

NOTES ON PHYTOSEIID MITES (MESOSTIGMATA: PHYTOSEIIDAE)
FROM THE DEAD SEA REGION OF ISRAEL*

E. SWIRSKI and S. AMITAI

*Dept. of Entomology, Agricultural Research Organization,
The Volcani Center, Bet Dagan, Israel*

ABSTRACT

The following 14 species of phytoseiid mites are recorded from various plants in the Dead Sea region of Israel: *Amblyseius bicaudus* Wainstein, *A. barkeri* (Hughes), *A. cucumeris* (Oudemans), *A. engaddensis* Amitai and Swirski, *Euseius eitanae* (Swirski and Amitai), *E. rubini* (Swirski and Amitai), *Phytoseius finitimus* Ribaga, *Typhlodromus athiasae* Porath and Swirski, *Anthoseius drori* (Grinberg and Amitai), *A. hierochunticus* (Amitai and Swirski), *Clavidromus transvaalensis* (Nesbitt), *Paragigagnathus tamaricis* Amitai and Grinberg, *Phytocerus desertorum* Amitai and Swirski and *Nabiseius rivnayae* Amitai and Swirski. A key for the females of the above mentioned species is given. **KEY WORDS:** Israel, Dead Sea Area, predacious mites, Phytoseiidae.

INTRODUCTION

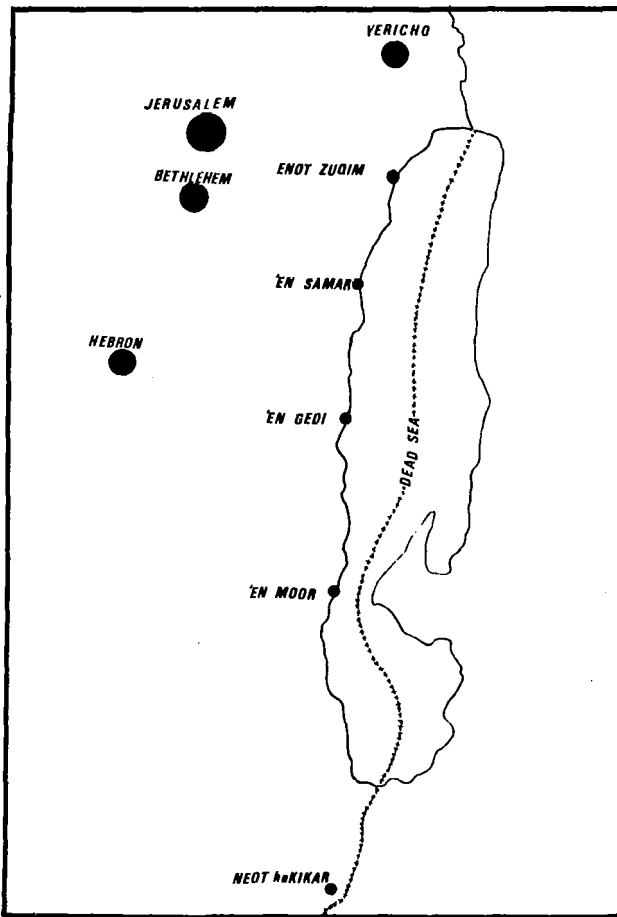
The present paper reports on results of surveys of the distribution of predacious mites of the family Phytoseiidae, carried out since 1963, in the hot and dry region of the Dead Sea (see Map 1). The mites were stored in 70% alcohol, cleared in Nesbitt's solution and mounted in Hoyer's fluid. The setal terminology of Rowell *et al.*, (1978) was followed.

Type-material of species described by the authors is deposited in the Collection of the Department of Entomology, Agricultural Research Organization, Bet Dagan, Israel.

This paper is dedicated to Prof. J. Kugler, on the occasion of his 70th birthday.

Amblyseius bicaudus Wainstein, 1962

MATERIAL EXAMINED: 'Enot Zuqim, 16.11.1982, 1....., *Inula* sp. (Compositae). 'En Gedi, 28.1.1980, 1....., *Phragmites communis* (Gramineae). Qumeran, 2.II.1980, 1.....,



Map 1. Collection sites.

undetermined Gramineae.

A. bicaudus was recorded in Israel from the Dead Sea Area and Jordan Valley (Grinberg, 1971).

Amblyseius barkeri (Hughes 1948)

MATERIAL EXAMINED: Qumeran, 26.III.1980, 3♀♀, 1 nymph, undetermined Gramineae. 'Enot Zuqim, 15.VII.1970, 8♀♀, undetermined Gramineae (Amitai and Swirski, 1978). 'En Samar, 4.IX.1973, 11♀♀, 3♂♂, *Lippia nodiflora* (Verbenaceae); 'En Gedi, 17.VI.1969, 1♀, *Adiantum capillus veneris* (Polypodiaceae); 16.II.1982, 4♀♀, undetermined Gramineae.

