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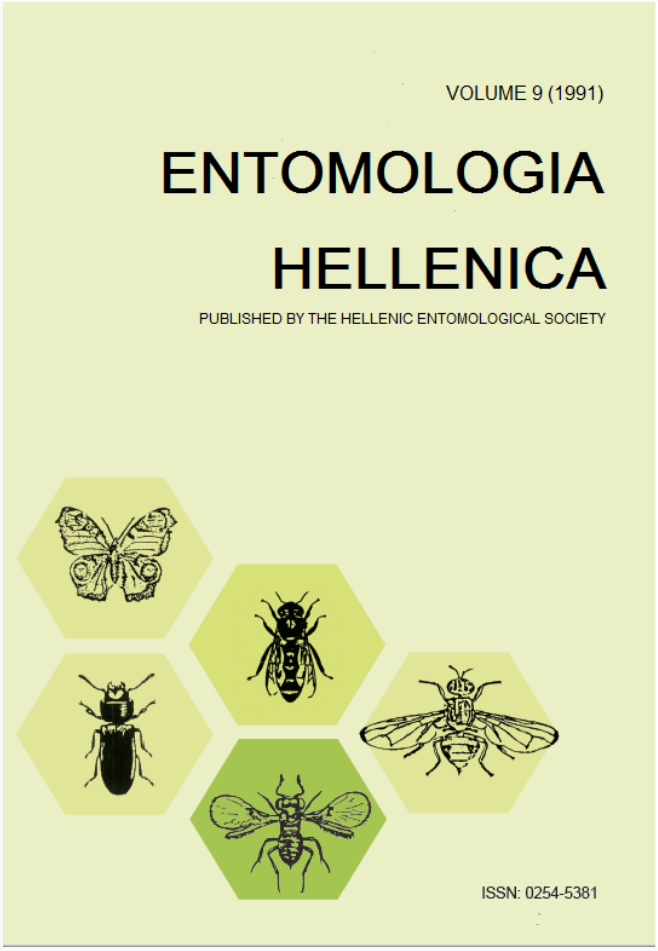

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The genus *Amblyseius* (Acari: Phytoseiidae) in Greece, with the Description of a New Species[1]

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ABSTRACT

A nationwide survey on Phytoseiid mites in Greece revealed the occurrence of 19 species belonging to the Genus *Amblyseius*. A key and illustrations of all these species are given along with the synonyms, habitats and distribution data. A new species, *A. makedonicus*, found on *Oryza sativa*, is described.

Introduction

Phytoseiid mites are well known predators of injurious arthropods and for this reason numerous studies have been made in many parts of the world. In Greece prior to the studies of the authors in 1982 the only references on Phytoseiid mites were those of: Wainstein (1969), Swirski and Ragusa (1976, 1977), Hatzinikolis (1977), Mc Murtry (1977), and Papaioannou - Souliotis (1981). During the present survey many species belonging to the genera *Amblyseius* Berlese, *Typhlodromus* Scheuten, *Phytoseius* Ribaga and *Phytoseiulus* Evans were found, some of which were new to science (Papadoulis and Emmanouel 1988, 1990, 1991a, 1991b, 1992).

The present paper deals with all species belonging to *Amblyseius*. *Amblyseius makedonicus* spec. nov. is described and illustrated. All other species are also illustrated, most of them in more detail than previously.

Material and Methods

Commencing in 1982 many samples of various wild and cultivated plants were collected throughout the year from many localities in Greece. Mites were extracted using the Berleze-Tulgren method or/and by direct observation under the binocular microscope. A Zeiss drawing tube was used for the illustrations. The setal nomenclature is based on the system of Lindquist and Evans (1965) as adapted for the family Phytoseiidae by Rowell et al. (1978). Other terminology follows Athias-Henriot (1975, 1977) for organotaxy, Evans and Till (1979) for the ventral pores and Wainstein (1973) for spermathecae. The dorsal and ventral setal pattern notation of Chant and Yoshida-Shaul (1989, 1991) is used. All measurements are given in microns for an average of 5 females. All specimens are deposited in the Acari collection of the Laboratory of Agricultural Zoology and Entomology, Agricultural University of Athens.

Results and Discussion

The present study revealed the presence of 19 *Amblyseius* species belonging to 8 species-groups. A key based on the female is provided. Synonyms, distributions and illustrations of all species found are also given.

Key to the adult females of the Greek species of the genus *Amblyseius*.

1. Setae J2 absent ..... *A. messor* (Wainstein)
– Setae J2 present 2
2. Interscutal membrane sclerotized; ventroanal shield fragmented into anal

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and ventral shields; all dorsal setae very short ..... *A. degenerans* (Berlese)
– Interscutal membrane not sclerotized; ventroanal shield entire 3
3. Setae j3, s4, Z4 and Z5 much longer than others dorsal setae which are very short; setae j1, z2, z4 and S2 may be relatively long, but not longer than setae j3; setae Z4 and Z5 very long and whip-like ..... *obtusus* group 4
– Without this combination of characters 6
4. Setae j1 longer than z4; Z4 and Z5 lightly serrated; s4 and Z4 subequal in length ..... *A. andersoni* (Chant)
– Setae j1 shorter than z4; Z4 and Z5 smooth; setae Z4 longer than s4 5
5. Spermatheca S-shaped; setae z4 and S2 subequal in length; macroseta on basitarsus IV longer than that on genu IV ..... *A. begljarovi* Abbasova
– Spermatheca bell-shaped; setae z4 much longer than S2; macroseta on basitarsus IV and genu IV subequal in length ..... *A. nemorivagus* Athias-Henriot
6. Ventroanal shield with one pair of preanal setae ..... *A. setosus* (Muma)
– Ventroanal shield with more than one pair of preanal setae 7
7. Ventroanal shield with preanal setae almost aligned in two transverse rows on the anterior third of the shield; setae JV1 usually in line with ZV2 ..... *finlandicus* group 8
– Preanal setae arranged in three transverse rows 9
8. Cervix of spermatheca tube-shaped; peritreme extenting to level of setae j3 ..... *A. stipulatus* (Athias-Henriot)
– Cervix of spermatheca not tube-shaped; peritreme short extending to level between the bases of setae z2 and z4 ..... *A. finlandicus* (Oudemans)
9. Dorsal shield with 16 pairs of setae (S4 absent) ..... *aberrans* group 10
– Dorsal shield with 17 pairs of setae (S4 present) 12
10. Tibia IV with 7 setae ..... *A. aberrans* (Oudemans)
– Tibia IV with 6 setae 11
11. Four pairs of setae on integument surrounding ventroanal shield ..... *A. keae* Papadoulis and Emmanouel
– Two pairs of setae on integument surrounding ventroanal shield ..... *A. hymetticus* Papadoulis and Emmanouel
12. Ventroanal shield elongated and slender, usually narrower than posterior margin of genital shield, with construction at the level of JV2 setae (vase-like) ..... *A. insuetus* Livshitz and Kuznetsov
– Ventroanal shield squarish, triangular or rectangular and broader than the posterior margin of genital shield ..... *cucumeris* group 13
13. Genu II with 9 setae ..... *A. graminis* Chant
– Genu II with fewer than 9 setae 14
14. Spermatheca with long neck (subequal in length with cervix) 15
– Spermatheca with short neck (less than cervix) or without neck 16
15. Fixed digit of chelicerae with one tooth; peritreme extending to level of j1 ..... *A. marginatus* (Wainstein)
– Fixed digit of chelicerae without teeth; peritreme extending to level of j3 ..... *A. cinstutus* Livshitz and Kuznetsov
16. Spermatheca without neck 17
– Spermatheca with short neck (less than the cervix) 18
17. Cervix of spermatheca bell-shaped ..... *A. cucumeris* (Oudemans)
– Cervix funnel shaped; major duct a broad tube ..... *A. barkeri* (Hughes)
18. Setae Z4, S4, S5 serrated; S5 longer than Z4 ..... *A. bicaudus* Wainstein
– Setae Z4, S4, S5, smooth; S5 shorter than Z4 ..... *A. makedonicus* spec. nov.

MESSOR GROUP

1. *Amblyseius messor* (Wainstein) (Figs. 1-6).

Typhlodromus messor Wainstein, 1960: 688.

Amblyseius messor (Wainstein); Athias-Henriot, 1961: 425; Athias-Henriot, 1966: 190; Swirski & Amitai, 1965: 132; Swirski & Amitai, 1968: 102; Livshitz & Kuznetsov, 1972: 21; Amitai & Wysoki, 1974: 45; Ragusa, 1977; 385; Wainstein, 1977: 1415; Amitai & Swirski, 1978: 130; Schicha, 1983: 111; Ragusa, 1985: 79; Papadoulis & Emmanouel, 1990: 14.

Amblyseius (Amblyseius) messor (Wainstein); Ehara, 1966: 22; Ueckermann & Loots, 1988: 66.

Amblyseius (Amblyseius) apheles Van der Merwe, 1968: 121 (Synonymy by Ueckermann & Loots, 1988).

Amblyseius obtusus (Koch); Womersley, 1954: 188.

Specimens examined: Kopais region, Co. Boiotia on several occasions during 1984-1990 on *Medicago sativa*.

Previous records: The type specimens were collected on Graminae in East Georgia, U.S.S.R. This species has been also recorded from: Algeria, Spain, Israel, Italy, U.S.S.R. and Australia.

DEGENERANS GROUP

2. *Amblyseius degenerans* (Berlese) (Figs. 7-11).

Seius degenerans Berlese, 1889, Acari Myr. Scorp., fasc. 54, No 9.

Iphiseius degenerans Berlese, 1921: 95; Evans, 1954: 517; Athias-Henriot, 1957: 335; Chant, 1959: 110; Swirski & Shechter, 1961: 97; Prichard & Baker, 1962: 299; Swirski & Amitai, 1961: 201; Carmona, 1962; Porath & Swirski,

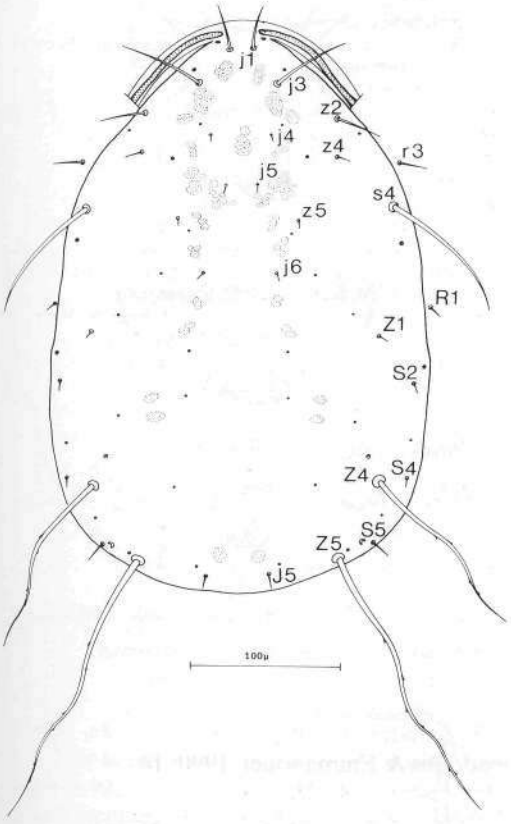


FIG. 1. *Amblyseius messor*: female, dorsal shield.

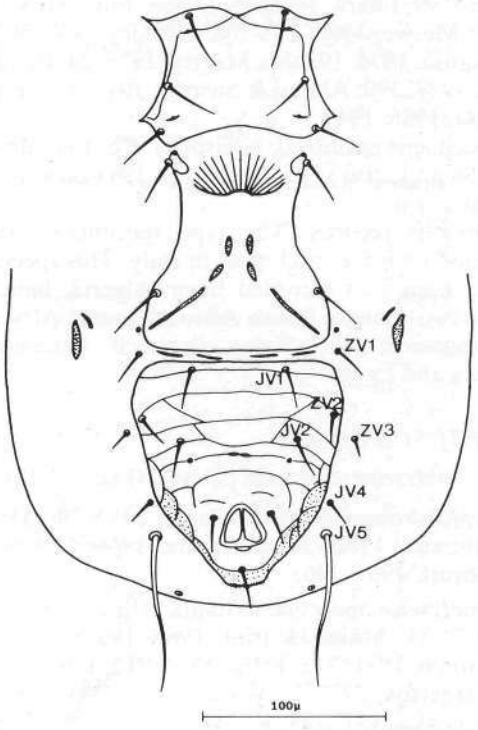
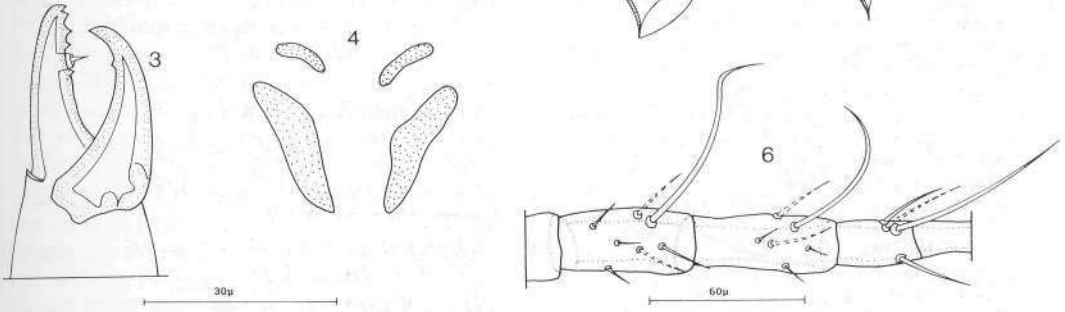


FIG. 2. *Amblyseius messor*: female, venter.



FIGS. 3-6. *Amblyseius messor*: 3 chelicerae of female, 4 metapodal plates, 5 spermatheca, 6 leg IV.

1965: 99; Ehara, 1966: 25; Dosse, 1967: 37; Van der Merwe, 1968: 105-108; Elbadry 1970: 502; Ragusa, 1976: 193; Mc Murtry, 1977: 24; Ragusa, 1977: 390; Amitai & Swirski, 1978: 133; Ragusa, 1986: 194.

Specimens examined: Kleisoura, Co. Ioannina, 1986 on *Citrus* spp.; Messologi, 1991 on *Citrus* spp.

Previous records: The type specimens were found on leaves and moss in Italy. This species has been also recorded from: Algeria, Israel, Turkey, Congo, South Africa, Central Africa, Tanganica, Hong-Kong, Portugal, Lebanon, Italy and Egypt.

OBTUSUS GROUP

3. *Amblyseius andersoni* (Chant) (Figs. 12-18).

Typhlodromus andersoni Chant, 1957: 296; Hirschmann, 1962: 24; Carmona, 1966: 189-191; Schruft, 1967: 190.

Amblyseius andersoni (Chant), Athias-Henriot, 1958: 33; Athias-Henriot, 1966: 195; Chant & Hansell, 1971: 715; Karg, 1971: 212; Livshitz & Kuznetsov, 1972: 23; Wainstein, 1973: 178; Kolodochka, 1973: 79; Kolodochka, 1978: 27-29;

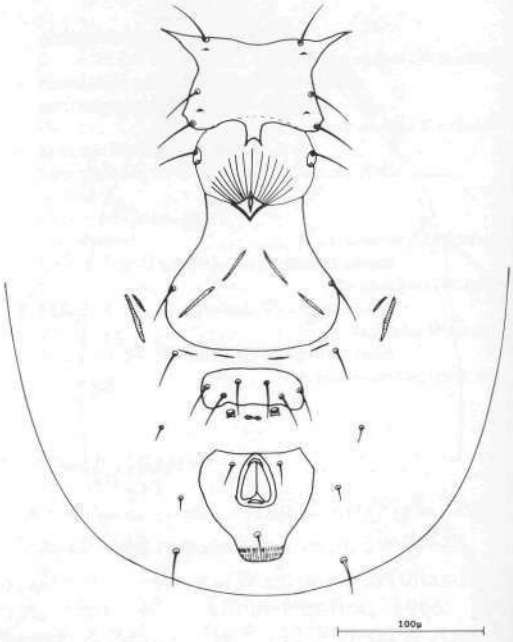


FIG. 8. *Amblyseius degenerans*: female, venter.

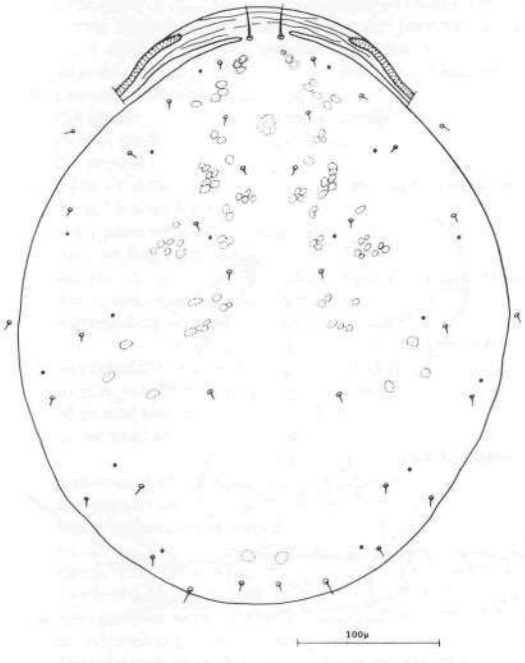


FIG. 7. *Amblyseius degenerans*: female, dorsal shield.

