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BIRDS AS THE FEEDERS OF TICKS (ACARI, IXODIDA) IN MEGALOPOLIS OF KYIV

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Birds as the Feeders of Ticks (Acari, Ixodida) in Megalopolis of Kyiv. Nebogatkin, I. V. — Data about ticks parasitizing on birds in the city of Kyiv were summarized. 117 birds and 27 nests were examined. Ticks were found on six species collecting food on the ground level: Great Tit (*Parus major*), White Wagtail (*Motacilla alba*), Rook (*Corvus frugilegus*), blackbird (*Turdus merula*), and Nuthatch (*Sitta europaea*). 56 Ixodidae specimens of four species from two genera were collected from the birds and their nests: *Ixodes ricinus* (Linnaeus, 1758); *I. arboricola* Schulze et Schlottke, 1930; *I. lividus* (Koch, 1844), *Haemaphysalis concinna* Koch, 1844. The role of birds as feeders of all developmental stages of ticks not only increases under conditions of urban landscape, but also becomes leading in the places with low population of small mammals. Ectoparasites of birds of the other taxonomic groups along with the ticks can play an important role in maintaining the circulation of pathogens of various aetiologies in the urban landscapes.

Key words: ticks, birds, urban landscapes, tick-borne disease, Ukraine.

Птицы как прокормители иксодовых клещей (Acari, Ixodida) на территории Киевского мегаполиса. Небогаткин И. В. — Обобщены данные об иксодовых клещах, паразитирующих на птицах в условиях мегаполиса на примере г. Киева. Осмотрено 117 птиц и 27 гнёзд. Иксодовые клещи обнаружены на 6 массовых видах птиц, собирающих корм в приземном ярусе: большая синица (*Parus major*), белая трясогузка (*Motacilla alba*), грач (*Corvus frugilegus*), чёрный дрозд (*Turdus merula*) и поползень (*Sitta europaea*). Снято с птиц или добыто из их гнёзд 56 иксодид четырёх видов двух родов: *Ixodes ricinus* (Linnaeus, 1758); *I. arboricola* Schulze et Schlottke, 1930; *I. lividus* (Koch, 1844); *Haemaphysalis concinna* Koch, 1844. Роль птиц, как прокормителей всех фаз развития иксодовых клещей, не только более значительна в условиях урбанизированных ландшафтов, но становится ведущей в местах с низким количеством мелких млекопитающих. В поддержании циркуляции возбудителей различной этиологии в урболандшафтах кроме иксодовых клещей, возможно, важную роль играют эктопаразиты птиц других систематических групп.

Ключевые слова: иксодовые клещи, птицы, урболандшафт, клещевые инфекции, Украина.

Birds are known to be random feeders of minor importance for the mass species of ticks. After the species specificity for the *Borrelia* genospecies such as *Borrelia garinii*, *B. valaisiana*, etc. (Kurtenbach et al., 2002; Comstedt et al., 2006) has been established, the interest to this group of warm-blooded vertebrates and to their ectoparasites increased. *Borrelia* species found in ticks were specific to birds (Kipp et al., 2006; Stern et al., 2006; Taragelova et al., 2008; Dubska et al., 2009; etc.). This paper summarizes the studies of ticks parasitizing birds in the forest parks, parks and recreation areas in the city of Kyiv.

Material and methods

The studies have been conducted since 1985 in all the forest parks around the city of Kyiv and in the settlements beyond the city boundary, and since 2000 also in the riparian areas, including islands. Examined birds were obtained casually: caught in the Hero traps for inventory of minor mammals; caught in traps and nets during field trips. Totally 117 birds and 27 nests were examined and 56 tick specimens of four species were collected. The following quantitative measurements were used in the analysis of the material: abundance index (AI) and occurrence index (OI) (Tularemia..., 1954). Microsoft Excel 2007, universal statistical package SPSS v15 and v10.0.5, Statistica v.5.5A and 6.0 were used for statistical analyses.

