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ON THE TAXONOMY AND BIOLOGY OF THE GENUS *MYOPiTES* (DIPTERA: TEPHRITiDAE)

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ABSTRACT

The authorship of *Myopites* Is credited to Blot, not to Breblsson. The typfe-specles of the genus Is *M. inulaedyssenterleae* Blot not *blotii* Breblsson. These nomenclatural corrections do not alter the concepts of the taxa Involved. Adults, third Instar larvae and puparla of *Myopites apicata* n.sp, are described from Israel (para- types also from Greece and Italy). This Species causes the formation of flower-head galls on *Puiicarla dySert- terica* (L.) Bernh. (Composltae). only slight differences were found between the third Instar larva and puparlum of the new species and those of other *Myopites* species occurring In Israel, namely, *M. cypriaca* Herlng, *M.'styfata* (Fabrlclus) and *M. variofasciata* Becker. The galls of the four species are described and figured, and the phenology of the species Is discussed. *M. shiakidesi* Dlrlbek Is established as a junior synonym of *M. cypriaca* Herlng.

INTRODUCTION

Authorship of the genus *Myopites* has been credited to Breblsson since its description (i.e. Seguy, 1934; Dirlbek, 1973), with *M. blotii* as its type-species (Hendel, 1927). In course of studies on the taxonomy and biology of some Israeli species of *Myopites* - presented here - attention was drawn by Dr. R.H.
Foote (Systematic Entomology Laboratory, USDA, Washington, D.C.) to the fact that the common usage of Myopites, as mentioned above, has become erroneously established in the nomenclature of Diptera. The pertinent facts and corrections are discussed and introduced here. In addition a new species of *Myopites* is described and information on the morphology and biology of larvae of the four known Israeli species of this genus is supplied.

A. The correct author and type-species of *Myopites*.

Myopites was erected by Blot (1827: 102) for the species *M. inulaedyssentericae* (idem, p. 103) which became the type-species by monotypy. In the same paper, Brébisson stated his opinion (in a footnote) that the species should be named after Blot. Blot followed Brébisson's opinion only to the extent of presenting the name proposed by Brébisson after his own binomen, enclosed within parentheses and printed in the following form:

M. DE L'AUNÉE DYSSENTERIQUE, M. INULAE DYSSENTERICAE.
Blot. (*M. blotii* de Brébisson) (1)

[As with the generic name, a vernacular name (the part of the quotation before the comma) preceded the Latin name; the (1) indicates the footnote.]

According to Article 26(a) of the International Code of Zoological Nomenclature, the name *inulae dyssentericae* is an acceptable compound name, being based on a single entity, the host-plant. The component words of such names are to be united, without a hyphen (in the present case, to form *inulaedyssentericae*). Since the name *M. blotii* Brébisson has been commonly used during the last two centuries (Hendel, 1927; Séguy, 1934; Dirlbek, 1973), it is to be treated as an available name and considered a junior synonym of *M. inulaedyssentericae* [Article 11(d)].

Following Blot's article, Brébisson published a report (1828) "approving" the erection of *Myopites* as a new genus. *Myopites* of Blot, however, satisfies the provision of the International Code, and there is no reason to credit this genus to Brébisson, as credited erroneously by various authors (see above).

B. Taxonomical and biological information on species of *Myopites*.

Hendel (1927) revised *Myopites* and included 6 species. Dirlbek (1973) provided a key for the identification of the Palaearctic species, including 14 species. Bodenheimer (1937) recorded *M. olivieri* Kieffer from Israel. This name, however, is a junior synonym of *M. inulaedyssentericae*, a species not recorded from Israel. Kugler and Freidberg (1975) recorded 3 species of *Myopites* from Israel: *M. cypriaca*, *M. stylata* and *M. variofasciata*. At that time the existence of *M. apicata* n.sp. (described here) was overlooked mainly because of its similarity to *M. stylata*. The misidentification was discovered after studies of the ovipositor were made.