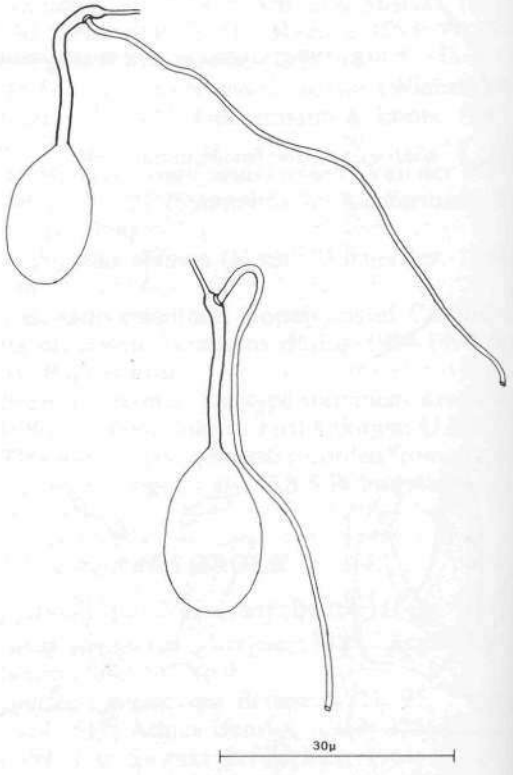
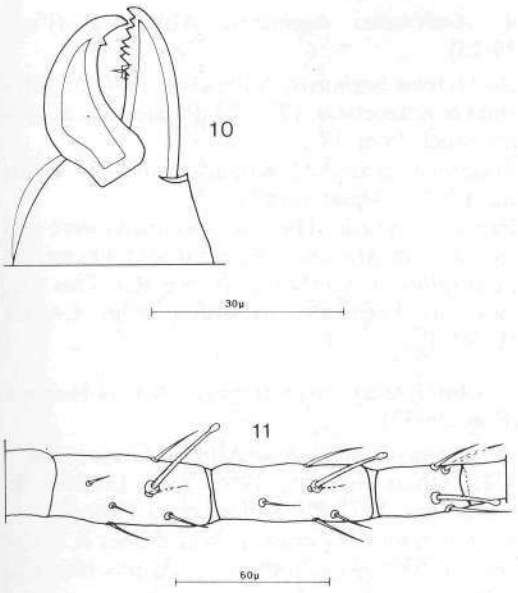


FIG. 9. *Amblyseius degenerans*: spermatheca.



FIGS. 10-11. *Amblyseius degenerans*: 10 chelicerae of female, 11 leg IV.

Forest et al., 1981: 21-22; Lehman, 1982: 216-217; Karg, 1982; Chant & Yoshida-Shaul, 1990: 5-12.

Amblyseopsis potentillae Garman, 1958: 76-77 (Synonymy by Chant and Yoshida-Shaul, 1990).

Amblyseopsis potentillae (Garman), Mc Murtry, 1977: 21-22; Swirski & Ragusa, 1977: 81-82; Ragusa, 1985 82-84; Ragusa, 1986: 194.

Typhlodromus (Amblyseius) andersoni Chant, Chant, 1959: 92; Boczek, 1964: 366-367.

Typhlodromus (Amblyseius) britannicus Chant, 1959: 87-88 (Synonymy by Chant and Yoshida-Shaul, 1990).

Amblyseius (Amblyseius) andersoni (Chant), Muma, 1961: 287; Wainstein & Vartapetov, 1973: 103; Ueckermann & Loots, 1988: 73.

Typhlodromus (Typhlodromus) andersoni Chant, Westerboer & Bernhard, 1963: 682-689.

Amblyseius reflexus Knisley & Denmark, 1978: 8-10 (Synonymy by Denmark & Muma, 1989; confirmed by Chant and Yoshida-Shaul, 1990).

Amblyseius (Multiseius) andersoni (Chant), Denmark & Muma, 1989: 84.

Specimens examined: M. Gotista, Co. Ioannina, 1986 on *Prunus* sp.; Kleisoura, Co. Ioannina, 1986 on *Citrus* spp.; Preveza, 1987 on *Citrus* spp.; Kalamata, Co. Messinia, 1986 on *Citrus*

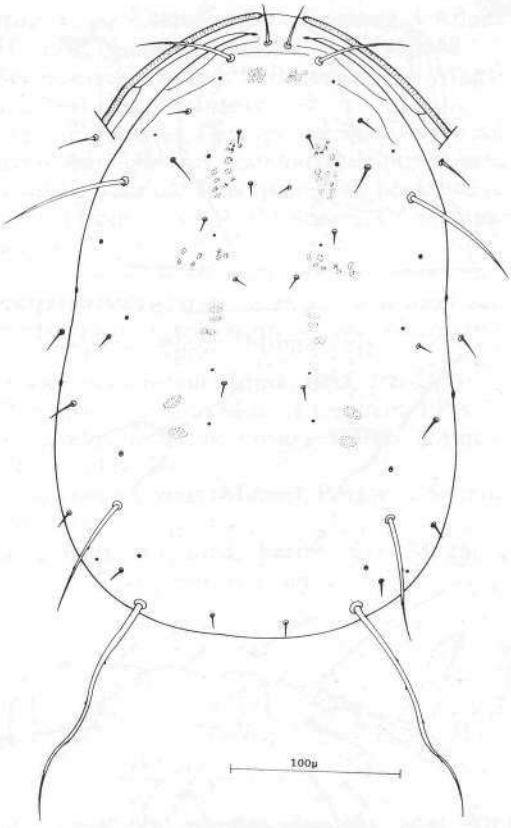


FIG. 12. *Amblyseius andersoni*: female, dorsal shield.

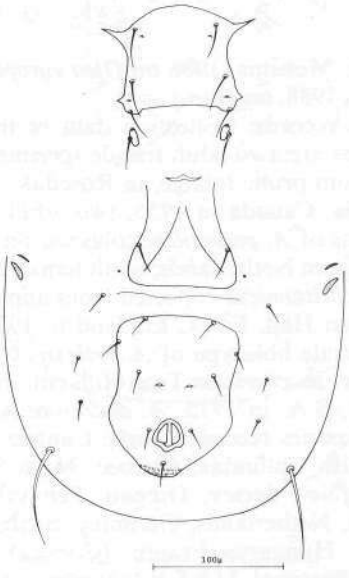
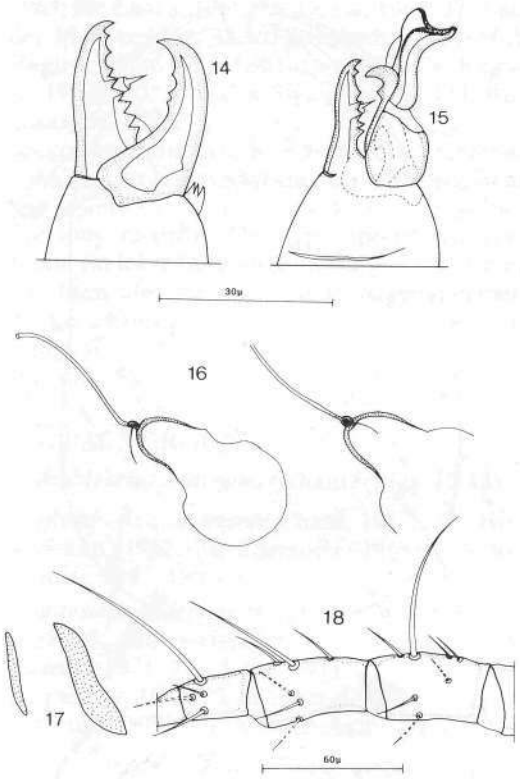


FIG. 13. *Amblyseius andersoni*: female, venter.



FIGS. 14-18. *Amblyseius andersoni*: 14 chelicerae of female, 15 chelicerae of male, 16 spermatheca, 17 metapodal plates, 18 leg IV.

spp.; Co. Messinia, 1986 on *Olea europea*; Co. Messinia 1988, on *Citrus* spp.
Previous records: Collection data of the type specimens are: two adult female specimens collected from prune foliage, in Rosedale, British Columbia, Canada in 1955; two adult female specimens of *A. potentillae* collected on *Potentilla* sp. from Netherlands; adult female holotype of *A. britannicus* collected from apple foliage, Penlan Hall, Essex, England in 1953; and adult female holotype of *A. reflexus* collected from *Acer saccharinum* Tron Hills country New Jersey, U.S.A. in 1975. *A. andersoni* is a well known species recorded from: Canada (Ontario, British Columbia, Quebec, Nova Scotia), U.S.A. (New Jersey, Oregon, Pennsylvania), England, Netherlands, Germany, Switzerland, Poland, Hungary, France (Corsica), Italy, Greece, Portugal, U.S.S.R. (Armenia, Crimea, Moldavia, Ukrania), Algeria and Iceland.

4. *Amblyseius begljarovi* Abbasova (Figs. 19-25).

Amblyseius begljarovi Abbasova, 1970: 52; Livshitz & Kuznetsov, 1972: 23; Papadoulis & Emmanouel, 1990: 14.
Specimens examined: Kopais region, Co. Boiotia, 1982 on *Opuntia* sp.
Previous records: The type specimens were collected from *Micromys minutus* and *Vespertilio pipistrellus* in Azerbaijan (U.S.S.R.). This species has been also recorded from Crimea (U.S.S.R.).

5. *Amblyseius nemorivagus* Athias-Henriot (Figs. 26-32).

Amblyseius nemorivagus Athias-Henriot, 1961: 424; Athias-Henriot, 1966: 197; Livshitz & Kuznetsov, 1972: 23; Kolodochka 1980: 45.
Typhlodromus hispaniensis Westerboer & Bernhard, 1963: 696 (Synonymy by Athias-Henriot, 1966).

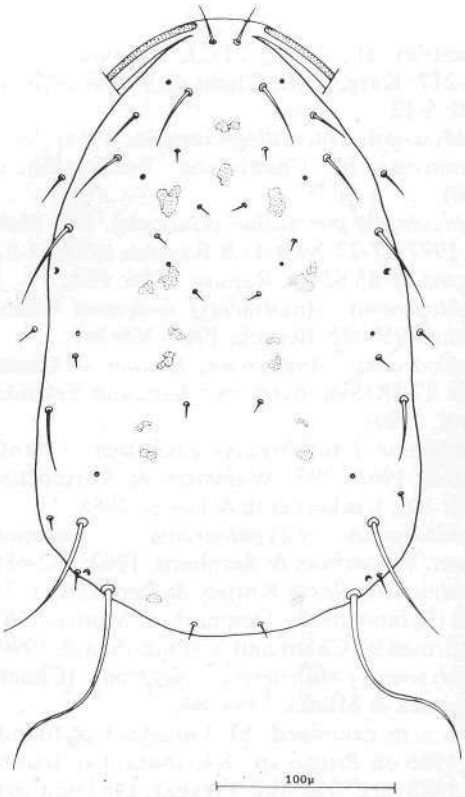


FIG. 19. *Amblyseius begljarovi*: female, dorsal shield.

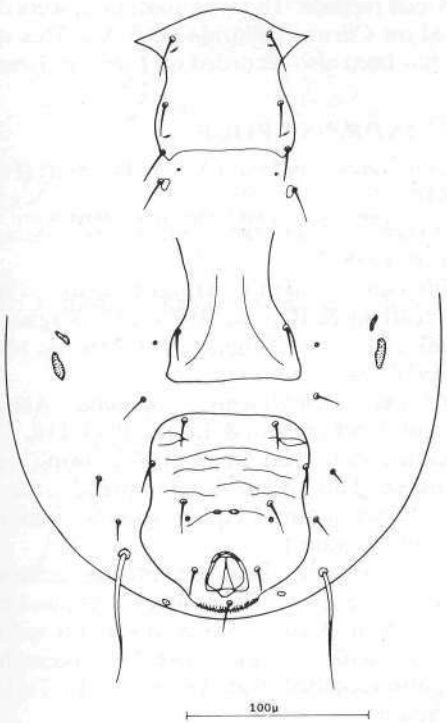
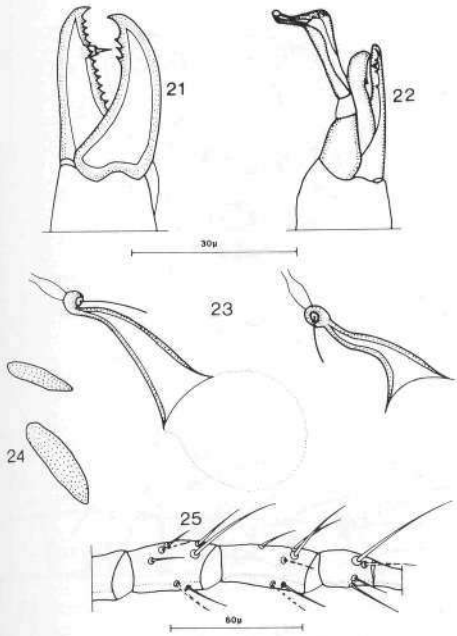


FIG. 20. *Amblyseius begljarovi*: female, venter.



FIGS. 21-25. *Amblyseius begljarovi*: 21 chelicerae of female, 22 chelicerae of male, 23 spermatheca, 24 metapodal plates, 25 leg IV.

Amblyseius (Amblyseius) nemorivagus Athias-Henriot, Ueckermann and Loots, 1988: 67.
Specimens examined: Makrynitsa, Co. Magnisia, 1991 on Graminae.
Previous records: The type specimens were collected from *Quercus suber* and soil under *Laurus nobilis* in Algeria. This species has been also recorded from: U.S.S.R. (Moldavia, Crimea) and Spain.

SETOSUS GROUP

6. *Amblyseius setosus* (Muma) (Figs. 33-38).

Amblyseiella setosa Muma, 1955: 266-268.
Phytoseiulus setosa (Muma), Garman, 1958: 70.
Typhlodromus (Amblyseius) setosus (Muma), Chant, 1959: 70.
Amblyseius setosus (Muma), Porath & Swirski, 1965: 97.
Specimens examined: Ferres, Co. Magnisia, 1990 on *Gossypium hirsutum*.

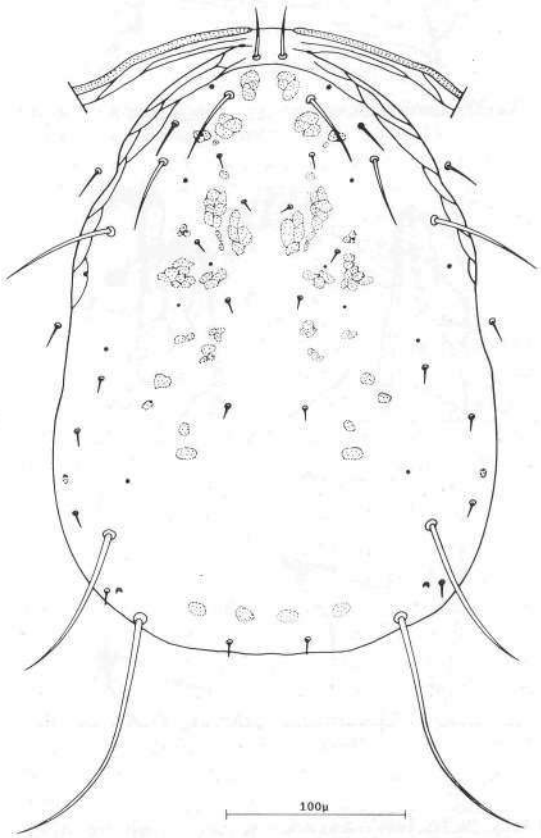


FIG. 26. *Amblyseius nemorivagus*: female, dorsal shield.

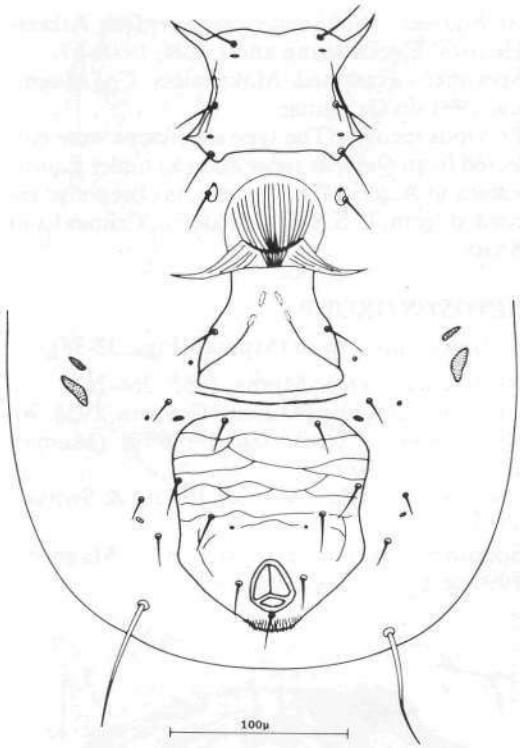


FIG. 27. *Amblyseius nemorivagus*: female, venter.

Previous records: The type specimens were collected on *Citrus* in Florida (U.S.A.). This species has been also recorded on *Citrus* in Israel.

FINLANDICUS GROUP

7. *Amblyseius stipulatus* (Athias-Henriot) (Figs. 39-44).

