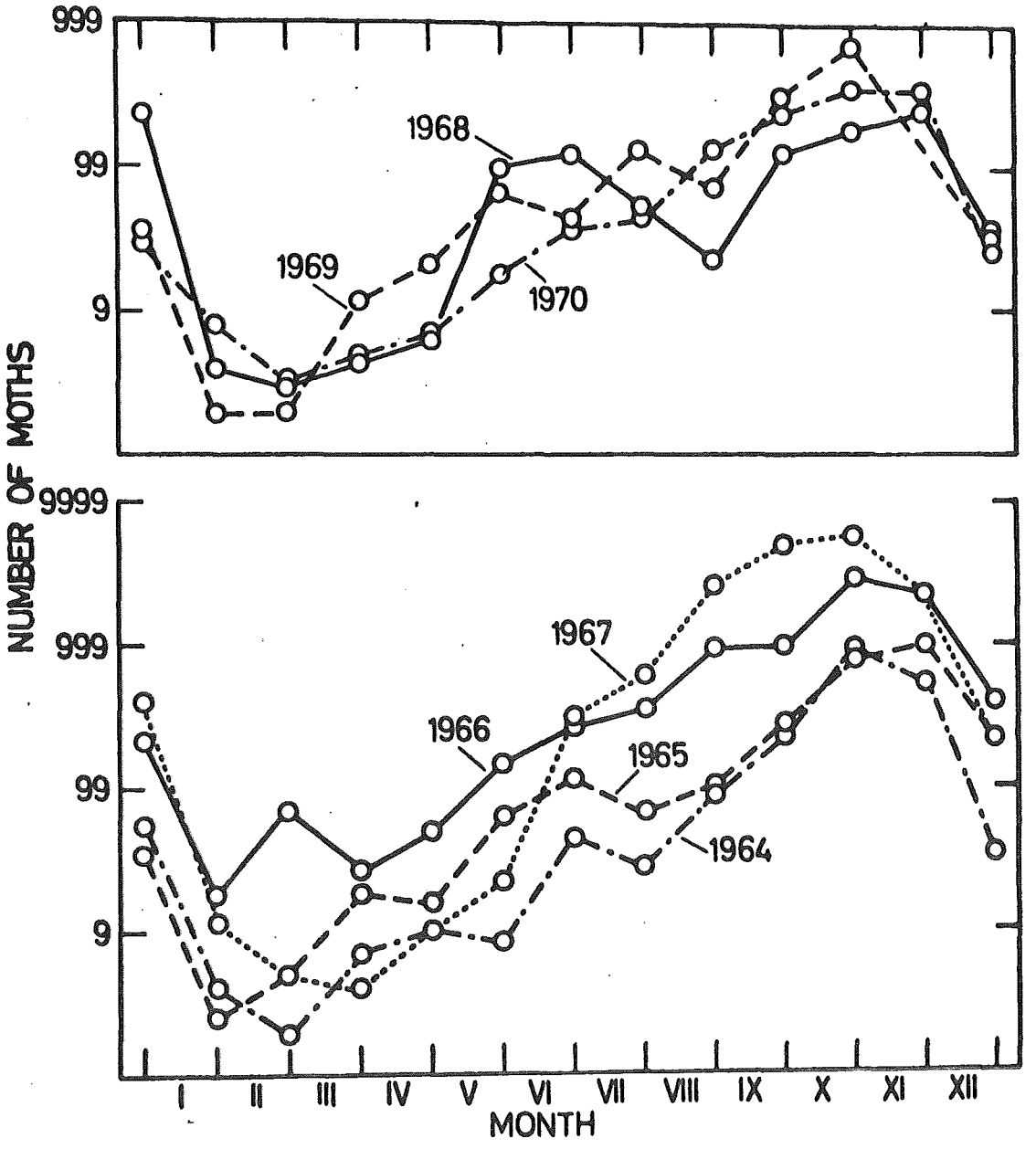

Fig. 2. Number of S. littoralis moths caught in a light trap in 'En Harod. (Averages per 10 nights for each month).

Spodoptera exigua Huebner

S. exigua Hb. is a widely distributed Paleotropical insect (10). It has been definitely established as a migratory species (11), present in Arabia (14) and in Egypt all year round (8, 13). In Iraq it inhabits both the plain and the mountains and according to Wiltshire (15) it appears in very high mountains in midsummer, while in winter it is on th wing and breeding in the southern desert near Kuwait and along the shores of the Persian Gulf.

In Israel, S. exigua is a well-known polyphagous pest (3) causing very much damage in some years and only slight damage in others. This may be explained as due to the migratory habit of the insect: in some years the flight period of moths coincides with favourable local ecological conditions.