Results

Twenty-two specimens of 3 species of birds were caught in traps for small mammals, and 39 specimens of 10 species were caught with nets and traps. On the mass species of birds, we collected only solitary specimens of ticks (table 1). In April 1996 we collected a female *Ixodes arboricola* Schulze et Schlottke, 1930 from a corpse of Great Tit in one of the Kyiv parks; also we examined 15 nests of the Sand Martin (*Riparia riparia*) in the city and collected 2 nymphs and 3 larvae of *Ixodes ricinus* (Linnaeus, 1758) and 6 nymphs of *I. lividus* (Koch, 1844) (Akimov, Nebogatkin, 2002). We examined 56 specimens and 12 nests of the Rock Dove (wild) (*Columba livia*) and found no ixodids.

We recorded two findings of *Hyalomma marginatum* (Koch, 1844) adults collected by tick flagging. This fact demonstrated that these ticks were introduced by the migratory birds to the studied areas. One female was collected on an artificial island, and the other one was captured in a park with a relict forest.

The ground-dwelling birds living in the wet biotopes with dense low vegetation and constructing nests on the ground or at the base of bushes and looking for food on the ground play a significant role in the sustenance of all ixodids development phases in a big city.

Ticks were found on the head, back and legs. In small mammal traps, 79 % of ticks were collected on heads, 6 % on legs and 5 % on back of birds. As for the birds caught in natural habitat, 92 % of ticks were collected on the bird heads, and 8 % on legs.

OI was 48.4-68.2 %, with mean 54.6 % for the ticks collected from birds captured in traps for small mammals, and 36.5-61.1 %, with mean 49.3 % for the birds under natural conditions.

Discussion

All the developmental phases of ticks parasitize mammals and birds living in urban landscapes (Akimov, Nebogatkin, 1999; Gray et al., 1999; Akimov, Nebogatkin, 2002; Movila et al., 2008).

Table 1. Indices of abundance of ticks removed from birds, caught during the records of small mammals and in natural habitat (nets, traps)

Таблица 1. Индексы обилия иксодовых клещей, снятых с птиц, отловленных при учётах мелких млекопитающих и в естественной среде обитания (сетями, ловушками)

Birds species	Number of birds	<i>I. ricinus</i>			<i>H. con-</i>	<i>I. arbo-</i>
		♂	♀	N	<i>cinna</i>	<i>ricola</i>
		N			N	♀
Caught during the records of small mammals						
Great Tit (<i>Parus major</i> L., 1758)	17	0.4	0.4	0.4		
Nuthatch (<i>Sitta europaea</i> L. 1758)	3		0.3			
Blackbird (<i>Turdus merula</i> L., 1758)	2		1.0	1.0		
Total birds and ticks	22	5	7	7		
In natural habitat						
White Wagtail (<i>Motacilla alba</i> L., 1758)	6	0.2		0.3		
Great Tit (<i>Parus major</i> L., 1758)	6	0.3		1.8	0.3	0.3
Rook (<i>Corvus frugilegus</i> L., 1758)	8	0.3	0.2	0.2		
Collared Dove (<i>Streptopelia orientalis</i> Latham, 1790)	1			1.0		
Blackbird (<i>Turdus merula</i> L., 1758)	4			3.0	1.0	
House Sparrow (<i>Passer domesticus</i> L., 1758)	7					
Chaffinch (<i>Fringilla coelebs</i> L., 1758)	1			0.2		
European Robin (<i>Erithacus rubecula</i> L., 1758)	4					
Middle Spotted Woodpecker (<i>Dendrocopos medius</i> L., 1758)	1					
Goldfinch (<i>Carduelis carduelis</i> L., 1758)	1					
Total birds and ticks	39	4	3	16	2	1

Table 2. Indices of occurrence of the ticks removed from small mammals in the parks, where beautification works are provided regularly and on the outskirts of the megacity

Таблица 2. Индексы встречаемости иксодовых клещей, снятых при очёсах мелких млекопитающих в парках, где проводятся постоянные работы по благоустройству, и на окраинах мегаполиса