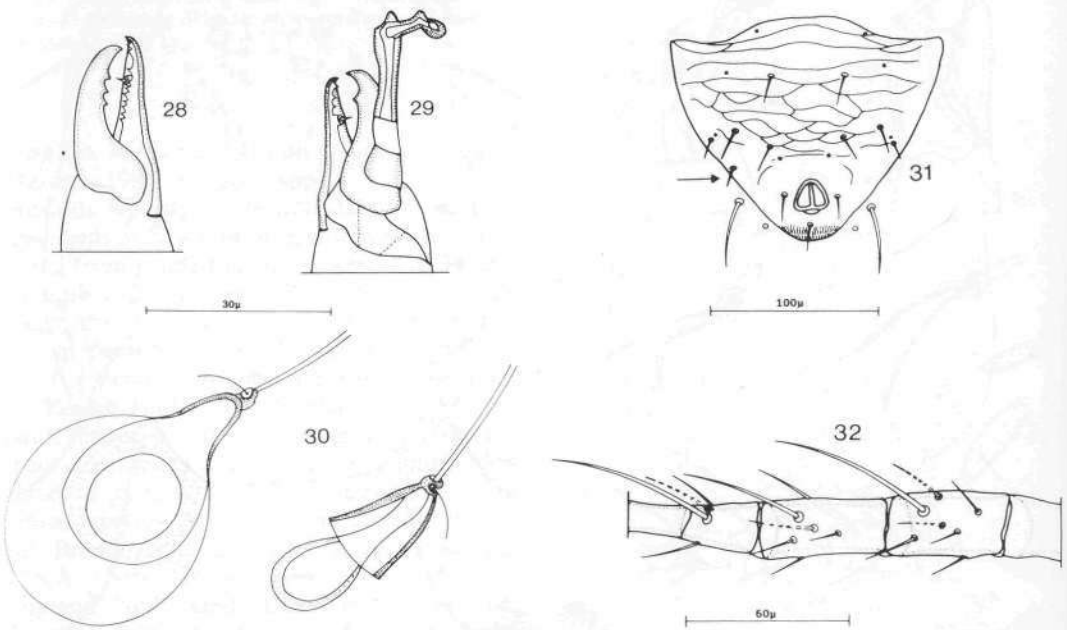
Amblyseius finlandicus (Oudemans); Athias-Henriot 1958: 3.

Amblyseius stipulatus Athias-Henriot, 1960: 294; Swirski & Ragusa, 1976: 119; Ragusa & Swirski, 1976: 192; Ragusa 1977: 386; Mc Murtry, 1977: 20.

Amblyseius (Amblyseius) stipulatus Athias-Henriot; Ueckermann & Loots, 1988: 110.

Specimens examined: In all citrus growing areas in Greece. This species is widespread, and the most dominant and frequent species on all *Citrus* spp. examined.

Previous records: This species was collected from *Citrus* spp. and other plants (Athias-Henriot, 1958) in Algeria. She mistook this species for *A. finlandicus* (Oudemans). This species has been also recorded from: Greece, Italy, Turkey and Spain.



FIGS. 28-32. *Amblyseius nemorivagus*: 28 chelicerae of female, 29 chelicerae of male, 30 spermatheca, 31 ventroanal shield of male, 32 leg IV of female.

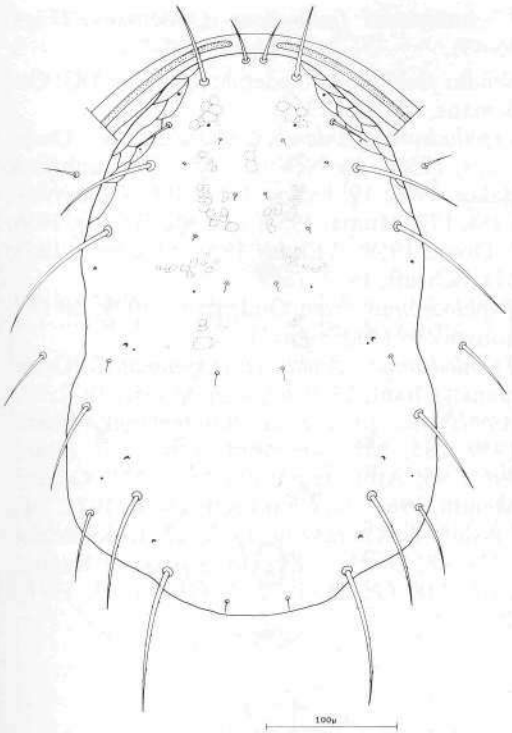
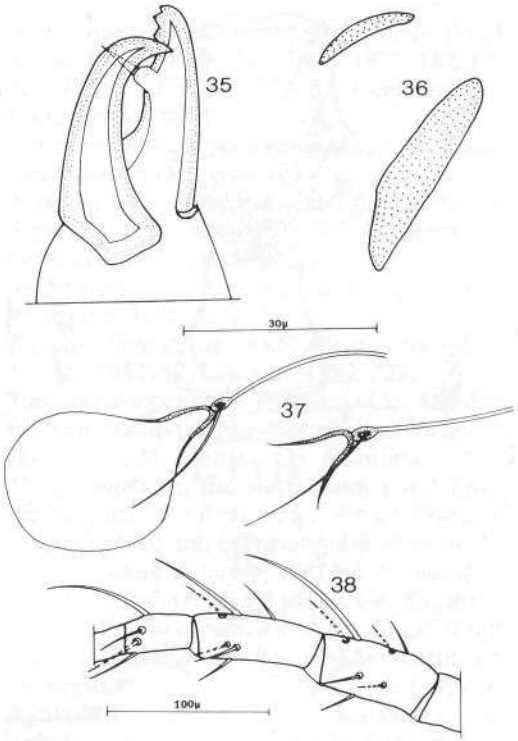


FIG. 33. *Amblyseius setosus*: female, dorsal shield.



FIGS. 35-38. *Amblyseius setosus*: 35 chelicerae of female, 36 metapodal plates, 37 spermatheca, 38 leg IV.

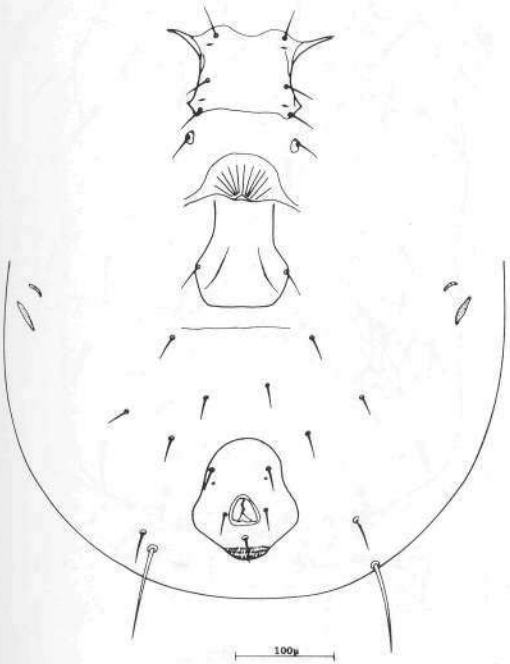


FIG. 34. *Amblyseius setosus*: female, venter.

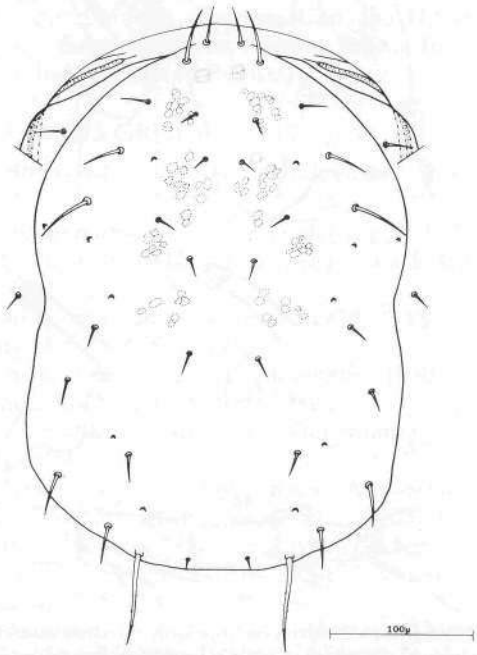


FIG. 39. *Amblyseius stipulatus*: female, dorsal shield.

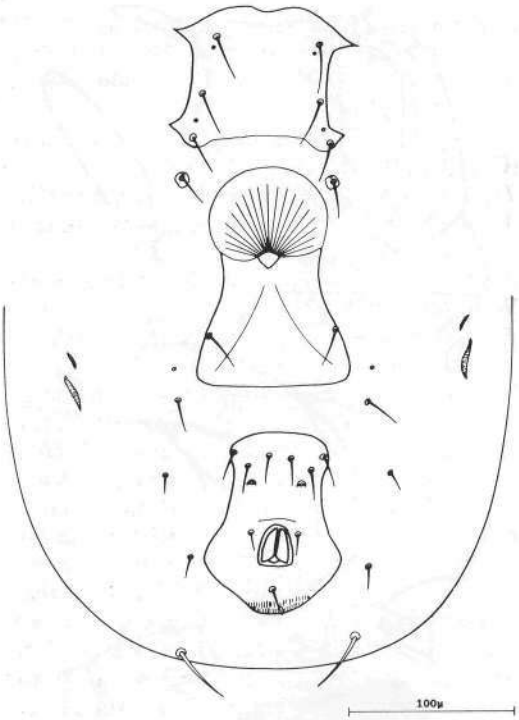
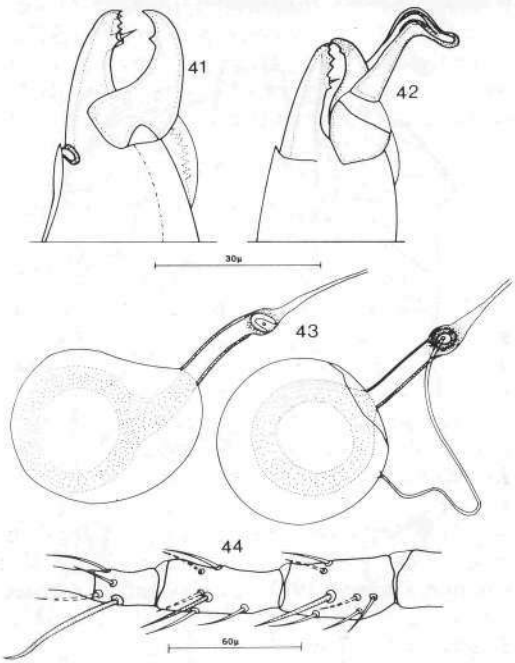


FIG. 40. *Amblyseius stipulatus*: female, venter.



FIGS. 41-44. *Amblyseius stipulatus*: 41 chelicerae of female, 42 chelicerae of male, 43 spermatheca, 44 leg IV of female.

8. *Amblyseius finlandicus* (Oudemans) (Figs. 45-49).

Seiulus finlandicus Oudemans, 1915a: 183; Oudemans, 1915b: 159.

Typhlodromus finlandicus (Oudemans); Oudemans, 1930a: 50; Nesbitt, 1951: 25; Cunliffe & Baker, 1953: 19; Evans, 1953: 466; Womersley, 1954: 173; Muma, 1955: 268; Mc Gregor, 1956: 7; Dosse, 1958: 5; Ehara, 1958: 53; Chant, 1958: 611; Schruft, 1967: 187.

Typhlodromus pruni Oudemans, 1929: 50 (Synonymy by Oudemans, 1930a).

Typhlodromus (Amblyseius) finlandicus (Oudemans); Chant, 1959: 67; Van de Vrie, 1972: 17.

Amblyseius finlandicus (Oudemans); Ehara, 1959: 285; Athias-Henriot, 1960: 296; Ehara, 1961: 95; Athias-Henriot, 1966: 221; Ghai & Menon, 1967: 70; Chant & Hansell, 1971: 706; Livshitz & Kuznetzov, 1972: 22; Kolodochka, 1973: 78; Gupta, 1975: 36; Swirski & Ragusa, 1976: 118; Gupta, 1977: 32; 1981a: 35; 1981b: 46.

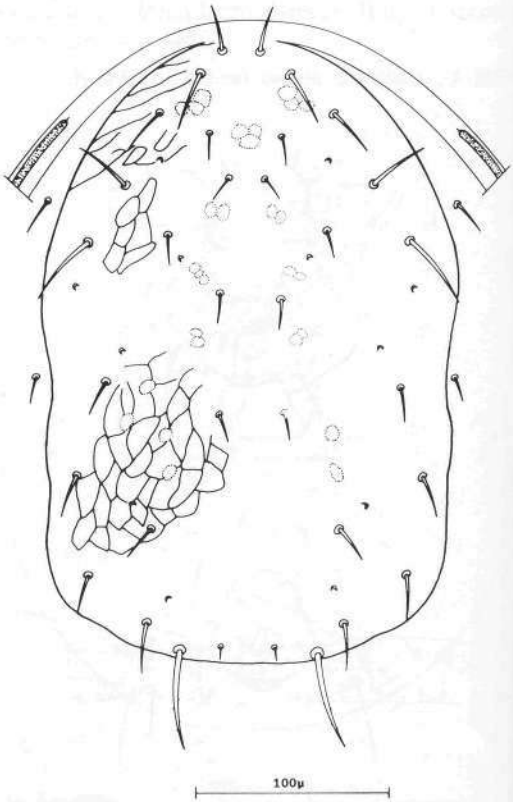


FIG. 45. *Amblyseius finlandicus*: female, dorsal shield.

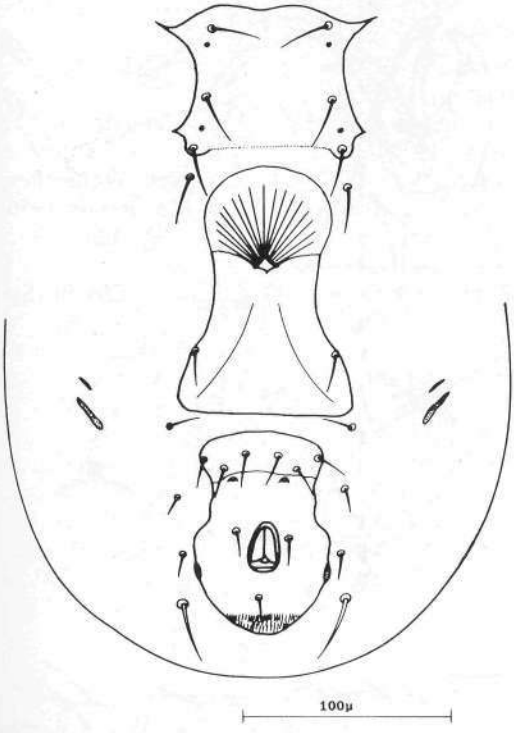
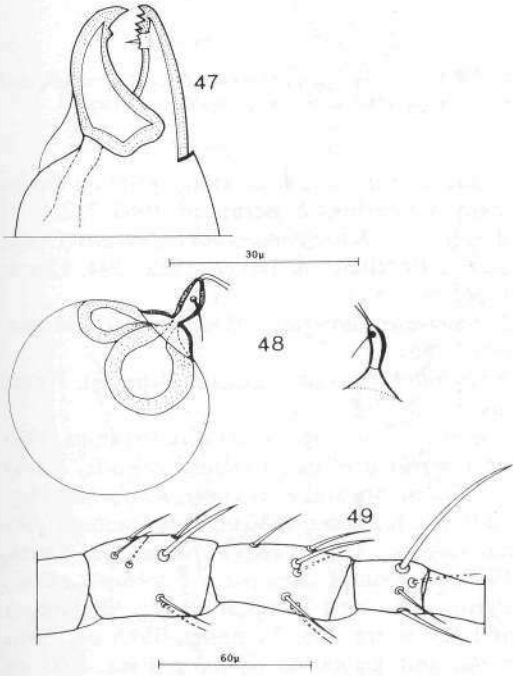


FIG. 46. *Amblyseius finlandicus*: female, venter.



FIGS. 47-49. *Amblyseius finlandicus*: 47 chelicerae of female, 48 spermatheca, 49 leg IV of female.

Amblyseius (Amblyseius) finlandicus (Oudemans); Ehara, 1966: 24; Ehara, 1972: 167; Ehara, 1975: 27; Ehara, 1977: 35; Ueckermann & Loots, 1988: 109.
Typhlodromus (Typhlodromopsis) finlandicus (Oudemans); De Leon, 1959: 113.
Typhlodromus (Typhlodromus) finlandicus (Oudemans); Beglyarov, 1958: 103; Westerboer & Bernhard, 1963: 592.
Amblyseius (Euseius) finlandicus (Oudemans); Wainstein, 1975; 921.
Euseius finlandicus (Oudemans); Swirski & Amitai, 1982: 57; Lehman, 1982: 223.
Specimens examined: Phylakti, Co. Karditsa, 1986 on *Prunus cerasus, Castanea sativa* and *Juglans regia*; M. Gotista, Co. Ioannina, 1986 on *Pyrus communis, Prunus domestica* and *Prunus* sp.; Serviana, Co. Ioannina, 1986 on *Prunus cerasus*; Phylakti and Oiti mountain, 1988 on *Prunus* sp.; Island of Crete, 1987 on *Prunus domestica* and *Juglans regia*; Trikala, Co. Korinthos, 1988 on *Prunus armeniaca*; Zitza, Co. Ioannina, 1986 on *Prunus avium*; Tymphi mountain, 1991 on *Fagus* sp. Vyzitsa, Co. Magnisia, 1991 and Aghia-Lavra Monastery, Kalavryta, Co. Achaia, 1991 on *Aesculus hippocastanum*.
Previous records: The type specimens were found on *Salix carpea* in Abo, Finland. This is a cosmopolitan species recorded from: U.S.S.R. (Georgia, Crimea), Europe, Canada, U.S.A. Mexico, South America, Algeria, Japan, Indonesia, India, Iran and Pakistan.