A. barkeri was found in the following regions of Israel: Dead Sea Area, Jordan Valley, Upper and Lower Galilee, Northern, Central and Southern Coastal Plain, Carmel Ridge, Yizre'el Valey, Foothills of Judea, Judean Hills, and Northern Negev (Amitai and Swirski, 1978; Grinberg, 1971; Swirski and Amitai, 1965, 1968, 1985).

Amblyseius cucumeris (Oudemans, 1930)

MATERIAL EXAMINED: 'Enot Zuqim, 21.IV.1971, ♀♀, *Inula crithmoides* (Compositae) (Amitai and Swirski, 1978); 16.II.1982, 4♀♀, *Inula* sp. 'En Samar, 27.II.1980, ♀♀, *Phragmites communis*. 'En Gedi, 17.VI.1969, 1♀, *Adiantum cappilus-veneris*.

A. cucumeris was recorded from the following regions of Israel: Central Coastal Plain, Judean Hills and the Dead Sea Area (Amitai and Swirski, 1978; Grinberg, 1971; Wysoki and Swirski, 1971a) and the Central Negev.

Amblyseius engaddensis Amitai and Swirski, 1970

MATERIAL EXAMINED: Holotype ♀, paratypes, 1♂, 1♀, Israel, 'En Gedi, 21.XII.1967, Gramineae. Other specimens: 'En Gedi, 11.II.1971, 1♀, *Moringa aptera* (Moringaceae); 2♀♀, undetermined Gramineae (Grinberg, 1971); 20.IV.1972, 3♀♀, 2♂♂, 2 nymphs, undetermined Gramineae (Amitai and Swirski, 1978).

In Israel *A. engaddensis* was recorded only from the Dead Sea Area.

Euseius eitanae (Swirski and Amitai, 1965)

MATERIAL EXAMINED: Israel, Holotype ♀, paratypes, 5♀♀, 1♂, Israel, 'En Gedi, 11.III.1964, *Solanum* sp., *Salvadora persica*, *Calotropis procera*. Other specimens: 'Enot Zuqim, 21.IV.1971, 4♀♀, *Inula crithmoides* (Amitai and Swirski, 1978). 'En Gedi, 12.XII.1967, 2♀♀, 1♂, 1 nymph, *Acacia raddiana* (Papilionaceae); 27.XII.1967, 3♀♀, *Acacia* sp; 30.IV.1970, 3♀♀, *Ochradenus baccatus* (Cruciferae), 1♀, *Tamarix* sp. (Tamaricaceae), Tova Rivnay; 11.II.1971, 1♀, 1 nymph; 18.II.1971, 6♀♀, 1♂, 1 nymph, *Acacia raddiana* (Amitai, and Swirski, 1978). 18.I.1979, 6♀♀, *Acacia raddiana*, 5♀♀, *Acacia spirocarpa*. Nahal 'Arugot (near 'En Gedi), 18.I.1979, 2♀♀, *Salvadora persica* (Salvadoraceae). Nahal Hever (near 'En Gedi), 18.I.1979, 1♀, undetermined plants.

E. eitanae was collected only in the Dead Sea Area (Amitai and Swirski, 1978; Grinberg, 1971; Swirski and Amitai, 1965, 1968; Wysoki and Swirski, 1971a).

Euseius rubini (Swirski and Amitai, 1965)

MATERIAL EXAMINED: Yeriho, 13.VII.1967, 6♀♀, 3♂♂; *Punica granatum* (Punicaceae); 15.VII.1970, 2♀♀, *Zizyphus spina-christi* (Rhamnaceae) (Amitai and Swirski, 1978); 18.I.1979, 12♀♀, 1♂, *Calotropis procera* (Asclepiadaceae); 27.II.1980, 1 nymph, *Zizyphus* sp. Qumeran, 26.III.1980, 5♀♀, 1♂, 4 nymphs, *Solanum* sp. (Solanaceae), associated with aphids (?sucking the excreta of siphunculi). 'En Samar 14.IX.1973, 1♀, *Lippia nodiflora* (Amitai and Swirski, 1978), 'En Gedi, 19.I.1963, 1♀, *Zizyphus spina-christi*; 11.III.1964, 5♀♀, 1♂, *Calotropis procera*; 10.II.1965, 4♀♀, *Salvadora persica* (Swirski and Amitai, 1965); 21.XII.1967, ♀♀, undetermined Gramineae; 12.XII.1968, 19♀♀, 4♂♂, 2 nymphs, *Salvadora persica* (Amitai and Swirski,

1978); 30.IV.1970, 3♀♀, *Moringa aptera* (Moringaceae) (Grinberg, 1970); 27.II.1980, ♀♀, *Salvadora persica* and *Zizyphus* sp.; 16.II.1981, 1♀, *Moringa aptera*, 1♀, *Abutilon* sp. (Malvaceae). Nahal 'Arugot (near 'En Gedi), 24.II.1974, ♀♀, *Zizyphus spina-christi*; 26.III.1980, 3♀♀, 2♂♂, nymphs, undetermined Chenopodiaceae; 4♀♀, *Artemisia* sp.

