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THE MITES ASSOCIATED WITH CITRUS IN ISRAEL

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A B S T R A C T

The history and development of citrus acarology in Israel is reviewed, from early spider mite investigations to current work on predators. More than 40 predaceous, mycophagous and saprophagous mites are discussed in an annotated list, the 7 local plant-feeding species being mentioned only in the historical section. A comparative tabulation of the mite families found on citrus trees in California, Florida, South Africa and Israel demonstrates the similarity between these faunas.

INTRODUCTION

Although the earliest report on local citrus mites was published in 1930 (Bodenheimer, 1930), citrus acarology was actually initiated in this country some time later by H.Z. Klein. This writer (subsequently known as

Z. Avidov) was the first to study the spider mites which infest citrus trees in Palestine (Israel). When he published his results (1935; 1936a,b; 1938) the study of local citrus mites came into its own.

Very few mites were known to inhabit citrus trees at that time, only five species (and of these one probably a misidentification) being noted in Bodenheimer's monograph (1951) on citrus entomology. All except one were phytophagous, as predaceous forms were not identified in those days. The following years witnessed a substantial increase in our knowledge and understanding of the local citrus mite fauna. Two additional phytophagous mites were identified first, followed by many predaceous and then saprophagous forms. It is one of the purposes of the present paper to briefly review this progress. Another aim is to present an annotated list, based on published and unpublished data, of all species currently known to occur on local citrus trees. Obviously no such tabulation can ever hope to be complete, and this report is intended mainly to be a "stock taking" of the mite fauna on citrus in Israel at the time of publication.

THE DEVELOPMENT OF CITRUS ACAROLGY IN ISRAEL

Bodenheimer (1930) recorded only three mite species from citrus, namely Epitetranynchus althaeae von Hanstein, Bryobia praetiosa Koch and Oribatula plantivaga Berlese. The former of these is now known as the common red spider mite, a member of the Tetranychus telarius complex. Bryobia praetiosa, although reported to infest citrus in other parts of the world (Ebeling, 1959), may have been a misidentification of the oriental red spider mite (Bytinski-Salz, 1966). The status of O. plantivaga will be discussed below.

The common red spider mite was never considered to be an important citrus pest in Israel, as it infests the trees only during a brief period in the early summer (Klein, 1936b). The oriental red spider mite, initially recorded with certainty by Klein (1935) as Anychus sp.n., was discovered in the interior valleys of Israel during the twenties and soon spread out from there to become one of the three main acarine pests of citrus. The name of this species has had a confused nomenclatorial history. First (Klein, 1936a) it was known as Anychus orientalis Zacher. This name, however, remained in manuscript, as Zacher never validated it by an appropriate publication. Pritchard and Baker (1955) therefore credited Klein with orientalis (because a detailed description was included in his 1936a paper). Concurrently they declared this name a synonym of Eutetranychus banksi (McGregor) (the genus Anychus McGregor being meanwhile reduced to a synonym of Eutetranychus Banks). Later Baker and Pritchard (1960) reversed themselves and recognized the name Eutetranychus orientalis (Klein) as valid, which is its current status. It had been the subject of a thorough ecological study by Klein (1936a, 1938), a study which still forms the main part of our current knowledge about this mite.

The second important acarine citrus pest is the citrus rust mite, Phyllocoptruta oleivora (Ashmead). This eriophyid was first recognized and recorded in Israel by Klein (1946), who also recommended various control measures. Approximately ten years later Swirski and his associates initiated a series of studies on this mite. They reported on its phenology, ecology and life history (Swirski, 1962; Swirski and Amitai, 1958, 1959), on control measures (Swirski et al. 1969, and many earlier publications) and on its apparent resistance to the acaricide zineb (Swirski and Mebel, 1965). In the latter paper these authors also verified that P. oleivora is the only rust mite infesting local citrus trees.

The citrus bud mite, Aceria sheldoni (Ewing) is the third major acarine pest of citrus in Israel, its presence here having been established by Harpaz (1955). The distribution of A. sheldoni was studied by Sternlicht (1964), who subsequently reported on the phenology and natural enemies of this mite (Sternlicht, 1969a) and on its chemical control (Sternlicht 1969b and earlier papers quoted therein). He also (Sternlicht and Goldenberg, 1971) discovered that the sperm of the citrus bud mite is transferred by spermatophores.

