COMMUNITY STRUCTURE OF MESOSTIGMATIC MITES (ACARI: PARASITIFORMES) IN NESTS OF THE GREAT TIT (*PARUS MAJOR*)

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Abstract. The mesostigmatic mite fauna in nests of *Parus major* (Linnaeus, 1758) in four localities in North eastern Bulgaria was studied. Altogether 912 specimens belonging to 16 species of order Parasitiformes were found. Twenty-five or 83.33% of nests were infested with mites and the average abundance per one nest was 30.40. The most abundant and frequent species was *Androlaelaps casalis* (dominance 83.00%, prevalence 76.67%). The mite communities are characterized by a large number of recedent and subrecedent species. The species *Androlaelaps fahrenholzi*, *Hypoaspis lubrica*, *Laelaps agilis*, *Hirstionyssus criceti*, *Myonyssus decumani*, *Myonyssus gigas*, *Macrocheles glaber* and *Haemogamasus nidi* are reported for the first time in nests of birds in Bulgaria.

Key words: Acari; Mesostigmata; nest of bird; community structure.

INTRODUCTION

Mesostigmatic mites are a major component of arthropod fauna inhabits the nests of small mammals and birds where they play diverse and important role. Many species of mites transmit virus and bacterial infections to their hosts and represented an essential factor in the spread and maintenance of various diseases in the nature. Others are associated more with the microenvironment of the nests than with the host, but according Bloszyk et al. (2011) may be beneficial to the birds, if they are predators that reduce the total parasite load. Some species, as a *Dermanyssus gallinae* and *Hirstionyssus criceti* attacked man and cause severe dermatitis (Sokolova & Lopatina 2003; Zhaksilikova 2006). The investigation of the composition and structure of communities of mites in nests of different bird species provides an opportunity to increase our knowledge about relationship between nest-inhabiting mites and host, as well as to reveal habitat preference and distribution of the mites.

The great tit *Parus major* (Linnaeus, 1758) is distributed in almost all Europe, except for the most northern parts of Scandinavian Peninsula and Iceland. It is occurred also in Algeria, Tunisia, northern Morocco, Asia Minor, Iran, India, Central and Southeast Asia and Japan. In Bulgaria, the species is widespread throughout the country except the highest mountain treeless areas, to about 2200 m a. s. l. Its density is uneven, from tens or less than 10 pairs/km^2 in the coniferous regions of the mountains, where the species breeds mostly in settlements to 1000 pairs/km^2 in the deciduous forests in low- and medium-high mountains. It nests in holes and hollows in trees, as well as in various man-made installations and human buildings. It constructs nest from moss, twisted hair, mainly from the badger, deer and vague and single feathers from other birds. The female lay from 7 to 15 eggs and incubates them alone over the next 13 – 14 days. By 16 – 22 days after hatching, young are covered with feathers. Often the great tit has two generations per year (Georgiev & Mitev 2007).

Data on occurrence of mites in the nests of great tit in Bulgaria are scarce. Investigating the gamasid fauna in nest holes of three passerine birds from

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Kamchia Mountain, Davidova & Vasilev (2011) found 5 species in 19 examined nests. The aims of the present paper are to: (1) describe the fauna of mesostigmatic mites in nests of great tit; (2) establish the structure of communities and (3) compare the fauna with the mites in nests of great tit in other countries.

MATERIAL AND METHODS

A total of 30 nests of *Parus major* were collected in 2010 at the following 4 sites from Northeastern Bulgaria (Fig. 1):

(1) **Panitsovo** (N 42°51'1.41" E 27°40'14.02", 250 – 300 m a. s. l., 3 nests, No 1 – 3). The area is situated in the eastern part of Stara Planina Mts. The region is dominated by xerothermic grass vegetation: *Dichantium ischaemum* and *Poa bulbosa*. The mountain part is mostly covered by deciduous forests.

(2) **Provadia** (N 43°12'12.24" E 27°26'38.06", 52 m a. s. l., 4 nests, No 4 – 7). The nests are collected in the edge of the forest, within the boundaries of the city, consisting primarily of artificially planted parks and ornamental trees. Near the area are mixed deciduous forests with a significant predominance of *Quercus cerris*, *Quercus frainetto*, *Quercus polycarpa* and *Carpinus betulus*.