Fruit-flies of the genus *Myopites* are characterized by the following combination of character states: small flies, from 2 to 6 mm in length; head usually longer than high; proboscis geniculate, very long and slender, both haustellum and labella somewhat longer than length of head; a single upper orbital seta and a pair of lower orbital setae present on each side of frons (Fig.1): scutellum with four equally long setae; wing characters almost invariable: last section of fourth longitudinal vein converging with third vein, terminating before apex of wing, only rarely almost parallel with third vein, terminating at wing apex; anal cross-vein straight or convex; wing pattern includes transverse bands and spots arranged in five levels (Fig. 2): 1. level of basal cross-veins, 2. level of stigma and anterior cross-vein, 3. level slightly beyond stigma, 4. level of posterior cross-vein, 5. level of apex of submarginal and first posterior cells; in addition the base of the wing often more or less blackened; the structure of the aedeagus is both unique for the genus and very uniform among the species (Fig. 3).

Outside the Palaearctic Region the genus *Myopites* is known from a single Ethiopian species, *M. delottoi* Munro, 1955. This species is remarkable for the absence of most spots from the wings (only stigma and a spot on humeral cross-vein are brownish) and for the extremely elongate proboscis, the haustellum and labella of which are twice the length of the lower border of the head. Beside these peculiarities (genitalia have not been checked) the species is typical for *Myopites*. *Urophora hemixantha* Munro, 1931 from South Africa has the head and eye higher than is normal for *Myopites*, and the fourth longitudinal vein terminates at the wing apex. However, the last section of fourth vein and third vein are converging, and the proboscis is long and geniculate, more similar to that of *Myopites* than to the shorter, long-spatulate proboscis of *Urophora*. Moreover, the wing pattern fits the scheme described above for *Myopites* and not the scheme of four transverse bands, typical for *Urophora*. On the whole, the species seems to belong to *Myopites*, a possibility already mentioned by Munro (1931). As with the previous species, the study of the male genitalia may assist in the correct placement of this species.

The morphology and biology of the larvae of *Myopites* are also distinctive. Third-instar larvae of *Myopites* are remarkable for having only two lobes or papillae on each of the anterior stigmata and only two openings in each of the posterior stigmata. As far as is known these are the smallest numbers recorded for any tephritid larva. The cephalopharyngeal skeleton and the stigmata are very similar in the species. However, it seems that slight differences exist in the oral hooks of the cephalopharyngeal skeleton, hence these were illustrated for the four species studied here.

All known larvae develop in flower heads of plants from the tribe Inuleae of the Compositae where they cause the formation of galls. The galls consist of the greatly swollen receptacle of the inflorescence, which becomes spherical or conical, and of those achenes through which the larvae penetrate into the receptacle, and through which the adults later emerge. These modified achenes are much enlarged, hollow and sometimes lignified. One to about 40 larvae of *Myopites* can develop in one flower head, but the average number differs among the species and even varies within the same species between different localities. Each larva develops in a separate tunnel or cell. A few examples of such galls were illustrated by Séguy (1934). When the gall is in an advanced stage of its development, a few or several thin, fluffy membranes of unknown origin are formed near the base of the achenes as additional partitions between the larvae and the outside. Sometimes a harder partition is produced and forms a discrete disc. The tunnel, where the larva is found, is usually vertical and may be 4 or more times as long as a fully grown larva. The hard gall and the various partitions do not prevent parasitism, and a large assortment of parasitic Hymenoperta have been reared from the galls.

Hendel (1927) states that the larvae hibernate in the galls and pupate in the following spring. According to Séguy (1934), *M. blotii* Brébisson (= *M. inulaedyssentericae* Blot) and *M. longirostris* Loew in Europe have one or two generations per year. Adults of the first generation emerge in April-May, and those of the second generation - in September. The variability in the phenology is even greater in the species in Israel as is demonstrated in this paper.