Theme Parks	2006	2007	2008	2009	2010	2011	2012	Average
In the parks	8.25	1.86	9.35	6.49	5.76	8.25	4.16	6.3 ± 0.6
On the outskirts of the metropolis	36.67	19	78.3	28.3	21.9	31.9	15.6	33.1 ± 1.6

Conditions favourable for the life of small mammals as the main feeders of tick immature phases in nature disappear in parks and forest parks of Kyiv where constant beautification is provided (table 2). This is confirmed by the indices of infestation of small mammals in these parks.

This table provides comparative data for the outskirts of the megacity, and the paired two-sample test for means has confirmed its accuracy ($t = -3.7$, and r (Pearson coefficient) = 0.7, with a probability of 0.05).

The closest “contacts” of birds and small mammals in Kyiv are observed in the ruderal (waste) areas, where also the maximum density of stray dogs and cats was noted; therefore, there is quite a high exchange possibility of infections of different aetiology in the ruderal areas. The presence of *Borrelia afzelii* species-specific to rodents in ticks collected on birds (Comstedt et al., 2006; Kipp et al., 2006; Stern et al., 2006; Taragelova et al., 2008; Dubska et al., 2009) may serve as confirmation.

Furthermore, we found that most phases of *I. ricinus* and immature phases of other tick species parasitize birds during the depression of small mammals. This is an adaptive and compensatory phenomenon that provides distribution of ixodids over a large area using birds as vectors.

Based on the results of the present study and data from literature, the features of ixodids parasitism on birds were assigned. Ticks usually attach only solely, almost never forming clusters, as it is usual in the case when ticks feed on small mammals. Tick infestation ratio on birds is low. In the focused studies it varied between 1.6–6.8 % with a maximum of 21.1 % (Tolstenkov et al., 2009; Hamer et al., 2012). When birds feed on ground-dwelling birds the effect of ecological traps is not excluded (Robertson, Hutto, 2006).

Based on these data as well having shown the role of finches and heiligid parasitic mite *Bakericheyla chanayi* (Berlese, Trouessart, 1889) in maintaining of arboviruses circulation (Akimov et al., 2001), we assume that not only ticks, but also other bird ectoparasites play a significant role in the “horizontal” transfer and circulation of pathogens of various aetiologies in nature.

Conclusions

1. Ticks were found on six bird species collecting food at the ground layer in the city of Kyiv: Great Tit (*Parus major*), White Wagtail (*Motacilla alba*), Rook (*Corvus frugilegus*), Blackbird (*Turdus merula*) and Nuthatch (*Sitta europaea*).

2. Four species of ixodids from two genera were collected either on birds or in their nests: *Ixodes ricinus*, *I. arboricola*, *I. lividus*, *Haemaphysalis concinna*.

3. The highest occurrence index was observed on birds accidentally caught in traps during accounts of small mammals.

4. The role of birds as feeders of all phases of ticks is leading, not only in a large city, but also in the places with a low population of small mammals.

5. The circulation of pathogens of various aetiologies in urban landscapes is provided not only by ticks, but also by other ectoparasites of birds of other taxonomic groups.