(3) **Albena** (N 43°21'48.02" E 28°04'43.26", 10 m a. s. l., 4 nests, No 8 – 11). The area is situated in the eastern part of Batova River, near the beach. It is covered with natural dense forest represented mainly of *Fraxinus oxycarpa*, *Ulmus minor*, *Quercus pedunculiflora*, *Acer campestre*, *Alnus glutinosa* and swamp and marsh hygrophytic formations.

(4) **Goritsa** (N 42°55'10.11" E 27°48'56.08', 160 – 205 m a. s. l., 19 nests, No 12 – 30). Located in the eastern part of Kamchia Mountain. The main habitats are represented by mixed deciduous forests dominated by *Quercus cerris, Quercus frainetto, Quercus dalechampii, Fagus orientalis* (Bondev 1991).

The nest material was collected from wooden nest boxes. Nests were picked up after the end of breeding and transported to a laboratory. The mites were extracted from the nests by means of Tulgren's funells and preserved in 75% ethanol. The collected specimens were mounted into slides in lactophenol

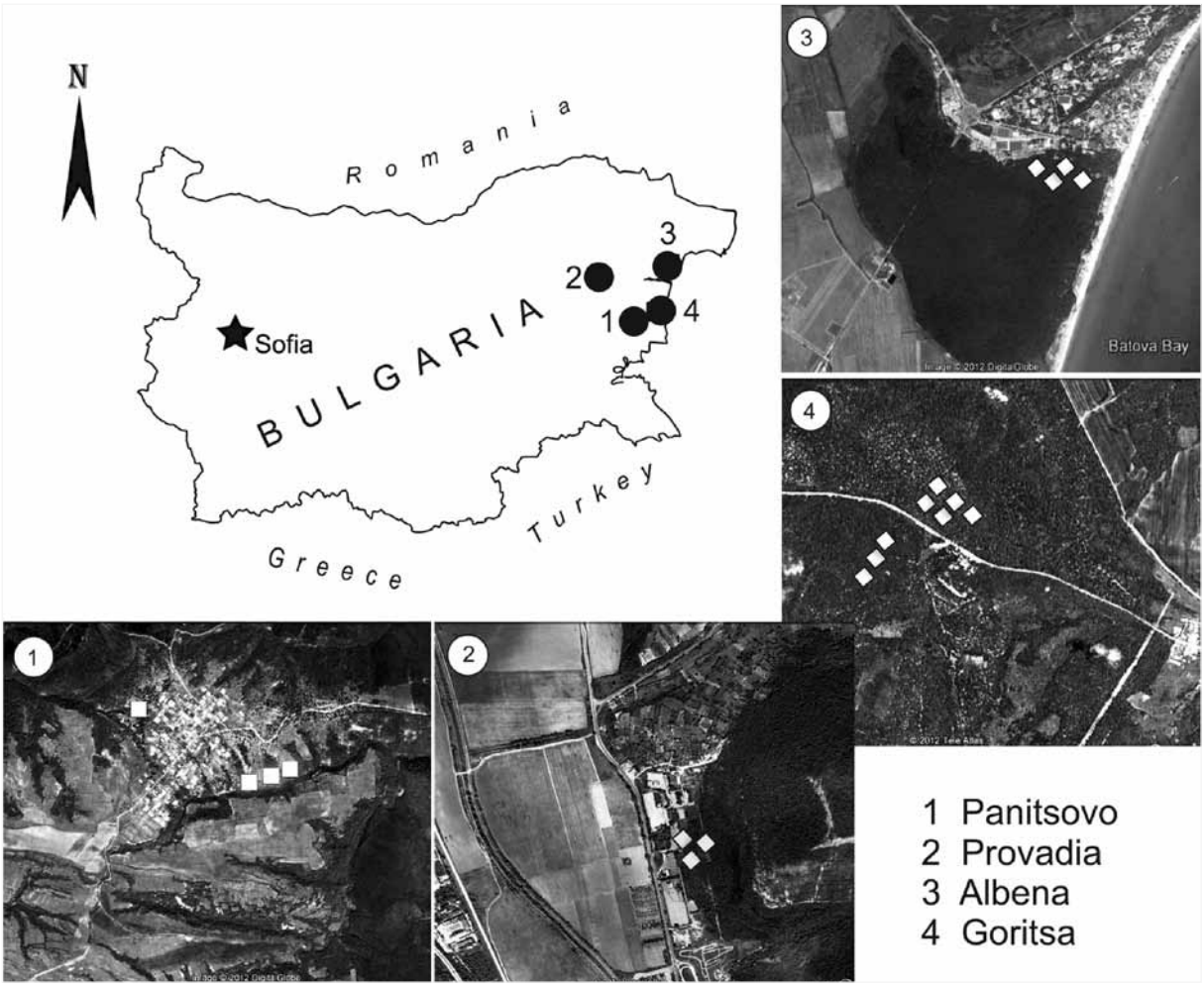

Figure 1. Location of study sites.

