

NEW RECORDS OF THE TRIBE BRYOBIINI BERLSESE (ACARI: TETRANYCHIDAE: BRYOBIINAE) FROM SERBIA, WITH NOTES ABOUT ASSOCIATED PREDATORS (ACARI: PHYTOSEIIDAE)

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Abstract - This paper gives an overview of the present knowledge and some new faunistic and zoogeographic data of the insufficiently researched tribe Bryobiini in Serbia. In Serbia, this group of mites is represented by eight species, including four species new to Serbian fauna: *Bryobia angustisetis* Jakobashvili, *B. lagodechiana* Reck, *B. ulmophila* Reck and *B. vasiljevi* Reck. New data on host plant species and families have also been obtained – two new host plant species for *B. angustisetis*, two host plant species and two host plant families for *B. graminum*, one host plant species for *B. lagodechiana*, four host plant species and one host plant family for *B. rubrioculus*, two host plant species and one host plant family for *B. ulmophila*, and one host plant species for *B. vasiljevi*. This overview was supplemented with data on the other groups of leaf-inhabiting mites that coexist with Bryobiini species. Statistical analysis of interspecific association was done to determine the role of 15 associated predatory mite species belonging to the families Phytoseiidae, Anystidae and Trombidiidae.

Key words: Bryobiini, Serbia, Phytoseiidae

INTRODUCTION

Worldwide, the subfamily of phytophagous mites, Bryobiinae, contains 388 species and 35 genera, included in three tribes: Bryobiini Berlese, 1913 *sensu* Reck, 1950, Hystrichonychini Pritchard and Baker, 1955, and Petrobiini Reck, 1952 (Migeon and Dorkeld, 2006-2011). All mentioned tribes are present in Europe, with 83 species from eight genera. The largest of all genera in the subfamily Bryobiinae is the genus *Bryobia* Koch, 1836, with 130 known species in the world and 62 species recorded in Europe (Bolland, 2011; Kulikova, 2008, 2011).

Mites of the genus *Bryobia* are rather conspicuous, darkly colored and larger than most of the other leaf-inhabiting mites. These organisms are mainly dis-

tributed on the upper leaf cuticle and are easily visible with the naked eye. Nevertheless, based on zoogeographical data, in most of the European countries there is a small number of recorded species. More than half of registered European species (36) was found only in a single country. Besides the fact that in several European countries mites of the tribe Bryobiini have not yet been discovered, in 20 European countries only 1-5 species have been recorded, in five countries 6-10 species; a greater number of species have been found only in France (12), Ukraine (19), Italy (20) and Greece (29), (Migeon and Dorkeld, 2006-2011; Bolland, 2011). For the completeness of the allegations, the significant data of 13 recorded species from Moldova should also be taken into consideration (Kulikova, 2008, 2011). Based on the above, it can be assumed that, with the exception

of a few widely distributed species, the majority of *Bryobia* species are not frequently found in Europe, and that they probably exist in lower population densities.

Over the past three decades in Serbia a relatively extensive and simultaneous sampling of the most important *leaf-inhabiting* mites has been conducted, primarily from the groups Tetranychoida, Eriophyoidea and Phytoseiidae (Stojnić and Petanović, 1994; Petanović and Stojnić, 1995; Petanović and Stanković, 1999; Glavendekić et al., 2002; Stojnić et al., 2002; Petanović et al., 2003; Stojnić et al., 2007; Mladenović et al., 2010). Mites were collected mostly from cultivated plants and weeds in agrobiocoenoses, but also from forest and ornamental woody plants, as well as ruderal herbaceous plants. Despite the effort expended in the period reviewed, only five species of subfamily Bryobiinae have been found (Tomašević 1965; Stojnić, 1993; Glavendekić et al., 2002; Stojnić et al., 2007): *Bryobia rubrioculus* (Scheuten), *B. graminum* (Schrank), *B. kissophila* van Eynhoven and *Pseudobryobia longisetis* (Reck), (Bryobiini), as well as *Tetranychopsis horridus* (Canestrini and Fanzago), (Hystrihonychini). In comparison with other spider mites, a small number of *Bryobia* individuals was collected in samples, and from rather few sites.

This research aimed to investigate the presence of *Bryobia* mites in natural forest habitats in Serbia, and to summarize all Bryobiini data collected so far. Statistical analysis of interspecific association was performed in order to assess the possibility of possible predator-prey interactions between predatory mites and *Bryobia* sp.

MATERIALS AND METHODS

Leaf samples were collected from deciduous forests in different parts of Serbia. In the laboratory, the mites were collected from standard and nonstandard leaf samples, consisting of 100 and 300-500 leaves respectively. Prior to mite extracting, both types of sample were exposed to ethyl acetate (a mite-killing agent) for 15 min. From the standard leaf sample, mites

were collected by direct examination under a stereomicroscope. Mite extraction from the nonstandard leaf samples was performed by a simple beating technique over white paper. Prior to microscopy, the mites were cleaned in ethyl alcohol and lactic acid solution for several days (Evans and Browing, 1955) and then mounted in Hoyer's mounting medium (Boczek, 1980). Identification was performed using suitable taxonomic keys for the families Tetranychidae (Reck, 1959; Mitrofanov et al., 1987; Hatzinikolis and Emmanouel, 1991) and Phytoseiidae (Begljarov, 1981; Karg 1993). All examined material is kept in the Acari collection, Department of Entomology and Agricultural Zoology, Faculty of Agriculture, University of Belgrade, Serbia.

Statistical analysis of interspecific association (two species case) was used (Dajoz, 1977; Ludwig and Reynolds, 1988) in order to assess the possibility of possible predator-prey interactions between predatory mites and *Bryobia* sp. The Jaccard Index (JI) presents the proportion of sampling units where both species occur to the total number of sampling units where at least one of the species is found:

$$JI = c / (a+b-c),$$

where a is the number of sampling units where species A occurs; b is the number of sampling units where species B occurs; c is the number of sampling units where species both species occur; d – represents the number of sampling units where neither A nor B are found; N is the total number of sampling units: a+b+c+d).

The probability or expected frequency of occurrence of both species in sample unit is given as:

$$P = ab/N$$

$P > c$, negatively associated pair of species; $P = c$, species are not associated; $P < c$ positively associated pair of species.

