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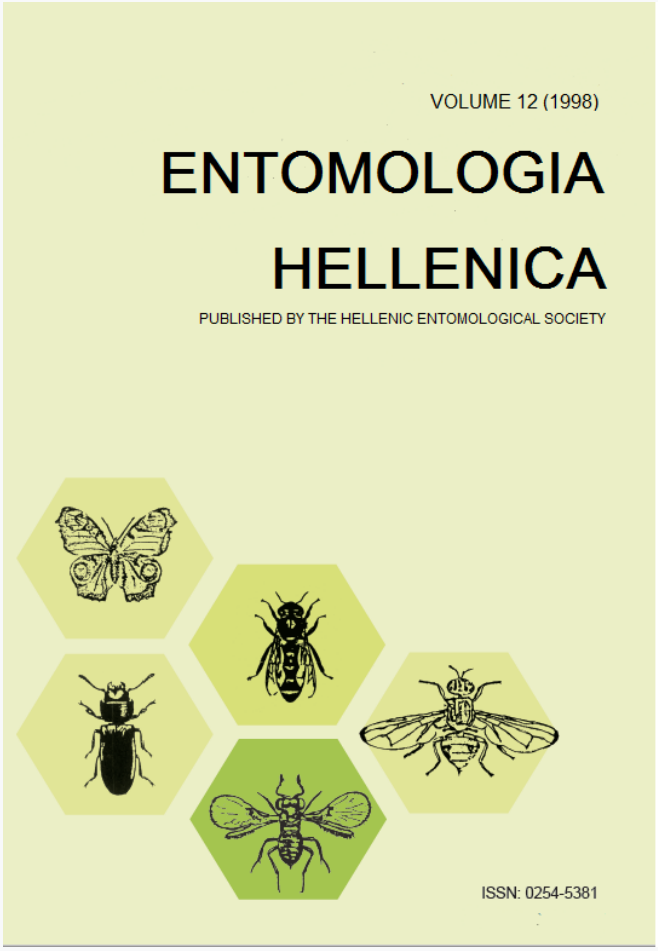

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Phytoseiid Mites (Parasitiformes, Phytoseiidae) of Lesvos Island (Greece) with a Description of a New Species[1, 2]

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ABSTRACT

A survey of phytoseiid mites associated with crops and wild plants on Lesvos Island was conducted. Of twenty three species collected the most abundant were the following: *Phytoseius finitimus* Ribaga sensu Denmark (30%), *Euseius finlandicus* (Oudemans) and *Typhlodromus psyllakisi* Swirski and Ragusa (26%), *Typhlodromus athenas* Swirski and Ragusa (19%), *Typhlodromus cryptus* Athias-Henriot, and *Typhlodromus intercalaris* Livshitz and Kuznetsov (15%). A new species, *Typhlodromus sapphicus* sp. n., collected on *Tilia sp.* is also described.

Introduction

The interest towards phytoseiid mites living on agricultural crops in Greece started during the '70s (Hatzinikolis 1977) and still nowadays surveys are carried out whose purpose is to acquire information on the composition and distribution of these predators especially on the Greek mainland (Swirski and Ragusa 1976, 1977, Papaioannou-Souliotis 1981, 1985, Papaioannou-Souliotis et al. 1994, Papadoulis and Emmanouel 1990, 1991, 1993, Ragusa et al. 1995). Very little has been investigated on Greek islands. Therefore we decided to survey phytoseiid mites living on different plants on Lesvos, one of the biggest islands of Greece.

Materials and methods

Phytoseiid mites were collected by the leaf-shaking method, preserved in 70% alcohol, cleared in Nesbitt solution, mounted in Hoyer's solution and observed under a diferential interference microscope for identification. Mites were collected from 11th to 20th August 1992.

The organotactic terminology for the dorsal and ventral sides is the one used by Chant and Yoshida-Shaul (1992) and Athias-Henriot (1975).

The type material is deposited in the collection of the Istituto di Entomologia agraria, Università di Palermo (Italy).