E. rubini was recorded in Israel from the following regions: Dead Sea Area, Jordan Valley, Upper and Lower Galilee, Northern, Central and Southern Coastal Plain, Carmel Ridge, Yizre'el Valley, Foothills of Judea, Judean Hills and Northern Negev (Amitai and Swirski, 1978; Grinberg, 1971; Porath and Swirski, 1965; Swirski and Amitai, 1961, 1965, 1968, 1985; Wysoki and Swirski, 1971a).

Phytoseius finitimus Ribaga, 1904

MATERIAL EXAMINED: 'Enot Zuqim, 6.II.1979, 3♀♀, *Atriplex* sp. 'En Gedi, 4.IV.1963, 5♀♀, *Forskahlea tenacissima* (Urticaceae), 11.III.1964, 4♀♀, *Erigeron bovei* (Compositae); 4♀♀, *Solanum* sp.; 10.II.1965, 1♀, *Forskahlea tenacissima* (Swirski and Amitai, 1965); 12.XII.1968, 8♀♀, 2 nymphs, *Ficus carica* (Moraceae); 30.IV.1970, 2♀♀, *Conyza dioscoridis* (Compositae) (Grinberg, 1971); 3.III.1975, ♀♀, *Forskahlea tenacissima* (Amitai and Swirski, 1978); 27.II.1980, ♀♀, *Ficus carica*.

P. finitimus was recorded in Israel from the following regions; Dead Sea Area, Jordan Valley, Upper and Lower Galilee, Northern, Central and Southern Coastal Plain, Carmel Ridge, Yizre'el Valley, Foothills of Judea and Judean Hills (Amitai and Swirski, 1978; Grinberg, 1971; Porath and Swirski, 1965; Swirski and Amitai, 1961, 1965, 1968; Wysoki and Swirski, 1971b).

Typhlodromus athiasae Porath and Swirski, 1965

MATERIAL EXAMINED: Yeriho, 21.IV.1971, 2♀♀, *Inula crithmoides*. Qalya, 18.I.1979, 1♀, *Atriplex dimorphostegia*. 'Enot Zuqim, 14.IV.1970, ♀♀; 12.IV.1970, 1♀, 1♂, *Atriplex* sp.; 5.VIII.1970, 1♀, *Juncus* sp. (Juncaceae). 'EnGedi, 11.III.1964, 5♀♀, *Salvadora persica*; 12.XII.1968, 20♀♀, 11♂♂, 8 nymphs, *Phoenix dactylifera* (Palmae); 30.IV.1970, 1♀, *Salvadora persica*; 18.II.1971, ♀♀, *Atriplex* sp.; 1.II.1980, II.1982, ♀♀, ♂♂, nymphs, common, *Phragmites communis* (inflorescence); 16.II.1982, 1♀, *Abutilon* sp. Neot haKikkar, 11.II.1971, 5♀♀, 2♂♂, *Atriplex* sp. (Amitai and Swirski, 1978; Grinberg, 1971; Swirski and Amitai, 1965, 1968, 1985).

T. athiasae was recorded in Israel from the following regions: Dead Sea Area, Jordan Valley, Upper and Lower Galilee, Northern, Central and Southern Coastal Plain, Carmel Ridge, Yizre'el Valley, Samaria, Foothills of Judea, Judean Hills and Northern Negev (Amitai and Swirski, 1978; Grinberg, 1971; Porath and Swirski, 1965; Swirski and Amitai, 1965, 1968; Wysoki and Swirski, 1971b) and the Central Negev.

Anthoseius drori (Grinberg and Amitai, 1970)

MATERIAL EXAMINED: Holotype ♀, 4 paratype ♀♀ and 1♂, *Tamarix* sp., Israel, 'Enot Zuqim, 20.IV.1970, Other paratypes on the same plant: 'Enot Zuqim,

12.V.1970; 'En Gedi, 30.IV.1970. Other specimens: Qalya, 18.I.1979, 3♀♀, 27.II.1980, 1♀, *Tamarix* sp. Qumeran, 26.III.1980, 1♀; 16.II.1982, 5♀♀, *Tamarix* sp. 'Enot Zuqim, 16.II.1982, 1♀, *Atriplex* sp. 'En Samar, 28.I.1980, 3♀♀, *Tamarix* sp. 'En Gedi, 18.I.1979, 1♀, *Acacia spirocarpa*; 16.II.1982, 1♀, *Tamarix* sp. Nahal 'Arugot (near 'En Gedi), 18.I.1979, 1♀, undetermined plant. Newe Zohar, 6.II.1979, ♀♀, *Tamarix* sp.