ABERRANS GROUP

9. *Amblyseius aberrans* (Oudemans) (Figs. 50-55).

Typhlodromus aberrans Oudemans, 1930: 48-49; Schruft, 1967: 186; Kropezynska & Jenser, 1968: 321.
Typhlodromus vitis Oudemans, 1930: 99 (Synonymy by Chant 1955, 1959).
Typhlodromus elongatus Oudemans, 1930: 50 (Synonymy by Chant 1955, 1959).
Kampimodromus elongatus (Oudemans); Nesbitt, 1951: 5.
Amblyseius aberrans (Oudemans); Athias-Henriot, 1958: 36; Swirski & Amitai, 1965: 127; Chant & Hansell, 1971: 722; Livshitz & Kuznetsov, 1972: 21; Ragusa, 1976: 192-193; Swirski & Ragusa, 1976: 118;
Typhlodromus (Amblyseius) aberrans Oudemans; Chant, 1959; 101, Boczek & Kropezynska, 1964: 4.

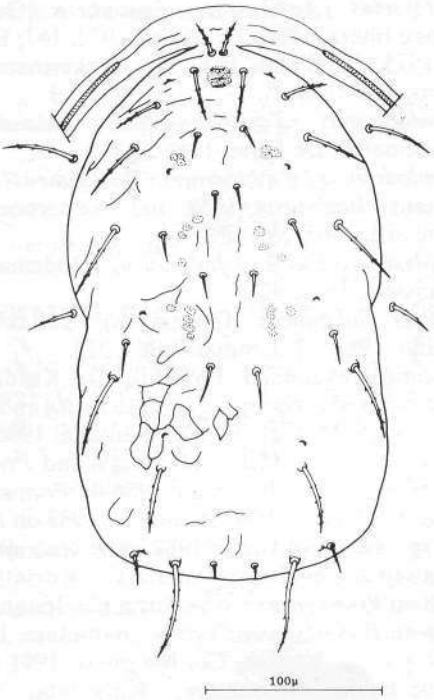


FIG. 50. *Amblyseius aberrans*: female, dorsal shield.

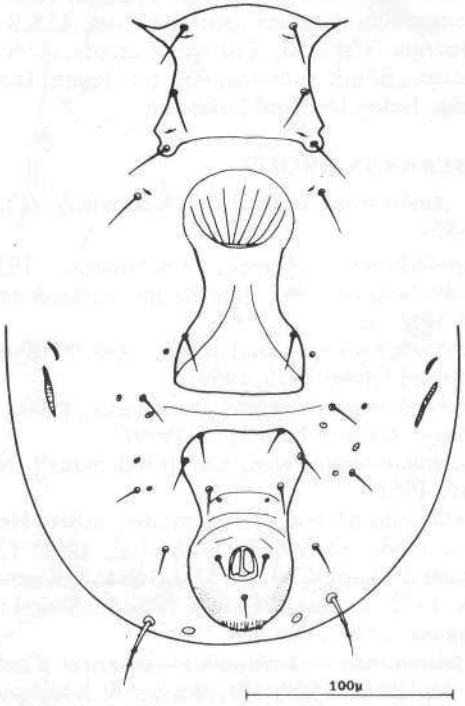
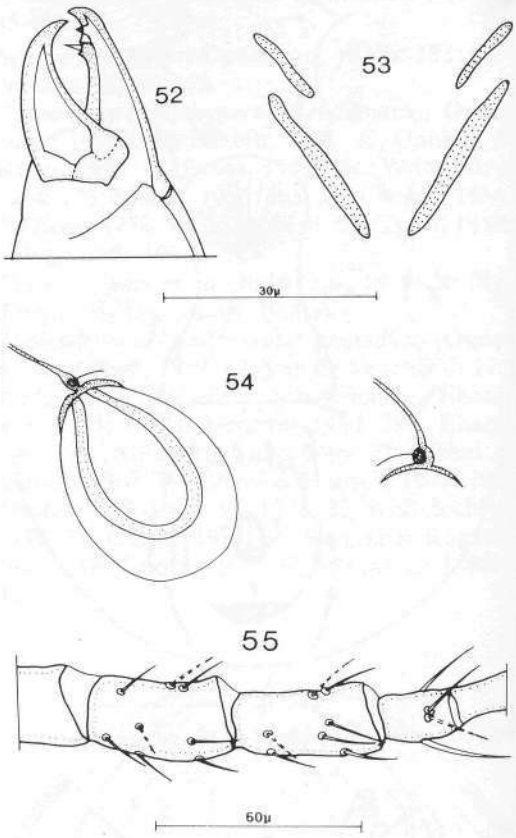


FIG. 51. *Amblyseius aberrans*: female, venter.



FIGS. 52-55. *Amblyseius aberrans*: 52 chelicerae of female, 53 metapodal plates, 54 spermatheca, 55 leg IV.

Typhlodromus (Typhlodromus) aberrans Oudemans; Westerboer & Bernhard, 1964: 712.
Amblyseius (Kampimodromus) aberrans (Oudemans); Pritchand & Baker, 1962: 294; Ehara, 1966: 24.
Paradromus aberrans (Oudemans); Muma, 1961: 286.
Kampimodromus aberrans (Oudemans); Hatzinikolis, 1973: 2.
Specimens examined: Zitza, Co. Ioannina, 1986 on *Corylus avellana, Cydonia vulgaris, Ulmus* sp., *Cornus* sp. and *Pyrus amygdaliformis*; Phylakti, Co. Karditsa, 1986 on *Pyrus malus, Cydonia vulgaris, Ulmus* sp.; Vyronia, Co. Serres, 1987 on *Prunus domestica, Corylus avellana, Pyrus malus* and *Diospyros kaki*; M. Gotista and Kleisoura, Co. Ioannina, 1986 on *Pyrus malus* and *Eriobotria japonica*; Evia, 1987 on *Eriobotria japonica*; Trikala Co. Korinthos, 1988 on *Clematis* sp.; Hymettos mountain, Co.

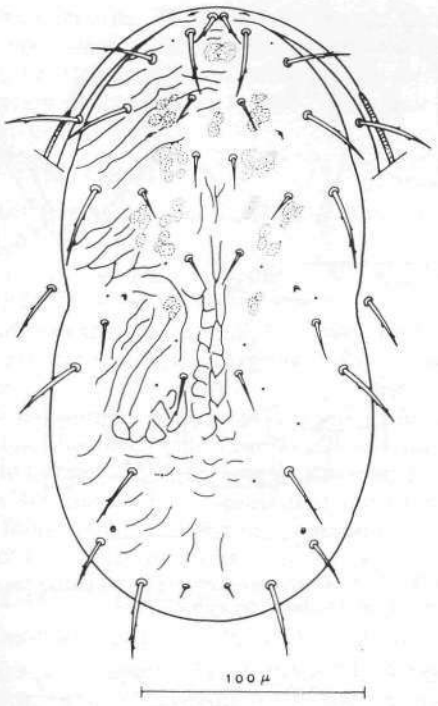


FIG. 56. *Amblyseius keae*: female, dorsal shield.

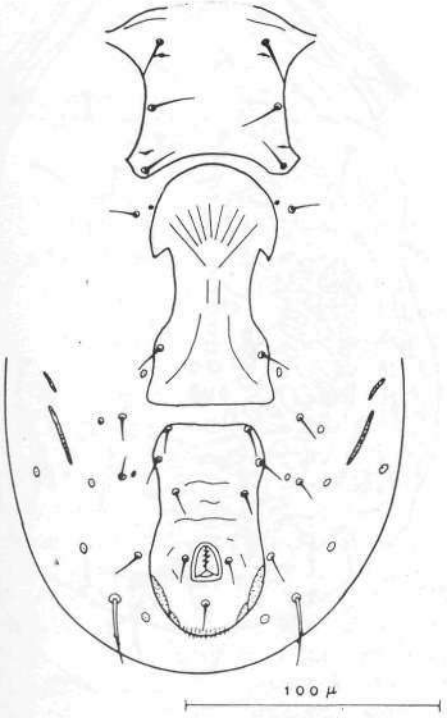


FIG. 57. *Amblyseius keae*: female, venter.

Attica, 1988 on *Flomis fruticosa*; and Karditsa, 1990 on *Ulmus* sp.

Previous records: The type specimens were found on *Tilia* sp. in the Netherlands. This species is well known in Europe (Germany, Italy, Switzerland, Hungary, Poland, Greece, England), U.S.S.R. (Crimea), Canada, U.S.A., Turkey, Israel and Algeria.

10. *Amblyseius keae* Papadoulis & Emmanouel (Figs. 56-61).

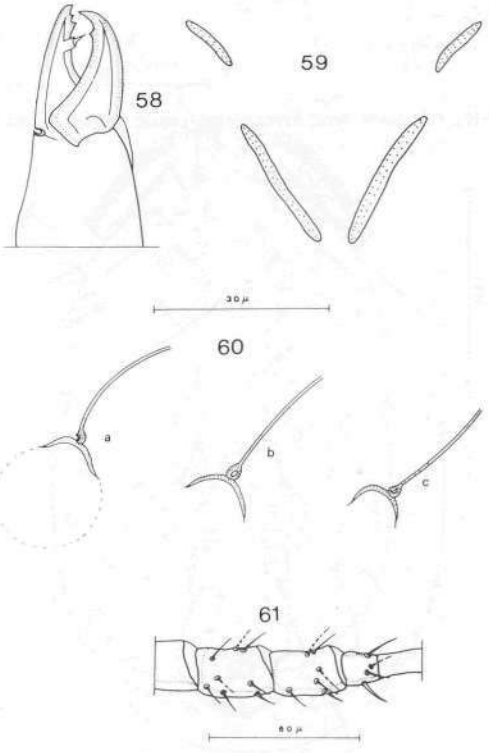
Amblyseius keae Papadoulis & Emmanouel, 1991: 265-269.

Specimens examined - Previous records: The type specimens were found on *Quercus aegilops* at Kea island of the Aegean Sea on October 2, 1988. This species is known only in Greece.

11. *Amblyseius hymetticus* Papadoulis & Emmanouel (Figs. 62-66).

Amblyseius hymetticus Papadoulis & Emmanouel, 1991: 265-269.

Specimens examined: Anilio, Pilio region, Co. Magnisia on *Pteris* sp.



FIGS. 58-61. *Amblyseius keae*: 58 chelicerae of female, 59 metapodal plates, 60 spermatheca, 61 leg IV.

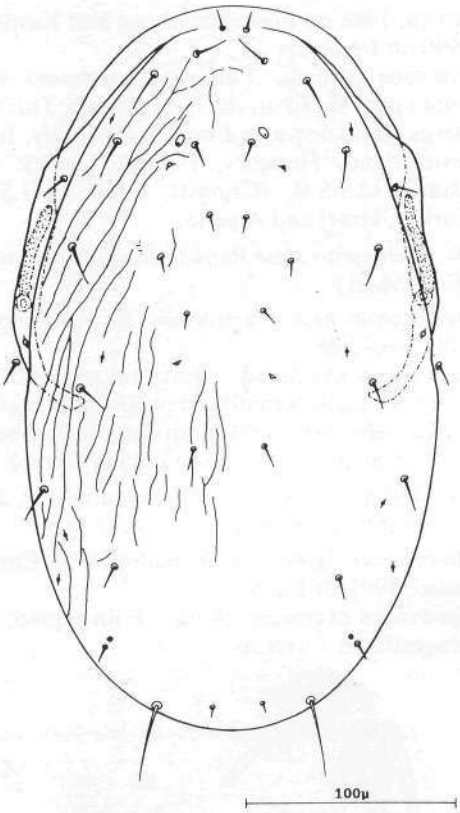
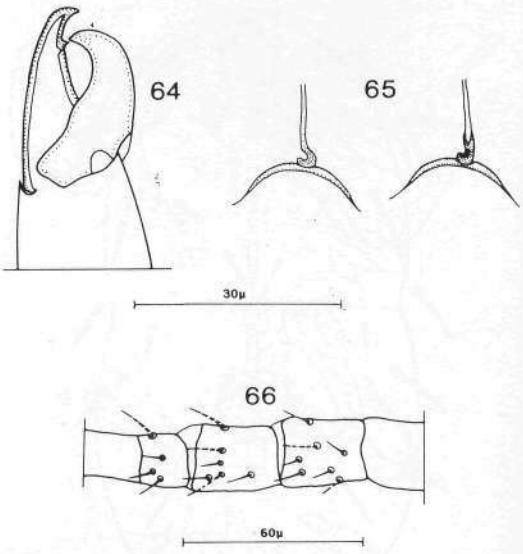


FIG. 62. *Amblyseius hymetticus*: female, dorsal shield.



FIGS. 64-66. *Amblyseius hymetticus*: 64 chelicerae of female, 65 spermatheca, 66 leg IV.

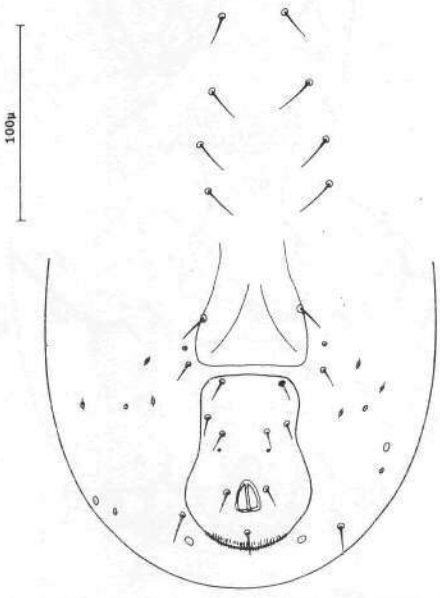


FIG. 63. *Amblyseius hymetticus*: female, venter.

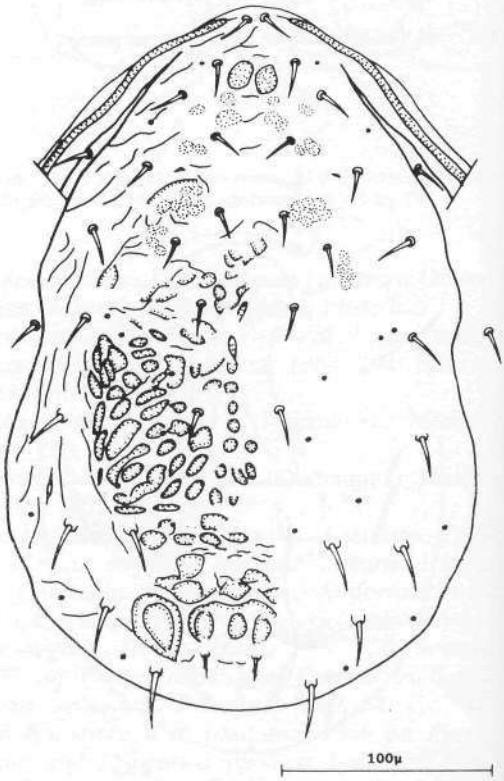


FIG. 67. *Amblyseius insuetus*: female, dorsal shield.

Previous records: The holotype female and 5 paratypes were collected from an unidentified plant of the family Labiatae at Hymettos mountain Attica on May 1, 1983. This species is known only in Greece.

NEWSAMI GROUP

12. *Amblyseius insuetus* Livshitz & Kuznetsov (Figs. 67-72).

Amblyseius insuetus Livshitz & Kuznetsov,1972: 27.

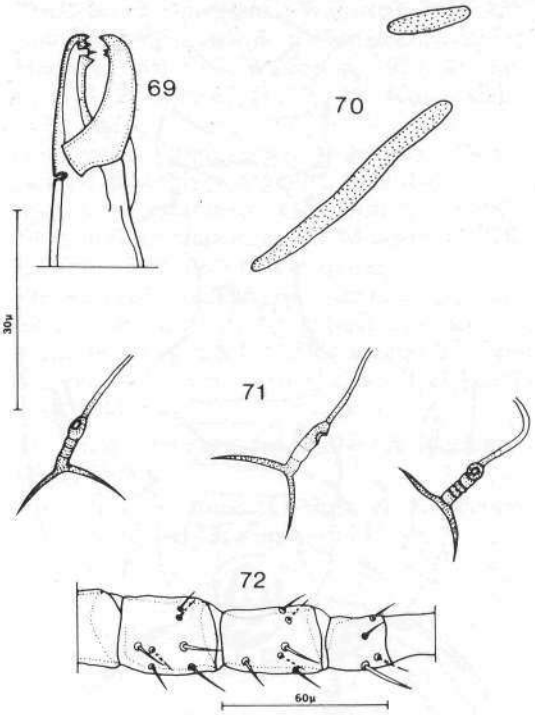
Specimens examined: Limni, Co. Evia, 1990 on *Tamarix* sp.; Argos, Co. Argolis, 1991 on Graminae.

Previous records - Remarks: It is interesting to note that this species has been found previously only in Crimea (U.S.S.R.) on the same host *Tamarix* sp. Generally, it seems that the Phytoseiid fauna of Crimea has many similarities to that of Greece (Papadoulis, unpublished).