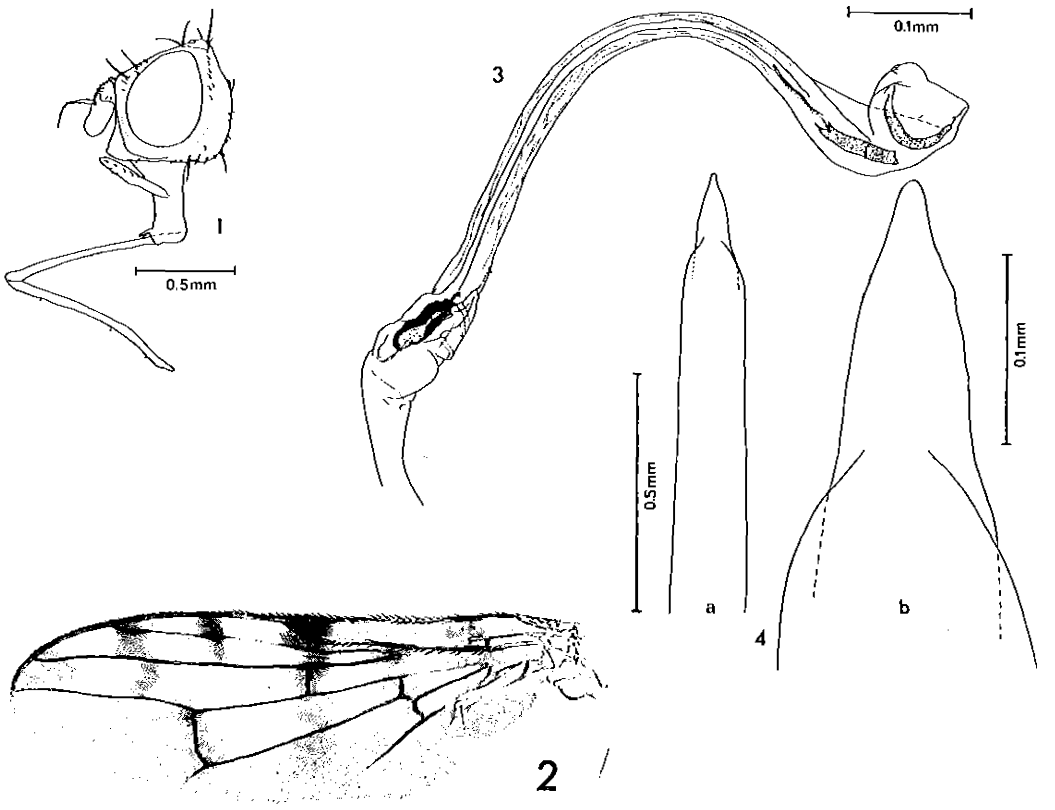
MYOPITES SPECIES OF ISRAEL

Myopites apicata n.sp. Figs. 1-8.

Male: length of body: 2.0-2.6 mm, of wing: 2.1-2.6 mm.

Female: length of body: 3.3-4.0 mm, of wing: 2.6-2.9 mm, of oviscape: dorsal side: 0.8-1.1 mm, ventral side: 1.0-1.3 mm.

Head (Fig.1): mainly yellow, parafacial, gena and proximal part of palp white; ocellar spot black; occiput mainly black, with broad yellow margins, or the black restricted to 2-3 spots above the occipital foramen; arista dark brown. Head without pollinosity, subshining, only occiput sparsely golden pollinose. Setae and pubescence dark brown or black, whitish on the lower occiput and gena.



Figs. 1-4. *Myopites apicata* n.sp. 1 - head in profile. 2 - wing. 3 - male, aedeagus. 4 - female, aculeus; a, entire, b, apex.

Head length-height-width ratio: 8.7:8.1:10.0. Frons 2.7 times as wide as an eye. Parafacial ½-2/3, gena 2/3-1 times as wide as antenna.