The significance of obtained values was tested by the chi-square test:

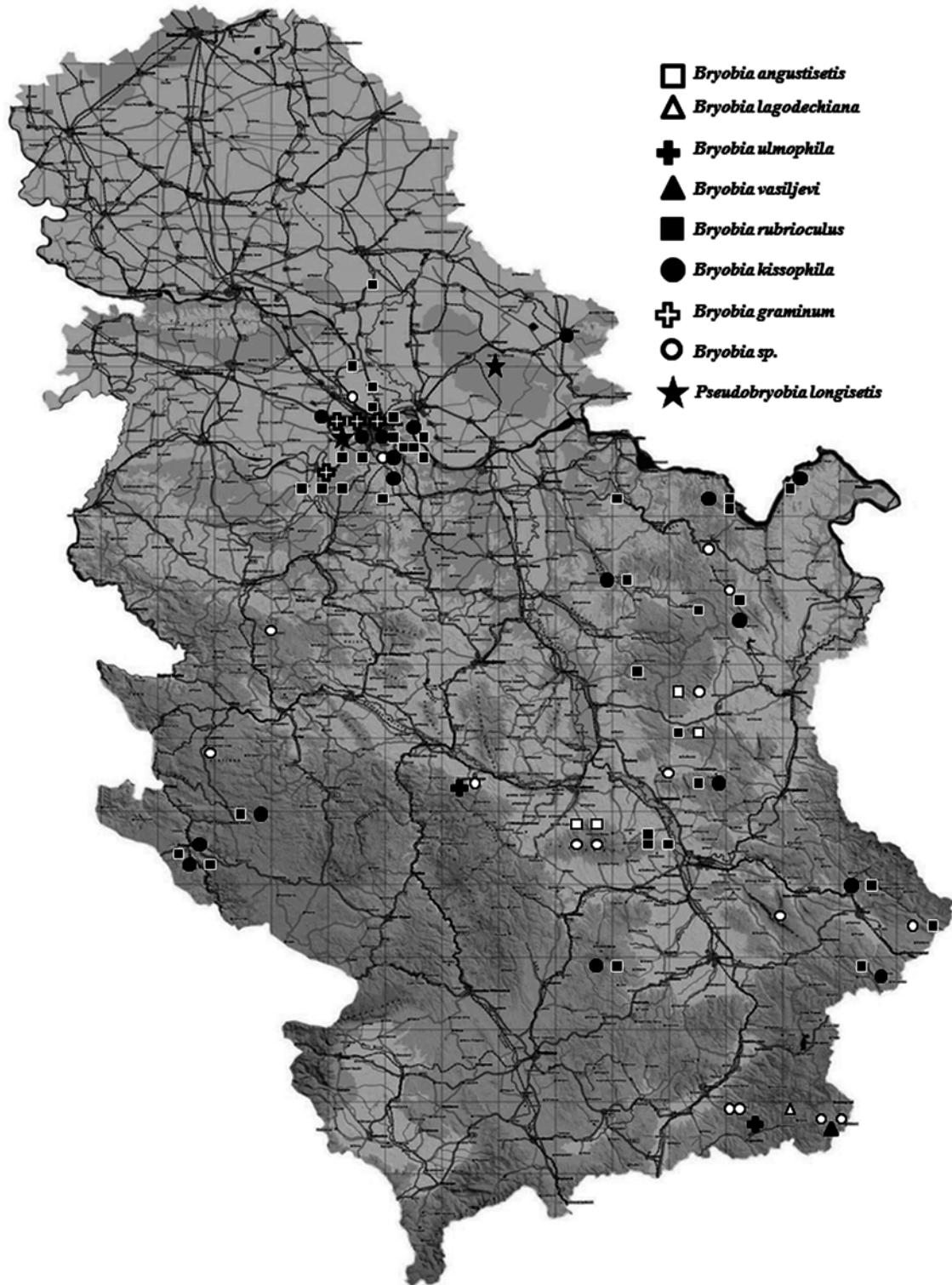


Fig.1 - Places in Serbia where Bryobiini species were observed.

$$X^2 = N^3(c-P)^2 / ab(N-a)(N-b);$$

if value $X^2 > 3.84$, the null hypothesis of independent co-occurrence of species A and B is rejected, and it can be concluded that species A and B are significantly associated (*); if value $X^2 > 6.64$, it can be concluded that species A and B are very significantly associated (**).

RESULTS AND DISCUSSION

A total of 85 samples of mites of the tribe Bryobiini were collected at 56 sites from the following plant species: *Allium cepa* L., *Cornus mas* L., *Corylus colurna* L., *Crataegus monogyna* Jacq., *Daucus carota* L., *Hedera helix* L., *Malus domestica* Borkh., *M. pumila* Mill., *M. silvestris* Mill., *Prunus avium* (L.), *P. cerasifera* Ehrh., *P. cerasus* L., *P. domestica* L., *P. serotina* Ehrh., *P. spinosa* L., *Pirus communis* L., *Pseudotsuga menziesii* (Mirb.), *Salvia pratensis* L., *S. nemorosa* L., and from mixed samples of Poaceae and Lamiaceae. This study revealed the presence of eight species of the tribe Bryobiini in Serbia, of which four species are new to our fauna. The finding places of species are shown in Fig. 1.

NOTES ON THE SPECIES

Bryobia angustisetis Jakobashvili

Nomenclature: *Bryobia angustisetis* Jakobashvili, 1958; type host: *Corylus colurna*; Type locality: Gruzija.

Distribution: Europe – Moldova (Kulikova, 2011); Near East – Gruzija (Jakobashvili, 1958; Mitrofanov, Strunkova and Livshits, 1987).

Hosts: Betulaceae (*Corylus colurna*) and Rosaceae (*Malus domestica*, *Prunus cerasus*, *P. divaricata*), (Jakobashvili, 1958; Kulikova, 2011).