CUCUMERIS GROUP

13. *Amblyseius graminis* Chant (Figs. 73-78).

Amblyseius graminis Chant 1956: 34; Athias-Henriot, 1957: 338; Chant, 1958: 636; Athias-Henriot, 1961: 435; Athias-Henriot, 1966: 218; Livshitz & Kuznetsov, 1972: 26; Kolodochka, 1973: 79.



FIGS. 69-72. *Amblyseius insuetus*: 69 chelicerae of female, 70 metapodal plates, 71 spermatheca, 72 leg IV.

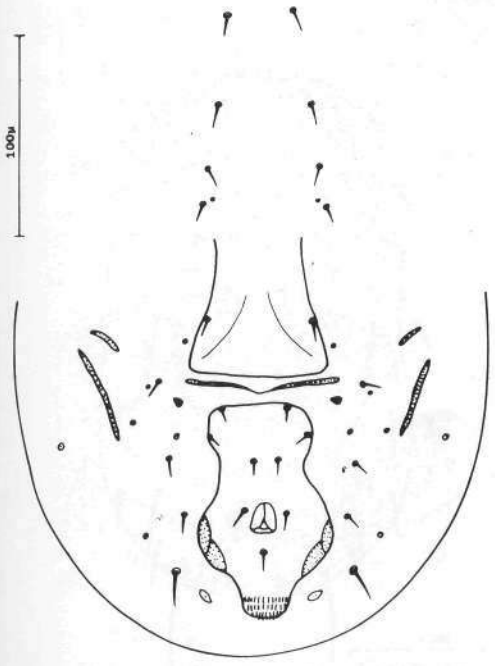


FIG. 68. *Amblyseius insuetus*: female, venter.

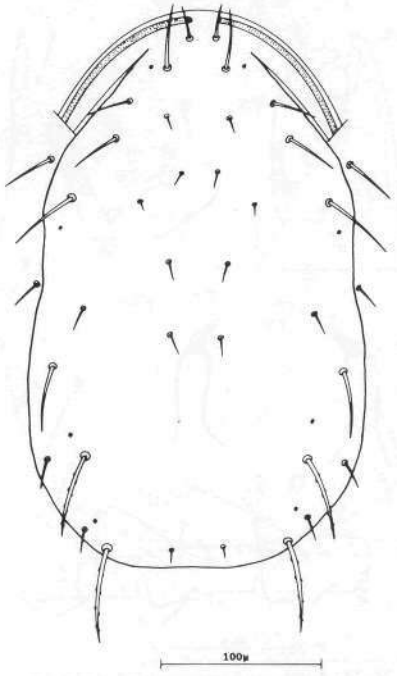


FIG. 73. *Amblyseius graminis*: female, dorsal shield.

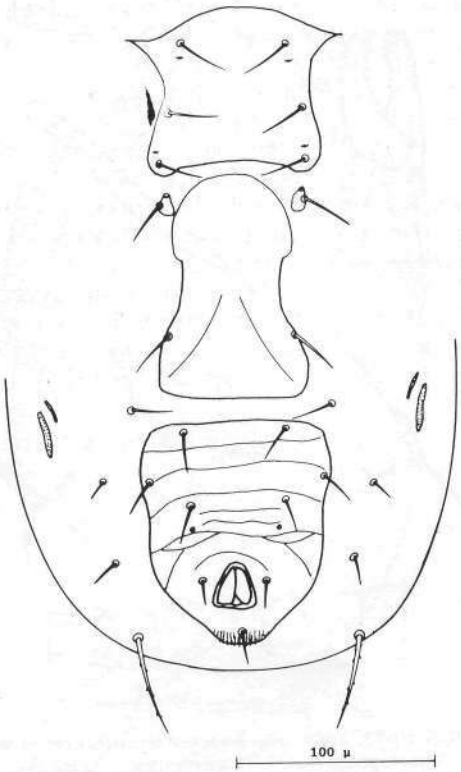
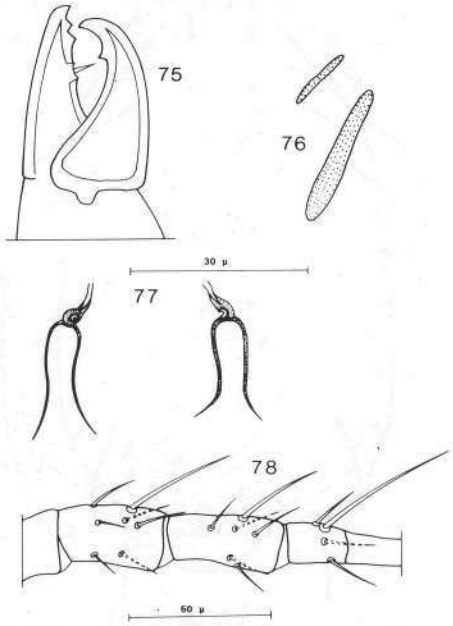


FIG. 74. *Amblyseius graminis*: female, venter.

Typhlodromus (Amblyseius) graminis (Chant); Chant 1959: 89.
Amblyseius (Typhlodromus) graminis (Chant); Muma, 1961: 287.
Typhlodromus (Typhlodromus) graminis (Chant); Westerboer & Bernhard, 1963: 636.
Amblyseius (Amblyseius) graminis Chant; Wainstein, 1973: 178; Wainstein, 1975: 920; Wainstein, 1977: 1415; Ueckermann & Loots, 1988: 132.
Amblyseius hamizortus Athias-Henriot, 1966: 219 (Synonymy by Ueckermann & Loots, 1988).
Typhlodromus (Amblyseius) collyerae Chant, 1959: 87 (Synonymy by Athias-Henriot, 1966).
Typhlodromus (Typhlodromus) exiguus Westerboer & Bernhard, 1963: 628 (Synonymy by Athias-Henriot, 1966).
Specimens examined: Pilio, Co. Magnisia, 1983 on Labiatae; Agchialos, Co. Magnisia 1983 on Graminae.
Previous records: This species was originally described on the basis of specimens commonly found on grasses, *Convolvulus* sp. and *Rubus* sp. in England. This species has been also recorded from: U.S.S.R. (Moldavia, Ukrania, Crimea), Spain and Algeria.

14. *Amblyseius marginatus* (Wainstein) (Figs. 79-84).



FIGS. 75-78. *Amblyseius graminis*: 75 chelicerae of female, 76 metapodal plates, 77 spermatheca, 78 leg IV.

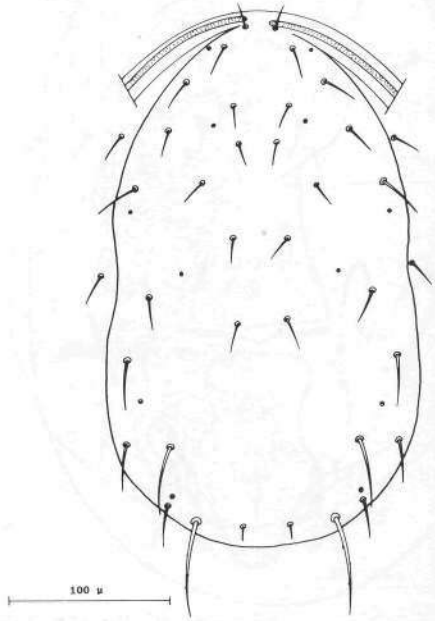


FIG. 79. *Amblyseius marginatus*: female, dorsal shield.

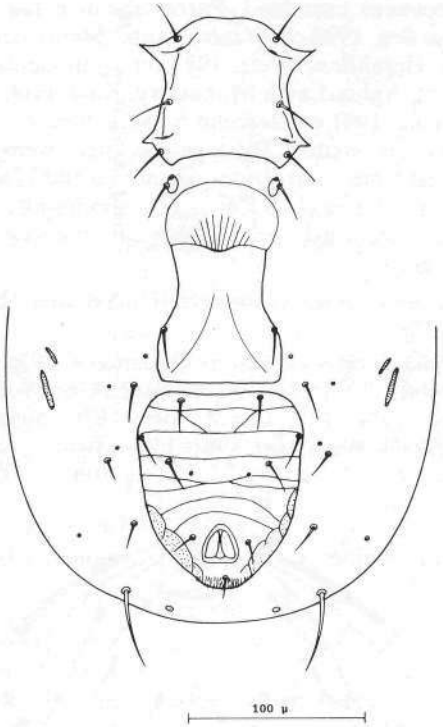
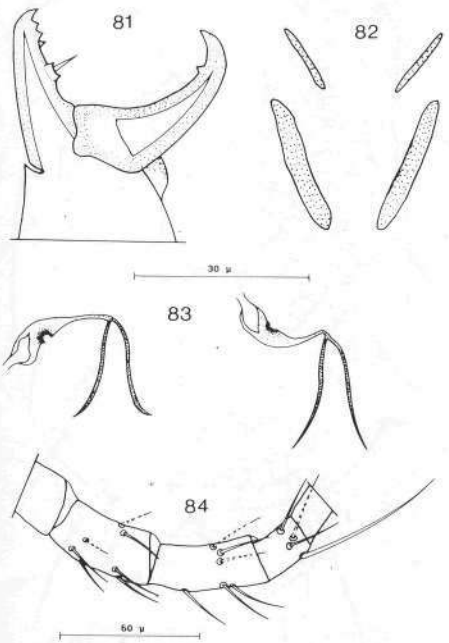


FIG. 80. *Amblyseius marginatus*: female, venter.



FIGS. 81-84. *Amblyseius marginatus*: 81 chelicerae of female, 82 metapodal plates, 83 spermatheca, 84 leg IV.

Typhlodromus marginatus Wainstein, 1961: 158.
Amblyseius marginatus (Wainstein); Athias-Henriot, 1966: 207; Wainstein, 1972: 41; Livshitz & Kuznetsov, 1972: 25; Kolodochka, 1973: 80.
Amblyseius (Amblyseius) marginatus (Wainstein); Ueckermann & Loots, 1988: 145.
Specimens examined: Giannitsa, Co. Pella, 1990 on *Gossypium hirsutum*; Messara, Co. Heraklion, Crete, 1983 on Graminae.
Previous records: The type specimens were collected from litter and highbush cranberry in Kazakhstan (U.S.S.R.). This species has been also recorded from: Algeria, U.S.S.R. (Ukrania and Moldavia).

15. *Amblyseius cinstutus* Livshitz & Kuznetsov (Figs. 85-90).

Amblyseius cinstutus Livshitz & Kuznetsov, 1972: 24; Swirski & Ragusa, 1977: 80.

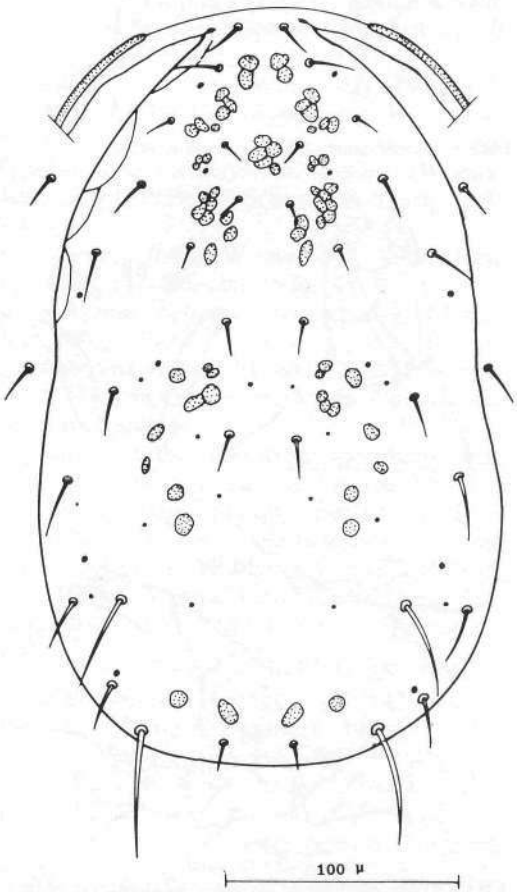


FIG. 85. *Amblyseius cinstutus*: female, dorsal shield.

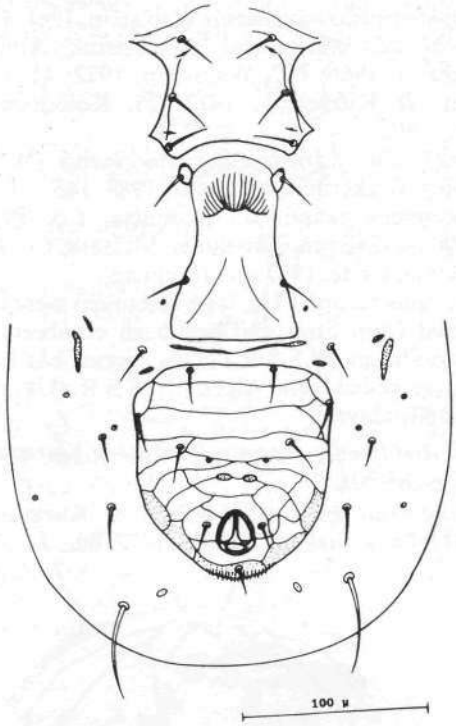
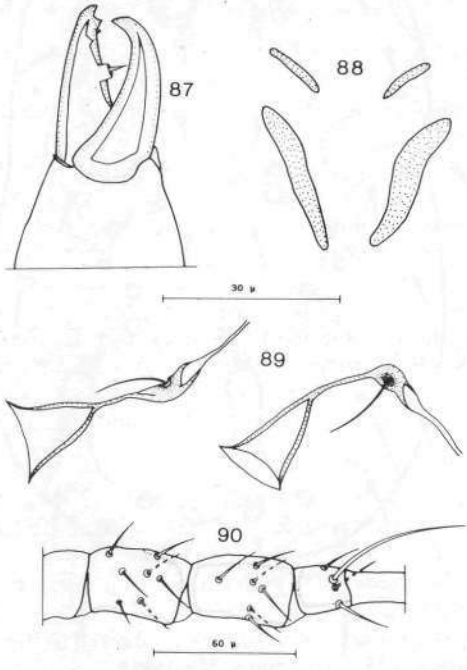


FIG. 86. *Amblyseius cinstutus*: female, venter.



FIGS. 87-90. *Amblyseius cinstutus*: 87 chelicerae of female, 88 metapodal plates, 89 spermatheca, 90 leg IV.

Specimens examined: Paros island in the Aegean Sea, 1990 on *Plantago* spp.; Metaxochori, Co. Heraklion, Crete, 1988 on an unidentified plant; Aghia-Lavra Monastery, Kalabryta, Co. Achaia, 1991 on *Aesculus hippocastanum*.
Previous records: The type specimens were collected from *Convolvulus contabrica* and *Hedera* sp. in Crimea (U.S.S.R.). This species also has been recorded on *Verbascum graecum* in Greece.

16. *Amblyseius cucumeris* (Oudemans) (Figs. 91-97).

Typhlodromus cucumeris Oudemans, 1930: 69; Nesbitt, 1951: 23; Evans, 1952: 416; Womersley, 1954: 175; Chant, 1958: 626; Sellnick, 1958: 27; Wainstein, 1961: 158.

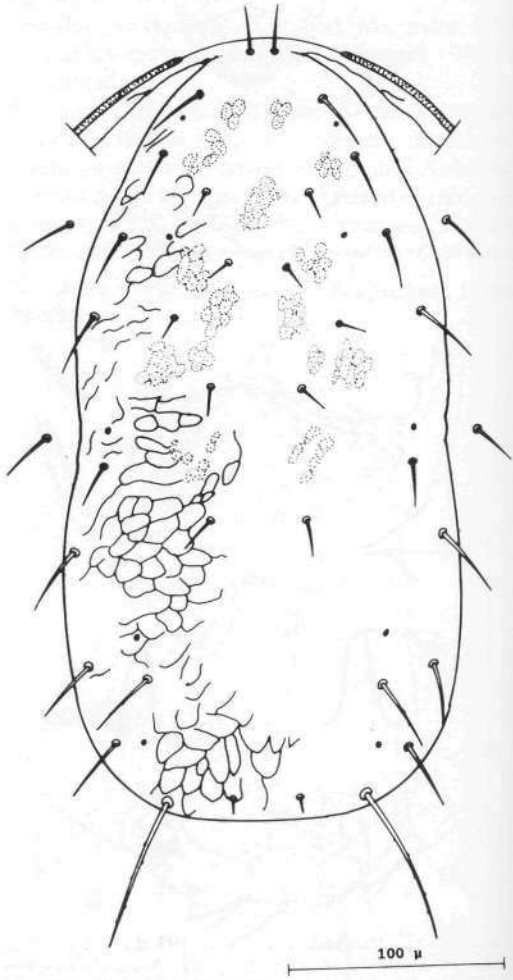


FIG. 91. *Amblyseius cucumeris*: female, dorsal shield.