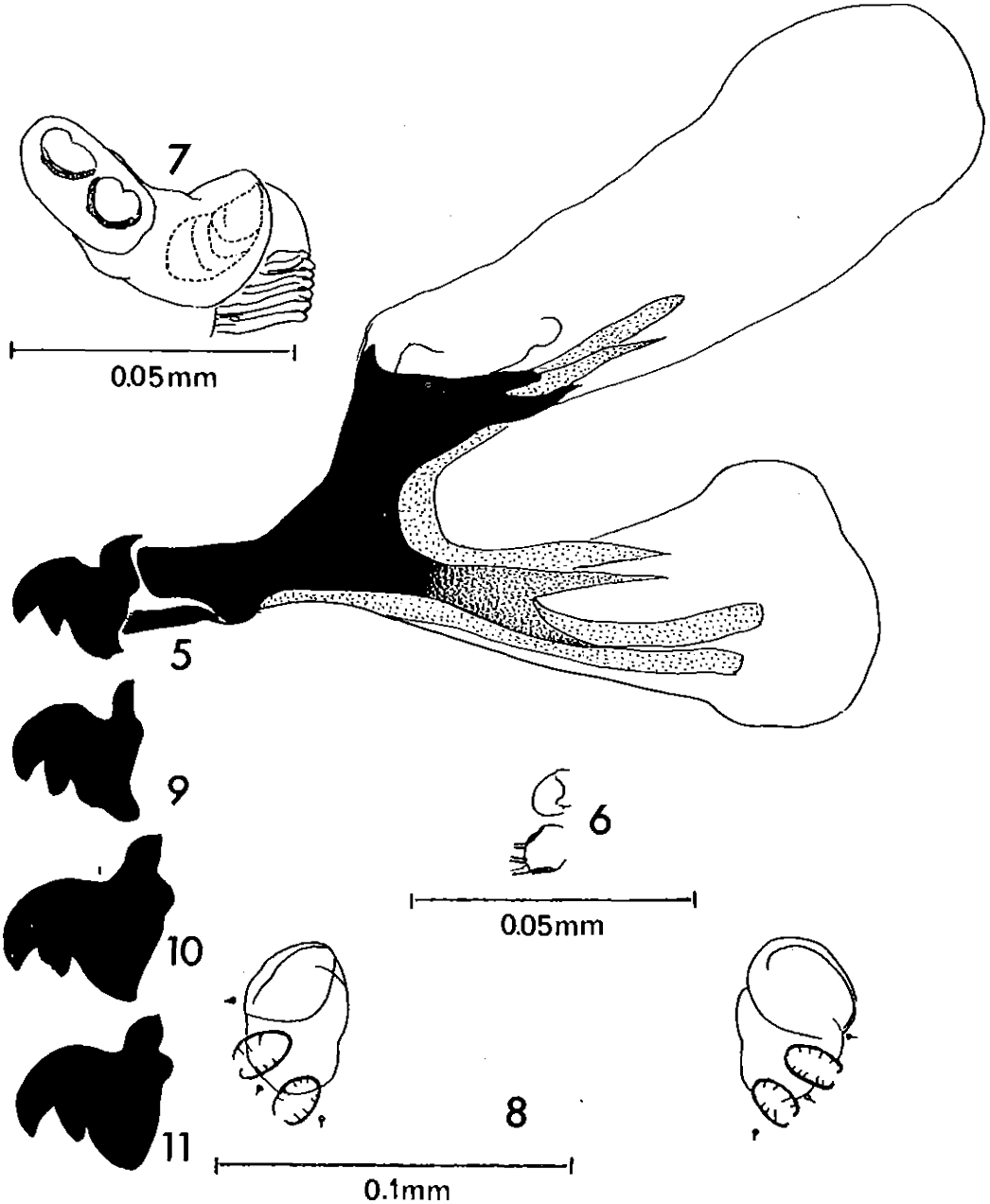
Thorax: Ground color of mesonotum and postnotum black, of all other parts yellow. All except the center of mediotergite covered with dense golden-yellow pollinosity, but the scutellum only very slightly pollinose. Mesonotum with rather sparse pubescence , aside from the hairs near the lateral margins, with a row of dorsocentral hairs on each side, two median rows and several hairs scattered between the median and dorsocentral rows, but the hairs of the median area of mesonotum sometimes irregular. Dorsocentral setae behind line of anterior supra-alars. Squamae whitish yellow, with brownish margins; halter yellow or brownish-yellow.