Collection data (5 samples: 10 females, 4 nymphs): Boljevac (altitude: 460 m), 11.06.2001, on *Prunus avium* (L.) - 4 females, 1 nymph; associated with *Diptacus gigantorhynchus* (Nalepa, 1892) and *Rhi-*

notergum cerasifoliae Petanović, 1988 (Diptilomiopidae), *Euseius finlandicus* (Oudemans, 1915) and *Typhlodromus pyri* Scheuten, 1857 (Phytoseiidae), and *Anystis* sp. (Anystidae), (leg. K. Mladenović); Mt. Veliki Jastrebac, Kruševac, 26.06.2001, on *P. avium* - 1 female, associated with *R. cerasifoliae* (Diptilomiopidae) and *E. finlandicus* (Phytoseiidae); same place, on *Malus silvestris* Mill. - 1 female, 1 nymph, (leg. K. Mladenović); Mt. Veliki Jastrebac, 26.06.2001, on *M. silvestris* Mill. - 2 females and 1 nymph, associated with Phytoseiidae, *Calepitrimerus baileyi* Keifer, 1938 (Eriophyidae) and Tydeidae (leg. K. Mladenović); Mt. Rtanj (X: 4845139 Y: 7575742, altitude: 610 m, orientation: W-SW, slope °: 8), 6.08.2010, on *Corylus colurna* L. - 2 females, 1 nymph, (leg. K. Mladenović).

Remarks: This is the first report of *B. angustisetis* from Serbia and second report from Europe. New records of host species (*M. silvestris*, *P. avium*) indicate that *B. angustisetis* is oligophagous species of woody hosts.

Bryobia graminum (Schrank)

Nomenclature: *Acarus graminum* Schrank, 1781; type host: *Poaceae*; type locality: Germany.

Synonymy: *Bryobia amygdali* Reck, 1947; *Tetranychus cristatus* Dugès, 1834; *Bryobia gloriosa* Koch, 1836; *Acarus graminum* Schrank, 1781; *Rhyncholophus haustor* Hardy, 1850; *Acarus rufus* Schrank, 1776; *Bryobia zachvatkini* Wainstein, 1956.

Distribution: Europe - Belgium, Bulgaria, France, Germany, Greece, Hungary, Italy, Moldova, Netherlands, Switzerland, United Kingdom. Distribution also includes the other parts of Palearctic region (Gruzija, Egypt, China, Japan, Kazakhstan), Neotropical region (Chile) and Australasian region (Australia, New Zealand), (Migeon and Dorkeld, 2006-2011; Kulikova, 2011).

Hosts: chiefly herbaceous plant species (Amaranthaceae, Asteraceae, Brassicaceae, Fabaceae, Lamiaceae, Malvaceae, Ranunculaceae), numerous grasses (Poaceae), shrubs or small trees (Rham-

Table 1. Proportion of predatory species in samples containing *Bryobia* sp.

Predatory mite species	<i>Bryobia</i> sp.	Host plant (number of samples)	χ^2	Jl
<i>Anthoseius rhenanus</i>	<i>Bryobia rubrioculus</i>	<i>Malus</i> sp.(1)	1.375	2.77
<i>Dubininellus corniger</i>	<i>Bryobia</i> sp.	<i>Malus silvestris</i> (1)	5.330	5.88*
<i>Dubininellus echinus</i>	<i>Bryobia vasiljevi</i>	<i>Malus silvestris</i> (1)	27.676	33.33**
	<i>Bryobia</i> sp.	<i>Prunus spinosa</i> (2)	4.233	11.11*
<i>Dubininellus juvenis</i>	<i>Bryobia</i> sp.	<i>Malus silvestris</i> (1)	5.330	5.88*
<i>Dubininellus macropilis</i>	<i>Bryobia rubrioculus</i>	<i>Prunus avium</i> (1), <i>Prunus domestica</i> (1)	0.101	5.26
	<i>Bryobia</i> sp.	<i>Malus silvestris</i> (2)	2.361	10.53
<i>Dubininellus</i> sp.	<i>Bryobia kissophila</i>	<i>Hedera helix</i> (1)	5.330	5.88*
<i>Euseius finlandicus</i>	<i>Bryobia angustisetis</i>	<i>Prunus avium</i> (2)	0.952	9.09
	<i>Bryobia kissophila</i>	<i>Hedera helix</i> (1)	3.321	-2.86
	<i>Bryobia rubrioculus</i>	<i>Prunus cerasus</i> (2), <i>Prunus cerasifera</i> (3), <i>Prunus avium</i> (4), <i>Prunus serotina</i> (1), <i>Corylus colurna</i> (1)	2.421	25.00
	<i>Bryobia ulmophila</i>	<i>Malus silvestris</i> (1),	0.902	5.00
	<i>Bryobia</i> sp.	<i>Prunus avium</i> (2), <i>Prunus spinosa</i> (1), <i>Malus silvestris</i> (1)	0.017	12.5
<i>Kampimodromus aberrans</i>	<i>Bryobia rubrioculus</i>	<i>Prunus avium</i> (1), <i>Prunus cerasus</i> (2), <i>Malus domestica</i> (2)	7.234	13.89**
<i>Paraseiulus talbii</i>	<i>Bryobia</i> sp.	<i>Prunus avium</i> (1)	5.330	5.88*
<i>Paraseiulus triporus</i>	<i>Bryobia</i> sp.	<i>Prunus spinosa</i> (1)	5.330	5.88*
<i>Typhlodromus pyri</i>	<i>Bryobia angustisetis</i>	<i>Prunus avium</i> (1)	7.195	16.67**
	<i>Bryobia</i> sp.	<i>Prunus spinosa</i> (1)	1.152	6.00
<i>Typhlodromus tiliae</i>	<i>Bryobia rubrioculus</i>	<i>Corylus colurna</i> (1), <i>Prunus avium</i> (1)	2.788	5.56
<i>Seiulus aceri</i>	<i>Bryobia lagodechiana</i>	<i>Crataegus monogyna</i> (1)	41.999	50.00**
	<i>Bryobia</i> sp.	<i>Prunus spinosa</i> (1)	1.152	5.56
Phytoseiidae	<i>Bryobia angustisetis</i>	<i>Malus silvestris</i> (1)		
	<i>Bryobia rubrioculus</i>	<i>Pyrus communis</i> (1), <i>Prunus avium</i> (1), <i>Malus silvestris</i> (1)		
	<i>Bryobia</i> sp.	<i>Corylus colurna</i> (2), <i>Malus silvestris</i> (1)		
<i>Allothrombium</i> sp. Trombidiidae	<i>Bryobia rubrioculus</i>	<i>Malus pumila</i> (1)	1.375	2.78
<i>Anystis</i> sp., Anystidae	<i>Bryobia angustisetis</i>	<i>Prunus avium</i> (1)	7.195	16.67**
	<i>Bryobia rubrioculus</i>	<i>Prunus avium</i> (1)	0.049	2.70
Stigmaeidae	<i>Bryobia kissophila</i>	<i>Hedera helix</i> (1)		
	<i>Bryobia rubrioculus</i>	<i>Corylus colurna</i> (1)		

Abbreviations: Jl - Jaccard Index value (%), χ^2 - chi-square test value, * - significant, ** - very significant.

naceae, Rosaceae, Rutaceae). *Bryobia graminum* is an important pest in pome fruit and citrus plantations, cole crops, clover and grasses in parts of Europe, North Africa, Asia, Australia, and New Zealand (Walter, 2006).