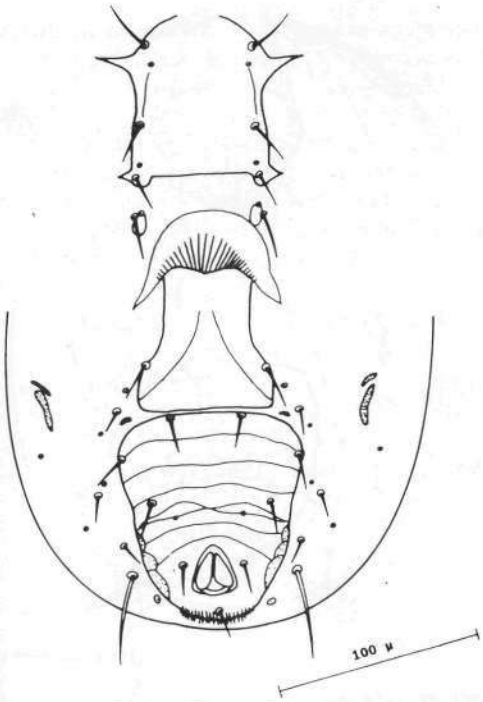
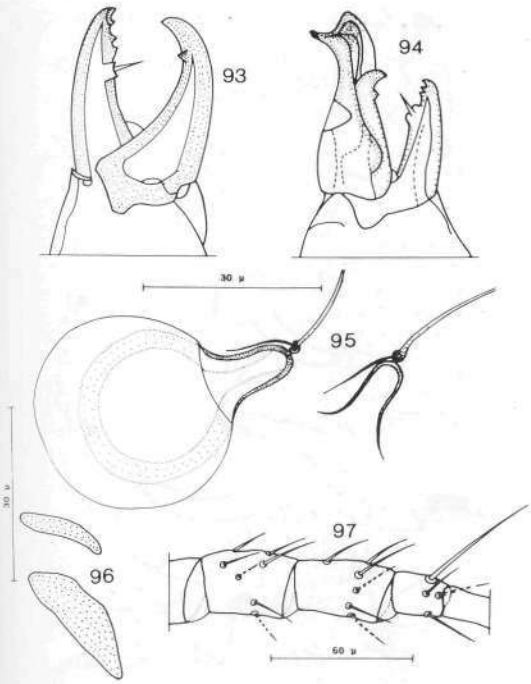


FIG. 92. *Amblyseius cucumeris*: female, venter.



FIGS. 93-97. *Amblyseius cucumeris*: 93 chelicerae of female, 94 chelicerae of male, 95 spermatheca, 96 metapodal plates, 97 leg IV.

Typhlodromus (Typhlodromus) cucumeris Oudemans; Cunliffe & Baker, 1953: 15; Westerboer & Bernhard, 1963: 609.
Typhlodromus (Amblyseius) cucumeris (Oudemans); Chant, 1959: 78.
Typhlodromus (Typhlodromus) cucumeris (Oudemans); De Leon, 1959: 113; Muma, 1961: 287.
Typhlodromus thripsi MacGill, 1939: 309 (Synonymy by Evans, 1952).
Amblyseius (Amblyseius) cucumeris (Oudemans); Wainstein, 1962: 15; Ehara, 1966: 20; Wainstein, 1973: 178; Wainstein, 1977: 1415; Ueckermann & Loots, 1988: 147.
Amblyseius cucumeris (Oudemans); Athias-Henriot, 1957: 336; 1960: 297; Schuster & Gonzalez, 1963: 185; Schuster & Pritchard, 1963: 277; Burrell & Cormick, 1963: 486; Athias-Henriot, 1966: 207; El Badry, 1970: 502; Chant & Hansell, 1971: 721; Livshitz & Kuznetsov, 1972: 25; Gupta, 1975: 34; Schicha, 1976: 337; Ragusa, 1977: 385; Gupta, 1977b: 31; Amitai & Swirski, 1978: 129; Jorgensen & Mongkolprasith, 1979: 67.
Typhlodromus bellinus Womersley, 1954: 177; Kennett, 1958: 472 (Synonymy by Dosse, 1957).
Typhlodromus (Amblyseius) bellinus (Womersley); Chant, 1959: 75; Schuster & Smith, 1960: 184.
Amblyseius bellinus (Womersley); Athias-Henriot, 1959: 147; Schicha, 1976: 336.
Cydnodromus bellinus (Womersley); Muma, 1961: 290.
Specimens examined: Messara, Co. Heraclion, Crete, 1988 on Graminae; Argos, Co. Argolis, 1990 on Graminae.
Previous records: The type specimens were found on *Cucumeris melo* in France. This is a well known cosmopolitan species found in: Switzerland, Germany, Netherlands, England, U.S.S.R. (Gruzia, Moldavia, Crimea), Poland, Italy, Egypt, Algeria, Israel, India, New Zealand, Australia, Canada, U.S.A. and Mexico.

17. *Amblyseius barkeri* (Hughes) (Figs. 98-103).

Neoseiulus barkeri Hughes, 1948: 142; Muma, 1961: 295; Muma & Denmark, 1968: 235; Ragusa & Athias-Henriot, 1983: 668.
Typhlodromus (Typhlodromus) barkeri (Hughes); Chant, 1959: 61.
Typhlodromus (Neoseiulus) barkeri (Hughes); Nesbitt, 1951: 31; Ehara, 1966: 18.
Amblyseius barkeri (Hughes); Athias-Henriot,

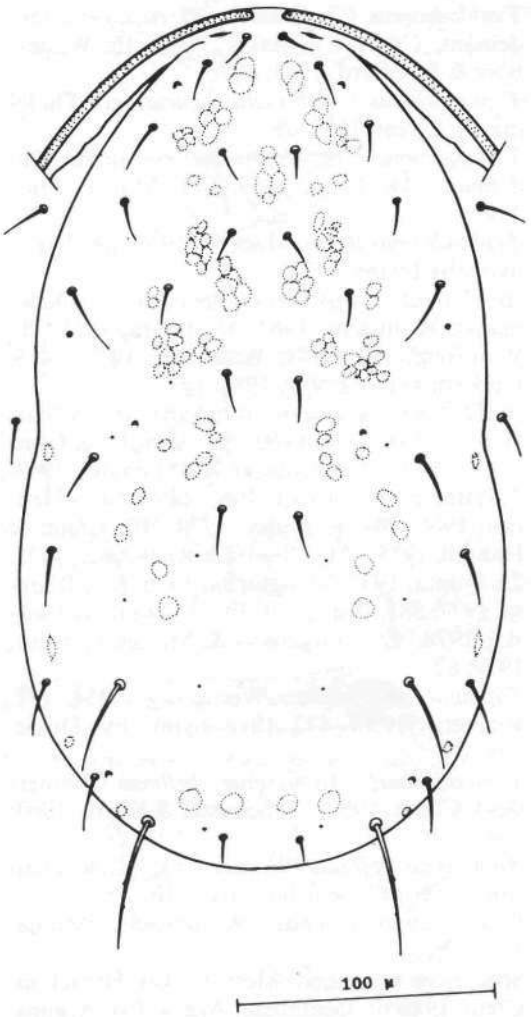


FIG. 98. *Amblyseius barkeri*: female, dorsal shield.

1961: 440; Porath & Swirski, 1965: 99; Swirski & Amitai, 1965: 128; Swirski & Amitai, 1968: 101; Wainstein & Shcherbak, 1972: 43; Swirski et al., 1973: 70; Ragusa, 1977: 384; Amitai & Swirski, 1978: 129; Swirski & Amitai, 1982: 56.
Amblyseius (Amblyseius) barkeri (Hughes); Ehara, 1972: 147; Wainstein & Vartapetov, 1973: 103; Ehara, 1977: 34; Papaioannou - Souliotis, 1981: 43; Ueckermann & Loots, 1988: 147-148.
Amblyseius (Amblyseius) usitatus Van der Merwe, 1965: 71; Van der Merwe, 1968: 140 (Synonymy by Ueckermann & Loots, 1988).
Amblyseius usitatus Van der Merwe; Meyer & Rodrigues, 1966: 28.

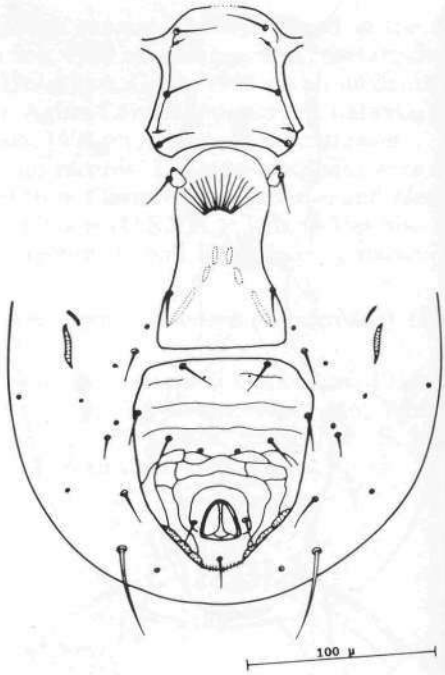
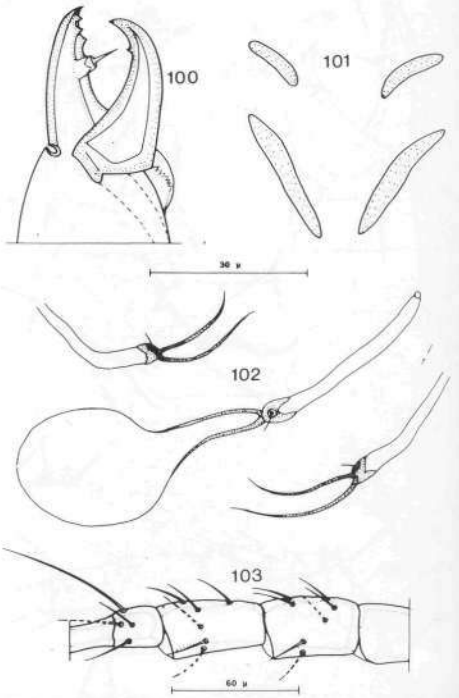


FIG. 99. *Amblyseius barkeri*: female, venter.



FIGS. 100-103. *Amblyseius barkeri*: 100 chelicerae of female, 101 metapodal plates, 102 spermatheca, 103 leg IV.

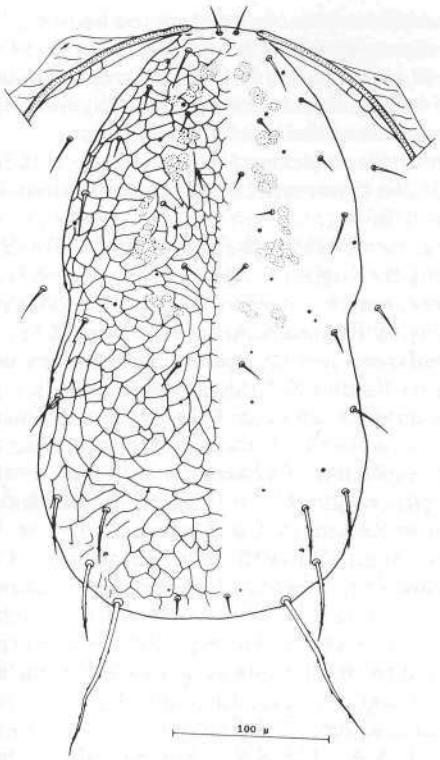
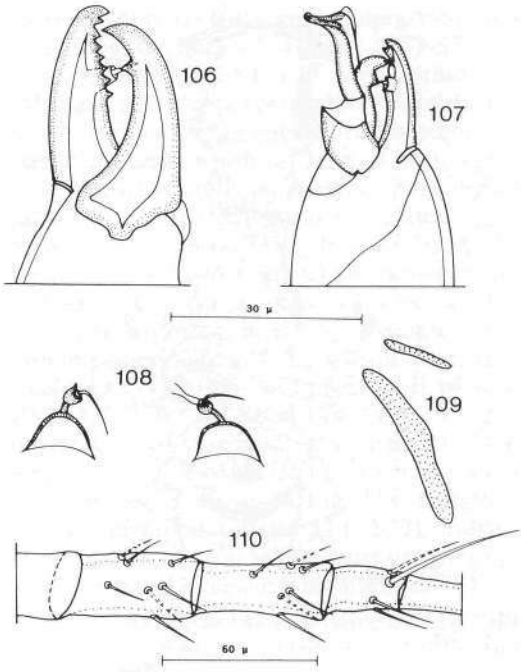


FIG. 104. *Amblyseius bicaudus*: female, dorsal shield.



FIGS. 106-110. *Amblyseius bicaudus*: 106 chelicerae of female, 107 chelicerae of male, 108 spermatheca, 109 metapodal plates, 110 leg IV.

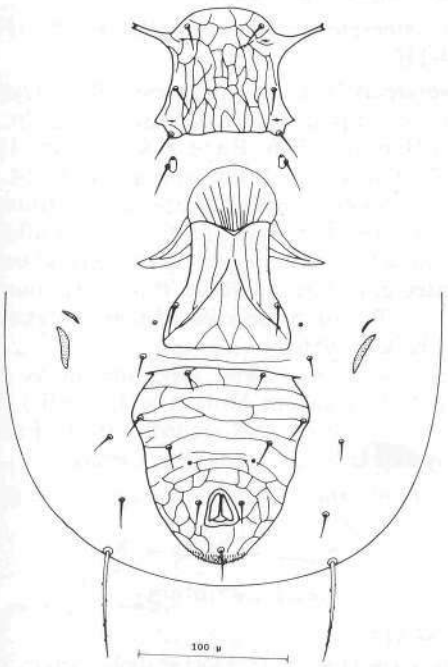


FIG. 105. *Amblyseius bicaudus*: female, venter.

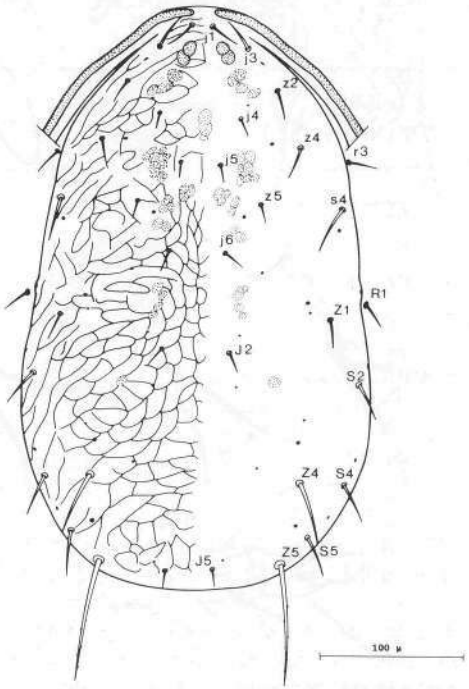


FIG. 111. *Amblyseius makedonicus* spec. nov.: female, dorsal shield.

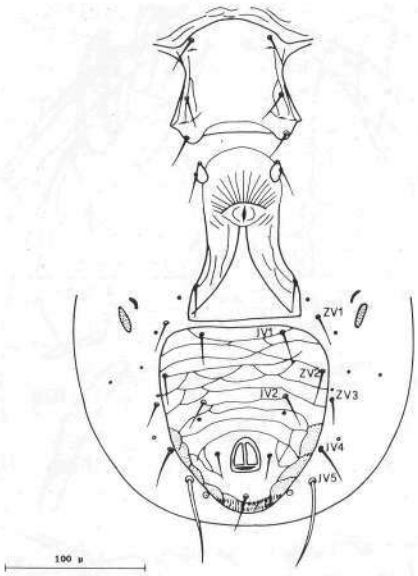


FIG. 112. *Amblyseius makedonicus* spec. nov.: female, venter.

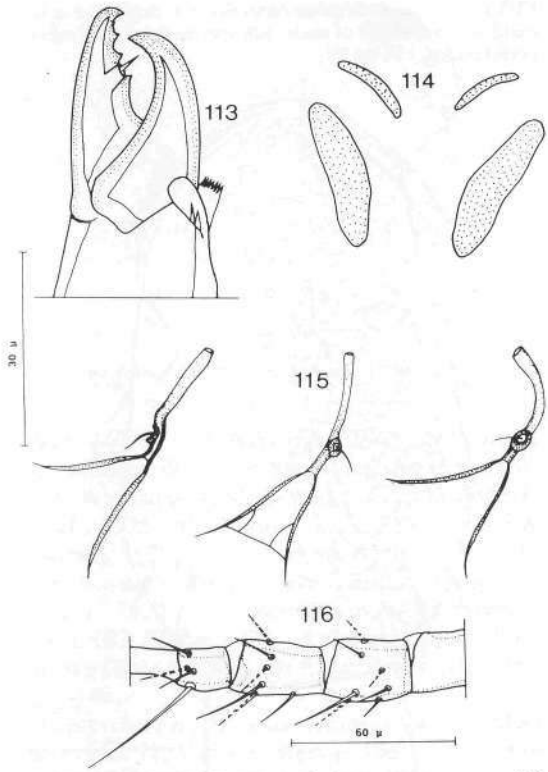


FIG. 113-116. *Amblyseius makedonicus* spec. nov.: 113 chelicerae of female, 114 metapodal plates, 115 spermatheca, 116 leg IV.