Results and discussion

Collection sites are given in Figure 1. It can be seen that the island was thoroughly surveyed. In Table 1 we report the various locations in which the species of phytoseiid mites were collected as well as the plants with which they were associated. The frequency of the species collected on different plants is shown in Figure 2. The most frequent species was *Phytoseius finitimus* Ribaga sensu Denmark, found on 30% of the plants. *Ph. finitimus* is very common throughout Greece on agricultural plants (vines, pears, figs, medlars etc.) as well as on wild plants (Rubus sp.)(Swirski and Ragusa 1976, Papaioannou-Souliotis et al. 1994). However, it was never found on forest trees, even when these trees were at sea level (Ragusa-Di Chiara et al. 1995). Moreover, *Ph. finitimus* was the dominant species in vineyards of Campania (Italy) (Nicotina and Tsolakis 1994). El-Banhawy (1974) studied in laboratory the

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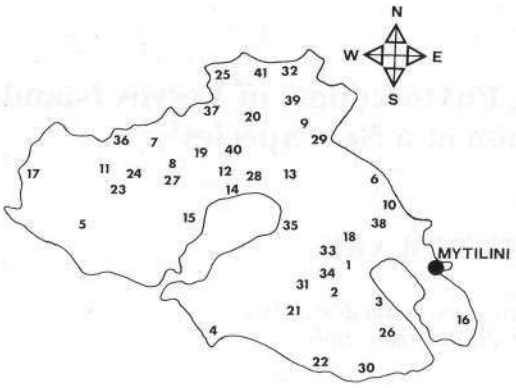

FIG. 1. Location of collection sites on Lesvos.
1. Ippion; 2. Agiassos; 3. Kato Tritos; 4. Akr. Ag. Fokas; 5. Eressos; 6. Skala Neon Kydonion; 7. Skalochori; 8. Anemotia; 9. Madamados; 10. Pyrgi Thermis; 11. Antissa; 12. Kalloni; 13. Agia Paraskevi; 14. Skala Kallonis; 15. Karakila; 16. Kratigos; 17. Sigri; 18. Lamprou Mylli; 19. Filia; 20. Stipsi; 21. Ampelikon; 22. Plomari; 23. Tzithra; 24. Moni Perivolis; 25. Molyvos; 26. Pappados; 27. Vatoussa; 28. Papiana; 29. Aspropotamos; 30. Agios Isidoros; 31. Olympos; 32. Skala Sikamias; 33. Keramia; 34. Asomatos; 35. Achladeri; 36. Gavathas; 37. Petra; 38. Thermi; 39. Kapi; 40. Moni Limona; 41. Eftalou.FIG. 8. Male reproductive system of *Euphyllura phillyreae* (x70). ag: accessory gland, ed: ejaculatory duct, sp: sperm pump, sr: seminal receptacle, t: testis, vd : vas deferens.

effect of different foods (pollen and prey) on postembryonic development and oviposition rate. The foods preferred were the prey *Aceria ficus* Cotte and date pollen on which the postembryonic development was 6.1 and 6.8 days respectively, while it was longer (8.8 days) on eggs and young stages of Tetranychus urticae Koch. The highest oviposition was also obtained on *A. ficus* added to date pollen (2 eggs/♀/day). Wysoki (1974) studied the influence of photoperiod on diapause and resistance to low temperatures of *Ph. finitimus*. He reported that at a temperature of 17°C, a photoperiod of 16 hours had a positive influence on both the preoviposition period and the total number of eggs laid. Wysoki and Swirski (1971) found that the overwintering of *Ph. finitimus* in Israel was mainly as females even if a low number of males and young stages was also found during the winter months.

The second most common species were *Typhlodromus psyllakisi* Swirski and Ragusa and *Euseius finlandicus* (Oudemans), found on 26% of the plants. *T. psyllakisi* has been collected so far on Cupressus, vines and pears only in Greece (Swirski and Ragusa 1976, Papaioannou-Souliotis et al. 1994). Nothing is known about this species from a biological point of view.