Collection data (4 samples: 31 females, 18 nymphs, 16 larvae): Zemun, Belgrade, 12.11.1990, in fallen cones of Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco - 5 females, 2 nymphs, 1 larva (leg. B. Stojnić); Stublina, Aleksinac, 31.08.1991, on wild carrot, *Dau-*

cus carota L. - 3 females and 2 nymphs, associated with *Tetranychus urticae* Koch, 1836 (Tetranychidae), (leg. B. Stojnić); Zemun, Belgrade, 11.05.1996, on the onion, *Allium cepa* L. - 19 females, 10 nymphs, 10 larvae; same place, on *Poaceae* and *Lamiaceae* - 7 females, 6 nymphs, 5 larvae (leg. B. Stojnić).

Remarks: Taking into account the worldwide distribution of *B. graminum*, the small number of samples does not provide sufficient data of its distribution in Serbia. The presence of this mite in the cones of Douglas fir certainly does not refer to a host plant, but to a hibernaculum. On the other hand, *A. cepa* (Alliaceae) and *D. carota* (Apiaceae) are new records, both for host plant species and families.

Bryobia kissophila van Eynhoven

Nomenclature: *Bryobia kissophila* Eynhoven, 1955; type host: *Hedera helix*, *Hedera* sp.; type locality: Netherlands.

Distribution: Europe - Belgium, Bulgaria, France, Greece, Hungary, Italy, Netherlands, Poland, Spain, Switzerland, Ukraine, United Kingdom. Distribution also includes Near East parts of Palearctic region (Gruziya), Neotropical region (Chile, Costa Rica) and Australasian region (Tasmania, New Zealand), (Migeon and Dorkeld, 2006-2011).

Hosts: the most frequently ivy family, Araliaceae (*Hedera helix*), also Buxaceae (*Buxus sempervirens*) and Convolvulaceae (*Ipomoea batatas*).

Collection data (17 samples: 41 females, 30 nymphs, 4 larvae): Surčin, Belgrade, 10.05.1995, on *Hedera helix* L. - 2 females, 2 nymphs, 1 larva (leg. B. Stojnić); Mt. Avala, Belgrade, 5.05.1996 and 24.05.1998, on *H. helix* - 5 females, 2 nymphs, 2 larvae (leg. B. Stojnić); Banjička šuma, Belgrade, 20.05.1996, on *H. helix* - 9 females, 3 nymphs (leg. B. Stojnić); Zemun, Belgrade, 15.05.1996, on *H. helix* - 4 females, 2 nymphs, 1 larva (leg. B. Stojnić); Vršac, 3.10.2002, on *H. helix* - 3 females, associated with *E. finlandicus* (Phytoseiidae), *Phytoptus hedericola* Keifer, 1943 (Eriophyidae), Stigmaeidae, Tydeidae and Oribatida

(leg. M. Glavendekić); Mt. Stara planina (X: 4784514, Y: 7640929, altitude: 978 m, orientation: E, slope °: 29) 23.06.2009, on *H. helix* - 2 females, 1 nymph (leg. K. Mladenović); Mt. Greben planina, River Jerma canyon (X: 4760447, Y: 7633740, altitude: 572 m, orientation: E, slope °: 23), 24.06.2009, on *H. helix* - 2 females, 2 nymphs (leg. K. Mladenović); Mt. Ozren, Sokobanja (X: 4829012, Y: 7570889, altitude: 926 m, orientation: N-NW, slope °: 5) 30.06.2009, on *H. helix* - 3 females, 1 nymph (leg. K. Mladenović); Vinča, Belgrade, 30.05.2010, on *H. helix* - 2 females and 2 nymphs, associated with *Dubininellus* sp. (Phytoseiidae), (leg. K. Mladenović); Gornjačka gorge, Homolje (X: 4903235, Y: 7544035, altitude: 342 m, orientation: NW, slope °: 30), 30.06.2010, on *H. helix* - 1 female, 2 nymphs (leg. K. Mladenović); Mt. Veliki Krš, Bor (X: 4898104, Y: 7583367, altitude: 740 m, orientation: W, slope °: 25), 1.07.2010, on *H. helix* - 2 females, 1 nymph (leg. K. Mladenović); Gospođin vir, Đerdap gorge (X: 4936400, Y: 7580598, altitude: 422 m, orientation: N-NE, slope °: 39), 20.07.2010, on *H. helix* - 2 females, 2 nymphs (leg. K. Mladenović); Veliki Štrbac, Đerdap gorge (X: 4935548, Y: 7602052, altitude: 520 m, orientation: S-SW, slope °: 10), 22.07.2010, on *H. helix* - 2 females, 2 nymphs (leg. K. Mladenović); Mt. Radan planina (X: 4759330, Y: 7544537, altitude: 1080 m, orientation: E, slope °: 27) 27.07.2010, on *H. helix* - 1 female, 2 nymphs (leg. K. Mladenović); Mt. Zlatar, Nova Varoš (X: 4815551, Y: 7400553, altitude: 1180 m, orientation: N-NW, slope °: 28), 1.07.2011, on *H. helix* - 2 females, 2 nymphs (leg. K. Mladenović); Ratajska River gorge (X: 4801974, Y: 7387903, altitude: 666 m, orientation: N-NE, slope °: 36) 1.07.2011, on *H. helix* - 2 females, 2 nymphs (leg. K. Mladenović); Gračanica River gorge (X: 4794674, Y: 7395077, altitude: 974 m orientation: N-NE, slope °: 31), 1.07.2011, on *H. helix* - 1 female, 2 nymphs (leg. K. Mladenović);

Remarks: In Serbia, *B. kissophila* is noticeably present on the leaves of ivy only early in the season, but later population densities are lower.