Another group of phytophagous citrus-infesting species, the false spider mites, have been very little studied in Israel. Three cosmopolitan species, namely Brevipalpus californicus (Banks), B. obovatus Donnadieu (= inornatus Banks) and B. phoenicis (Geijskes) were recorded from citrus by Bytinski-Salz (1966), and Gruenberg (1956) states that these mites cause very little damage to local citrus trees.

To sum up, studies on phytophagous mites were initiated in this country more than 30 years ago and continue to the present, seven species of plant-feeding Acari being currently known to infest citrus in Israel. Three of these are pests whose control requires annual or periodical chemical treatments.

Studies on predaceous mites which inhabit citrus were initiated in Israel only within the last decade. Such local mites can be roughly separated to species which feed mainly on other mites, and to those preying mostly on armored scale insects (Diaspididae) and their crawlers (first stage larvae).

Mites of the family Phytoseiidae make up the former group, whose citrus-inhabiting members were reviewed by Porath and Swirski (1965). Acari belonging to the families Cheyletidae, Hemisarcoptidae and Eupalopsellidae belong to the scale insect-feeders, and they were studied by Avidov, Blumberg and Gerson (1968), Gerson (1967b) and Gerson and Blumberg (1969), respectively.

Some additional citrus mites were collected during the latter studies. Several are predaceous, but most appear to feed on sooty-mold fungi, on plant debris or to have obscure feeding habits. Very little is known about these groups in Israel, and they will be included in the annotated list which follows. All mites currently known to occur on citrus trees in Israel are to be discussed, with the exception of species found on dead tree stumps and in the litter below the trees, and of the above-mentioned phytophagous forms. These, which belong in the prostigmatic families Eriophyidae,

Tenuipalpidae and Tetranychidae, were recently reviewed by Avidov and Harpaz (1969), and will not be further discussed. Representatives of these families, often actually the same genera and species, are also known to infest citrus in California (McGregor, 1956), Florida (Muma, 1961) and in South Africa (M.K.P. Meyer, personal communication, 1971).

AN ANNOTATED LIST OF THE CITRUS MITES OF ISRAEL

Order Astigmata, Superfamily Acaroidea

Family Acaridae

Suidasia sp.

This is probably an undescribed species which occurs on citrus leaves and fruit, feeding on sooty-mold fungi. It has also been collected on other trees (i.e. Morus, Nephelium), in similar habitats.

Thyreophagus sp.

A cigar-shaped, milk-colored mite, this species - also probably undescribed - commonly occurs among and underneath the shields of dead armored scale insects on citrus bark. It was reared in the laboratory for several generations on a culture of the fungus Ascochyta, and may thus be regarded as mycophagous. No males of this species were ever observed in field-collected samples or in laboratory rearings.

Specimens of the local Thyreophagus appear to be similar to others collected in Canada (courtesy of Dr. F.T. Lord of Kentville, Nova Scotia) under shields of the oystershell scale, Lepidosaphes ulmi (L.) on apples. They also appear to be very near a specimen obtained under shields of the purple scale, L. beckii (Newman), figured by McGregor (1956, plate IX, 1-2). The similarity is not only in the specific habitat-shields of dead armored scales - but also in morphological characters, especially in the curved form of solenidion w1 on tarsi I. A comparative study of this genus, especially of the scale-associated group, appears to be overdue.

Tyrophagus putrescentiae (Schrank)

A cosmopolitan species which occurs in many diverse habitats, this species is believed to be mycophagous. It was found under the buttons (calyx) of citrus fruits, where sooty-molds accumulate, and on leaves with similar fungal growth. It also occurs on California citrus (McGregor, 1956), and other species of Tyrophagus inhabit citrus trees in South Africa (Meyer, personal communication, 1971).