Fig. 3

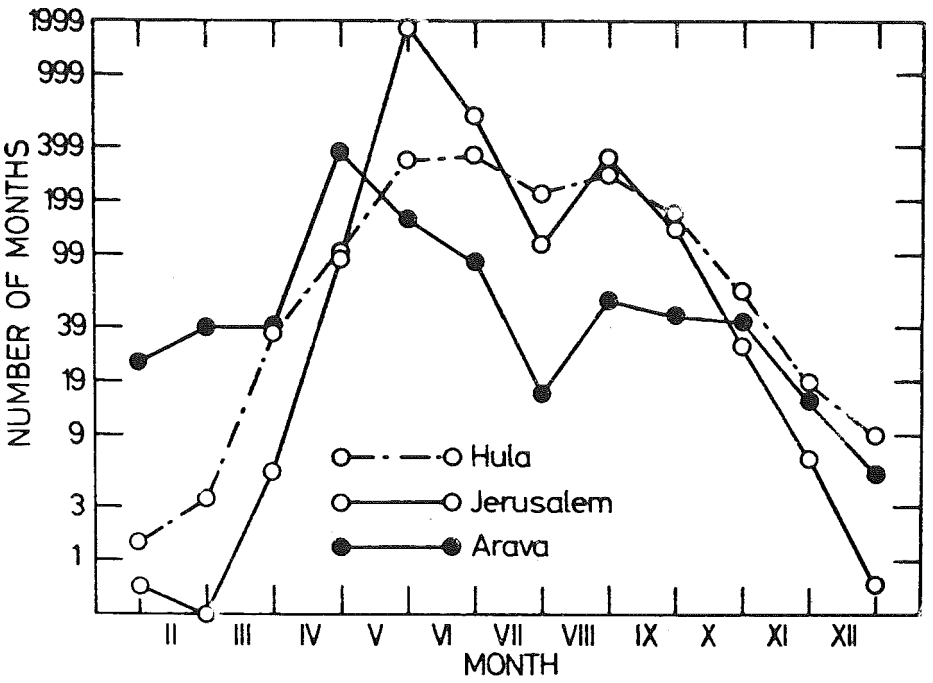

Fig. 3. Number of S. exigua moths trapped in three regions of Israel in light traps. (Averages per 10 nights for each month).

The numbers of moths trapped varied from site to site, as shown in Table 1 and Fig. 3, and at individual sites, populations varied greatly from year to year, as shown in Table 3 and Fig. 4. Within years, too, fluctuatuions were abrupt and steep, as shown in Fig. 4, especially for 1968.

Table 3. Number of S. exigua moths caught annually at five sites in 1960-1970 (averages per 100 nights).

Year / Site	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Elat	394	311	156	218	317	48	130	555	1958	389	-
Jerusalem	2290	361	174	623	1920	251	733	5881	13501	2762	-
Dor	88	88	28	60	114	57	22	133	1388	160	8
'En Harod					1833	1303	1906	697	1720	775	172
Huliot	746	-	-	1959	3628	2231	1104	1098	2182	1566	530

In agricultural areas the fluctuations were not so steep as at sites which are known to attract migrating swarms. Thus in Jerusalem the highest numbers, no doubt of migratory origin, were always trapped in the spring, while in the valleys - which provide large areas of food plants- the population seemed to be more uniform throughout the season and in years of low population, like 1970, there was even a build up toward the end of the season.

Fig. 4.