Amblyseius (Amblyseius) pieteri Schultz, 1972: 17 (Synonymy by Ueckermann & Loots, 1988).
Amblyseius masiaca Blommers & Chauzeau, 1974: 308; Schicha, 1980: 252; (Synonymy by Ueckermann & Loots, 1988).
Amblyseius mackenziei Schuster & Pritchard, 163: 268 (Synonymy by Ragusa & Athias-Henriot, 1983).
Amblyseius oahuensis Prasad, 1968: 1518 (Synonymy by Ragusa & Athias-Henriot, 1983).
Amblyseius mycophilus Karg, 1970: 290 (Synonymy by Ragusa & Athias-Henriot, 1983).
Amblyseius picketti Specht, 1968: 681 (Synonymy by Ragusa & Athias-Henriot, 1983).
Specimens examined: This species was found in all cultivated and uncultivated graminae samples collected in Greece. It was also found at Kopais region, Co. Boiotia, 1986 on *Medicago sativa*; Kalamata, Co. Messinia, 1986 on *Plantago* spp.; Messara, Co. Heraklion, Crete, 1986-87 on *Sonchus oleraceus* and *Solanum nigrum*; Spata, Co. Attica, 1990 on *Vitis vinifera*.
Previous records: The type specimens were collected from plumules of germinating barley on the London docks, England. This species has been also recorded from: Italy, Spain, Germany, U.S.A., U.S.S.R., Algeria, Mozambique, Madagascar, South Africa, Zimbabwe, Egypt, Israel, Japan and Guinea.

18. *Amblyseius bicaudus* Wainstein (Figs. 104-110).

Amblyseius bicaudus Wainstein, 1962, Arutunjan, 1969; Livschitz & Kuznetsov, 1972: 26; Athias-Henriot, 1966; Ragusa & Paoletti, 1986: 78-79; Papadoulis & Emmanouel, 1990: 14.
Specimens examined: This species was found to be the most dominant and frequent of all Phytoseiid mites occurring on cultivated and uncultivated graminae in Greece. It was also found at Evia, 1987 on *Capsicum annum*; Polykastro, Co. Kilkis, 1986 on *Vicia* sp.
Previous records: The type specimens were found on cereals in Alma Ata (U.S.S.R.). This species has been also recorded from: France, Italy and U.S.S.R. (Armenia, Crimea).

19. *Amblyseius makedonicus* spec. nov. (Figs. 111-116).

Description

FEMALE
Dorsum (Fig. 111). Dorsal setal pattern 10A: 9B (r3 off, R1 off). Ventral setal pattern 14:

JV-3:ZV. Dorsal shield sclerotized, reticulated with seven pairs of relatively inconspicuous solenostomes: posterolateral to j3, mediad to j4, posteromediad to j5, posteriad to s4, anteromediad to J1, anteriad to z4 and anteromediad to S5. Twelve pairs of small pores (sensillae) visible, on dorsal shield. Muscle marks (sigilles) visible, mostly on podosoma. Length of dorsal shield (j1-J5) 387 (381-390); Width (distance between bases of S2) 221 (211-230). All dorsal setae smooth except Z5 which is faintly serrated. Sublateral setae r3 and R1 on interscutal membrane, smooth. Measurements of setae as follows: j1 25, j3 32 (31-32), j4 15 (14-16), j5 14 (13-14), j6 19 (18-20), J2 20, J5 13 (13-14), z2 24 (22-25), z4 25 (23-27), z5 14 (13-16), Z1 24 (23-25), Z4 51 (49-54), Z5 88 (86-90), s4 38 (36-40), S2 31 (29-32), S4 28 (27-31), S5 32 (31-34), r3 26 (23-27) and R1 23 (22-25). Peritremes very long 233 (230-239) in length (from stigma to apex) extending anteriorly the level of j1.

Venter (Fig. 112). Sternal shield sclerotized with three pairs of setae (ST1, ST2, ST3) and two pairs of pores (pst1, pst2); lateral margin of shield slightly lineated. Length (ST1-ST3) 73 (72-74), width (ST2-ST2) 70. Metasternal setae (MS) and a pair of pores (pst3) on platelets. Genital shield with weak lineate ornamentation on lateral margins; width (at level of setae G) 73 (73-76); pst5 laterally on posterior part of genital shield. Ventroanal shield reticulated with 3 pairs of preanal setae (JV1, JV2, ZV2), anal setae (a1, a2, a3) and a pair of solenostomes posteriad of the base of setae JV2. Distance between solenostomes 56 (50-61). Muscle marks visible posteriolaterally. Length of ventroanal shield 135 (131-139), width (at level of setae ZV2) 122 (119-124). Setae JV4, JV5, ZV1, ZV3 on integument surrounding ventroanal shield. Setae JV5 longer 66 (65-68) than others. Metapodal plates as shown in Fig. 114. Length of primary metapodal plates 22 (20-23), width 5. In addition to pst5 at least 6 pairs or pores present on ventral interscutal membrane.

Chelicerae (Fig. 113). Fixed digit with four visible teeth and *pilus dentilis*; movable digit without teeth.

TABLE 1. Comparison of setal lengths of females of *Amblyseius makedonicus* spec. nov. with those of related species.

Setae	*Amblyseius makedonicus**	*Amblyseius paramarinus***	*Amblyseius marinus****	*Amblyseius reticulatus*****
j3	32 (31-32)	20-22	–	23
Z4	51 (49-54)	40-43	32	39
Z5	88 (86-90)	59-66	48	55
s4	38 (36-40)	23-24	28	55
S2	31 (29-32)	20-23	–	23
S4	28 (27-31)	20-23	–	20
S5	32 (31-34)	20-23	–	20
JV5	66 (65-68)	43-47	32	37
sgeIV	46 (45-49)	38-41	–	25
stiIV	47 (45-49)	38-40	–	28
stIV	83 (81-86)	66-68	52	45

* From 5 specimens
** From Evans (1988)
*** From Evans (1987)
**** From Kolodochka (1988)

Legs, Palps (Fig. 116). Measurements of legs (base of coxae to base of claws) and palp (base of trochanter to apex of tarsus) as follows: Leg I 372 (367-376), Leg II 295 (294-298), Leg III 296 (294-298), Leg IV 407 (404-409) and Palp 115. Genu II with eight setae (2-2/0-2/1-1). Leg IV with three macrosetae: genu 46 (45-49) long, tibia 47 (45-49) and basitarsus 83 (81-86).

Spermatheca (Fig. 115). Cervix funnel-shaped. Atrium connected with relatively short neck of the same breadth as the tube-like major duct. Minor duct visible.

MALE. Unknown.

TAXONOMIC NOTES - DIAGNOSIS

A. makedonicus is most similar to *A. paramarinus* (Evans). It is also close with *A. marinus* (Willmann) and *A. reticulatus* (Oudemans), as they have been redescribed by Evans 1987 and Kolodochka 1988, respectively. The new species can be readily distinguished from the latter two species by the neck of the spermatheca (much shorter or absent in *A. reticulatus* and longer in *A. marinus*). In addition, the movable digit of *A. reticulatus* bears two teeth instead of none as in *A. makedonicus*. The setal lengths of the above four species are shown in Table I. All setae are much longer in *A. makedonicus* than in *A. paramarinus*. Additionally, the ratio of Z5/Z4 is 1,75 and 1,5 respectively.

TYPE MATERIAL

The holotype female, collected on *Oryza sativa* at Thessaloniki region on October 11, 1987, and 4 female paratypes with the same data are deposited in the Acari collection, Laboratory of Agricultural Zoology & Entomology, Agricultural University of Athens, Greece.

ETYMOLOGY

The name of this new species is derived from Makedonia of Northern Greece where it was found.

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References

Abbasova, E.D. 1970. Little known species and a new subspecies of the genus *Mumaseius* De Leon (Acarina, Phytoseiidae). Zool. Zh. 69 (9): 1410-1414 (in Russian).

Amitai S. and Wysoki, M. 1974. Two unknown males of the genus *Amblyseius* Berlese and their karyotypes (Mesostigmata: Phytoseiidae). Acarologia 16: 45-51.

Amitai, S. and Swirski, E. 1978. A new genus and new records of phytoseiid mites (Mesostigmata: Phytoseiidae) from Israel. Isr. J. Ent. 12: 123-143.

Arutunjian, E.S. 1969. New species of the genus *Amblyseius* Berlese, 1904 (Parasitiformes: Phytoseiidae). Proc. Acad. Scien. Armenian S.S.R. 49: 120-123 (in Russian).

Athias-Henriot, C. 1957. Phytoseiidae et Aceosejidae (Acarina, Gamasina) d'Algerie I. Genres *Blattisocius* Keegan, *Iphiseius* Berlese, *Phytoseius* Ribaga, *Phytoseiulus* Evans. Bull. Soc. Hist. Nat. Afr. N. 48: 319-352.

Athias-Henriot, C. 1958a. Contribution a la connaissance du genre *Typhlodromus* Scheuten (Acariens, Parasitiformes, Phytoseiidae). Description de deux espéces nouvelles D'Algerie et clé des espéces du *finlandicus*. Rev. Path. Veg. Ent. Agr. France 37: 179-186.

Athias-Henriot, C. 1958b. Phytoseiidae et Aceosejidae (Acarina, Gamasina) d'Algerie. II. Phytoseiidae: clé des genres, genres *Amblyseius* Berlese (suite) et *Seiulus* Berlese. Bull. Soc. Hist. nat. Afr. N. 49: 23-43.

Athias-Henriot, C. 1959. Acariens planticoles d'Algerie I. 5e contribution au genre *Amblyseius* Berlese (Phytoseiidae). II. Premiere liste d'Actinochitinosi (Cheyletidae, Caligonellidae, Hemisarcoptidea). Bull. Acad. e. Belgique, Cl. Scient. ser. 5 (45): 130-153.

Athias-Henriot, C. 1960. Nouveaux *Amblyseius* d'Algerie (Parasitiformes, Phytoseiidae). Acarologia 2: 288-289.

Athias-Henriot, C. 1961. Mesostigmates (Urop. excl.) Edaphiques Mediterraneens (Acaromorpha, Anactinotrichidae). Acarologia 3: 341-509.

Athias-Henriot, C. 1966. Contribution a l'étude des *Amblyseius* palearctiques (Acariens anactinatriches, Phytoseiidae). Bull. Scient. Bourgogne 24: 181-230.

Athias-Henriot, C 1975. Nouvelles notes sur les Amblyseiinii. II. La releve organotoxique de la face dorsal adulte (Gamasides Protoadeniques, Phytoseiidae): Acarologia 17: 20-29.

Athias-Henriot, C. 1977. Nouvelles notes sur les Amblyseiinii. III. Sur le genre *Cydnodromus*: Redefinition, composition (Parasitiformes, Phytoseiidae). Entomophaga 22: 61-73.

Beglyarov, G.A. 1958. Species of Phytoseiidae (Parasitiformes, Gamasoidea) predators of the Tetranychidae family in orchards of the Drasnondas region. Pr. Vses. Nauchno-Issled. Inst. Zashch rast. 10: 98-124 (in Russian).

Berlese, A. 1881-1898. Acari, Myriapoda et Scorpiones hucusque in Italia reperta. Padua, Florence et Portici.

Berlese, A. 1921. Acari, Myriapoda et Pseudoscorpiones Indice Sinonimico. Redia 14:95.

Blommers, L. and J. Chazeau, 1974. Two news species of predator mites of the genus *Amblyseius* Berlese (Acarina: Phytoseiidae) in Madagascar, Z. angew. Ent. 10: 308-314.

Boczek, J. and D. Kropczynska, 1964. Studies on mites living on plants in Poland I. Fragm. Faun. 11 (II) 161-188 (in Polish).

Burrell, R.W. and Mc Cormick, W.J. 1963. *Typhlodromus* and *Amblyseius* (Acarina: Phytoseiidae) as predators on orchard mites. Ann. Ent. Soc. Am. 57: 483-487.

Chant, D.A. 1956. Some mites on the subfamily Phytoseiinae (Acarina: Laelaptidae) from Southestern England, with description of new species. Can. Ent. 88: 26-37.

Chant, D.A. 1957. Description of some Phytoseiid mites (Acarina: Phytoseiidae). Part I. Nine new species from British Columbia with keys to the species of British Columbia. Part II. Redescription of eight species described by Berlese. Can. Ent. 89: 289-308.

Chant, D.A. 1958. Immature and adult stages of some British Phytoseiidae Berlese 1916 (Acarina). Linn. Soc. Lond. Zool. 43 (294): 599-643.

Chant, D.A. 1959. Phytoseiid mites (Acarina: Phytoseiidae). Part. I. Bionomics of seven species in Southestern England. Part. II. A Taxonomic review of the family Phytoseiidae, with descriptions of 38 new species. Can. Ent. 91 (suppl. 12): 5-166.

Chant, D.A. and R.I.C. Hansell, 1971. The genus *Amblyseius* (Acarina: Phytoseiidae) in Canada and Alaska. Can. J. Zool. 49: 703-758.

Chant, D.A. and E. Yoshida-Shaul. 1989. Adult dorsal setal patterns of the family Phytoseiidae (Acari: Gamasina). Intern. J. Acarol. 15: 219-233.

Chant, D.A. and E. Yoshida-Shaul. 1990. The identities of *Amblyseius andersoni* (Chant) and *A. potentillae* (Garman) (Acari: Phytoseiidae). Inter. J. Acarol. 16: 5-12.

Chant, D.A. and E. Yoshida-Shaul. 1991. Adult ventral setal patterns in the family Phytoseiidae (Acari: Gamasina). Inter. J. Acarol. 17: 187-199.

Cunliffe, F. and E.M. Baker. 1953. A guide to the predatory Phytoseiid mites of the United States. Pinellas Biol. Lab. Inc. Publ. 1, 28 pp.

De Leon, D. 1958. Four new *Typhlodromus* from Southern Florida (Acarina: Phytoseiidae). Fla. Ent. 41: 73-76.

Denmark, H.A. and M.H. Muma. 1989. A revision of the genus *Amblyseius* Berlese 1914 (Acari: Phytoseiidae). Occasional papers of Fla. State Coll. of Arthropods. Vol. 4. 149 pp.

Dosse, G. 1957. Morphologie und Biologie von *Typhlodromus zwolferi* n.sp. (Acar., Phytoseiidae). Z. angew. Ent. 41: 301-311.

Dosse, G. 1958. Die Spermethecae, ein zusatzliches Bestimmungsmerkmalbei Raubmilben (Acar., Phytoseiidae). Pflanzenschutz Berichte, 20: 1-11.

Dosse, G. 1967. Schadmilben des Libanons und ihre Predatoren. Z. angew. Ent. 59: 16-48.

Ehara, S. 1958. Three predatory mites of the genus *Typhlodromus* from Japan (Phytoseiidae). Annot. Zool. Jap. 31: 53-57.

Ehara, S. 1959. Some predatory mites of the genera *Typhlodromus* and *Amblyseius* from Japan (Phytoseiidae). Acarologia 1: 285-295.

Ehara, S. 1961. On some Japanese mesostigmatic mites (Phytoseiidae and Aceosejidae). Annot. Zool. Jap. 34: 95-98.

Ehara, S. 1966. A tentative catalogue of predatory mites of Phytoseiidae known from Asia, with description of five new species from Japan. Mushi 39: 9-30.

Ehara, S. 1972. Some Phytoseiid mites of Japan, with descriptions of thirteen new species (Acarina: Mesostigmata). Mushi 46: 137-173.

Ehara, S. 1975. List and keys to Phytoseiidae of Japan. JABP Synthesis: Approaches to Biological Control, 25-37.

Ehara, S. 1977. A review of taxonomic studies on natural enemies of spider mites in Japan. Review pl. protect Res. 10: 29-48.

El Badry, E.A. 1970. Taxonomic review of the Phytoseiid mites of Egypt (Acarina: Phytoseiidae). Bull. Soc. Ent. Egypt. 54: 495-510.

Evans, G.O. 1952. A new Typhlodromid mite predacious on *Tetranychus bimaculatus* Harvey in Indonesia. Ann. Mag. Nat. Hist. 5 (ser. 12): 413-416.

Evans, G.O. 1953. On some mites of the genus *Typhlodromus* Scheuten, 1857, from S.E. Asia. Ann. Mag. Nat. Hist. 6: 449-467.

Evans, G.O. 1954. The genus *Iphiseius* Berlese (Acarina: Laelaptidae). Proc. Zool. Soc. Lond. 124: 517-526.

Evans, G.O. and W.M. Till. 1979. Mesostigmatic mites of Britain and Ireland (Chelicerata: Acari-Parasitiformes) - An introduction to their external morphology and classification. Trans. Zool. Soc. Lond. 35: 139-270.

Evans, G.O. 1987. The status of three species of Phytoseiidae (Acari) described by Carl Willmann. J. Nat. Hist. 21: 1461-1467.

Evans, G.O. 1988. Two new species of phytoseiid mites from Southern England with a redescription of *Typhlodromus tiliae*. J. Zool. Lond. 214: 71-79.

Forest, J., J.G., Pilon and R.O. Paradis. 1981. Acariens des versers de prommiers du sud-ouest de Quebec. Ann. Soc. Entomol. Quebec 27 (1): 715.

Garman, P. 1958. New species belonging to the genera *Amblyseius* and *Amblyseopsis* with keys to *Amblyseius, Amblyseopsis* and *Phytoseiulus*. Ann. Entomol. Soc. Amer. 51: 69-79.

Ghai, S. and M.G.R. Menon. 1967. Taxonomic studies on Indian mites of the family Phytoseiidae (Acarina). Orient. insects 1: 65-79.

Gupta, S.K. 1975. Mites of the genus *Amblyseius* (Acarina: Phytoseiidae) from India with descriptions of eight new species. Intern. J. Acarol. 1: 26-45.

Gupta, S.K. 1977a. Phytoseiidae (Acarina: Mesostigmata) of Andaman Nicobar islands with descriptions of eight new species. Orient. insects 11: 623-638.