Bryobia lagodechiana Reck

Nomenclature: *Bryobia lagodechiana* Reck, 1953; type

host unknown; type locality: Gruzija. Synonymy: *Bryobia longicornis* Mathys, 1957; *Bryobia praetiosa* f. *longicornis* Mathys, 1957; *Bryobia recki* Wainstein, 1956.

Distribution: Europe - Hungary, Moldova, Netherlands, Poland, Spain, Switzerland. Distribution also includes the other parts of Palearctic region (Gruzija, Japan, Kazakhstan), Nearctic region (Canada) and Australasian region (New Zealand), (Migeon and Dorkeld, 2006-2011; Kulikova, 2011).

Hosts: plant species from 15 families (Apiaceae, Boraginaceae, Campanulaceae, Cucurbitaceae, Equisetaceae, Fabaceae, Lamiaceae, Malvaceae, Poaceae, Ranunculaceae, Rosaceae, Rubiaceae, Salicaceae, Saxifragaceae). *Bryobia lagodechiana* is typically polyphagous, known as field and greenhouse pest of vegetables, clover and flowers in Europe, Japan, New Zealand and Canada (Walter, 2006).

Collection data (single sample: 2 females, 1 nymph): Gornja Ljubata, Vlasina (X: 47100000 Y: 76100000, altitude: 1300 m, orientation: SW), 28.07.2005, on hawthorn, *C. monogyna* - 2 females, 1 nymph; associated with *S. aceri* (Phytoseiidae) and *Phyllocoptes goniothorax* (Nalepa, 1889) (Phyllocoptinae) (leg. K. Mladenović);

Remarks: This is the first report of *B. lagodechiana* from Serbia, and new host record (hawthorn, *C. monogyna*); previous records of the family Rosaceae were from *Potentilla* sp., *Rosa* sp. and *Prunus cerasus* (Migeon and Dorkeld, 2006-2011; Kulikova, 2011).

Bryobia rubrioculus (Scheuten)

Nomenclature: *Sannio rubrioculus* Scheuten, 1857; type locality: Germany. Synonymy: *Bryobia arboorea* Morgan and Anderson, 1957; *Bryobia bioculus* Amerlind, 1862; *Bryobia goriensis* Reck, 1947; *Acarus pyri* Boisduval, 1867; *Bryobia redikorzevi* Reck, 1947.

Distribution: *Bryobia rubrioculus* is a cosmopolitan species. It has already been recorded in 30 Eu-

ropean countries, as well as in another 32 countries worldwide (Migeon and Dorkeld, 2006-2011).

Hosts: This is polyphagous species, with more than 60 host species from 21 plant families. Nearly half of the recorded host species is belonging to the family Rosaceae (*ibid.*).

Collection data (36 samples: 83 females, 18 nymphs, 11 larvae): Padinska Skela-Vrbovski, Beograd, 18.06.1990, on cherry plum, *Prunus cerasifera* Ehrh. - 7 females and 1 nymph, associated with *T. urticae* (Tetranychidae), (leg. B. Stojnić); Zvezdara, Belgrade, 5.07.1990, on sour cherry, *Prunus cerasus*, L., 2 females, associated with *E. finlandicus*, *Kampimodromus aberrans* (Oudemans, 1930) (Phytoseiidae), (leg. B. Stojnić); Vrčín, Grocka, 6.05.1991, on *Malus domestica* Borkh - 4 females, associated with *K. aberrans* (Phytoseiidae), *Cenopalpus pulcher* (Canestrini and Fanzago, 1876) (Tenuipalpidae), (leg. B. Stojnić); Jajinci, Beograd, 11.06.1991, on *P. cerasifera* - 1 female and 1 nymph, associated with *E. finlandicus* (Phytoseiidae) and Tydeidae (leg. B. Stojnić); Stojnik, Mt. Kosmaj, 24.06.1991, on *M. domestica* - 2 females, associated with *K. aberrans* (Phytoseiidae), *T. urticae* (Tetranychidae) and *C. pulcher* (Tenuipalpidae), (leg. B. Stojnić); New Belgrade, 26.06.1991, on *Malus* sp. - 2 females, associated with *Aculus schlechtendali* (Nalepa, 1890) (Eriophyidae), with *Anthoseius rhenanus* (Oudemans, 1905) (Phytoseiidae), *T. urticae* (Tetranychidae) and Tydeidae (leg. B. Stojnić); Zaklopača, Grocka, 12.07.1991, on *P. avium* - 2 nymphs, 1 larva, associated with *E. finlandicus* (Phytoseiidae), *Panonychus ulmi* (Koch, 1836) (Tetranychidae), *Cenopalpus mespili* (Livshitz and Mitrofanov, 1967) (Tenuipalpidae) and Tydeidae; same place, on *P. cerasus* - 1 female, associated with *Amphitetranychus viennensis* (Zacher, 1920) (Tetranychidae), (leg. B. Stojnić); New Belgrade, 14.08.1991, on Turkish hazel, *C. colurna* - 2 females, associated with *E. finlandicus* and *Typhlodromus tiliae* Oudemans, 1929 (Phytoseiidae), Tydeidae and Stigmaeidae (leg. B. Stojnić); Ivanovo, Pančevo, 16.08.1991, on *P. cerasifera* - 1 female and 3 nymphs, associated with *E. finlandicus* (Phytoseiidae), *Tetranychus turkestanii* Ugarov &