A. drori was recorded in Israel from the Dead Sea Area and Jordan Valley.

Anthoseius hierochunticus (Amitai and Swirski, 1968)

MATERIAL EXAMINED: Holotype ♀, paratypes 1♂, 4♀♀, Israel, Yeriho, 13.VII.1967. *Citrus* sp. Other specimens: 'En Gedi, 30.IV.1970, 2♀♀; 11.II.1971, 6♀♀, 1♂, *Moringa aptera* (Grinberg, 1971); 4.IX.1973, 4♀♀, 1♂, *Salvadora persica* (Amitai and Swirski, 1978).

A. hierochunticus was recorded in Israel from the Dead Sea Area (Amitai and Swirski, 1968, 1978; Grinberg, 1971) and Judean Desert.

Clavidromus transvaalensis (Nesbitt, 1951)

MATERIAL EXAMINED: 'Enot Zuqim, 12.V.1970, ♀♀, nymphs, *Atriplex* sp. and *Inula crithmoides* (Amitai and Swirski, 1978).

C. transvaalensis was recorded in Israel from the following regions: Dead Sea Area, Lower Galilee, Yizre'el Valley and Central Coastal Plain (Amitai and Swirski, 1978, Grinberg, 1971).

Paragigagnathus tamaricis Amitai and Grinberg, 1971

MATERIAL EXAMINED: Holotype ♀, paratypes, 7♀♀, 4♂♂, Israel, 'En Gedi, 30.IV.1970, *Tamarix* sp. Other paratype ♀♀ and ♂♂ were collected at 'Enot Zuqim, 'En Moor and 'En Mishmar (Judean Desert). Other specimens: Qumeran, 27.II.1980, 1♀, undetermined Gramineae. 'Enot Zuqim, 16.II.1982, 1♀, *Atriplex* sp. 'En Samar, 28.I.1980, 1♀, *Tamarix* sp. Newe Zohar, 6.II.1979, 1♀, *Tamarix* sp.

P. tamaricis was recorded in Israel from the Dead Sea Area, Judean Desert and Central Negev (Amitai and Grinberg, 1971).

BIOLOGICAL OBSERVATIONS: Amitai and Grinberg (1971) suggest that the females of *P. tamaricis* are viviparous. In the laboratory breedings of this mite no eggs or egg-shells were discovered, nor was any larviposition observed. Larvae were seen microscopically in mounted mature females. *P. tamaricis* preys upon the tenuipalpid mite *Mobdulia tamaricis* Pritchard and Baker, causing galls on *Tamarix*.

Phytocerus desertorum Amitai and Swirski, 1978

MATERIAL EXAMINED: Holotype ♀, paratypes, 4♀♀; Israel, 'En Gedi,

11-18.II.1971, 18-28.I.1972, 8 paratypes ♀♀, *Acacia raddiana*. Other specimens: 'En Gedi, 18.I.1979; 23.XI.1980, 5♀♀, *Acacia spirocarpa* and *A. raddiana*. Neot haKikkar, 6.II.1979, 1♀, *Acacia raddiana*.

Ph. desertorum was recorded in Israel from the Dead Sea Area (Amitai and Swirski, 1978) and Arava valley.

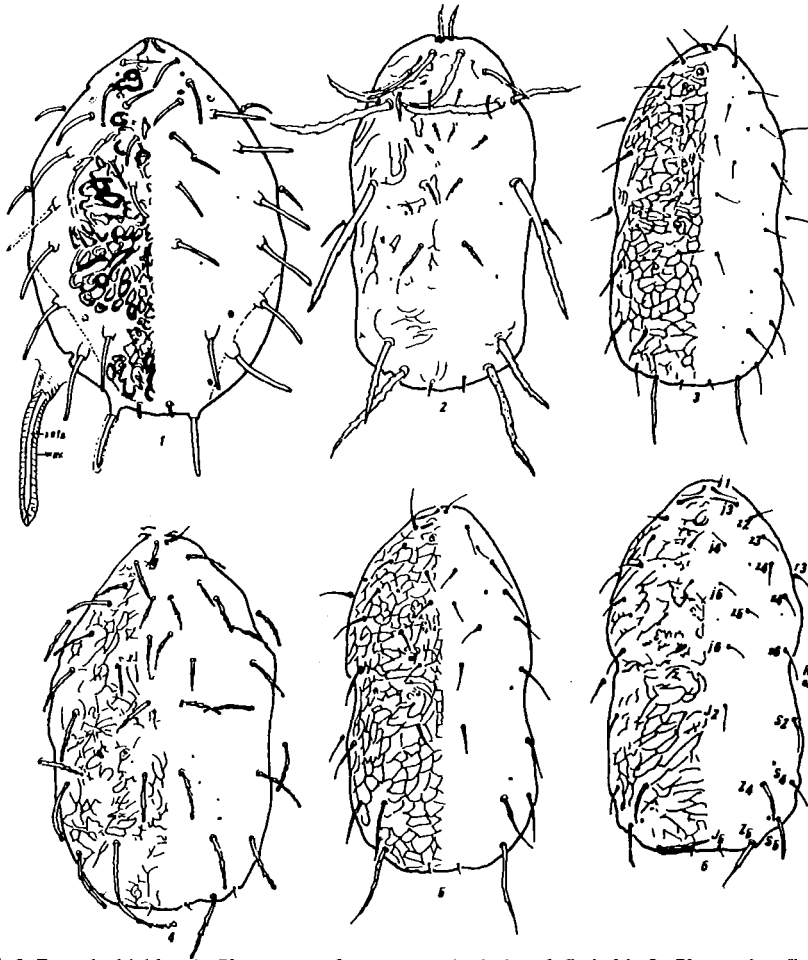
NOTES: The setae of the mites are "waxen" and the dorsal shield carries "wax plates", probably protecting the mites from desiccation.