Gupta, S.K. 1977b. Some underscribed and little known species of *Amblyseius* (Acarina: Phytoseiidae) from Western and Northern India. Indian J. Acarol. 1: 28-37.

Gupta, S.K. 1981a. On a collection of Phytoseiidae (Acari: Mesostigmata) from Himachal Pradesch (India), with descriptions of two new species. Indian J. Acarol. 5: 32-36.

Gupta, S.K. 1981b. Phytoseiidae (Acari: Mesostigmata) from Jammu and Kashmir, India with descriptions of five new species. Indian J. Acarol. 5: 37-49.

Hatzinikolis, E. 1973. Acariens predateurs signales sur les plantes cultivees. Symposium of the Greek Agric. Res. Inst. Athens Febr. 1973 (Greek, with French summary).

Hirschmann, W. 1962. Acarologie. Gangsystematic der Parasitiformes. Teil 5 Gamasiden. Furth/bay, 56 pp.

Hughes, A.M. 1948. The mites associated with stored food products. (Phytoseiidae). Ministry Agric. Fish. London, 168 pp.

Jorgensen, C.D. & V. Mongkoprasith. 1979. Phytoseiid predators of mite pests in Utah apple orchards. Great Basin Nat. 39: 63-80.

Karg, W. 1970. Neue Arten der Raubmilbenfamilie Phytoseiidae Berlese, 1916 (Acarina, Parasitiformes). Dt. ent Z., 17: 289-301.

Karg, W. 1971. Acari (Acarina), Milben Unterordnung Anactinochaeta (Parasitiformes) Die freilebenden Gamasina (Gamasides), Raubmilben, In: Die Tierweld Deutschlands und der angrenzenden Meeresteile. Teil. 59. Edited by M. Dahl and F. Peus. VEB Gu-

stav Fishcher Verlag, Jena, East Germany. 475 pp.
Karg, W. 1982. Diagnostik und Systematik der Raubmilben aus der Familie Phytoseiidae Berlese in Obstanlagen. Zool. Jahrb. Abt. Syst. Oekol. Geogr. Tiere, 109: 188-210.
Kennett, C.E. 1958. Some predacious mites of the subfamilies Phytoseiinae and Aceosejinae (Acarina: Phytoseiidae, Aceosejidae) from Central California with descriptions of new species. Ann. Ent. Soc. Am. 51: 471-479.
Knisley, C.G. and H.A. Denmark. 1978. New phytoseiid mites from successional and climax plant communities in New Jersey. Fla. Ent. 61: 518.
Kolodochka, L.A. 1973. Carnivorous mites (Parasitiformes, Phytoseiidae) of the forest-steppe of the Ukranian S.S.R. Vest. Zool. 5: 78-81 (in Russian).
Kolodochka, L.A. 1978. Some demographic data of two species belonging to the mite family Phytoseiidae (Parasitiformes: Phytoseiidae). Ecology 4: 62-65.
Kolodochka, L.A. 1980. New phytoseiid mites (Parasitiformes, Phytoseiidae) from Moldavija. Vest. Zool. 4: 39-45 (in Russian).
Kolodochka, L.A. 1988. Description of little known *Amblyseius reticulatus* (Parasitiformes, Phytoseiidae). Vest. Zool. 5: 21-25.
Kropczynska D. and G. Jenser. 1968. Data to the knowledge of the Phytoseiidae in Hungarian orchards. Folia Ent. hung. 21: 321-323 (in Hungarian, with English summary).
Lehman, R.D. 1982. Mites (Acari) of Pensylvania conifers. Trans Amer. Ent. Soc. 108: 181-286.
Lindquist, E.E. and G.O. Evans. 1965. Taxonomic concepts in the Ascidae with a modified setal nomeclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). Mem. Ent. Soc. Can. 47: 1-66.
Livshitz, I.Z. and N.N. Kuznetsov. 1972. Phytoseiid mites from Krimea (Parasitiformes: Phytoseiidae). Tr. Akad. Nauk Nikiski Bot. Sad, Yalta, 61: 13-64 (in Russian).
Mac Gill, E.I. 1939. A gamasid mite (*Typhlodromus thripsi* n.sp.), a predator of *Thrips tabaci* Lindl. Ann. Appl. Biol. 26: 309-317.
Mc Gregor, E.A. 1956. The mites of citrus trees in Southern California. Mem. S. Calif. Acad. Sci. 3: 42 pp.
Mc Murtry, J.A. 1977. Some predacious mites (Phytoseiidae) on citrus in the Mediterranean region. Entomophaga 22: 19-30.
Meyer, M.K.P. and M. Rodrigues. 1966. Acari associated with cotton in Southern Africa: with reference to other plants. Garcia de Orta 13 (2): 46 pp.
Muma, M.H. 1955. Phytoseiidae (Acarina) associated with citrus in Florida. Ann. Ent. Soc. Am. 48: 262-272.
Muma, M.H. 1961. Some families, genera and species of Phytoseiidae (Acarina: Mesostigmata). Bull. Fla. St. Mus. Biol. Sci. 5: 267-303.
Muma, M.H. and H.A. Denmark. 1968. Some generic descriptions and name changes in the family Phytoseiidae (Acarina: Mesostigmata). Fla. Ent. 51: 229-240.
Nesbitt, H.H.J. 1951. A taxonomic study of the Phytoseiinae (family Laelaptidae) predacious upon Tetranychidae of economic importance. Zool. Verh. Leiden, 12: 64 pp.
Oudemans, A.C. 1915a. Acarologische Aanteekeningen 56. Ent. Ber., Amst. 4: 180-188.
Oudemans, A.C. 1915b. Notizien über Acari, 22. Arch. Naturges. Berlin 81A: 122-180.
Oudemans, A.C. 1929. Acarologische Aanteekeningen 100. Ent. Ber. Amst. 8 (170): 28-36.
Oudemans, A.C. 1930a. Acarologische Aanteekeningen 101. Ent. Ber., Amst. 8 (171): 48-53.
Oudemans, A.C. 1930b. Acarologische Aanteekeningen 102. Ent. Ber., Amst. 8 (172): 69-74.
Oudemans, A.C. 1930c. Acarologische Aanteekeningen 103. Ent. Ber., Amst. 8 (173): 97-101.
Papadoulis, G.Th. and N.G. Emmanouel. 1988. *Typhlodromus erymanthii*, a new species of the family Phytoseiidae (Acari: Mesostigmata) from Greece. Entomologia Hellenica 6: 3-6.
Papadoulis G.Th. and N.G. Emmanouel. 1990a. Phytoseiid mites of Greece: new records of species and description of the male and immature stages of *Typhlodromus erymanthii* Papadoulis & Emmanouel. Biologia Gallo-hellenica 17: 13-26.
Papadoulis G.Th. and N.G. Emmanouel 1990b. Two new species of the genus *Typhlodromus* Scheuten (Acari: Phytoseiidae) from Greece. Entomologia Hellenica 8: 11-19.
Papadoulis, G.Th. and N.G. Emmanouel 1991. Two new species of *Amblyseius* Berlese (Acari: Phytoseiidae) from Greece. Intern. J. Acarol. 17: 265-269.
Papadoulis G.Th. and N.G. Emmanouel. 1993. Phytoseiid mites of Greece: new records of species and description of the larva of *Typhlodromus erymanthii* Papadoulis & Emmanouel Intern. J. Acarol. 19: 51-56.
Papaioannou-Souliotis, P. 1981. Predacious mites (Phytoseiidae) observed on various plants in Greece. An. Inst. Phytopath. Benaki (new ser.) 13: 36-58.
Porath, A. and E. Swirski. 1965. A survey of Phytoseiid mites (Acarina: Phytoseiidae) on citrus, with a description of one new species. Isr. J. Agric. Res. 15: 87-100.
Prasad, V. 1968. *Amblyseius* mites from Hawaii. Ann. Ent. Soc. Am. 61: 1514-1521.
Pritchard, A.E. and E.W. Baker. 1962. Mites of the family Phytoseiidae from Central Africa, with remarks on the genera of the world. Hilgardia 33 (7): 205-309.
Ragusa, S. 1977. Notes on Phytoseiid mites in Sicily with a description of a new species of *Typhlodromus* (Acarina: Mesostigmata). Acarologia 18: 379-392.
Ragusa, S. 1986. A five years study on population fluctuations of Phytoseiid mites in a citrus orchard in Sicily. Acarologia 27: 193-201.
Ragusa, S. and E. Swirski. 1976. Notes on predacious mites of Italy, with a description of two new species and of an unknown male (Acarina: Phytoseiidae). Redia 59: 179-196.
Ragusa, S. and C. Athias-Henriot. 1983. Observations on the genus *Neoseiulus* Hughes (Parasitiformes: Phytoseiidae). Redefinition. Composition. Geography. Description of two new species. Rev. Suisse de Zool. 90: 657-678.
Ragusa, S. and M.G. Paoletti. 1985. Phytoseiid mites (Parasitiformes: Phytoseiidae of corn and soybean agroecosystems in the low laying plain of Veneto (N-E Italy). Redia 38: 69-89.
Rowell, H.J., D.A. Chant and R.I.C. Hansell. 1978. The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata). Can. Entomol. 110: 859-876.
Schicha, E. 1976. The underscribed male of *Amblyseius bellinus* (Womersley), and females of the latter and *A. cucumeris* (Oudemans) redescribed (Acarina: Phytoseiidae). Z. angew. Zool. 63: 333-342.

Schicha, E. 1980. Three new species (Acari: Phytoseiidae) from Australia and collection records of two first described from Madagascar and Hawaii. Intern. J. Acarol. 6: 245-253.

Schicha, E. 1983. New species, new records and redescriptions of Phytoseiid mites from Australia. Tahiti and the African region (Acari: Phytoseiidae). Inter. J. Ent. 25: 103-126.

Shrouft, G. 1967. Das Vorkommen rauderisher Mlben aus der Familie Phytoseiidae (Acari: Mesostigmata) an Reben. III. Beitrag über Untersuchungen zur Faunistik and Biologie der Milben (Acari) an kultur Reben (Vitis spec.). Die Weinwissenschaft 22: 184-201.

Schultz, F.W. 1972. Three new species of the family Phytoseiidae (Acari: Mesostigmata) from South Africa. Phytophylactica 4: 13-18.

Schuster, R.O. and R.H. Gonzalez. 1963. Redescription and notes on *Amblyseius cucumeris* (Oudemans) (Acarina: Phytoseiidae). Acarologia 5: 185-188.

Schuster, R.O. and A.E. Pritchard. 1963. Phytoseiid mites of California. Hilgardia 34 (7): 191-285.

Schuster, R.O. and L.M. Smith. 1960. The spermathecae as taxonomic features in Phytoseiid mites of Western North America. (Acarina: Phytoseiidae). Ent. Soc. Wash. Proc. 62: 181-188.

Sellnick, M. 1958. Milben aus landwirschaftlichen Betrieben Nordschwedens. Medd. Vaxtskyddsanst. Stockh. 11: 9-59.

Specht, H.B. 1968. Phytoseiidae (Acarina: Mesostigmata) in the New Jersey apple orchard environment with descriptions of spermathecae and three new species. Can. Ent. 100: 673-682.

Swirski, E. and S. Amitai. 1961. Some Phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of two new species. Israel J. Agric. Res. 11: 193-202.

Swirski, E. and S. Amitai. 1965. Further Phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of one new species. Israel J. Agric. Res. 15: 123-138.

Swirski, E. and S. Amitai. 1968. Notes on Phytoseiid mites (Acari: Phytoseiidae) of Israel, with a description of one new species. Isr. J. Entomol. 3: 95-108.

Swirski, E. and S. Amitai. 1982. Notes on predacious mites (Acarina: Phytoseiidae) from Turkey, with a description of the male of *Phytoseius echinus* Wainstein & Aratujian. Isr. J. Entomol. 16: 55-62.

Swirski, E. and S. Ragusa. 1976. Notes on predacious mites of Greece, with a description of five new species (Mesostigmata: Phytoseiidae). Phytoparasitica 4 (2): 101-122.

Swirski, E. and S. Ragusa. 1977. Some predacious mites of Greece, with a description of one new species (Mesostigmata: Phytoseiidae). Phytoparasitica 5 (2): 75-84.

Swirski, E., S. Ragusa, H. Van Emden and M. Wysoki. 1973. Description of the immature stages of three predacious mites, belonging to the genus *Amblyseius* Berlese (Mesostigmata: Phytoseiidae). Isr. J. Ent. 8: 69-87.

Swirski, E. and R. Schechter. 1961. Some Phytoseiid mites (Acarina: Phytoseiidae) of Hong-Kong, with a description of a new genus and seven new species. Isr. J. Agric. Res. 11: 97-116.

Ueckermann, E.A. and G.C. Loots. 1988. The African species of the subgenera *Anthoseius* De Leon and *Amblyseius* Berlese (Acari: Phytoseiidae). Entomol. Mem. (Dept. Agr. & Wat. Suppl.) 73: 1-168.

Van de Vrie, M. 1972. Phytoseiid mites on tree crops, ornamental and wild plants in Netherlands. Ent. Ber. 32: 13-20.

Van der Merwe, G.G. 1965. South Africa Phytoseiidae (Acarina). Nine new species of the genus *Amblyseius* Berlese. J. Ent. Soc. sth. Afr. 28: 57-76.

Van der Merwe, G.G. 1968. A taxonomic study of the family Phytoseiidae (Acari) in South Africa with contributions of the biology of two species, S. Afr. Dept. Agric. tech. Serv. Ent. Mem. 18: 198 pp.

Wainstein, B.A. 1960. Species and subspecies of the genus *Typhlodromus* Scheuten (Parasitiformes; Phytoseiidae) of the U.S.S.R. fauna. Zool. Zh. 39: 683-690) (in Russian).

Wainstein, B.A. 1961. New species of Acarina of the genus *Typhlodromus* (Parasitiformes: Phytoseiidae) in Gruzia. Trudy Inst. Zool. Acad. Nauk. Gruz. S.S.R.. 18: 153-162 (in Russian).

Wainstein, B.A. 1962. Revision du genre *Typhlodromus* Scheuten, 1857 et systematique de la famille des Phytoseiidae (Berlese, 1916) (Acarina: Parasitiformes). Acarologia 7: 5-30.

Wainstein, B.A. 1969. Two new species of *Phytoseius* (Parasitiformes: Phytoseiidae). Zool. Zh. 48: 1741-1743 (in Russian).

Wainstein, B.A. 1972. New species and subgenus of the genus *Anthoseius* (Parasitiformes: Phytoseiidae). Zool. Zh. 51: 1477-1482 (in Russian).

Wainstein, B.A. 1973a. Predatory mites of the family Phytoseiidae (Parasitiformes) of the Moldavian fauna. In: Yaroshenko, M. et al. (Eds.) Shtuntza, Kishiney, 186 pp (in Russian).

Wainstein, B.A. 1973b. On the structure of some organs of Phytoseiidae (Parasitiformes) important for taxonomy. Zool. Zh. 52: 1871-1872 (in Russian).

Wainstein, B.A. 1975. On the fauna of predatory mites of Phytoseiidae (Parasitiformes) from the Yaroslav district. Ent. Rev. U.S.S.R. 54: 914-922 (in Russian).

Wainstein, B.A. 1977. A contribution to the fauna of the family Phytoseiidae (Parasitiformes) in Australia. Zool. Zh. 56: 1413-1416 (in Russian).

Wainstein, B.A. and G.I. Shcherbak. 1972. Gamasid species of the genus *Amblyseius* Berlese 1904 (Parasitiformes: Phytoseiidae) new for the Ukranian fauna. Vest. Zool. 6: 35-44 (in Russian).

Wainstein, B.A. and S.G. Vartapetov. 1973. Predatory mites of Phytoseiidae (Parasitiformes) in Adzhar U.S.S.R. Biol. Zh. Armenii 26: 102-105 (in Russian).

Westerboer, I. and F. Bernhard. 1963. Die Familie Phytoseiidae Berlese 1916. Beit. Syst. Ökol. Acarina Bd 11. Mesostigmata 1: 451-791.

Womersley, H. 1954. Species of the subfamily Phytoseiinae (Acarina: Laelaptidae) from Australia. Aust. J. Zool. 2: 169-191.

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Το γένος *Amblyseius* (Acari, Phytoseiidae) στην Ελλάδα, με Περιγραφή ενός Νέου Είδους.

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ΠΕΡΙΛΗΨΗ

Η μελέτη των ακάρεων της Οικογένειας Phytoseiidae στην Ελλάδα, έδειξε την παρουσία 19 ειδών, τα οποία ανήκουν στο γένος *Amblyseius*. Από αυτά το *A. makedonicus*, το οποίο ευρέθη στο φυτό *Oryza sativa*, περιγράφεται και σχεδιάζεται ως νέο είδος στην επιστήμη. Δίδονται επίσης κλειδί προσδιορισμού, τα συνώνυμα και περισσότερο λεπτομερή και ακριβή (των προηγουμένων περιγραφών) σχέδια θηλυκού ή και αρσενικού για όλα τα ανευρεθέντα στην Ελλάδα είδη *Amblyseius*, καθώς και πληροφορίες της παγκόσμιας εξάπλωσης αυτών. Αναφέρονται ακόμα οι ξενιστές και η γεωγραφική εξάπλωση των ακάρεων αυτών στην Ελλάδα.