Table 1. Mesostigmatic mites (Parasitiformes) established in nests of *P. major*.
N – abundance; D – dominance; P – prevalence; R – relative density; I – mean intensity; Pa – Panitsovo; Pr – Provadia; A – Albena; G – Goritsa.

Species	N	D%	P%	R	I	Sampling sites
Ameroseius corniculus Karg, 1971	5	0.55	10.0	0.17	1.67	G
Androlaelaps casalis (Berlese, 1887)	757	83.00	76.67	25.23	32.91	Pa, Pr, A, G
Androlaelaps fahrenholzi (Berlese, 1911)	2	0.22	3.33	0.07	2.00	G
Cyrtolaelaps chiropterae Karg, 1971	3	0.33	10.0	0.10	1.00	G
Dermanyssus gallinae (De Geer, 1778)	41	4.50	26.67	1.37	5.13	Pr, A, G
Dermanyssus hirundinis (Hermann,1804)	9	0.98	6.67	0.30	4.50	Pr, A
Haemogamasus nidi Michael, 1892	1	0.11	3.33	0.03	1.00	G
Hypoaspis heselhausi Oudemans, 1912	3	0.33	3.33	0.10	3.00	G
Hypoaspis lubrica Oudemans et Voigts, 1904	24	2.63	10.0	0.80	8.00	G
Hirstionyssus criceti (Sulzer, 1774)	3	0.33	3.33	0.10	3.00	G
Hirstionyssus musculi (Johnston, 1849)	5	0.55	3.33	0.17	5.00	G
Laelaps agilis C. L. Koch, 1836	5	0.55	3.33	0.17	5.00	G
Macrocheles glaber (J. Müller, 1860)	17	1.86	6.67	0.57	8.50	G
Myonyssus decumani Tiraboschi, 1904	4	0.44	3.33	0.13	4.00	G
Myonyssus gigas (Oudemans, 1912)	1	0.11	3.33	0.03	1.00	G
Ornithonyssus sylviarum (Canestrini et Fanzago, 1877)	32	3.51	13.33	1.07	8.00	Pa, G

and examined using a light microscope (Bloszyk et al. 2006).

Species identification was made according to Bregetova (1956), Till (1963), Kontschán (2007), Roy & Chauve (2009) and Roy et al. (2009).

For analysis of community structure of mites were used the following indices (according to Margolis et al. 1982): prevalence (P%) (percentage of nests in which the species occurred); relative density (R) (ratio of the number of specimens of every species to the number of all nests); mean intensity (I) (ratio of the number of specimens of every species to the number of nests, in which the species was found) and dominance (D%) (ratio of the number of specimens of every species to the number of all the specimens, in percent). According to their dominance the species were divided into 5 groups: eudominant (> 10%); dominant (5 – 10%); subdominant (1 – 5%); recedent (0.5 – 1%), and subrecedent (< 0.5%).

RESULTS

A total of 912 specimens belonging to 16 species of order Parasitiformes were found in nests of *Parus major*. The list of taxa and values of some indices of established mites in the studied sites are presented in Table 1.

Of the 30 nests examined, 25 or 83.33% were infested with mesostigmatic mites. No mites were found in 1 nest from Albena, 2 nests from Provadia and 2 nests from Goritsa. Eleven out of 16 identified species were found only in one of the sites surveyed. Fifteen or 93.8% of the species were established in nests from Goritsa. Only one species – *Androlaelaps casalis* was found in all four areas studied (Table 1).

The number of species per one nest fluctuated between 1 and 7, the average number of mites per one nest was 1.87. Eleven or 44% of the nests where mesostigmatic mites were recorded were occupied only by one species. The highest number of species (7) was found in a single nest. The abundance of mites fluctuated between 1 and 154 specimens in one nest, the average abundance per one nest was 30.40 (Table 2).