Nabiseius rivnayae Amitai and Swirski, 1980

MATERIAL EXAMINED: Holotype ♀, paratypes, 7♀♀, Israel, 'En Samar, VIII.1972, *Tamarix* sp.

KEY TO THE SPECIES – FEMALES

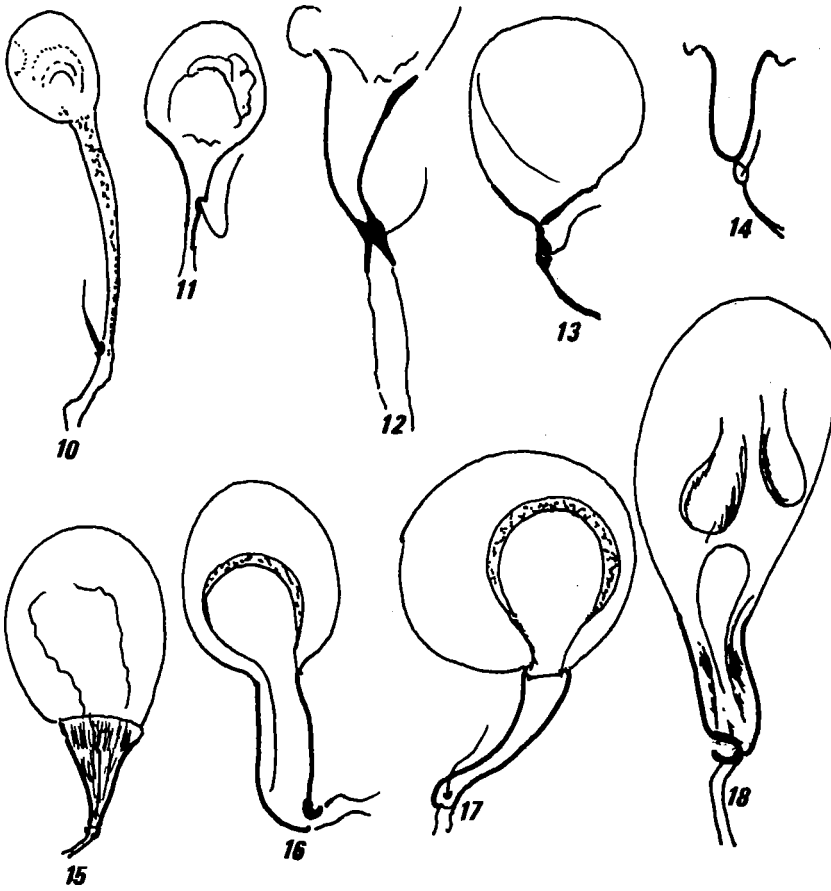
1. Fixed digit of the chelicerae reduced (Fig. 19). Primary and secondary metapodal plates joined by a bridge *Nabiseius rivnayae* Amitai and Swirski
- Fixed digit of chelicerae normal (Fig. 20). Primary and secondary metapodal plates not joined by a bridge 2
2. Setae on the dorsal shield covered by wax; the shield is strongly chitinised, with many "wax plates" (Fig. 1) *Phytocerus desertorum* Amitai and Swirski
- Setae on the dorsal shield nude, without wax; no "wax plates" on the shield (Figs. 2-6) 3
3. Gnathosoma narrow; hypostome and palpi together as long as leg I. Dorsal shield strongly sclerotised and reticulated, bearing 17 pairs of thornlike setae. Ventrianal shield (Fig. 7) vase-shaped, with a notch at the anterior margin, with 2 pairs of preanal setae *Paragigagnathus tamaricis* Amitai and Grinberg
- Gnathosoma normal. Other characters variable 4
4. Seta r3 located on the dorsal shield; setae S2, S5 absent; setae s4, s6, Z4, Z5 thickened, serrated, situated on tubercles (Fig. 2) *Phytoseius finitimus* Ribaga
- Seta r3 located on the interscutal membrane; setae S2, S5, present; all the setae s4, s6, Z4, Z5 different from above 5
5. Seta z3 absent on the dorsal shield (Fig. 3) 6
- Seta z3 present on the dorsal shield (Figs. 4-6) 11
6. Ventrianal shield vase-shaped; preanal setae arranged in two transverse curved rows (Fig. 8) 7
- Ventrianal shield not vase-shaped, usually subtriangular; preanal setae not arranged in two transverse rows (Fig. 9) 8
7. Cervix of the spermatheca narrow and very elongate (Fig. 10). Macrosetae on the hind leg pointed. Apex of peritreme reaches the bases of setae z2-z4 *Euseius rubini* (Swirski and Amitai)
- Cervix of the spermatheca funnel-shaped (Fig. 11). Macrosetae on the hind leg knobbed. Apex of peritreme reaches the bases of setae j1-j3 *Euseius eitanae* (Swirski and Amitai)