SUPERFAMILY CANESTRINIOIDEA

Family Hemisarcoptidae

Hemisarcoptes coccophagus Meyer

This is a specific predator of armored scale insects, which also occurs on South African citrus (Meyer, l.c.). A closely-related species, H. malus (Shimer), feeds on citrus scale insects in California and Florida (McGregor, l.c., Muma, l.c.). The hypopi ("traveling nymphs") of H. Coccophagus are phoretic on, and thus disseminated by, adults of the lady beetle Chilocorus bipustulatus (L.). The mite is common on citrus bark heavily incrustated by its main prey, the chaff scale, Parlatoria pergandii Comstock and the tropical grey scale, P. cinerea Hadden. On citrus the predator was also observed to attack the California red scale, Aonidiella aurantii (Maskell), and on other plants, additional armored scale insects (Gerson, 1967b).

The populations of H. coccophagus undergo a pronounced annual cycle in Israel, peaking in midsummer. Chilocorus bipustulatus is also most abundant during that season (Rosen and Gerson, 1965), a concurrence which synchronizes the phenology of the mite and its vector in local citrus groves, facilitating the dispersal of the former by the latter.

Order Cryptostigmata, Superfamily Oribatuloidea

Family Oribatulidae

Siculobata sicula (Berlese)

The systematic status of this species was clarified by Grandjean (1950, 1953). According to that authority, Berlese initially named the mite (collected on citrus trees in Palermo) Oppia tibialis (Nic.) var sicula, but later, while using this name for other mites, changed it to Oribatula plantivaga. Grandjean (l.c.) examined type material of both sicula and plantivaga, and found that actually they were different species which he had to place in two new genera (Siculobata and Domatorina, respectively). Domatorina plantivaga has not yet been positively identified from citrus in Israel, its record (as O. plantivaga in Bodenheimer, 1930) probably being a misidentification. Grandjean (1953) states that prior to his own work the two species were commonly confused.

Several collections of S. sicula are at hand. The mite is probably mycophagous, subsisting on sooty-mold fungi and various molds which develop in moist areas on the trees. Occasionally S. sicula aggregates in large numbers on citrus fruit or bark, occurring in small depressions or where branches fork.

Other oribatulid mites occur on citrus trees in California (McGregor, 1956) and South Africa (Meyer, l.c.).

Order Mesostigmata, Superfamily Parasitoidea
Family Ascidae

Melichares dentriticus (Berlese)

Apparently known only from a single collection on citrus (Costa, 1966).

Family Phytoseiidae

Mites of this family are known from citrus in many parts of the world, having been intensively studied in recent years due to their potential as biological control agents. In Israel phytoseiids are regarded as important factors in the natural control of various pests. The decreasing use of nonselective acaricides in local citrus groves (Swirski et al., 1967b; Swirski et al., 1969) has brought about a substantial increase in their phytoseiid fauna. This in turn reduced the citrus rust mite from a major pest to a minor one. (E. Swirski, personal communication, 1971). Porath and Swirski (1965) conducted a survey of the phytoseiid mites which occur on citrus in Israel and found nine species. Additional host-plant records were presented by Swirski and Amitai (1968).

Amblyseius barkeri (Hughes)

Relatively rare on citrus.

Amblyseius rubini Swirski and Amitai

This species occurs on many wild and cultivated plants besides citrus (Swirski and Amitai, 1968), on which it is not very abundant. The effects of various diets on the development and reproduction of A. rubini were studied by Swirski et al. (1967a). who concluded that this species is not very effective as a biocontrol factor in citrus groves.

The synonymy of A. rubini with A. libanesi Dosse had been suggested by Swirski and Amitai (l.c.).

Amblyseius swirskii Athias

Porath and Swirski (1965) reported A. swirskii to be very prevalent on citrus trees along the coastal plain of Israel. A comparative study on the nutrition and feeding preferences of A. Swirskii (Swirski et al., 1967a) showed that the rate of increase of this mite was much higher than that of A. rubini when both were offered the same diets. From these and various field observations Swirski et al (l.c.) concluded that A. swirskii is an effective biocontrol factor in citrus groves. Sternlicht (1969a) concurred

in these conclusions, stating that single adults of A. swirskii devour 10 to 15 citrus bud mites per day, and that the larvae of the predator also feed on bud mites.

Amblyseius swirskii occurs in Israel on many additional plants (Swirski and Amitai, 1968).

Iphiseius degenerans (Berlese)

This mite is abundant on citrus trees in the coastal plain of Israel, but rare in the inner valleys (Porath and Swirski, 1965). Sternlich (1969a) often observed I. degenerans near buds infested by the citrus bud mite, but no feeding on this prey took place and all specimens of the phytoseiid died in laboratory trials.