The species *Androlaelaps fahrenholzi*, *Hypoaspis lubrica*, *Laelaps agilis*, *Hirstionyssus criceti*, *Myonyssus decumani*, *Myonyssus gigas*, *Macrocheles glaber* and *Haemogamasus nidi* are reported for the first time in nests of birds in Bulgaria.

The most frequent species was *A. casalis* presented in 23 nests, prevalence 76.67%. Other comparatively frequently occurring mites were *Dermanyssus gallinae* (present in 7 or 23.33% of nests) and *Ornithonyssus sylviarum* (present in 4 or 13.33% of nests). Other mite species were infested less than 10% of nests. There was no species established in all positive for gamaside mites nests (Table 1).

The highest dominance was recorded of *A. casalis* again (83.00%). The ectoparasites *D. gallinae* (4.50%) and *O. sylviarum* (3.51%) as well as *H. lubrica* (2.64%) and *M. glaber* (1.86%) were established

Table 2. Abundance (N) and dominance (D) of the most frequent and abundant Mesostigmata species in individual nests of *P. major.*

Sampling sites		Species established with the highest frequency and dominance										Number of all specimens	Number of all species
		Dermanyssus gallinae		*Ornithonyssus sylviarum*		*Androlaelaps casalis*		*Hypoaspis lubrica*		*Macrocheles glaber*			
		N	D%	N	D%	N	D%	N	D%	N	D%		
Panitsovo	1	–	–	–	–	5	100	–	–	–	–	5	1
	2	–	–	3	23.1	10	76.9	–	–	–	–	13	2
	3	–	–	–	–	2	100	–	–	–	–	2	1
Provadia	4	–	–	–	–	3	100	–	–	–	–	3	1
	5	–	–	–	–	–	–	–	–	–	–	–	–
	6	–	–	–	–	–	–	–	–	–	–	–	–
	7	5	45.5	–	–	–	–	–	–	–	–	11	2
Albena	8	–	–	–	–	90	100	–	–	–	–	90	1
	9	10	62.5	–	–	3	18.8	–	–	–	–	16	3
	10	10	7.14	–	–	130	92.9	–	–	–	–	140	2
Goritsa	11	–	–	–	–	–	–	–	–	–	–	–	–
	12	–	–	–	–	30	100	–	–	–	–	30	1
	13	–	–	–	–	10	38.5	4	15.4	–	–	26	5
	14	2	16.7	–	–	10	83.3	–	–	–	–	12	2
	15	–	–	–	–	–	–	–	–	–	–	–	–
	16	1	8.33	–	–	10	83.3	–	–	–	–	12	3
	17	–	–	–	–	40	95.2	–	–	–	–	42	3
	18	–	–	1	3.23	30	96.8	–	–	–	–	31	2
	19	–	–	–	–	30	100	–	–	–	–	30	1
	20	10	16.7	15	25.0	30	50.0	–	–	–	–	60	4
	21	–	–	–	–	15	100	–	–	–	–	15	1
	22	–	–	–	–	–	–	–	–	–	–	1	1
	23	–	–	–	–	20	100	–	–	–	–	20	1
	24	2	5.56	13	36.1	20	55.6	–	–	–	–	36	4
	25	–	–	–	–	–	–	–	–	–	–	–	–
	26	–	–	–	–	140	90.9	–	–	10	6.49	154	4
	27	–	–	–	–	3	100	–	–	–	–	3	1
	28	–	–	–	–	60	80.0	15	20.0	–	–	75	2
	29	1	100	–	–	65	77.4	5	5.95	7	8.33	84	7
	30	–	–	–	–	1	100	–	–	–	–	1	1

with a smaller number of specimens and belong to the subdominants. The remaining 11 species (or 68.75% of the observed species) were found with 1 – 9 specimens only and belong to the recedent and subrecedent.

Analysing the relative density and mean intensity of established species were received similar results – again the highest values of these indices were observed in *A. casalis* (32.91 and 25.23), *O. sylviarum* (8.00 and 1.07) and *D. gallinae* (5.13 and 1.37). The species *H. lubrica* and *M. glaber* had high mean intensity – 8.00 and 8.50 respectively, but low relative density – 0.80 and 0.57. In other species these values were much lower (Table 1).