Nikolskii, 1937 and *A. viennensis* (Tetranychidae), and Tydeidae (leg. B. Stojnić); Grocka, 26.08.1991, on *P. avium* - 1 female, associated with *E. finlandicus* (Phytoseiidae), *A. viennensis* and *T. urticae* (Tetranychidae), Eriophyoidea and Tydeidae (leg. B. Stojnić); Grabovac, Obrenovac, 28.08.1991, on *P. avium* - 1 female, associated with *E. finlandicus*, *K. aberrans* and *Dubininellus macropilis* (Banks, 1909) (Phytoseiidae); same place, on *P. cerasus* - 4 females, associated with *E. finlandicus* and *K. aberrans* (Phytoseiidae), *T. turkestanii* (Tetranychidae) and Tydeidae, (leg. B. Stojnić); Stublina, Aleksinac, 31.08.1991, on *P. avium* - 1 female, associated with *E. finlandicus* and *T. tiliae* (Phytoseiidae) and Tydeidae (leg. B. Stojnić); Kučevo, 7.06.1993, on *Malus pumila* Mill. - 8 females, 2 nymphs, 6 larvae; found associated with *T. urticae* (Tetranychidae), *Aculus schlechtendali* (Eriophyoidea), and *Allothrombium* sp. (Trombidiidae), (leg. R. Petanović); National Park Đerdap, Zlatica, 7.06.1993, on *Prunus serotina* Ehrh. - 1 female and 2 larvae, associated with *E. finlandicus* (Phytoseiidae), (leg. R. Petanović). Carska bara, Zrenjanin, 9.06.1994, on *P. cerasifera* - 1 female and 2 nymphs, associated with *E. finlandicus* (Phytoseiidae), (leg. R. Petanović); Stari Banovci, Stara Pazova, 16.07.1995, on *Prunus domestica* L. - 2 females, associated with *D. macropilis* (Phytoseiidae), *T. urticae* (Tetranychidae) and Tydeidae (leg. B. Vidović); Resavica, Despotovac (X: 4869391; Y: 7549978, altitude: 531 m, orientation: N, slope °: 18), 15.06.2009, on *C. colurna* - 2 females (leg. K. Mladenović); Mt. Vidlič, Pirot (X: 4775820; Y: 7561907, altitude: 1200 m, orientation: NE slope °: 23), 23.06.2009, on *C. colurna* - 2 females, 1 nymph (leg. K. Mladenović); Mt. Stara planina (X: 4784514; Y: 7640929, altitude: 978 m, orientation: E, slope °: 29), 23.06.2009, on *Pyrus communis* L. - 4 females, 1 nymph (leg. K. Mladenović); Mt. Greben planina, River Jerma canyon (X: 4760447, Y: 7633740, altitude: 572 m, orientation: E, slope °: 23), 24.06.2009, on *P. avium* - 2 females (leg. K. Mladenović); Mt. Ozren, Sokobanja (X: 4829012, Y: 7570889, altitude: 926 m, orientation: N-NW, slope °: 5), 30.06.2009, on *P. avium* - 3 females (leg. K. Mladenović); Mt. Severni Kučaj (X:4893517, Y:7565357, altitude: 600 m, orientation: N, slope °: 21), 29.06.2010, on *C.*

colurna - 2 females, associated with *Tegonotus depressus* (Nalepa, 1894) (Eriophyoidea) and Tydeidae (leg. K. Mladenović); Mt. Severni Kučaj (X:4903235, Y:7544035, altitude: 342 m, orientation: NW, slope °: 30), 30.06.2010, on *P. avium* - 2 females (leg. K. Mladenović); Mt. Veliki Krš, Bor (X: 4898104, Y: 7583367, altitude: 740 m, orientation: W, slope °: 25), 7.07.2010, on *P. avium* - 3 females, 1 nymph (leg. K. Mladenović); Gospođin vir, Đerdap gorge (X: 4936400; Y: 7580598, altitude: 422 m, orientation: N-NE, slope °: 39), 20.07.2010, on *C. colurna* - 2 females (leg. K. Mladenović); Mt. Miroč (X: 4935548; Y: 7602052, altitude: 520 m, orientation: S-SW, slope °: 10), 22.07.2010, on *C. colurna* - 2 females, 1 nymph (leg. K. Mladenović); Radan planina (X: 4759330; Y: 7544537, altitude: 1080 m, orientation: E, slope °: 27), 27.07.2010, on *C. colurna* - 3 females, 1 nymph (leg. K. Mladenović); Mt. Mali Jastrebac, 28.06.2011, on *P. avium* - 4 females, associated with *R. cerasifoliae* (Diptilomiopidae), Tetranychidae, Phytoseiidae, and *Anystis* sp. (Anystidae); on *M. silvestris* - 4 females, associated with Tetranychidae and Phytoseiidae; on *P. communis* - 1 female, associated with *Epitrimerus pyri* (Nalepa, 1891) (Eriophyoidea), Phytoseiidae and Tydeidae (leg. K. Mladenović); Mt. Zlatar, Nova Varoš (X: 4815551; Y: 7400553, altitude: 1180 m, orientation: N-NW slope °: 28), 1.07.2011, on *C. colurna* - 1 female, 1 nymph (leg. K. Mladenović); Ratajska River gorge (X: 4801974; Y: 7387903, altitude: 666 m, orientation: N-NE, slope °: 36), 1.07.2011, on *C. colurna* - 1 female, 1 nymph (leg. K. Mladenović); Gračanica River gorge, Prijepolje (X: 4794674; Y: 7395077, altitude: 974 m, orientation: N-NE, slope °: 31), 1.07.2011, on *P. communis* - 3 females (leg. K. Mladenović); Mt. Rtanj (X: 4845139; Y: 7575742, altitude: 610 m, orientation: W-SW, slope °: 8), 6.08.2011, on *P. avium* - 2 females (leg. K. Mladenović).

Remarks: In Serbia, among the Bryobiini species, *B. rubrioculus* has been most frequent, found at most of the sites and on the greatest number of host species (10). Three new hosts of *B. rubrioculus* have been recorded from Rosaceae (*Malus pumila*, *M. silvestris* and *Prunus serotina*). The presence of this mite spe-

cies on *Corylus colurna* is the first information about the one more host family, Betulaceae.

Bryobia ulmophila Reck

Nomenclature: *Bryobia ulmophila* Reck, 1947; type host: *Ulmus* sp.; type locality: Gruziya.

Distribution: Europe - Greece (Hatzinikolis, 1986; Hatzinikolis and Emmanouel, 1991), Moldova (Kulikova, 2011), Ukraine (Mitrofanov, Strunkova and Livshits, 1987); Asia - Armenia, Azerbaijan, Georgia, Kazakhstan (Bolland, 2011; Migeon and Dorkeld, 2006-2011).