E. finlandicus, which is able to colonise habitats from sea level to m 1800 a.s.l., was the most common species associated with forest trees in Greece (Ragusa-Di Chiara et al. 1995). It is also very common on fruit plants in central and northern Europe (Boczek 1965, Kropczynska and Jenser 1968, Khorkhordin and Losev 1989, Duso 1992) and it is considered as one of the most important biological control agents of phytophagous mites of citrus trees in Greece (Souliotis 1986). In spite of its wide distribution from Finland to Sicily and Greece, which may lead to the idea of a species complex, a comparison of the specimens collected by us with the type material showed that they were similar in all respects to the holotype. *A. finlandicus* is considered to be the most important predator of *T. urticae* living on fruit trees in Kashmir (India) (Rishi and Rather 1983). Schausberger (1991, 1992) reported that when *E. finlandicus* was provided with Cecidophyopsis ribis Westwood and with pollens of cherry and birch as food, it completed its postembryonic development in a short time (6.07, 6.32 and 6.71 days respectively). On the other hand, when *T. urticae,* Panonychus ulmi Koch, and apple pollen were supplied, the postembryonic development was longer (8.97, 7.84 and 7.51 respectively). A preference toward eriophyid mites was also reported by Kropczynska-Linkiewicz (1971). *E. finlandicus* laid a greater number of eggs when supplied with Aculus schlechtendali (Nalepa), if compared with those laid when *T. urticae* was supplied. However, the duration of postembryonic development was shorter when fed on the tetranychid (8.9 days) than on the eriophyid (10.8 days).

Typhlodromus athenas Swirski and Ragusa was found on 19% of plants commonly associated with vines, citrus trees, olive trees, but was also found on pines, cypresses, ivy, etc. (Papaioannou-Souliotis et al. 1994). This species is also commonly associated with olive trees in Sicily with a frequency of 12% (Ragusa-Di Chiara and Tsolakis 1995a) and on olive trees, pines and *Tamarix* sp. on the island of Pantelleria (Ragusa-Di Chiara and Tsolakis 1995b). No biological information is available for this species.

Typhlodromus cryptus Athias-Henriot and *Typhlodromus intercalaris* Livshitz and Kuznetsov were found on 15% of sampled plants. T. cryptus is quite common in the Mediterranean area and it is the most common species in Sicily, where it is present with a frequency of 45%