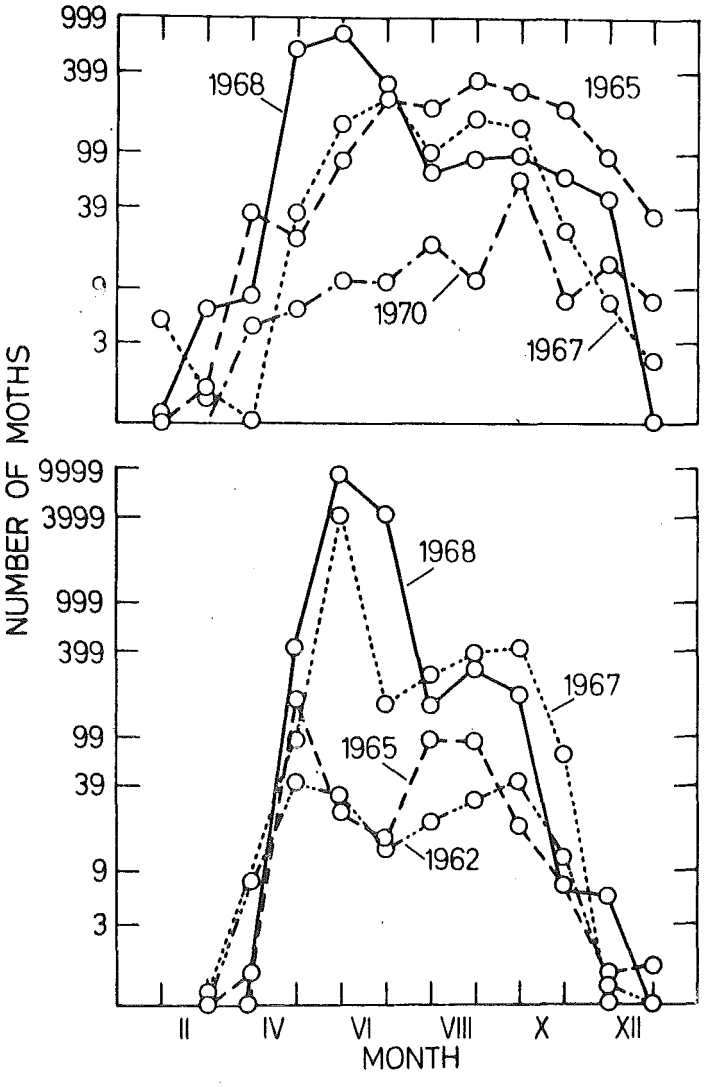

Fig. 4. Number of S. exigua moths caught in light traps in Jerusalem and 'En Harod; below Jerusalem, above 'En Harod. (Averages per 10 nights for each month).

Sesamia cretica Lederer

S. cretica Led. is a widely distributed insect of the Mediterranean region, (10. 11). It is a notorious pest of sorghum and maize, and other summer graminaceous crops.

In the present study it was trapped at 11 sites, but in different numbers. In the southern arid area the numbers trapped were very low,

Fig. 5.

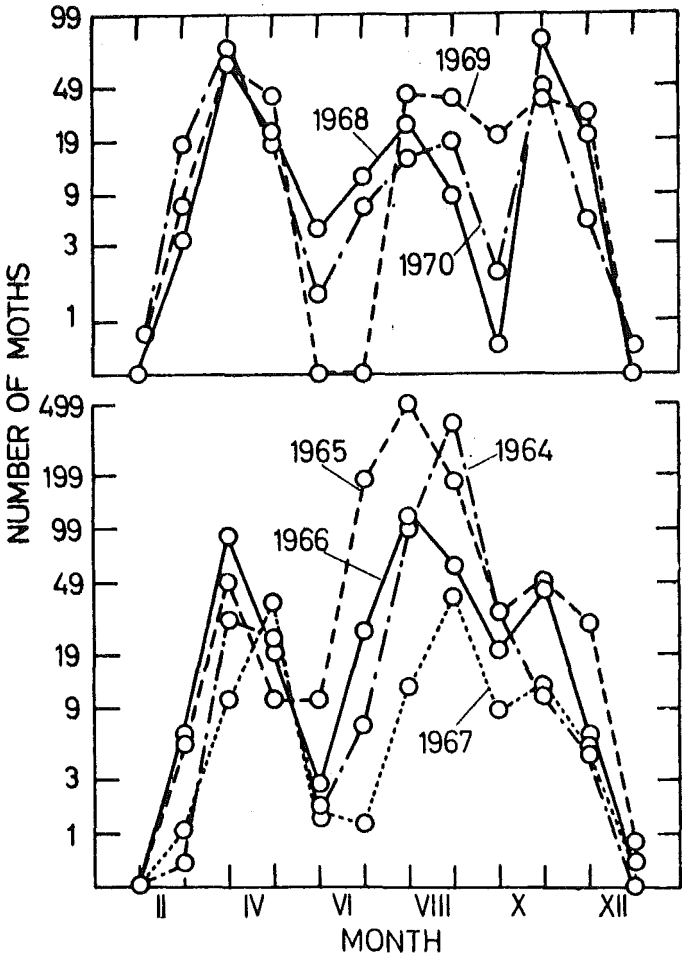

Fig. 5. Number of S. cretica moths caught in a light trap in 'En Harod. (Averages per 10 nights for each month).

which was also the case in non-agricultural areas up north. On the other hand, in agricultural areas the populations were highest, although much smaller than those of the polyphagous pests (Table 1).

The population was not uniform throughout the years; it was high in some years (1965), and five times lower in another (1967).

The insect is active, mainly during the summer, but adults may be found on the wing throughout the year. There are very few found during the winter, and almost none during December-January. The numbers trapped begin to rise in February, reaching a peak in March-April, with a marked drop in May, as seen in Fig. 5. In June the adult population started to rise again, reaching its annual peak in July-August. An additional peak usually appeared in October. Thus there are three peaks of adult population annually; if local ecological conditions caused a delay in emergence of the overwintering generation, this delay was also felt in the subsequent population peaks.

Hoplodrina ambigua Schiffermiller

H. ambigua Schiff. is of Mediterranean origin with an Euriental distribution, inhabiting intermediate altitudes in Iraq (15). It was recorded previously in this country (1, 4) and was trapped in this study in all areas except the most southern eremic desert; it was most prevalent in the northern humid parts of the country (Table 1).

There were fluctuations between the annual populations at each site, but they did not seem to indicate migrations from remote areas.