Legs: yellow, last 1-3 tarsal segments dark brown to black. Pubescence and setae on thorax and legs dark brown or black, pubescence on propleuron and anterior coxa whitish.

Wings (Fig. 2): elongate, length-width ratio 3:1. Veins brown, orange-yellow at base of wing. Last section of fourth longitudinal vein along its distal 2/3 almost parallel with third vein, ending on, or just slightly before, apex of wing; last section of costa as long, or longer than, anterior cross-vein. The brown spots narrower than the hyaline gaps between them. A grayish spot on humeral cross-vein; basal band represented only by small spots on the veins; second band complete or interrupted; reaching the middle of third posterior cell, or terminating in an isolated spot on fifth longitudinal vein.

Abdomen: mainly yellow; a pair of black spots on each of tergites 3-6 in the females; smaller spots or none at all on tergites 3-5 in the males; pleural membrane along the tergites black. Pubescence and setae black, rather short and sparse. Tergite 5 in males wider at base than long. Aedeagus (Fig. 3) typical for the genus, very much elongate, with sclerotization restricted to both ends. Oviscape shining yellow, basal third dorsally and apical third black; occasionally the black areas wider, especially on the dorsal side; dorsal side somewhat longer than combined length of last 4 tergites. Aculeus as in Fig. 4.

MATERIAL EXAMINED: Holotype, male, allotype, female, paratypes, 11 ♂♂, 4 ♀♀, ISRAEL, Hadera, 14.X.1972, sweeping *Pulicaria dysenterica*. Additional paratypes: Israel: Hadera, 9.X.1976 (9 ♂♂, 11 ♀♀); Tel Aviv, III-V.1977, 30 ♂♂, 20 ♀♀ emerged from flower head galls on *Pulicaria dysenterica*, collected in VIII. 1976; Tel Aviv, from galls collected on 20.IX.1977, 1 ♂ emerged on 21.IX.1977, and 1 ♀ on 22.IX.1977; Tel Aviv, 20.X.1971 (1 ♂), 16.IX.1977 (6 ♂♂, 4 ♀♀); Damiya, 25.X.1969 (3 ♂♂); Yoqne'am, 1.VIII.1970 (1 ♂); Ma'ayan Harod, 15.X.1978 (1 ♂); Elabone, 28.X.1969 (1 ♂); Betecha, 11.VIII.1970 (2 ♂♂); Hula, 31.VIII.1970 (1 ♂); Yesod Ha'Ma'ala, 20.IX.1969 (1 ♀); Akko, 22.VII.1970 (1 ♀); Nahal Gush Halav, 16.IX.1978 (2 ♂♂); Tanur, 26.VI.1974 (1 ♂); Tel Dan 18.X.1969 (1 ♂); Baniass, 2.VIII.1978 (1 ♂); Majdel Chams, 1.X.1975 (1 ♂); all the specimens, except those from Nahal Gush Halav and Tanur, which were collected by Mrs. F. Kaplan, were reared or collected by the author. GREECE, Crete, Agia, 5.VII.1978, ex. *Pulicaria* in water P. Neuenschwander (1 ♂, 1 ♀). ITALY, Susa, Piemonte, VIII. 1905, Bezzi (1 ♂, 1 ♀). The holotype, allotype and most paratypes will be deposited in the entomological collection of the Department of Zoology, Tel Aviv University. Paratypes will be deposited in the British Museum (Natural History), London; National Museum of Natural



Figs. 5-11. *Myopites* spp. 5-8. *Myopites apicata* n. sp. 5 - larva, cephalopharyngeal skeleton. 6 - larva, anterior sensory organs. 7 - larva, anterior stigma. 8 - larva, posterior stigma. 9 - *Myopites cypriaca* Hering, larva, oral hooks. 10 - *Myopites stylata* (Fabricius), larva, oral hooks. 11 - *Myopites variofasciata* Becker, larva oral hooks.