References

- Akimov, I., Nebogatkin, I. Monitoring of paths of circulation of the activator of Lyme disease in urban natural refuges // Abstr. Proceedings, VIII International Conference on Lyme Boreliosis and other Emerging Tick-Borne Diseases (20–24 June 1999, Munich). — Munich, 1999. — P. 44.
- Akimov, I. A., Nebogatkin, I. V. Ixodidae ticks in Kiev urbozoologic and epizootologic aspects // Vestnik zoologii. — 2002. — **36**, N 1. — P. 91–95. — Russian : Акимов И. А., Небогаткин И. В. Иксодовые клещи г. Киева — урбозоологические и эпизоотологические аспекты.
- Akimov, I. A., Nebogatkin, I. V., Poluda, A. V. et al. Arbovirus Uukuniemi of parasitic mites heyletid Bakericheyla chanayi and finches // Vestnik zoologii. — 2001. — **35**, N 1. — P. 95. — Russian : Акимов И. А., Небогаткин И. В., Полуда А. В. и др. Арбовирус Укуниemi от паразитических клещей хейлетид Bakericheyla chanayi и зябликов.
- Comstedt, P., Bergström, S., Olsén, B. et al. Migratory passerine birds as reservoirs of Lyme borreliosis in Europe // Emerg. Infect. Dis. — 2006. — **12**, N 7. — P. 1087–1095.
- Dubska, L., Literak, I., Kocianova, E. et al. Differential role of passerine birds in distribution of Borrelia spirochaetes, based on data from ticks collected from birds during the post breeding migration period in Central Europe // Appl. Environ. Microbiol. — 2009. — **75**, N 3. — P. 596–602.
- Gray, J. S., Kirstein, F., Robertson, J. N. et al. Borrelia burgdorferi sensu lato in Ixodes ricinus ticks and rodents in a recreational park in south-western Ireland // Exp Appl Acarol. — 1999. — **23**, N 9. — P. 717–729.
- Hamer, S., Goldberg, T., Kitron, U. et al. Wild Birds and Urban Ecology of Ticks and Tick-borne Pathogens, Chicago, Illinois, USA, 2005–2010 // Emerg. Infect. Dis. — 2012. — **18**, N 10. — P. 1589–1595.
- Kipp, S., Goedecke, A., Dorn, W. et al. Role of birds in Thuringia, Germany, in the natural cycle of Borrelia burgdorferi sensu lato, the Lyme disease spirochaete // Int. J. Med. Microbiol. — 2006. — **296**. — P. 125–128.
- Kurtenbach, K., De Michelis, S., Etti, S. et al. Host association of Borrelia burgdorferi sensu lato — the key role of host complement // Trends Microbiol. — 2002. — **10**. — P. 74–79.
- Movila, A., Gatewood, A., Toderas, I. et al. Prevalence of Borrelia burgdorferi sensu lato in Ixodes ricinus and I. lividus ticks collected from wild birds in the Republic of Moldova // Int. J. Med. Microbiol. — 2008. — **298**. — P. 149–153.
- Robertson, B. A., Hutto, R. L. A framework for understanding ecological traps and an evaluation of existing evidence // Ecology. — 2006. — **87**. — P. 1075–1085.
- Stern, C., Kaiser, A., Maier, W. A., Kampen, H. Die Rolle von Amsel (Turdus merula), Rotdrossel (Turdus iliacus) und Singdrossel (Turdus philomelos) als Blutwirte für Zecken (Acari: Ixodidae) und Reservoirwirte für vier Genospezies des Borrelia burgdorferi-Artenkomplexes // Mitteilungen der Deutschen Gesellschaft für allgemeine und angewandte Entomologie. — 2006. — **15**. — P. 349–356.
- Taragelova, V., Koci, J., Hanincova, K. et al. Blackbirds and song thrushes constitute a key reservoir of Borrelia garinii, the causative agent of borreliosis in Central Europe // Appl. Environ. Microbiol. — 2008. — **74**, N 4. — P. 1289–1293.
- Tolstenkov, O., Alekseev, A., Dubinina, H. Hematophagous biting-lice (Insecta, Phthiraptera, Amblycera) and Ixodes ticks (Acari, Ixodidae) of Curonian Spit migratory birds // Volga Journal of Ecology. — 2009. — N 4. — P. 327–336. — Russian : Толстенко О. О., Алексеев А. Н., Дубинина Е. В. Пухоеды-гематофаги (Insecta, Phthiraptera, Amblycera) и клещи (Acari, Ixodidae) перелетных птиц Куршской косы.
- Tularemia (organizational and teaching materials). — Moscow : Medgiz, 1954. — 184 p. — Russian : Туляремия (организационно-методические материалы).

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