Phytoseius finitimus (Ribaga)

This species was initially recorded from Israel as P. plumifer (Canestrini and Fanzago), but later (Swirski and Amitai, 1968) the name was amended to P. finitimus.

Typhlodromus athiasae Porath and Swirski

In contrast to A. swirski, this species occurs on citrus mostly in the inner, warmer and dryer parts of Israel (Porath and Swirski, l.c.). The effects of various diets on the development and reproduction of T. athiasae were studied by Swirski et al. (1967c). These authors remarked on the necessity of conserving the populations of this mite as well as of A. swirskii, the two mites which appear to be the most important acarine predators in local citrus groves.

Typhlodromus rhenanus (Oudemans)

Typhlodromus talbii Athias

Specimens of the former were observed by Sternlicht (1969a) near buds infested by the citrus bud mite.

Order Prostigmata, Superfamily Anystoidea

Family Anystidae

Anystis baccharum (L.)

A cosmopolitan species which occurs on citrus trees in other regions also, A. baccharum is a large, red mite which has a characteristic habit of running in circular figure 8 patterns. It preys upon various small arthropods. Isolated specimens were collected on citrus all over the country.

Superfamily Bdelloidea

All members of this group are predaceous, usually collected in and on the soil. Their rare occurrence on citrus trees is probably fortuitous. They are found on citrus in California, Florida and South Africa also.

Family Bdellidae

Cyta latirostris (Hermann)

Bdellodes lapidaria (P. Kramer)

Family Cunaxidae

Cunaxa spp.

Superfamily Cheyletoidea

Family Cheyletidae

Cheletogenes ornatus (Canestrini and Fanzago)

Avidov et al. (1969) reported on the phenology and life history of this mite, which feeds mainly on armored scale insect crawlers. The development of C. ornatus takes about 3 months at 28°C. The mite produces, at most, 13 progeny whilst feeding on one crawler per day, and it has some tolerance for low humidities and lack of food.

Field populations of C. ornatus peak in late summer, the mite probably raising two annual generations in this country. It is usually the most abundant mite on citrus bark, occurring in small numbers on other tree parts also.

Cheletogenes ornatus was collected from many additional trees and from some shrubs, usually associated with armored scale insects or tenuipalpid mites. It is known to inhabit citrus in many parts of the world.

Cheletomimus berlesei (Oudemans)

This mite also feeds on scale insect crawlers, mainly on citrus bark. In some groves, especially along the northern coastal plain of Israel, it is very abundant and may even be the dominant acarine predator on the bark. Its populations reach their largest numbers in early summer, subsequently declining (Gerson 1967a). Sternlicht (1969a) reported that C. berlesei commonly preys on A. sheldoni in infested citrus buds, adult predators devouring about ten bud mites.

Hemicheyletia bakeri (Ehara)

A cosmopolitan species, H. bakeri often occurs, in small numbers, on different parts of citrus trees. It has been collected from many other plants all over Israel, usually associated with tenuipalpid mites (Gerson, unpublished). Biological studies on this mite were reported by Kanavel and Selhime (1967) from Florida. It reproduced while feeding on various mites and on scale insect crawlers, the females of H. bakeri living about two months and depositing an average of 65 eggs. Despite its favorable attributes, this mite is believed to contribute very little to the biological control of citrus pests in Florida, because it is not abundant there.

Hemicheyletia wellsi (Baker)

Eutogenes citri Gerson

Two species which appear to be quite rare on local citrus trees. The former mite commonly occurs on citrus trees in Florida, whence it was reported to feed on phytoseiid mites (Muma, 1961).

Superfamily Raphignathoidea

Family Camerobiidae

Neophyllobius spp.

At least two separate, undescribed species of Neophyllobius were obtained in very small numbers from local citrus trees. All members of this cosmopolitan genus prey on other mites and on scale insect crawlers. One unnamed species of Neophyllobius is regarded as the most important predator of the armored scale insect Quadraspidotus ostreaeformis (Curtis) on apples in New Zealand (Richards, 1962). Other species occur on citrus in North America and in South Africa.

The familial name Neophyllobiidae was recently replaced by the name Camerobiidae, a family which now includes the genera Camerobia and Neophyllobius (Gerson, in press).