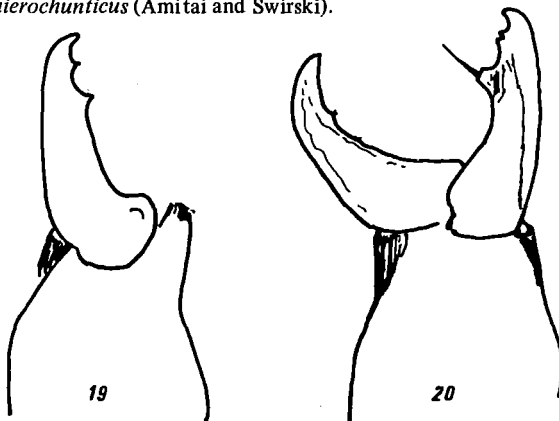
Figs. 1-6 Dorsal shields: 1. *Phytocerus desertorum* Amitai and Swirski. 2. *Phytoseius finitimus* Ribaga. 3. *Amblyseius cucumeris* (Oudemans). 4. *Clavidromus transvaalensis* (Nesbitt). 5. *Typhlodromus athiasae* Porath and Swirski. 6. *Anthoseius drori* (Grinberg and Amitai).



Figs. 7-9. Ventrianal shields. 7. *Paragigagnathus tamaricis* Amitai and Grinberg. 8. *Euseius eitanae* (Swirski and Amitai). 9. *Amblyseius cucumeris* (Oudemans).



Figs. 10-18. Spermathecae. 10. *Euseius rubini* (Swirski and Amitai). 11. *Euseius eitanae* (Swirski and Amitai). 12. *Amblyseius barkeri* (Hughes). 13. *Amblyseius bicaudus* Wainstein. 14. *Amblyseius cucumeris* (Oudemans). 15. *Amblyseius engaddensis* Amitai and Swirski. 16. *Typhlodromus athiasae* Porath and Swirski. 17. *Anthoseius drori* Grinberg and Amitai. 18. *Anthoseius hierochunticus* (Amitai and Swirski).



Figs. 19, 20. Chelicerae. 19. *Nabiseius rivnaya*e Amitai and Swirski. 20. *Typhlodromus athiasae* Porath and Swirski.

8. In the spermatheca the atrium bifid; major duct broad; cervix funnel-shaped (Fig. 12). Dorsal shield not reticulated *Amblyseius barkeri* (Hughes)
- In the spermatheca the atrium not bifid; major duct thin (Figs. 13-15). Dorsal shield reticulated (Fig. 3) 9
9. Short neck is present between cervix and atrium of the spermatheca (Fig. 13). Apex of peritreme reaches the bases of setae j1 *Amblyseius bicaudus* Wainstein
- Neck is absent between cervix and atrium of the spermatheca (Figs. 14,15). Apex of peritreme reaches the bases of setae j1-j3, or j3-z2 10
10. Cervix of the spermatheca elongated and narrow (Fig. 14). Apex of peritreme reaches the bases of setae j1-j3. Movable digit of the chelicera has 3 teeth *Amblyseius cucumeris* (Oudemans)
- Cervix of the spermatheca cone-shaped (Fig. 15). Apex of peritreme reaches the bases of setae j3-z2. Movable digit of the chelicera has 5 teeth *Amblyseius engaddensis* Amitai and Swirski
11. Most setae of the dorsal shield knobbed and serrated (Fig. 4). Hind leg carries 3 macrosetae *Clavidromus transvaalensis* (Nesbitt)
- Most setae of the dorsal shield pointed and smooth (Figs. 5,6) 12
12. Seta S5 of the dorsal shield absent. In the spermatheca atrium incorporated in the cervix (Fig. 16). Movable digit of the chelicera carries 2 teeth *Typhlodromus athiasae* Porath and Swirski
- Seta S5 present on the dorsal shield (Fig. 6) 13
13. Hind leg carries 3 macrosetae. Cervix of the spermatheca elongate and narrow, gradually flared towards the vesicle (Fig. 17). Setae on the lateral margins of the podoscutum shorter than the distances between their bases (Fig. 6) *Anthoseius drori* (Grinberg and Amitai)
- Hind leg carries one macroseta. Cervix of the spermatheca flask-shaped (Fig. 18). Setae on the lateral margins of the podoscutum longer than the distances between their bases *Anthoseius hierochunticus* Amitai and Swirski

DISCUSSION

The relative humidities and temperatures of the dry and hot 'En Gedi region are given in Table 1.