The comparison of the abundance of widespread species in particular nests shows that *A. casalis* appears eudominant in all nests in which it is found, as in 10 or 43.48% of them he has 100% dominance. However, the number of specimens with which it is established varies considerably – between 1 and 140 (Table 2). The blood-sucking mite *D. gallinae* is eudominant in 5 and dominant in 3 of the nests and the number of specimens varies between 1 and 10. *O. sylviarum* also present with a different number of specimens in individual nests (between 1 and 15), as in 3 of them it is eudominant and in 1 – subdominant. Similar results on the distribution of mesostigmatic mites are reported by Mašán & Stanko (2005). Investigating the nests of *Mus spicilegus*

authors indicate that abundance and dominance of the species markedly varied in individual nests, according to microhabitat condition at individual collection sites.

Only one mite – *A. casalis* of the 5 eudominant and dominant species predominate in all four studied sites. *D. gallinae* has a high relative significance in nests from three of sites – Provadia, Albena and Goritsa, *O. sylviarum* – in two of them: Panitsovo and Goritsa, and *H. lubrica* and *M. glaber* were established in Goritsa only.

DISCUSSION

The mesostigmatid mite fauna in nests of *P. major* is dominated by *A. casalis*, a facultative parasite of birds with cosmopolitan distribution and a large number of recedent and subrecedent species.

A. casalis as well as *H. lubrica*, which are typical nidicolous inhabitants in nests of different bird species and exhibit a special affinity to nest boxes (Madej & Stańska 1999; Krištofík et al. 2003; Fenďa 2010; Fenďa et al. 2011) represent 85.64% of all established specimens. The haematophagous ectoparasites of various wild and domestic birds *D. gallinae*, *D. hirundinis* and *O. sylviarum* represent only 18.75% of the species and 8.99% of the specimens found in nests of *P. major*. Most of the established mites (68.75%) are ectoparasites mainly on small mammals or free-living predators. This is consistent with observations of other authors (Hicks 1959; Gajdoš et al. 1991; Ambros et al. 1992; Krištofík et al. 1993, 1996; Tryjanowski et al. 2001) who indicated that many elements of bird nest fauna are of accidental origin and their presence is not related to the host of the nest. It should be noted however that in terms of abundance they represent only 5.37% of specimens. These mites could have been brought into the nests together with the nest constructing material, with food for the nestlings or in case of contact of some small mammals with the nests of birds. Although they are not specific parasites of birds the species *Hypoaspis heselhausi, Cyrtolaelaps chiropterae, Laelaps agilis, Macrocheles glaber*, *Haemogamasus nidi*, *Ameroseius corniculus* and *Hirstionyssus musculi* were reported by many authors as inhabiting the nests of different birds (Koyumdjieva 1981; Ambros et al. 1992; Gwiazdowicz et al. 1999; Madej & Stańska 1999; Salmane 2001; Tryjanowski et al. 2001; Krištofík et al. 2003, 2005, 2007; Švaňa et al. 2006, Fenďa 2010).

The comparison of gamasid mite fauna in nests of *P. major* in our material and in material from Slovakia (Ambros et al. 1992) shows that the communities are very similar in both of the presence of ecological groups mites and from the viewpoint of representation of predominant species. Ambros et al. (1992) indicate that the most frequent and abundant is *A. casalis*, established with 614 specimens, while the other species are presented in considerably smaller abundance. In contrast to our material, the recorded in Slovakia average abundance per one nest is considerably lower – 11.9. Only 14 out of 69 examinated nests were positive for mites and in them the authors were found 11 species. Four of them – *Cyrtolaelaps chiropterae*, *Macrocheles glaber*, *Androlaelaps casalis* and *Dermanyssus gallinae* were established in the present investigation. Later Švaňa et al. (2006) explore mesostigmatic mites in nests of different bird species in SW Slovakia and found 5 species in great tit nests – *Blattisocius keegani* Fox, 1947, *Paragarmania dentritica* Berlese, 1918, *Dermanyssus hirundinis*, *Androlaelaps casalis* and *Hypoaspis lubrica*. With the highest number of specimens were established *A. casalis* and *D. hirundinis*. In our material *D. hirundinis* occurred only sporadically. Our results and the analysis showed that the mesostigmatic mites in nests of *P. major* may be highly diverse in terms of both species composition and degree of infestation of nests of different species. The mesostigmatic mite fauna in nests of *P. major* have a common feature – marked presence of the species *A. casalis*. The reasons for the observed differences are probably geographic distribution of species or differences in the collection of nests (Wasylik 1971; Krištofík & Mašán 1996; Tryjanowski et al. 2001).

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