The insect is distinctly bivoltine, being on the wing during April-May and again in October-November (Fig. 6). Both of these flight periods are a month earlier than in Iraq (14). The spring population was much higher than the autumn one, at all sites.

Fig. 6

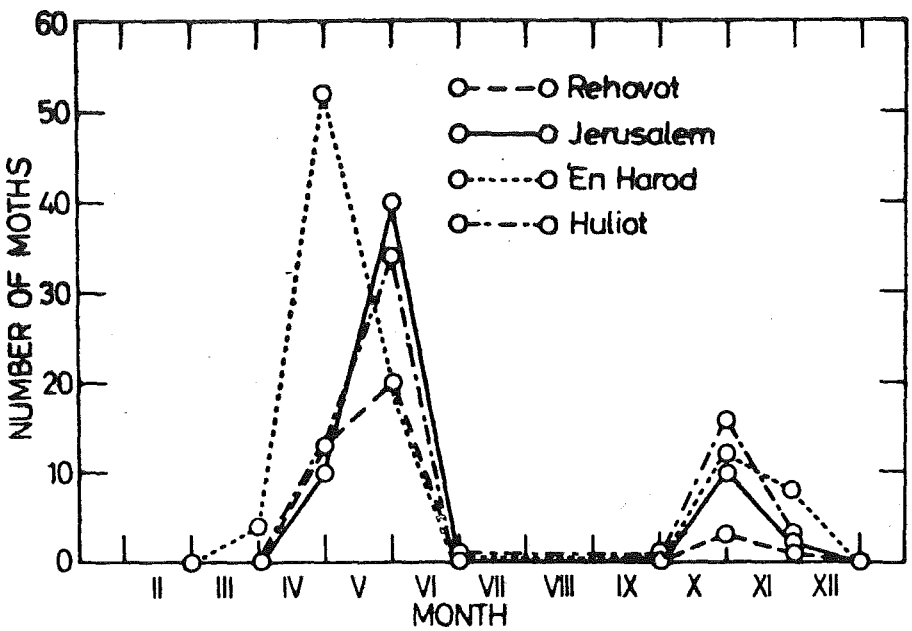

Fig. 6. Number of H. ambigua moths caught in light traps in four sites in Israel. (Averages per 10 nights for each month).

H. ambigua is considered polyphagous, but as its populations were relatively low and as the spring population was much larger than the autumn one, it must be assumed that it breeds on wild plants, which are prevalent in winter and early spring.

Caradrina atriluna Guennee

G. atriluna Guen. is an African species which is widely distributed

(10). The Mediterranean type originates in Egypt, where it is found all year round in the neighbourhood of Cairo and Alexandria (13).

In the present study it was trapped all over the country; the highest numbers were caught in Jerusalem and only a few in the sourthern desert (Table 1).

Populations trapped at different sites showed different patterns; in Jerusalem there were great fluctuations from year to year, but in 'En Harod and Huliot the populations were more uniform (Table 4). In Huliot, moths could be found on the wing all year rond, with higher numbers in spring; at 'En Harod two peaks in the adult populations were observed, whereas in Jerusalem, where the highest population was present, only one distinct peak was observed during March-April (Fig. 7). Most of the moths trapped in Jerusalem occurred on a single night or on a succession of nights, whereas at the other two sites the moths trapped were spread more over the season. The only explanation for this phenomenon would be that in the valleys, populations breed locally and reach the trap through individual search flights; the Jerusalem trap must have caught individuals from a migratory swarm which passed by.

Table 4. Number of C. atriluna moths caught annually at three sites

Year / Site	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Jerusalem	24	111	107	11	38	119	145	24	279	150	-
'En Harod					44	82	89	86	97	153	99
Huliot				23	18	38	31	28	5	2	-