Hosts: Oleaceae (*Fraxinus excelsior*), Tiliaceae (*Tilia* sp.), Ulmaceae (*Ulmus* sp.) and Rosaceae (*Prunus domestica*, *Cerasus vulgaris*), (Migeon and Dorkeld, 2006-2011; Kulikova, 2011).

Collection data (2 samples : 2 females, 1 nymph): Mt. Goč, 28.09.2001, on crab apple, *M. sylvestris* - 1 female and 1 nymph, associated with *E. finlandicus* (Phytoseiidae), Tydeidae, Tarsonemidae and Oribatida (leg. K. Mladenović); Klenike, Bujanovac (X: 47000000 Y: 75800000, altitude: 885 m, slope °: 15, orientation: N), 9.08.2005, on cornel, *Cornus mas* L. - 1 female, associated with *Anthocoptes platynotus* Nalepa, 1892 (Eriophyidae), Tydeidae, Tarsonemidae and Oribatida (leg. K. Mladenović).

Remarks: This is the first report of *B. ulmophila* from Serbia. New records of host plant species (*M. sylvestris*, *C. mas*) as well as a new host family (Cornaceae), indicate that *B. ulmophila* prefers woody hosts.

Bryobia vasiljevi Reck

Nomenclature: *Bryobia vasiljevi* Reck, 1953; type host unknown; type locality: Gruziya; Synonymy: *Bryobia repensi* Manson, 1967.

Distribution: Europe – France, Greece, Hungary, Italy, Moldova and Ukraina; also Near East (Gruziya), Australasian region (Australia, New Zealand)

and Neotropical region (Chile), (Migeon and Dorkeld, 2006-2011; Kulikova, 2011).

Hosts: mostly herbaceous plants, Fabaceae (*Clianthus* sp., *Lathyrus* sp., *Medicago sativa*; *Medicago* sp., *Melilotus* sp., *Trifolium* sp., *Vicia sativa*), Amaranthaceae (*Amaranthus* sp.), Asparagaceae (*Asparagus* sp.), Asteraceae (*Cousinia microcarpa*). Campanulaceae (*Campanula alliariifolia*), Solanaceae (*Solanum gayanum*), Urticaceae (*Parietaria* sp.; *Urtica* sp.), as well as Poaceae (*Agrostis* sp., *Festuca rubra*, *Lolium perenne*, *Triticum aestivum*), Rosaceae (*Fragaria* sp., *Malus domestica*, *Prunus cerasus*) and Passifloraceae (*Passiflora mollissima*), (Migeon and Dorkeld, 2006-2011).

Collection data (single sample: 1 female): Joint border Serbia-Bulgaria-Macedonia, Bosilegrad (X: 4688088, Y: 7619070, altitude: 1015 m), 11.08.2005, on crab apple, *M. sylvestris* - 1 female, associated with *Dubininellus echinus* (Wainstein and Arutunjan, 1970) (Phytoseiidae), *D. gigantorhynchus* (Diptilomiopidae), Tydeidae and Tarsonemidae (leg. K. Mladenović);

Remarks: This is the first report of *B. vasiljevi* from Serbia. Crab apple, *M. sylvestris*, is new host record.

Bryobia sp.

The present study also includes several findings of unidentified juvenile stages of *Bryobia* sp.

Collection data (17 samples : 18 nymphs, 11 larvae): Zemun, Beograd, 5.09.1991, on *P. avium* - 1 nymph, associated with *T. urticae* and *A. viennensis* (Tetranychidae), Tydeidae and Tarsonemidae (leg. B. Stojnić); Divčibare, Mt. Maljen (altitude: 980 m), 05.08.2000, on *P. cerasifera* - 2 larvae (leg. K. Mladenović); Mt. Zlatibor, 4.09.2000, on *M. sylvestris* - 1 nymph, associated with *Phyllocoptes malinus* (Nalepa, 1892) (Eriophyidae), *Dubininellus corniger* (Wainstein 1959) and *D. macropilis* (Phytoseiidae), Tydeidae, Tetranychidae and Tarsonemidae (leg. K. Mladenović); Mt. Veliki Jastrebac, 3.06.2001, on *P. avi-*

um - 3 nymphs and 1 larva, associated with *D. gigantorhynchus* and *R. cerasifoliae* (Diptilomiopidae), and Tydeidae (leg. K. Mladenović); Mt. Avala, 7.06.2001, on *P. avium* - 1 nymph, associated with *R. cerasifoliae* (Diptilomiopidae), *E. finlandicus* (Phytoseiidae), Tydeidae and Tenuipalpidae (leg. K. Mladenović); Boljevac (altitude: 460m), 12.06.2001, on *P. communis* - 1 larva, associated with *Epitrimerus pyri* (Nalepa, 1891) (Eriophyidae), (leg. K. Mladenović); Mt. Veliki Jastrebac, Kruševac, 26.06.2001, on *P. communis* - 1 larva, associated with *Epitrimerus pyri* (Eriophyidae) and Tarsonemidae (leg. K. Mladenović); Debeli Lug, Majdanpek, 17.07.2001, on *P. avium* - 1 nymph and 1 larva, associated with Tydeidae and Oribatida (leg. K. Mladenović); Mt. Goč, 28.09.2001, on *M. sylvestris* - 2 nymphs, associated with *Dubininellus juvenis* (Wainstein and Arutunjan, 1970), *D. macropilis* and *E. finlandicus* (Phytoseiidae), and Tarsonemidae (leg. K. Mladenović); Bosilegrad (X:47000000, Y:76200000, altitude: 1040 m, orientation: NE), 28.07.2005, on *Prunus spinosa* L. - 2 nymphs and 4 larvae, associated with *Dubininellus echinus* (Wainstein and Arutunjan, 1970), *Paraseiulus triporus* (Chant and Shaul, 1982), *S. aceri* and *E. finlandicus* (Phytoseiidae), and with *Phyllocoptes abaenus* Keifer, 1940 (Eriophyidae), Tydeidae, Tarsonemidae and Oribatida (leg. K. Mladenović); Vranje (X:4701841; Y: 7585501; altitude: 1184 m, orientation: E), 9.08.2005, on wild cherry, *P. avium* - 1 nymph, associated with *E. finlandicus* and *Paraseiulus talbii* (Athias-Henriot, 1960) (Phytoseiidae), Eriophyidae, Tydeidae and Tarsonemidae; same place, on *P. spinosa* - 1 larva, associated with *T. pyri* (Phytoseiidae), *D. gigantorhynchus* (Diptilomiopidae), Tetranychidae and Tydeidae (leg. K. Mladenović); border of Serbia-Bulgaria-Macedonia, Bosilegrad (X:4688088, Y:7619070, altitude: 1015 m), 11.08.2005, on *P. spinosa* - 2 nymphs and 1 larva, associated with *D. echinus* (Phytoseiidae), Tetranychidae, Tydeidae, Tarsonemidae and Oribatida (leg. K. Mladenović); Mt. Vidlič, Pirot (X:4775820; Y:7561907, altitude: 1200 m, orientation: NE, slope °: 23), 23.06.2009, on *C. colurna* - 3 nymphs, associated with Tydeidae and Tetranychidae (leg. K. Mladenović); Suva planina, Bela Palanka (altitude: 1000 m, orientation: E-NE, slope °: 15), 20.08.2010, on *C. colurna* - 1 nymph, associated