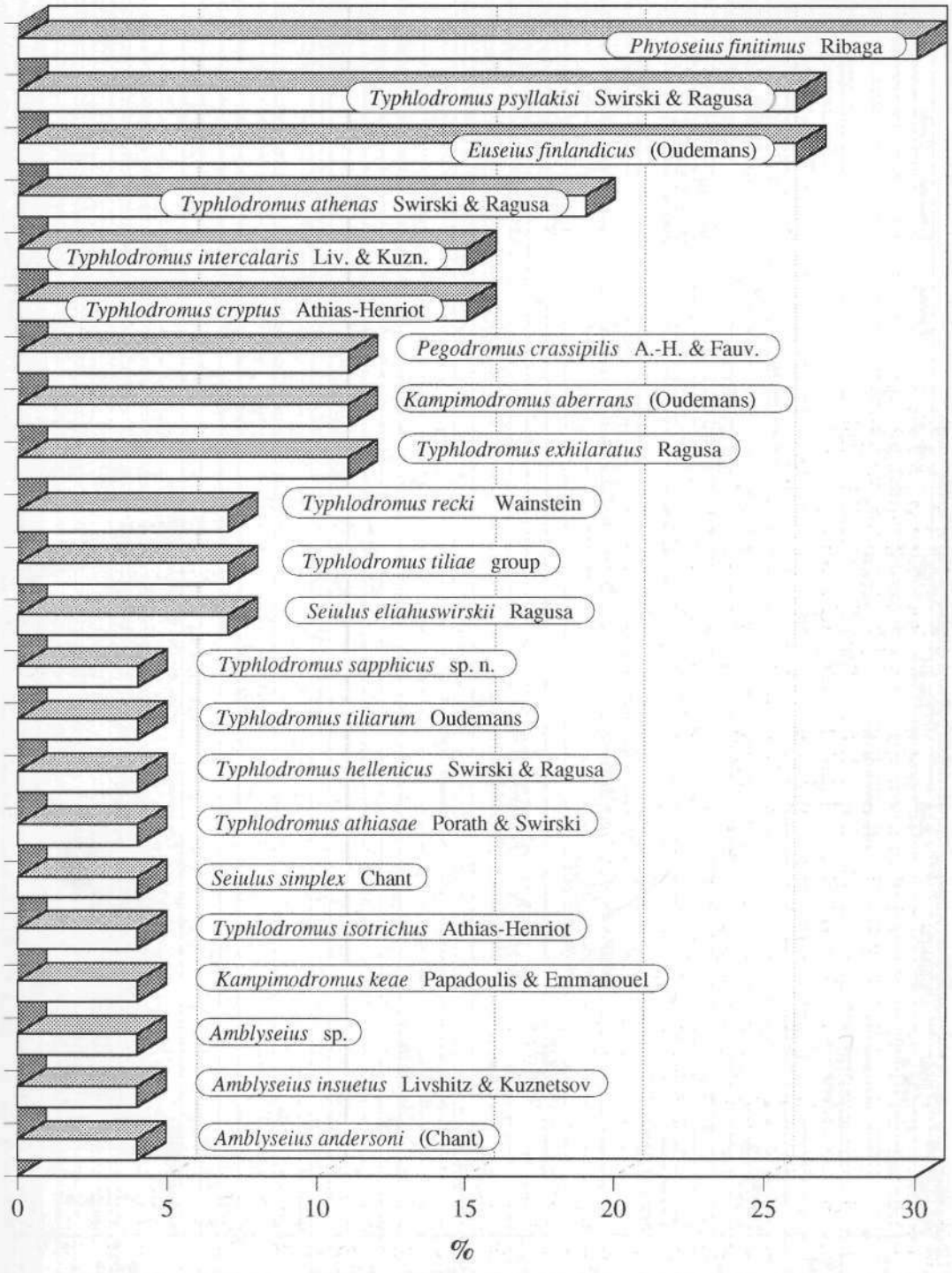

FIG. 2. Frequency of different species of phytoseiid mites collected on various plants.

TABLE 1. Collection sites and list of plants on which different species of phytoseiid mites were collected (Number of specimens collected are reported in brackets