Fig. 7

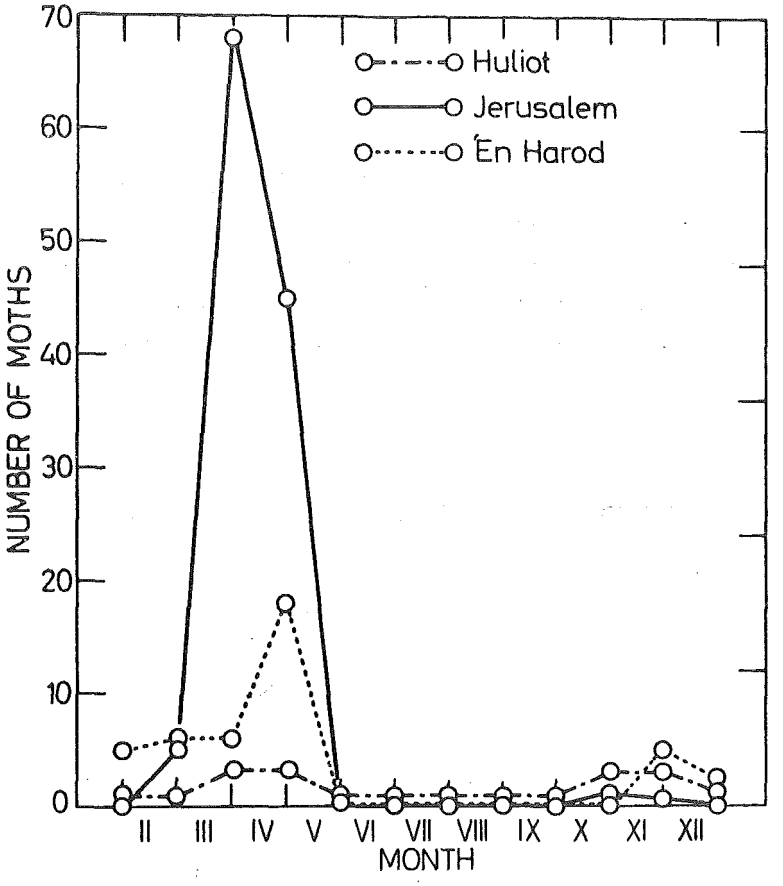

Fig. 7. Number of A. atriluna moths caught in light traps in three sites in Israel. (Averages per 10 nights for each month).

Spodoptera cilium Guenne

S. cilium Guen. is an African species distributed all over Africa and Asia Minor (6, 9). It was trapped in all parts of this country (Table 1), but numbers varied greatly from one site to the other and presented very

different patterns. The numbers trapped in the Northern Valleys were the highest and quite uniform from year to year at each site, suggesting a steady local population which presented a very typical annual cycle (Fig. 8). The moth was absent during winter, and reappeared in April, reaching a small peak in May. The numbers caught dropped during June-July, increased in August, and reached the annual peak in September-October.

In all other parts of the country, a total of 181 S. cilium moths were trapped (Table 1), of which 33 were trapped in spring and 148 in autumn. All catches except those in the Inland Valleys were low and sporadic, not indicative of a local permanent population or of a migrant species, but rather of stray individuals dispersing from their breeding sites.

Fig. 8

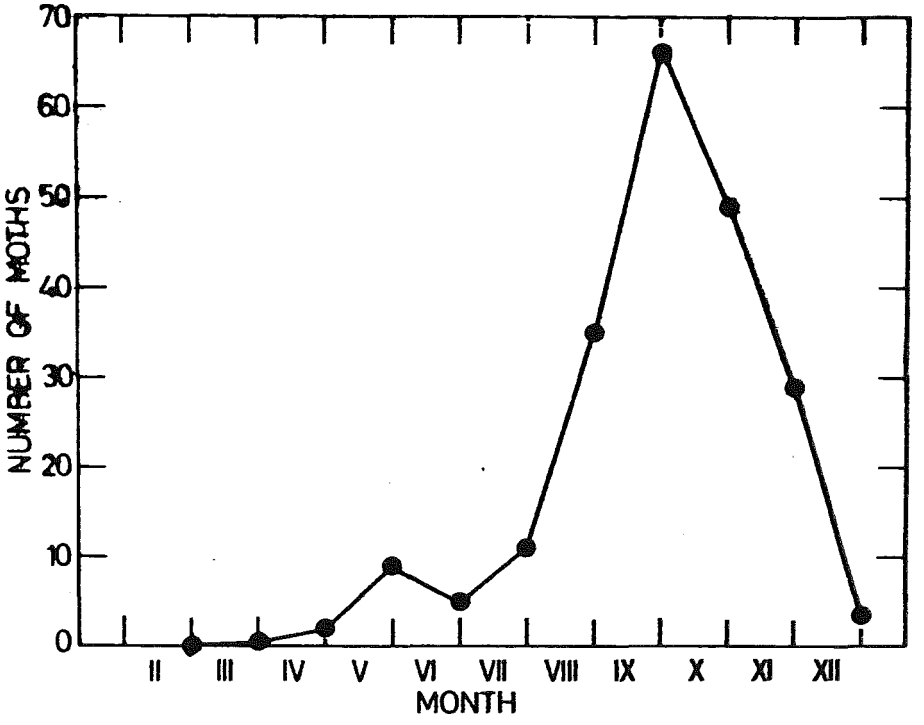

Fig. 8. Number of S. cilium moths caught in a light trap in Huliot. (Averages per 10 nights for each month).

S. cilium is a known lawn pest in South Africa (5), feeding on grasses and perhaps cereals as well (15). This would explain its prevalence in the Inland Valleys with their extensive lawn areas; it probably rears two generations annually in those areas, whereas the moths trapped in the other parts of the country are probably stray individuals, mostly heading southward in the autumn.