The distribution of phytoseiid mites of the Dead Sea Area in the various geographical regions of Israel is given in Table 2.

Amblyseius engaddensis Amitai and Swirski, *Euseius eitanae* (Swirski and Amitai), *Phytocerus desertorum* Amitai and Swirski and *Nabiseius rivnayae* Amitai and Swirski were found only in the Dead Sea and Arava regions. *Amblyseius bicaudus* Wainstein, *Anthoseius drori* (Grinberg and Amitai), *A. hierochunticus* (Amitai and Swirski) and *Paragigagnathus tamaricis* Amitai and Grinberg were recorded also from some other, inland regions, such as Jordan Valey, Judean Desert and Central Negev. The results of thorough searches in the littoral zone of Israel for *P. tamaricis* on its main host *Tamarix* spp. were negative. Other species, such as *Amblyseius barkeri*

TABLE 1. MONTHLY RELATIVE HUMIDITY (%) AND TEMPERATURE (°C) AT 'EN GEDI
(AFTER METEOROLOGICAL SERVICE, STATE OF ISRAEL).

| Month | Relative Humidity | Average | Temperature Minimum | Maximum |
|-----------|-------------------|---------|---------------------|---------|
| January | 56 | 16.3 | 13.2 | 19.4 |
| February | 51 | 18.3 | 14.6 | 22.0 |
| March | 47 | 21.0 | 16.6 | 25.5 |
| April | 42 | 23.6 | 18.9 | 28.2 |
| May | 37 | 27.5 | 22.2 | 32.8 |
| June | 35 | 32.0 | 27.0 | 36.9 |
| July | 35 | 33.1 | 27.8 | 38.4 |
| August | 38 | 31.1 | 28.7 | 37.5 |
| September | 42 | 31.1 | 26.7 | 35.5 |
| October | 41 | 28.2 | 24.5 | 32.0 |
| November | 51 | 23.2 | 20.3 | 26.6 |
| December | 56 | 18.5 | 15.4 | 21.6 |

(Hughes), *A. cucumeris* (Oudemans), *Euseius rubini* (Swirski and Amitai), *Phytoseius finitimus* Ribaga, *Typhlodromus athiasae* Porath and Swirski and *Clavidromus transvaalensis* (Nesbitt), are distributed in various geographical regions of Israel.

Most of the phytoseiid mites were collected in oases, mainly at 'En Gedi. The following remarks of Fishelson (1967) on the animal life along the shore of the Dead Sea are relevant also to phytoseiids: "Ein Gedi is situated within the Dead Sea Valley – a region rich in water and also characterized by high temperatures during most months of the year (see Table 1) ... a habitat suitable both for desert life forms as well as for animal species dependent on water and the accompanying succulent vegetation. Here, closely juxtaposed, are animals which originate from the faunas of different geographical regions. Consequently we now find at Ein Geddi an intermixing of desert and tropical, hydrophilous faunas, representatives of each occasionally living but few meters apart."

REFERENCES

- Amitai, S. and Grinberg, T. 1971. Description of a new phytoseiid genus and species (Acarina: Mesostigmata) from Israel. *Israel Journal of Entomology*, 6:327-335.
- Amitai, S. and Swirski, E. 1968. A new species of *Typhlodromus* (Acarina: Phytoseiidae) from the Middle East. *Israel Journal of Agricultural Research*, 18:35-38.
- Amitai, S. and Swirski, E. 1970. A new species of *Amblyseius* (Acarina: Phytoseiidae) from Israel. *Israel Journal of Entomology*, 5:1-5.
- Amitai, S. and Swirski, E. 1978. A new genus and new records of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. *Israel Journal of Entomology*, 12:123-143.
- Amitai, S. and Swirski, E. 1980. Two new species of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. *Israel Journal of Entomology*, 14:1-7.
- Fishelson, L. 1967. (Animal life along the Western shore of the Dead Sea). 87 + V pp., Sifriat

TABLE 2. DISTRIBUTION OF PHYTOSEIID MITES OF THE DEAD SEA REGION IN THE VARIOUS GEOGRAPHICAL AREAS OF ISRAEL.