	Ph. finitimus	*T. psyllakisi*	*E. finlandicus*	*T. athenas*	*T. intercalaris*	*T. cryptus*	*P. crassipilis*	*K. aberrans*	*T. exhilaratus*	*T. recki*
Achladeri		*Quercus* sp. (1♀)								
Agia Paraskevi							Undet. (1♀, 1♂, 1dn)			
Agiassos		*Olea europaea* L. (1♀) *Pyrus communis* L. (1♀)		*Olea europaea* L. (2♀, 1dn)						
Agios Isidoros		*Quercus* sp. (1♀)								
Akr. Ag. Fokas									*Cupressus* sp. (4♀)	
Ampelikon		*Pinus* sp. (3♀, 2dn)								
Anemotia							*Prunus dulcis* (Mill.)(4♀, 1♂)			
Antissa	*Ficus carica* L. (4♀)									
Asomatos	*Rubus* sp. (2♀)			*Origanum vulgare* L. (2♀)						
Aspropotamos							Undet. (4♀, 1♂)			
Eftalou									*Pinus* sp. (11♀, 1♂)	
Eressos					*Quercus* sp. (1♀)				*Olea europaea* (1♀)	
Filia	*Pistacia vera* L. (1♀) *Prunus dulcis* (Mill.) (1♀)					*Prunus dulcis* (Mill.)(2♀)			*Pistacia vera* L. (1♀)	
Gavathas			*Prunus dulcis* (Mill.)(1♀)	*Olea europaea* L. (4♀) *Prunus dulcis* (Mill.)(2♀)	*Quercus* sp. (6♀, 2dn)	*Prunus dulcis* (Mill.)(1♀)				
Ippion			*Junglans regia* L. (2♀) *Punica granatum* L. (1♀, 1♂)			*Punica granatum* L. (2♀)				
Kalloni		*Quercus* sp. (5♀)							*Pinus* sp. (1♀)	
Kapi		*Pinus* sp. (4♀, 1 dn)								
Kato Tritos			*Junglans regia* L. (3♀)	*Olea europaea* L. (2♀, 2♂)					*Cidonia vulgaris* (6♀)	
Keramia			*Vitis vinifera* L. (1♀, 1♂)	*Vitis vinifera* L. (1♀)						
Kratigos	*Ficus carica* L. (1♀)									
Lampou Milli	LuPinus sp. (2♀, 1dn)									
Madamados		*Junglans regia* L. (3♀) *Tilia* sp. (1♀) *Laurus* sp. (1♀, 2dn)	*Junglans regia* L. (1♀, 1♂) *Tilia* sp. (1♀)	*Olea europaea* L. (4♀, 1♂)						
Molivos										
Moni Limona						*Olea europaea* L. (2dn)				
Moni Perivolis										
Mount Olympos						*Castanea* sp. (1♀)	*Castanea* sp. (1♀)			
Papiana					*Morus nigra* L. (4♀)					
Pappados	*Rubus* sp. (1♀) *Cydonia vulgaris* Pers. (2♀)									
Parakila					*Pinus* sp. (1♀) *Quercus* sp. (1♀)					
Petra	*Ficus carica* L. (4♀)							*Ficus carica* L. (1♀)		
Pirgi Thermis	*Vitis vinifera* L. (10♀, 1♂)									
Plomari					*Quercus* sp. (2♀ 1dn)					
Sigri	*Prunus dulcis* (Mill.)(2♀) *Vitis vinifera* L. (6♀, 1♂)			*Pyrus communis* (3♀)	*Prunus dulcis* (Mill.)(1♀)	*Prunus dulcis* (Mill.) (1♀)				
Skala Kallonis										
Skala N. Kydonion	*Pistacia lentiscus* L. (1♂)			*Olea europaea* L. (1♀)						
Skala Sikamias										
Skalochori					*Quercus* sp. (1♀)					
Stipsi		*Quercus* sp. (1♀)								
Thermi			*Ficus carica* L. (4♀, 1♂, 2dn)							
Tzithra										*Inula* sp. (5♀, 1dn)
Vatoussa			*Platanus* sp. (1♂, 1♀)					*Platanus* sp. (3♀, 1dn)		

TABLE 1. (cont.)

	T. tiliae group	*S. eliahuswirskii*	*T. sapphicus*	*T. tiliarum*	*T. hellenicus*	*T. athiasae*	*S. simplex*	*T. isotrichus*	*K. keae*	*Amblyseius* sp.	*A. insuetus*	*A. andersoni*
Achladeri												
Agia Paraskevi												
Agiassos												
Agios Isidoros												
Akr. Ag. Fokas												
Ampelikon												
Anemotia	Arbutus unedo L. (1♀)											
Antissa												
Asomatos												
Aspropotamos												
Eftalou												
Eressos									*Quercus* sp. (1♀)			
Filia												
Gavathas												
Ippion												*Hedera helix* L. (3♀)
Kalloni												
Kapi												
Kato Tritos				*Junglans regia* L. (1♀)								
Keramia												
Kratigos								*Ficus carica* L. (1♀)				
Lampou Milli												
Madamados			*Tilia* sp. (1♀)									
Molivos		*Quercus* sp. (3♀, 2♂, 1dn)										
Moni Limona												
Moni Perivolis	*Citrus sinensis* (L.) (1♀, 1♂)					*Citrus sinensis* (L.) (1♀)						
Mount Olympos												
Papiana												
Pappados												
Parakila												
Petra												
Pirgi Thermis												
Plomari												
Sigri										*Purus communis* L. (2♀)		
Skala Kallonis											*Foeniculum vulgare* Mill. (1♀)	
Skala N. Kydonion		*Pistacia lenticus* (L.) (1♀)			*Pistacia lentiscus* L. (1♀, 1♂)							
Skala Sikamias		*Quercus* sp. (3♀)										
Skalochori							*Quercus* sp. (3♀, 1♂, 2dn)					
Stipsi												
Thermi												
Tzithra												
Vatoussa												

(Ragusa-Di Chiara and Tsolakis 1995a). T. cryptus is the second most frequent species collected on forest trees in Greece, with a frequency of 27%; it has been found at altitudes ranging from m 10 to m 850 a.s.l. To account for the importance of T. cryptus in Sicily, trials on its life-table parameters and the influence of different kinds of foods on biological parameters were carried out. Results will be published in the near future (Ragusa-Di Chiara and Tsolakis in preparation).