History, Washington, D.C.; Naturhistorisches Museum Wien; Museum National d'Histoire Naturelle, Paris; Institute for Plant Production, Praha; Plant Protection Research Institute, Pretoria; Museum civico Storia Naturale, Milano; P. Neuenschwander collection.

Myopites apicata n.sp. differs from other *Myopites* species in the orientation of the last section of fourth longitudinal vein in the wing, the distal 2/3 of which is parallel or almost parallel to third vein, terminating in the wing apex, or very slightly before. This is occasionally the case in *M. inulaedyssentericae*, but the latter is a larger species, with mainly black pleura and pleural membrane and completely black oviscape, which is longer than the preabdomen; in addition, the spots on the wing of the latter species are usually wider than the hyaline gaps. *M. apicata* is similar to *M. tenella* Frauenfeld, but differs from the latter, in addition to the above mentioned character of the wing venation, by having golden rather than yellowish-brown pollinosity on the mesonotum, by the fifth abdominal tergite in the male, which is wider at base than long, not longer than wide and by the oviscape, which is partly yellow, not entirely black. *M. apicata* resembles *M. stylata* (F.) in color, differing from it in its smaller size and in the narrow bands of the wing, which are narrower than the hyaline gaps between them, not broader. Further, in *M. stylata* the apical spot extends into second posterior cell, crossing fourth vein, whereas in *M. apicata* it does not cross this vein. The aculeus of the female of *M. stylata* is more elongate than that of *M. apicata*, being about 1.5 times as long as the latter.

Fully-developed third instar larvae are yellowish and measure 2.5x1.3 mm (ranges: 2.1-3.0 and 1.2-1.5 respectively: n=27). Their cephalopharyngeal skeleton, sensory organs at anterior end of the body, anterior and posterior stigmata are shown in Figs. 5-8, respectively. The puparium is barely shining, pale honey-yellow, hardly darker at the ends and with more or less well defined segmentation. The surface is not entirely smooth, being provided with numerous minute tubercles. It measures 2.6x1.05 mm (ranges: 2.4-2.9 and 1.0-1.1 respectively; n=7).

The only known host-plant of the species is *Pulicaria dysenterica* (L.) Bernh. (Compositae), which usually grows along the banks of rivers and streams. Adults were collected only in habitats where the host grows, and are present in the field mainly from August to October. This period coincides with the flowering season of the host. Rearing records show that the species has two generations per year, although only part of the second generation emerges as adults in the same year; the other part remains in the

galls as diapausing larvae. Parasitized larvae pupate earlier, before they are killed by their parasites. The emergence in the laboratory during the months March-May was probably due to some unnatural conditions, and it is assumed that diapause in nature is longer and broken just in time for the adults to emerge, when the host blooms. One to 37 larvae per gall were found, the average number differing considerably among the various localities, e.g., 3.1 (range: 1-8; n=23) for a sample collected in Ma'ayan Harod in October 1978, and 13 (range: 2-37; n=65) for a sample collected in Baniass in November 1978.

The galls (Fig. 12a) are usually spherical, and may reach 13-14 mm in diameter. The receptacle is usually swollen considerably above the bracts of the flower head, as well as below them, and the modified achenes are short and loosely attached to the receptacle.

Myopites cypriaca Hering, 1938

Myopites shiakidesi Dirlbek, 1974, n.syn.