Family Eupalopsellidae

Eupalopsis maseriensis (Canestrini and Fanzago)

A comparatively rare mite, it was several times collected from citrus bark where it feeds on crawlers of armored scale insects. A modern re-description of E. maseriensis, a little-known species, was published by Gerson (1966), who also included a key to the genera of the family Eupalopsellidae.

Saniosulus nudus Summers

The populations of this mite peak during late summer on citrus in Israel (Gerson, 1967a). It is a quick-moving predator of scale insect eggs and crawlers, occurring mostly on the bark. The mite attacks many species of armored scale insects, and its voracity may endanger the laboratory rearing of such insects (Gerson, 1968a). Observations on the biology of S. nudus were presented by Gerson and Blumberg (1969).

Family Raphignathidae

Raphignathus gracilis (Rack)

Several specimens of this species were obtained from various parts of citrus trees as well as from diverse ornamental plants. Nothing is definitely known about the biology and feeding habits of species of Raphignathus.

Family Stigmaeidae

Agistemus exsertus Gonzalez

Sternlicht (1969a) collected this species in association with the citrus bud mite, on which it feeds. Five to eight bud mites were daily devoured by a single adult A. exsertus.

Agistemus industani Gonzalez

This mite has often been collected on all above-ground parts of citrus trees, in many parts of Israel. It appears to be predaceous mainly on tenuipalpid mites. Collection records of A. industani are available from many other economic and ornamental plants in this country (Gerson, 1968a).

Eryngiopus sp.

A rather rare species which Sternlicht (1969a) found to be associated with the citrus bud mite. (Through a typographical error this name was replaced by the name Czenspinskia in the above paper. -Sternlicht, personal communication, 1970).

Mediolata similans Gonzalez

Another predaceous mite often encountered on citrus and some other trees. The taxonomic status of Agistemus, Mediolata and Zetzellia (see below) was established and clarified by Gonzalez (1965), who also summed up their biology. Some mites of these genera are known to inhabit citrus in other parts of the world.

Zetzellia sp.

Sternlicht (1969a) stated that this mite occurs in buds infested by the citrus bud mite.

Superfamily Tarsonemoidea

Family Tarsonemidae

Mites of the family Tarsonemidae are known to feed on various molds, on cultivated mushrooms, on living green plants and even on insects. The group is poorly known in Israel. Three species are on hand.

Tarsonemus setifer Ewing

Tarsonemus nr. randsi Ewing

Daidalotarsonemus sp.

The first of these is known to occur on citrus in California (McGregor, 1956), Florida (Muma, 1961) and South Africa (Meyer, personal communication, 1971). The two former species appear to feed on sooty-mold fungi, whereas the third was observed to browse on lichen growing on citrus bark.

Tarsonemus aurantii (Oudemans)

Tarsonemus mühlei Wetzel

Tarsonemus nodosus Schaarschmidt

Tarsonemus smithi Ewing

These four species were found by Sternlicht (1969a) in buds infested by the citrus bud mite. None was ever seen to prey on the bud mite.

Superfamily Tydeoidea

Family Tydeidae

Tydeid mites are perhaps the most ubiquitous plant-inhabiting Acari, being also common in the soil. Conflicting reports about their feeding habits, based mostly only on observations, occur in the literature; these mites have variously been stated to be predators, plant feeders and saprophagous (Gerson, 1968b). Life-history studies concerned with three members of this family revealed that they feed mainly on coccid-excreted honeydew and on various fungi (Brickhill, 1958; McCoy et al., 1969). In the former study the tydeids also fed on spider mite eggs, but all fed-upon eggs subsequently hatched and produced normal larvae. McCoy et al. (e.c.), who

worked with a species formerly believed to be a predator (Muma, 1961), showed it to be mycophagous. Some other tydeids feed on algae and lichens.

About a dozen mites of this family occur on citrus trees in Israel, of which the following have been identified to the species level.

Lorryia magdalenae Gerson

A rare species, obtained on citrus bark. It is the only representative of its genus so far known from local citrus.

Paralorryia mali (Oudemans)

This species is quite abundant, the year around, on citrus foliage, fruit, branches and bark. Its color appears to depend on the food ingested; specimens collected from leaves were yellowish-green, whereas those obtained from lichen-overgrown bark had a dark-green color. The mite occurs on numerous other plants in Israel (Gerson, 1968b).