Apopestes (Protonestra) silenides Staudinger

A. silenides Stgr. is of Anatolian-Iranian origin with a Saharo-Sindian

Fig. 9

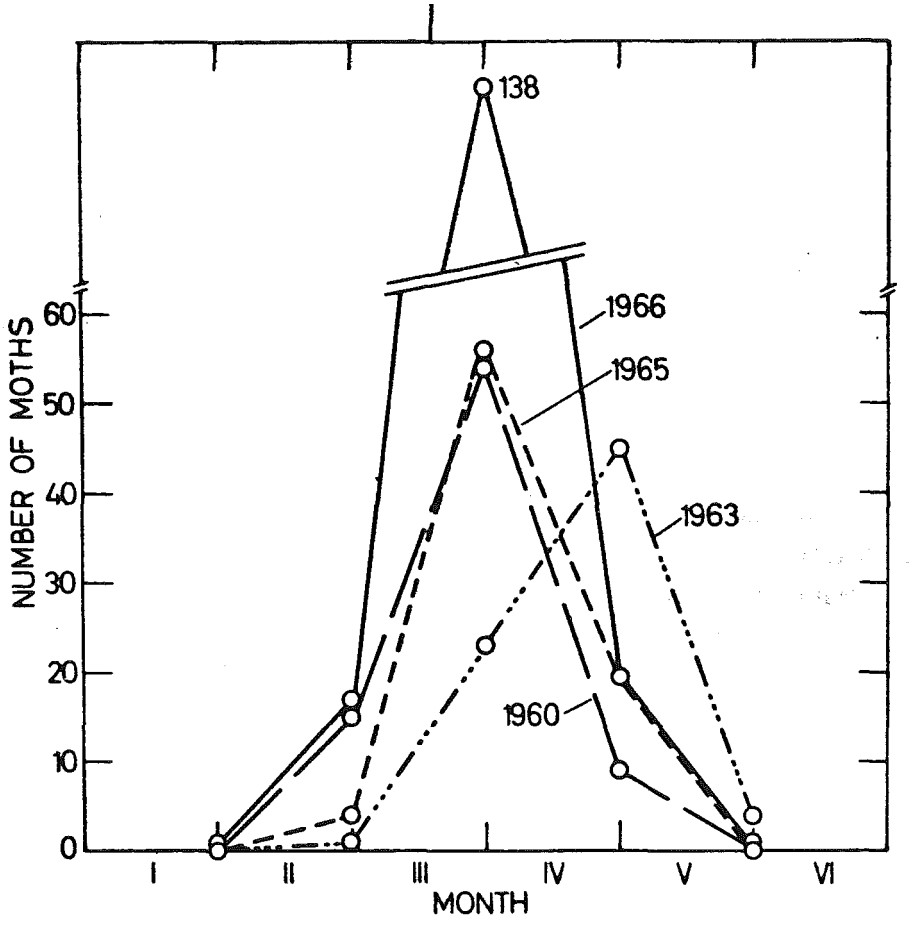

Fig. 9. Number of A. silenides moths caught in a light trap in Jerusalem. (Averages per 10 nights for each month).

eremic range; it is widespread in the desert and was recorded in Arabia and Iraq (14, 15).

Populations of A. silenides caught in light traps were low, and fluctuated in various parts of the country. The highest numbers were trapped in Jerusalem, followed by the Negev - which displays eremic features; in the desert proper, the Arava, the moth was not trapped (Table 1).

Moths were on the wing from February to May, and only very rarely were a few individuals trapped in January (Fig. 9). The flight period in Israel corresponds to that in Iraq (15).

Oria (Tapinostola) musculosa Huebner

O. musculosa Hb. is an Anatolian-Iranian species of limited distribution. It has been reported as a serious pest of cereal crops in southern Russia, when primitive agricultural methods are followed (7). In our part of the world, O. musculosa has been reported to be sacrce in Iraq, inhabiting the plain and perhaps the intermediate altitudes in the mountain areas (15).

In Israel O. musculosa was trapped in the areas displaying Mediterranean components; the highest population was trapped in the hilly area of Jerusalem, followed by the Inland Valleys and the Coastal Plain (Fig. 10). The lowest population was trapped in the Hula Valley, and practically none were caught in the eremic desert, the Arava or the Negev (Table 1).

O. musculosa is definitely univoltine, being on the wing for a short period. In the valleys flight occurred during April-May and in Jerusalem during May-June, the delay probably due to climatic differences, which influence populations breeding locally (Fig. 10).

Populations were not unifrom throughout the years. In 1965 and 1966 the population reached a peak in the Coastal Plain and the Inland Va-

lleys, whereas in Jerusalem the highest populations occurred in 1964 and 1965.