The type localities of both *Myopites cypriaca* and *M. shiakidesi* are in Cyprus. Dirlbek (1974, p. 75) based *M. shiakidesi* on differences between the wing pattern of his species and that of *M. cypriaca*, as illustrated by Hering (1938, p. 401, Fig. 14). It appears from the descriptions that an additional difference exists in the color of the thorax, which is mainly yellow in *M. shiakidesi*, and mainly blackish in *M. cypriaca*. I compared paratypes of both species (by courtesy of J. Dirlbek, Central Research Institute for Plant Production, Praha, and B.H. Cogan, British Museum (Nat. Hist.), London), and in my opinion they all belong to a single species, for these reasons: First, Hering's figure is applicable only to some of his paratypes; second, the difference in the color of the thorax between the two groups of paratypes, which is indeed noticeable, does not seem to be of taxonomic importance. In 200 specimens of *M. cypriaca* from Israel, there is a gradual variation in color between two extremities i.e. mainly yellow and mainly black, which correspond to the two groups of paratypes. This color variation seems to be season-dependent, as specimens collected in Israel in April and November (beginning and end of summer) have darker thorax and abdomen than specimens from the middle of the summer. The same explanation apparently applies to the population in Cyprus, since the checked paratypes were collected in April and in August respectively.

The third instar larva and puparium are similar to those of *M. apicata*, except for slight differences in the oral hooks