Pronematus ubiquitous (McGregor)

Another common mite, it also occurs on citrus trees in North America and in South Africa. Although reported to be a scavenger as well as a predator (Gerson, l.c.), no definite statement concerning its biotic role can be made due to the lack of experimental evidence. A similar situation exists in regard to the next species.

Tydeus californicus (Banks)

Reports claiming phytophagous and predaceous feeding habits for this mite were summarized by Gerson (1968b). It is rather common and occurs on many plants besides citrus. This species and P. mali are the most abundant tydeid mites in Israel.

Tydeus californicus is in the habit of aggregating in large numbers on plant leaves. Fleschner and Arakawa (1953) reported the occurrence of over 100 mites per avocado leaf in California. A similar phenomenon was observed in a citrus grove along the southern coastal plain of Israel. At that locality thousands of T. californicus were seen on the leaves, branches and bark of the trees, as well as on annual and perennial weeds under the trees' canopy. No damage to any of the plants could be found.

Sternlicht (1969b) believed this mite to feed on buds uninfested by the citrus bud mite.

DISCUSSION

Fairly comprehensive lists of citrus mites are available from California (McGregor, 1956), Florida (Muma, 1961) and South Africa (Meyer, personal communication, 1971). A tabulation of the family names noted in these

TABLE 1 : A comparative list of mite families found on citrus trees in California, Florida, South Africa and Israel (r = rare)

Family	California	Florida	South Africa	Israel
Acaridae	+	+	+	+
Alicorhagiidae			+ (r)	
Ameroseiidae			+ (r)	
Anoetidae			+	
Anystidae	+	+	+	+
Ascidae	+	+	+	+
Bdellidae	+	+	+	+
Camerobiidae	+	+	+	+
Cheyletidae	+	+	+	+
Cunaxidae		+	+	+
Eremaeidae		+		
Eriophyidae	+	+	+	+
Erythraeidae	+		+	
Eupalopsellidae		+	+	+
Eupodidae			+ (r)	
Galumnidae	+	+		
Glycyphagidae		+		
Hemisarcoptidae	+	+	+	+
Macrochelidae		+ (r)		
Oribatulidae	+		+	+
Parasitidae	+ (r)			
Phytoseiidae	+	+	+	+
Pyemotidae	+	+		
Raphignathidae				+
Stigmaeidae	+	+	+	+
Tarsonemidae	+	+	+	+
Tenuipalpidae	+	+	+	+
Tetranychidae	+	+	+	+
Tydeidae	+	+	+	+
Tuckerellidae		+ (1)	+	

(1) According to DeLeon (1955).

lists (slightly amended in keeping with current taxonomic concepts and supplemented by one name from Florida), together with those recorded from Israel, is presented in Table 1. A comparison of these lists shows that representatives of almost two-thirds of the families occurring on citrus in other regions can also be found on citrus in Israel. The similarity is even more pronounced when the rare records (marked by r in Table 1) are omitted. Further, the families not present in some of the regions (i.e., Eremaeidae, Raphignathidae) are those whose members usually occur in small numbers and whose ecological role in citrus groves appears to be negligible. The important groups - the plant feeding Eriophyidae, Tenuipalpidae and Tetranychidae, the predaceous Cheyletidae, Hemisarcoptidae, Phytoseiidae and Stigmaeidae, and the saprophagous or mycophagous Acaridae, Tarsonemidae and Tydeidae - occur on citrus in all regions from which such lists are available. Even the same genera are often found on these trees in different parts of the world, although usually not the same species. These observations suggest that a comparative study of citrus acarine faunae in additional regions may further our understanding of the evolution and ecology - and therefore facilitate in our manipulation - of citrus mites.