Fig. 10

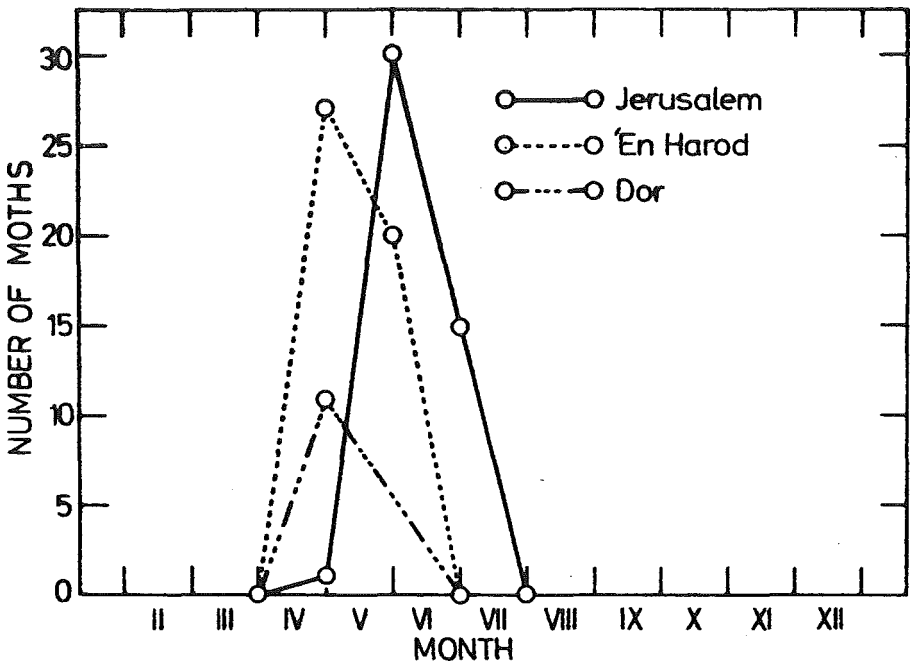

Fig. 10. Number of O. musculosa moths caught in light traps in three sites in Israel. (Averages per 10 nights for each month).

Caradrina bodenheimeri Draudt

C. bodenheimeri is an eremic species found in desert foothills and at intermediate altitudes in the mountains of Iraq (15). Its populations in Israel were low and concentrated in the southern part of the country. Over 90% was trapped in the Arava and Negev, about 8% in Jerusalem, and

only a few individuals at other sites.

At sites where moths were prevalent they occurred every year, but populations fluctuated from 22 to 121 annually at Sede Boqer, and from 15 to 57 annually at Elat. In Jerusalem there were years when none were trapped.

The moth was on the wing during October-November and disappeared in December. In January, moths began to appear and the population increased, reaching a peak in February-March and dropping during April; from May through September no moths were trapped. Thus there appear to be two flushes, one in autumn and one in spring. The autumn flight may be absent, as happened in 1964 at Elat (Fig. 11).

Fig. 11

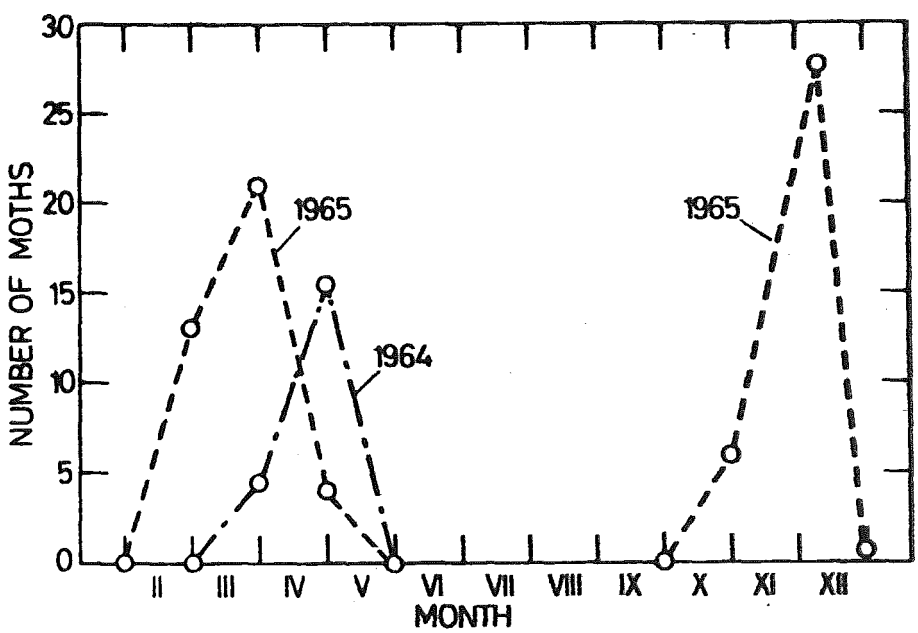

Fig. 11. Number of C. bodenheimeri moths caught in a light trap in Elat. (Averages per 10 nights for each month).

Populations fluctuated from year to year by 200-300%. There seems to be an indication of a migratory nature of the species: the moths appeared in sudden flushes on certain nights or concentrated in a short flight period and then disappeared.