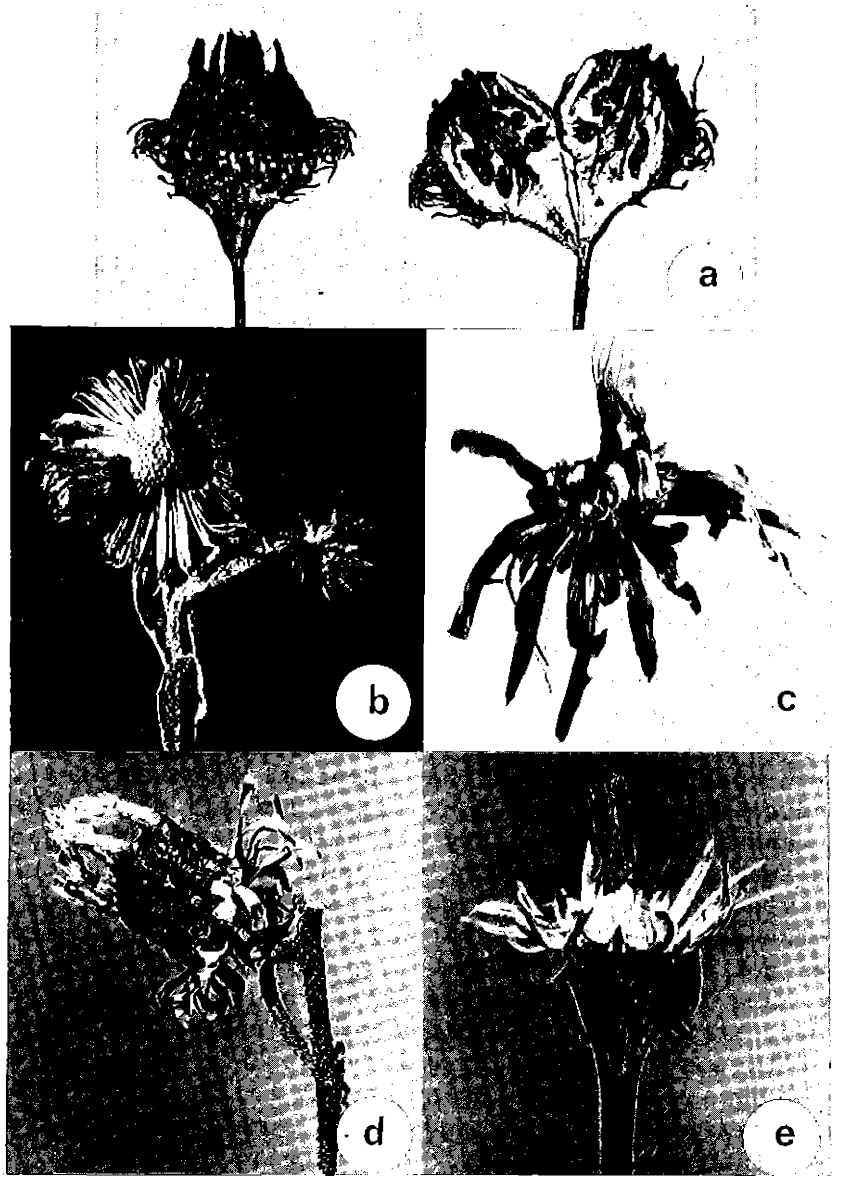


Fig. 12. Galls of *Myopites* spp.: a. of *M. apicata* on *Pulicaria dysenterica* (the gall on the right side was cut open and shows the tunnels and a larva). b. of *M. cypriaca* on *P. arabica*. c. of *M. cypriaca* on *Inula graveolens*. d. of *M. stylata* on *I. viscosa*. e. of *M. variofasciata* on *I. crithmoides*. (a and d x2, b and c x3, e x4).

(Fig. 9) and in the color, which in the larva is whitish and in the puparium is definitely brownish at the anterior 3½ segments, as well as at the caudal end.

The species was bred from *Pulicaria arabica* (L.) Cass. (mentioned also by Dirlbek (1974)) and *Inula graveolens* (L.) Desf.. The first plant usually grows on soils flooded during the winter, and it flowers in Israel from April to September. The latter is a ruderal plant, which flowers from September to December. The species was bred from *P. arabica* in May and July, while galls on *I. graveolens*, which were collected in November, yielded flies in the same month, or only in the following May. These data show that the number of generations in Israel is at least three per year, but it has not yet been established whether the flies hibernate only in *I. graveolens* or also in *P. arabica*.

The galls on the two hosts are similar (Fig. 12b,c). The receptacle is conical under the bracts and mainly flat at the upper surface; only at the places of the modified achenes the receptacle is somewhat raised. The wall of these achenes is fairly thin and fragile. One to three larvae were found in galls on *I. graveolens*, collected in Tel Aviv in November 1978 (Average: 1.5; n=31).

Myopites stylata (Fabricius, 1794)

Another European species of *Myopites* which occurs in Israel. The fully developed larva is yellowish, and measures 2.5x1.35 mm (ranges: 2.3-2.7 and 1.2-1.5 respectively; n=7). The oral hooks are shown in Fig. 10. The puparium is more brownish than that of *M. apicata*, and the segmentation better defined, whereas the roughness of the surface is less distinct. It measures 3.25x1.25 mm (ranges 2.9-3.6 and 1.1-1.4 respectively; n=10).

The host plant, *Inula viscosa* (L.) Ait., is a very common ruderal plant in the northern and central regions of Israel, growing also near streams. It flowers from August to November, the very same months when adults of *M. stylata* are on the wing. This species, however, has only one generation per year, as adults emerge always from galls formed in the previous year.

The galls are usually spherical or cylindrical (Fig. 12d). The receptacle is swollen extensively and only above the whorl of bracts, and the modified achenes are the largest in comparison with those of other studied galls. The average number of larvae per gall

was 3.5 in a sample of 145 galls, collected in Tel Aviv in November 1978 (range: 1-10).

Myopites variofasciata Becker, 1903

The species is known from Egypt and Israel. Efflatoun (1927) described the third instar larva and puparium and added a few comments about the galls formed by it on *Inula crithmoides* L.. Fully developed larvae collected by us were considerably shorter than those described by Efflatoun (about 1 mm on the average). The reason for this discrepancy may be the inflation of Efflatoun's larvae during preservation, whereas our larvae were measured live.

The oral hooks are shown in Fig. 11. Adult specimens were collected in Israel from August to November (a single catch from January), and bred in September and November. Hence, it seems that there are at least two generations each year. The host, *I. crithmoides*, grows at the seashore and on inland saline soils in the Jordan Valley and the Northern Negev. It flowers from May to November. The form of the galls on this plant (Fig. 12e) is intermediate between the form of *Myopites* galls on *Inula graveolens* and those on *Pulicaria dysenterica*. The entire upper surface of the receptacle is usually raised, but not as much as in galls on *P. dysenterica*. The average number of larvae which develop in one gall was 1.7 in a sample of 20 galls collected in Tel Aviv in November 1978 (range: 1-5).

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