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R E F E R E N C E S

- Avidov, Z., Blumberg D. and Gerson, U., 1968. Cheletogenes ornatus (Acarina: Cheyletidae), a predator of the chaff scale on citrus in Israel. Israel J. Entomol. 3:77-94.
- Avidov, Z. and Harpaz, I. 1969. Plant Pests of Israel. Israel Universities Press, Jerusalem, 549 p.
- Baker, E.W. and Pritchard, A.E. 1960. The tetranychoid mites of Africa. Hilgardia 29: 455-574.
- Bodenheimer, F.S. 1930. Die Schädlingfauna Palästinas. P. Parey, Berlin, 438 p.
- Bodenheimer, F.S. 1951. Citrus Entomology in the Middle East. W. Junk, The Hague, 663 p.
- Brickhill, C.D. 1958. Biological studies of two species of tydeid mites from California. Hilgardia 27:601-620.
- Bytinski-Salz, H. 1966. An annotated list of insects and mites introduced into Israel. Israel J. Entomol. 1:15-48.
- Costa, M. 1966. The present stage of knowledge of mesostigmatic mites in Israel (Acari, Mesostigmata). Israel J. Zool. 15:69-82.
- DeLeon, D. 1955. Hosts of Tuckerella pavoniformis (Ewing) and T. ornata (Tucker) in Florida (Acarina: Tuckerellidae). Flo. Entomol. 38:89-90.
- Ebeling, W. 1959. Subtropical Fruit Pests. University of California, Division of Agricultural Sciences, 336 p.
- Fleschner, C.A. and Arakawa, K.Y. 1953. The mite Tydeus californicus on citrus and avocado leaves. J. Econ. Entomol. 45:1092.
- Gerson, U. 1966. A redescription of Eupalopsis maseriensis (Canestrini and Fanzago) (Acarina: Eupalopsellidae). Israel J. Zool. 15: 148-154.
- Gerson, U. 1967a. The natural enemies of the chaff scale, Parlatoria pergandii Comstock, in Israel. Entomophaga 12 : 97-109.
- Gerson, U. 1967b. Observations on Hemisarcoptes coccophagus Meyer (Astigmata: Hemisarcoptidae), with a new synonym. - Acarologia 9 : 632-638.
- Gerson, U. 1968a. Some Raphignathoid mites from Israel. - J. Nat.Hist. 2 : 429-437.

- Gerson, U. 1968b. Five tydeid mites from Israel (Acarina:Prostigmata). Israel J. Zool. 17:191-198.
- Gerson, U. A new species of Camerobia Southcott, with a redefinition of the family Camerobiidae (Acarî: Prostigmata). Acarologia, in press.
- Gerson, U. and Blumberg, D. 1969. Biological notes on the mite Saniosulus nudus. J. Econ. Entomol. 62:729-730.
- Gonzalez-Rodriguez, R.H., 1965. A taxonomic study of the genera Mediolata, Zetzellia and Agistemus (Acarina:Stigmaeidae). Univ. Calif. Pub. Entomol. 41:1-64.
- Grandjean, F. 1950. Sur deux espèces du genre Dometorina n.g. et les moeurs de D. plantivaga (Berl.) (Acariens, Oribates). Bull. Soc. Zool. France 75:224-242.
- Grandjean, F., 1953. Sur les genres "Hemileius" Berl. et "Siculobata" n.g. (Acariens, Oribates). Mem. Mus. Nat. Hist. Natur., Ser. A, 6: 117-138.
- Gruenberg, A. 1956. Citrus Pests in Israel and Their Control. J. Chachnik, Tel Aviv, 169 p. (in Hebrew).
- Harpaz, I. 1955. Notes on the eriophyid mites of Israel. Bull. Res. Council. Israel 5b:61-69.
- Kanavel, R.F. & Selhime, A.G. 1967. Biological studies on Paracheyletia bakeri (Acarina:Cheyletidae). Flo. Entomol. 50:107-113.
- Klein, H.Z. 1935. The citrus red spiders in Palestine. Hassadeh 15: 168-171 (in Hebrew).
- Klein, H.Z. 1936a. Contributions to the knowledge of the red spiders in Palestine. 1. The oriental red spider, Anychus orientalis Zacher. Hadar 9: 107-111, 126-132.
- Klein, H.Z. 1936b. Contributions to the knowledge of the red spiders in Palestine. 2. The common red spider, Epitetranychus althaeae V. Haust. Hadar 9: 195-199, 219-225.
- Klein, H.Z. 1938. On the ecology of the citrus red spiders in Palestine. Bull. Entomol. Res. 29:37-40.
- Klein, H.Z. 1946. The rust mite- a new pest in our citrus groves. Hassadeh 26:344-347 (in Hebrew).
- McCoy, C.W., Selhime, A.G. and Kanavel, R.F. 1969. The feeding behavior and biology of Parapronematus acaciae (Acarina:Tydeidae). Flo. Entomol. 52:13-19.
- McGregor, E.A. 1956. The mites of citrus trees in southern California. Mem. South Calif. Acad. Sci. 3:1-42.