with *Aculus comatus* (Nalepa, 1892) and *Eriophyes sp.* (Eriophyidae), Phytoseiidae, Tydeidae and Tarsonemidae (leg. K. Mladenović); Mt. Mali Krš, Bor (X: 4905201; Y: 7582800, altitude: 814 m, orientation: W, slope °: 15), 24.05.2011, on *C. colurna* - 1 nymph, associated with *A. comatus* (Eriophyidae), Phytoseiidae, Tydeidae, Tarsonemidae and Oribatida (leg. K. Mladenović); Bovansko jezero, Sokobanja, 25.05.2011, on *M. sylvestris* - 6 larvae, associated with Phytoseiidae, Tetranychidae and Tenuipalpidae (leg. K. Mladenović).

Pseudobryobia longisetis (Reck)

Nomenclature: *Bryobia longisetis* Reck, 1947; type host: *Salvia nemorosa*, *Salvia sp.*; type locality: Gruziya. Synonymy: *Pseudobryobia longisetis* (Reck, 1947); *Bryobia multisetis* Livshits and Mitrofanov, 1966.

Distribution: Europe – Greece (Hatzinikolis, 1986; Hatzinikolis and Emmanouel, 1991), Serbia (Stojnić et al., 2007); Near East and Oriental region – China, Pakistan, Armenia, Azerbaijan, Georgia, Kazakhstan, Ukraine and Tajikistan (Migeon and Dorkeld, 2006-2011).

Hosts: mints, Lamiaceae (*Mentha sp.*, *Phlomis sp.*, *Salvia nemorosa*, *S. officinalis*, *S. sibthorpii*, *Salvia sp.*), also Asteraceae (*Cynara scolymus*), Campanulaceae (*Asyneuma argutum*) and Convolvulaceae (*Convolvulus sp.*) (Migeon and Dorkeld, 2006-2011).

Collection data (2 samples: 21 females, 8 males, 13 nymphs, 8 larvae): Deliblatski pesak, 25.05.1993, on meadow sage, *Salvia pratensis* L. - 6 females, 2 nymphs; mites were found associated with *Aceria salviae* (Nalepa, 1981) (Eriophyidae) and with *T. turkestanii* (Tetranychidae), (leg. R. Petanović); New Belgrade, 8.09.2007, on woodland sage, *Salvia nemorosa* L. - 15 females, 8 males, 11 nymphs and 8 larvae; mites were found associated with *A. salviae* (Eriophyidae) and *T. turkestanii* (Tetranychidae), (leg. B. Vidović);

Remarks: In both samples, *P. longisetis* has been found in sages on sandy soil, in moderate population

density, associated with *A. salviae* and *T. turkestanii*. Different stages of *P. longisetis* were present on both sides of sage leaves, as well as yellow spots. The silk webs of the other tetranychid species, *T. turkestanii*, have been poorly spun. This was the first report of *P. longisetis* from Serbia and second report from Europe. Meadow sage, *S. pratensis*, was new host data (Stojnić et al., 2007).

Notes on the associated predator mites

Mites of the tribe Bryobiini have been found associated with other mite groups in the majority of the examined samples. predatory mites were present in 43.5% of samples with *Bryobia* sp. (Table 1). Twelve species of the family Phytoseiidae were found: *Anthoseius rhenanus* (Ouds.), *Dubininellus corniger* (Wainstein), *D. echinus* (Wainstein and Arutunjan), *D. juvenis* (Wainstein and Arutunjan), *D. macropilis* (Banks), *Euseius finlandicus* (Ouds.), *Kampimodromus aberrans* (Ouds.), *Paraseiulus talbii* (Athias-Henriot), *P. triporus* (Chant and Shaul), *Seiulus aceri* (Collyer), *Typhlodromus pyri* Scheuten and *T. tiliae* Ouds., as well as unidentified juvenile stages of phytoseiid mites in a number samples. In addition, few samples contained mites of families Anystidae (*Anystis* sp.), Stigmaeidae and Trombidiidae (*Allothrombium* sp.)

At the outset, it should be clearly recognized that interspecific association between pairs of species, as well as the Jaccard similarity coefficient drawn from these analyses, are limited by the relatively small number of samples, and also by the relatively small number of collected *Bryobia* individuals, commonly accompanied with the other more numerous phytophagous and mycophagous mites. However, it is believed that these data could provide a useful base for future sampling.

The main result of this analysis is a conclusion that the pair of two most frequent species, *E. finlandicus* and *B. rubrioculus*, is not significantly associated in a broad spectrum of host plant species and habitats. Contrary to these findings, the results of some earlier studies obtained mainly in neglected or-

chards, showed that the same pair of species was very significantly associated (JI%=18.3**) (Stojnić, 1993). Similar to the above, a very significant association (JI%=13.9**) between *K. aberrans* and *B. rubrioculus* was inevitably determined by the origin of samples – also from neglected fruit trees. The same goes for all the other significant and very significant values (Table 1), obtained on the basis of too few simultaneous findings of pairs of species. Further studies of interspecific association between these pairs of species are necessary to obtain representative results and to draw valid conclusions.

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