T. intercalaris has been collected on forest trees in Greece, at altitudes ranging from m 130 to m 1600 a.s.l. (Ragusa-Di Chiara et al. 1995). It has been commonly found on *Quercus* spp. in Sicily and Calabria (Ragusa-Di Chiara et al. 1991). No data from a biological point of view are available so far.

The collection of the remaining species did not show a high rate of frequency and their presence ranged from 4% to 11%.

Of interest was the presence of *Pegodromus crassipilis* Athias-Henriot and Fauvel, reported previously only in southern France on *Pirus amygdaliformis* (Athias-Henriot and Fauvel 1981). It would be worthwhile investigating its presence on Lesvos; additional surveys in the adjacent countries are therefore needed.

Description

Typhlodromus sapphicus sp. n.
FEMALE (Figs. 3-6)
Dorsal shield (Fig. 3) suboval, with slight constriction in median part, sclerotized and ornamented with irregular reticula mainly in region posterior to seta s6. Adenotaxy three deficient (gd1, gd4 and gd5 missing). All solenostomes prominent and crateriform. 12 pairs of poroides and muscle marks shown in fig 3. Setae, other than Z5, almost of same length (isotrichy), smooth; setae Z4 and Z5 slightly serrated. Peritreme entire, short (92μ), its apex almost at level of setae z4.

Insemination apparatus (Fig. 4): receptaculum slightly differentiated. Adductor duct short, cylindrical, simple. Calyx glass-flute-shaped, thick-walled in the upper part from atrium towards vescicle; atrium incorporated in calyx, without neck; accessus not differentiated; embolus prominent; sperm duct visible.

Sternal scutum (Fig. 5a) smooth, almost square, carrying three pairs of setae and two pairs of poroides. St3 as well as poroides pv2 hoplochorous.

Epigynial shield smooth (Fig. 5b) with post-

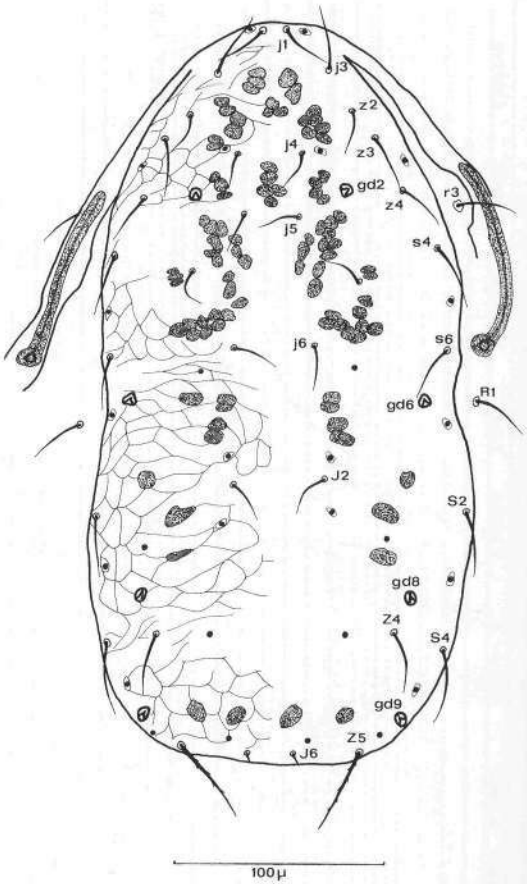

FIG. 3. Typhlodromus sapphicus sp. n. female, dorsal shield.