- Muma, M.H. 1961. Mites associated with citrus in Florida. Univ. Florida, Agr. Exp. St., Bull. 640.
- Porath, A & Swirski, E. 1965. A survey of phytoseiid mites (Acarina: Phytoseiidae) on citrus, with a description of one new species. Israel J. Agric. Res. 15:87-100.
- Pritchard, A.E. and Baker, E.W. 1955. A Revision of the Spider Mite Family Tetranychidae. Pac. Coast Entomol. Soc. Mem. 2:1-472.
- Richards, A.M., 1962. The oyster-shell scale, Quadraspidotus ostreae-formis (Curtis) in the Christchurch district of New Zealand. N.Z. J. agric. Res. 5:95-100.
- Rosen, D. and Gerson, U. 1965. Field studies of Chilocorus bipustulatus (L.) on citrus in Israel. Ann. Epiphyt. 16:71-76.
- Sternlicht, M. 1964. The citrus bud mite (Aceria sheldoni Ewing), and its spread in Israel. Hassadeh 44:1410-1412, 1538-1541 (in Hebrew).
- Sternlicht, M. 1969a. A study of fluctuations in the citrus bud mite population. Ann. Zool. Ecol. anim. 1:127-147.
- Sternlicht, M. 1969b. Further trials in the control of the citrus bud mite Aceria sheldoni (Ewing) (Eriophyidae, Acarina). Zeit. angew. Entomol. 64:137-151.
- Sternlicht, M. and Goldenberg, S. 1971. Fertilisation, sex ratio and postembryonic stages of the citrus bud mite Aceria sheldoni (Ewing) (Acarina, Eriophyidae). Bull. Entomol. Res. 60:391-397.
- Swirski, E. 1962. Contribution to the knowledge of the fluctuations in population of the citrus rust mite (Phyllocoptura oleivora Ashm.) in the coastal plain of Israel. Israel J. agric. Res. 12:175-187.
- Swirski, E. and Amitai, S. 1958. Contribution to the biology of the citrus rust mite (Phyllocoptura oleivora Ashm.). A. Development, adult longevity and life cycle. Ktavim 8: 189-207.
- Swirski, E. and Amitai, S. 1959. Contribution to the biology of the citrus rust mite (Phyllocoptura oleivora Ashm.). C. Oviposition and longevity of males and females. Ktavim 9:281-285.
- Swirski, E. and Amitai, S. 1968. Notes on phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of one new species. Israel J. Entomol. 3:95-108.
- Swirski, E., Amitai, S. and Dorzia, N. 1967a. Laboratory studies on the feeding, development and reproduction of the predaceous mites Amblyseius rubini Swirski and Amitai and Amblyseius swirskii Athias (Acarina:Phytoseiidae) on various kinds of food substances. Israel J. agric. Res. 17:101-119.

- Swirski, E., Amitai, S. and Dorzia, N. 1967b. Field and laboratory trials on the toxicity of some pesticides to predaceous mites (Acarina: Phytoseiidae). Israel J. agric. Res. 17:149-159.
- Swirski, E., Amitai, S. and Dorzia, N. 1967c. Laboratory studies on the feeding, development and oviposition of the predaceous mite Typhlodromus athiasae P. and S. (Acarina: Phytoseiidae) on various kinds of food substances. Israel J. Agric. Res. 17: 213-218.
- Swirski, E., Dorzia, N., Amitai, S. and Greenberg, S. 1969. Trials on the control of the citrus rust mite (Phyllocoptruta oleivora Ashm.) with four pesticides, and on their toxicity to predaceous mites (Acarina:Phytoseiidae). Israel J. Entomol. 4:145-155.
- Swirski, E. and Mebel, A. 1965. On failures in the control of the citrus rust mite with zineb compounds. Alon HaNotea 20:33-42 (in Hebrew).