Tathorhyncus exsiccatus Lederer

T. exsiccatus Led. is a paleotropic species of wide distribution and penetrating the subtropics. It occurs in Egypt (13), Arabia (14) and Iraq (15). However, very little is known about its phenology.

In our study it was trapped at all sites throughout the country, although in some places the numbers were very low. The highest population occurred in the Hula area (Table 1) where the moth was present throughout the year, with the exception of the winter months. Populations showed a build up toward August-September. At sites where populations were low the moths appeared more sporadically, and their appearance did not suggest a migratory nature. At the most it was of a dispersive nature.

Stilbina hypaenides Staudinger

S. hypaenides Stgr. is a Mediterranean species which has already been recorded (1, 4). It is found at intermediate altitudes in Iraq (15).

In the present study the moth did not appear in the eremic sites of the Arava and Negev, and in only very low numbers at the other extreme - the Hula Valley (Table 1).

The moth is distinctly univoltine, being on the wing in October-November.

Hadjina palaestinensis Staudinger

H. palaestinensis Stgr., which is known only from Egypt and Palestine (13), was found almost exclusively in the Hula Valley. It was absent in winter. Populations started to build up in July and reached a peak in October-November, thus displaying the typical pattern of a locally breeding species.

Caradrina melanurina Staudinger

C. melanurina Stgr. is an eremic species (10, 13) known to occur in Palestine and the Eastern Desert of Egypt.

The moth was trapped in the eremic sites of the Arava and Negev (Table 1). Moths were on the wing in October-November, but in 1966 some were trapped in April. It seems to be a univoltine species, aestivating as pupae (13), but some moths probably emerge without diapause in March.

Autophila cerealis Staudinger

A. cerealis Stgr. is an eremic desert and steppe species. It ranges from the Sinai Peninsula to Central Asia and was recorded in Egypt (13), Arabia (14) and Iraq (15).

In the present study it was trapped in the eremic sites - about 80% in the Arava. Its known host, Salvia, is prevalent in the above mentioned areas, which might explain the occurrence of the species in these parts of the country, as well as the occasional occurrence of individuals in other parts of the country.

The population of this moth was not high, and there were fluctuations from year to year - with an exceptionally high population in 1964. The moth was on the wing in the spring months, and only rarely in December, as in 1964. The peak in population occurred in April, with some moths still present in May, after which there were none.

Wiltshire considers the probability of the moth being bivoltine, but there seems to be no indication of this in the present study. The individual records referred to be Wiltshire for Arabia (14) and Egypt (13) fall within the same seasons as ours. It seems more probable that the moth is univoltine with a long emergence or flight period. The sudden appearance of high numbers in 1964 suggests a migrant swarm arriving in the area; in 1964 many migrant species came to Israel from the south during the spring months (16).

Megalodes eximia Freyer

M. eximia Frr. is known to appear in this part of the world on malvaceous flowers (10).

In the present study it was trapped in small numbers. Most of the population occurred in Dor, where it appeared annually, while at other sites its occurrence was very sporadic.

The moth is univoltine, being on the wing in March-April.

Hypeutina fulgurita Lederer

H. fulgurita Led. is of Anatolian-Iranian origin. In Iraq it inhabits the lower altitudes of the mountain area and the desert foothilles (15).

In the present study it did not occur in the eremic parts, and the highest numbers were trapped in Jerusalem, followed by the northern Valleys (Table 1).

As populations were rather low, between year no differences could be established. The moth is univoltine and was on the wing in October-November at all sites. In the Hula Valley some moths appeared in March-April, and a total of 10 moths were caught there in spring, whereas in the autumn 105 were trapped.

Luperina dumerilii Duponchel

L. dumerilii Dup. is of Anatolian-Iranian origin with an Euriental range (15). It was trapped mainly at two sites, Jerusalem and Dor, on the coast; at the other sites very few were found.

The moth was on the wing in October-November. There were years in which it did not occur at all.

Trigonophora (Brotolomia, Phlogophora) meticulosa Linnaeus

T. meticulosa L. is an Euriental species, occurring in Egypt (13) and Iraq (15).

The moth was trapped in small numbers, at all sites except those situated in the most eremic part. Most specimens were caught in the autumn, with only 6 out of the total of 41 being trapped in spring. There was no indication of migratory habits.

Phragmitiphila (Nonagria) typhae Thunberg

P. typhae Thunb. is an Euriental species which feeds on typha and is present in Egypt (13) and Iraq (15). In Israel it appeared at both ends of the country: the eremic Elat and the northern Hula Valley. Most moths were trapped in June, and only a few specimens occurred in April, in Elat, in 1964.

Autophila libanotica

A. libanotica Stgr. was trapped only in the Arava and the most southern site of the Negev. Populations were very low at both sites - only 2-3 individuals annually, and there were years when none occurred. No deduction as to its phenology could be made.

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