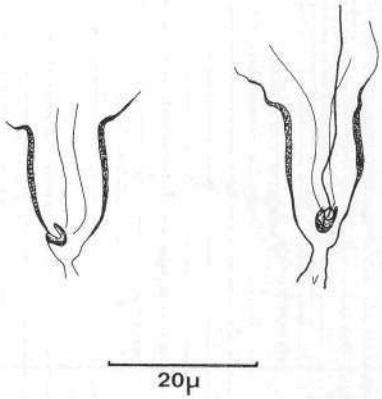

FIG. 4. Typhlodromus sapphicus sp. n. insemination apparatus.

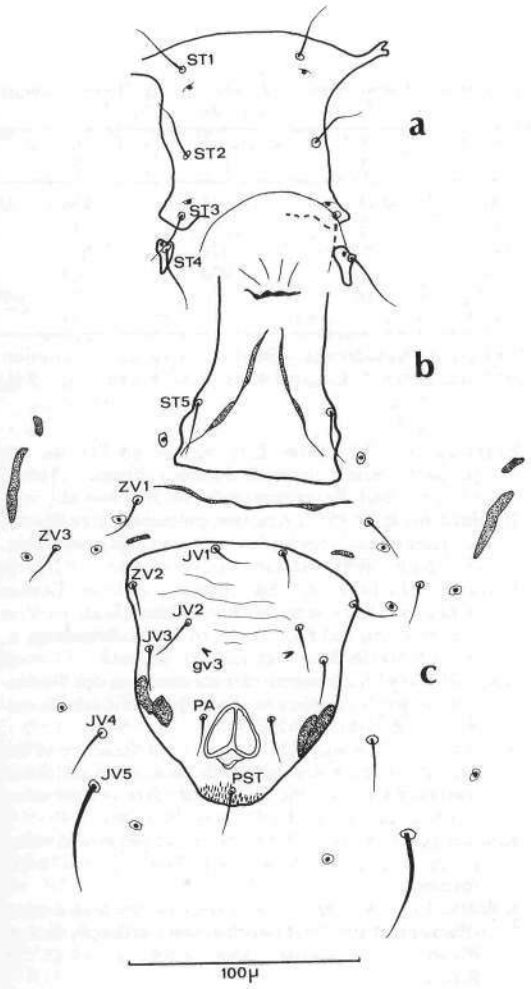

FIG. 5. Typhlodromus sapphicus sp. n. female, ventral side.

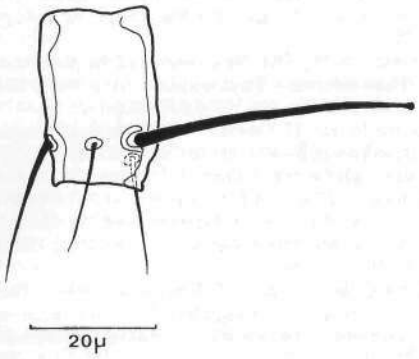

FIG. 6. Typhlodromus sapphicus sp. n. basitarsus IV of female.

erior margin almost straight; shield narrower than opisthogastral shield; 4th and 5th pair of genital sigilla linear; 6th pair (sgpa), free and close to anterior lateral margin of opisthogastral shield.

Opisthogastral shield (Fig. 5c) subpentagonal, slightly constricted lateraly, with anterior part widened; ornamented with very few striae; with four pairs of setae. Solenostomes gv3 prominent, posteroparaxial to JV2 and at same level as JV3; four pairs of setae and five pairs of poroids surround shield. Inguinal sigillum 32μ. Movable digit of chelicerae with one tooth. Only one slightly knobbed macroseta present on basitarsus IV (44μ)(Fig. 6). On genu II, seven setae present.

Measurements (in microns): j1 20, j4 17, j5 19, j6 24, J2 24, j3 30, z2 19, z3 27, z4 24, s4 31, s6 28, S2 32, S4 35, Z5 43, z5 21, Z4 31, JV5 48, r3 28, R1 27, Lva 120, lva 104, ds 366.

Type material and habitat: Holotype 1 female (G 1604) on *Tilia sp.* at Madamados (Lesvos) on August 17, 1992.