| Species | Dead | Jordan | Arava | Galilee | | Carmel | Coastal Plain | | | Yizre'el | Shomron Mts. | Foothills of Judea | Judean Hills | Judean Desert | Negev | |
|-----------------------------------|------|--------|-------|---------|-------|--------|---------------|---|---|----------|--------------|--------------------|--------------|---------------|-------|---|
| | Sea | Valley | | Upper | Lower | | N | C | S | Valley | | | | | N | C |
| <i>Amblyseius barkeri</i> | + | + | | + | + | + | + | + | + | + | | + | + | | + | |
| <i>A. bicaudus</i> | + | + | | | | | | | | | | | | | | |
| <i>A. cucumeris</i> | + | | | | | | | + | | | | | + | | | |
| <i>A. engaddensis</i> | + | | | | | | | | | | | | | | | |
| <i>Euseius eitanae</i> | + | | | | | | | | | | | | | | | |
| <i>E. rubini</i> | + | + | | + | + | + | + | + | + | + | | + | + | | + | |
| <i>Phytoseius finitimus</i> | + | + | | + | + | + | + | + | + | + | | + | + | | | |
| <i>Typhlodromus athiasae</i> | + | + | | + | + | + | + | + | + | + | + | + | + | | + | + |
| <i>Anthoseius drori</i> | + | + | | | | | | | | | | | | | | |
| <i>A. hierochunticus</i> | + | | | | | | | | | | | | | + | | |
| <i>Clavidromus transvaalensis</i> | + | | | | + | | | + | + | | | | | | | |
| <i>Paragigagnathus tamaricis</i> | + | + | | | | | | | | | | | | + | | + |
| <i>Phytocerus desertorum</i> | + | | + | | | | | | | | | | | | | |
| <i>Nabiseius rivnaya</i> | + | | | | | | | | | | | | | | | |

N – Northern

C – Central

S – Southern

- Hapoalim, Tel Aviv. (Hebrew, with English summary)
- Grinberg, T. 1971. (Studies on predaceous mites (Acarina: Phytoseiidae) of wild vegetation in Israel.) MSc. thesis. Tel Aviv University, Ramat Aviv, Israel 103+ II pp. and 39 figs. (Hebrew with English summary)
- Grinberg, T. and Amitai, S. 1970. Description of a new *Typhlodromus* (Acarina: Phytoseiidae) from the Dead Sea region in Israel. *Israel Journal of Entomology*, 5:7-11.
- Hughes, A.M. 1948. The mites associated with stored food products. Ministry of Agriculture and Fisheries, London, 168 pp.
- Nesbitt, H.H.J. 1951. A taxonomic study of the Phytoseiinae (Family Laelaptidae) predaceous upon Tetranychidae of economic importance. *Zoologische Verhandelingen*, Leiden, 12:1-64.
- Oudemans, A.C. 1930. Acarologische aanteekeningen, 101-103, *Entomologische Berichten, Amsterdam*, 8:48-99.
- Porath, A. and Swirski, E. 1965. A survey of phytoseiid mites (Acarina: Phytoseiidae) on citrus, with a description of one new species. *Israel Journal of Agricultural Research*, 15:87-100.
- Ribaga, C. 1904. Gamasidi planticoli. *Rivista di Patologia vegetale*. 10:175-178.
- Rowell, H.J., Chant, D.A. and Hansell, R.I.C. 1978. The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata). *The Canadian Entomologist*. 110:859-876.
- Swirski, E. and Amitai, S. 1961. Some phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of two new species. *Israel Journal of Agricultural Research*, 11:193-202.
- Swirski, E. and Amitai, S. 1965. Further phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of one new species. *Israel Journal of Agricultural Research*, 15:123-138.
- Swirski, E. and Amitai, S. 1968. Notes on phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of one new species. *Israel Journal of Entomology*, 3:95-108.
- Swirski, E. and Amitai, S. 1985. Notes on phytoseiid mites (Mesostigmata: Phytoseiidae) from the Mediterranean littoral zone of Israel, with a description of a new species of *Typhloctonus*. *Israel Journal of Entomology*, 18:71-82.
- Wainstein, B.A. 1962. (Some new predatory mites of the family Phytoseiidae (Parasitiformes) of the U.S.S.R. fauna.) *Entomologicheskoe Obozrenie*, 41:230-240. (Russian)
- Wysoki, M. and Swirski, E. 1971a. Studies on overwintering of predaceous mites of the genera *Amblyseius* Berlese, *Typhlodromus* Scheuten and *Iphiseius* Berlese (Acarina: Phytoseiidae) in Israel. in: Entomological Essays to Commemorate the Retirement of Professor K. Yasumatsu. pp. 265-292. Hokuryukan Publ. Co., Tokyo.
- Wysoki, M. and Swirski, E. 1971b. Studies on overwintering of predaceous mites of the genera *Seiulus* Berlese and *Phytoseius* Ribaga in Israel (Acarina: Phytoseiidae). *Israel Journal of Entomology*, 6:55-70.