Taxonomic notes

Adult females of the following species resemble the new species: *Typhlodromus rodovae* Wainstein and Arutunian (1968), *Typhlodromus corticis* Herbert (1958), *Typhlodromus kykladiticus* Papadoulis and Emmanouel (1993), *Typhlodromus ernesti postici* Karg (1989) and *Typhlodromus laurentii* Ragusa and Swirski (1978). They can be easily distinguished because the first two have five pairs of solenostomes (four pairs in the new species) and different length of seta Z5 (57μ in *T. rodovae,* 49μ in *T. corticis,* 44μ in the new species). Moreover in *T. rodovae* three macrosetae are present on the hind leg. *T. kykladiticus* differs because it has three pairs of solenostomes, peritreme apex between z2-z3, gv3 in ventrianal shield absent and longer Z4 (45μ) and Z5 (68-70μ), while in the new species they are shorter (31 and 44μ respectively). *T. ernesti* postici and T. laurentii have also four pairs of solenostomes, but are distinguished from *T. sapphicus* by apex of peritreme being between j3-z2, absence of gv3, longer Z4 , Z5 and stIV (40-41μ, 55-60μ and 52-55μ in *T. ernesti* postici and 38-43μ, 60-65μ and 50-56μ in *T. laurentii*).

Females of the following other species are also similar to *T. sapphicus: Typhlodromus accessorius* Kolodochka (1993), *Typhlodromus klimenkoi* Kolodochka (1980), *Typhlodromus pentelicus* Papadoulis and Emmanouel (1990), *Typhlodromus quercicolus* Denmark (1992) and *Typhlodro-*

TABLE 2. Distinguishing characters between species belonging to the *Typhlodromus tiliae* group and *Typhlodromus sapphicus* sp. n.

	T. sapphicus	*T. accessorius* (1)	*T. klimenkoi* (2)	*T. pentelicus* (3)	*T. quercicolus* (4)	*T. inhabilis* (5)
Z5	43μ	52μ	50μ	49-52μ	64μ	58μ
Mov. digit (teeth)	1	1	1	2	1	1
gv3	yes	yes	no	yes	yes	yes
StIV	44μ	55μ	47μ	49μ	60μ	50μ
Apex of peritreme	z4	z3-z4	z3-z4	z4	z3	z3
N° solenostomes	4	5	4	3	4	4

1. Original description (Kolodochka, 1993) - 2. Original description (Kolodochka, 1980) - 3. Original description (Papadoulis and Emmanouel, 1990) - 4. Original description (Denmark, 1992) - 5. Original description (Kuznetsov, 1984).

mus inhabilis Kuznetsov (1984). Distinguishing characters between them and the new species are reported in Table 2.

Derivatio nominis

The species is named in honour of Sappho, the great Greek woman poet, who lived on Lesvos in the sixth century B.C.

Acknowledgements

We wish to thank Mrs E. Chiavetta-Ragusa who patiently assisted the senior author during collections and for checking the English text.

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Ακάρεα Phytoseiidae (Parasitiformes, Phytoseiidae) της Λέσβου και Περιγραφή ενός Νέου Είδους

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Περίληψη

Έχουν γίνει δειγματοληψείες των ακάρεων της οικογένειας Phytoseiidae από διάφορα καλλιεργούμενα και αυτοφυή φυτά στο νησί της Λέσβου. Βρέθηκαν συνολικά είκοσι τρία είδη ακάρεων της παραπάνω οικογένειας. Τα πιο άφθονα ήταν τα εξής: *Phytoseius finitimus* Ribaga sensu Denmark (30%), *Euseius finlandicus* (Oudemans) και *Typhlodromus psyllakisi* Swirski and Ragusa (26%), *Typhlodromus athenas* Swirski and Ragusa (19%), *Typhlodromus cryptus* Athias-Henriot, και *Typhlodromus intercalaris* Livshitz and Kuznetsov (15%). Περιγράφεται και σχεδιάζεται, επίσης, ένα νέο είδος, *Typhlodromus sapphicus* sp. n., που βρέθηκε σε φύλλα φλαμουριάς (*Tilia* sp.).