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Diversity of Ectoparasites and their Pathogens in Birds (Passeriformes and Columbiformes) in Bouinan Region (Blida - Algeria)

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ABSTRACT

The present study focuses on the diversity of ectoparasites and their pathogens in birds (Passeriformes and Columbiformes) species in Bouinan region (Blida,Algeria).To detect ectoparasites potential vectors and reservoirs of bird's pathogens, the arthropods are researched and collected from different bird nests; Passeriformes; the Europe Greenfinch (*Carduelis Chloris*); the black robin (*Turdus merula*); hybrid sparrow (*Passer dmoesticus* x *Passer hispaniolensis*) and Columbiformes rock dove (*Columba livia*) in Bouinan region (Blida). the present study permitted to record about 701 arthropods species collected from 40 nests. It consisted of 6 mite species with a dominance of *Ornithonyssus bursa* (58.5%) followed by *Dermanyssus gallinae* (11.4%) and a single species of lice *Menacanthus stramineus* 11.8 % respectively on the one hand, and on the other hand, we noticed the complete absence of fleas and ticks in these 40 analyzed nests. It should also be noted here that Mites are used as epidemiological tools to detect the pathogen by sensitive PCR molecular biology. The PCR results showed that *Dermanyssus gallinae* and *Menacanthus stramineus* are vectors of Borealis in the study area with Shells sparrows and Europe greenfinch.

Key words: *Ectoparasite, Birds, Nests, Mites, PCR, Blida.*

Introduction

The major cause of human infectious diseases is transmitted by vectors mites from wild or domestic animals themselves virus reservoirs (Cornet *et al.*, 2004). Among the mites that are destructive to human populations, It comes first ticks, Bloodsucking arthropods that parasitism in nourishment from the

blood of all classes of vertebrates in almost all regions of the world. They can hang on humans and transmit bacterial, viral and parasitic particularly spotty *Rickettsial diseases*, *Recurrent fevers, Crimean-Congo fever*. *Q fever*, *Ehrlichiosis, Anaplasmosis*, *Lyme disease*, and *Babesiosis* (Socolovschi *et al.*, 2008). Most of the deals with human pathogenic infections are distinguished by ticks that are recognized as proven vectors (Cornet *et al.,* 2004), with shells beings are cattle, sheep, goats, rodents, and birds. Bird parasites have been studied worldwide, with studies on the ectoparasites of birds conducted by Cornet *et al.* (2004) in Thailand; Sychar *et al.* (2007, 2010) in the Czech Republic, in addition to Beaucournu *et al.* (2005, 2012) in France and Rawag - Zian *et al.* (2007) in northeastern Algeria. However, the originality of this work is related to the dependability of sampling that took place on the nests of passerines and Colombiformes that we identified all species of arthropods.

Materials and Methods

The sampling from nests was conducted in the forest; farms and urban areas in the Bouinan region (Blida) that situated in the southeastern of Algiers (36° 29' 00''N., 2° 50' 00''E.)(Fig. 1). The investigation was conducted on a period from April to June of 2012. The harvest of ectoparasites is performed on 40 nests, with 10 rock dove nests, 10 nests hybrid sparrow, 10 black robin nests and 10 European Greenfinch nests. To keep moisture necessary for ectoparasites, nests are placed in sealed black plastic bags containing cotton soaked with water. The different nests collected in the field are sent to the Pasteur Institute of Ecology (the service of Scalable Vector Systems).

Each nest is placed directly in a basin to collect the chips. After the nests removed the basin, they are immediately placed on a large bench on white sheets for harvest lice and mites that fall from the nest. In the end, it is husked and each branch, twigs, leaves, and clay used in its construction, are observed under a dissecting microscope to pick ectoparasites remaining. Individuals found are stored in labeled tubes containing alcohol 70% until identification.

Identifying method

Firstly; each arthropod was placed in a Petri dish with 70 ° alcohol added to prevent desiccation. Then the observation was conducted under a dissecting microscope to 40x10 magnifications. Secondly; the identification of mites was carried by using slide and cover slip then observed under a light microscope with magnification of 10x40, to illustrate their identification criteria. Finally, Every ten ectoparasites belonging to the same species (pool) is stored into a tube and coded for PCR analysis. According to Etienne (2000), Tagu and Moussard (2005).

Fig. 1. Geographical location of the study area

DNA extraction

The purpose of DNA extraction in a first step; is to release the DNA from other cellular components, while ensuring protection from degradation. In a second step, the DNA is separated from other components. To release the DNA from the samples a combined mechanical, enzymatic and chemical means was used. The results obtained from the indices of diversity as follows: the total wealth (S) which is the total number of species found in all the nests of birds (Blondel, 1975) and the relative abundance (% AR) which is the ratio of the number of individuals of a species (or) the total number of individuals of all species (N) (Zaime and Gautier, 1989).

Results

The Arthropods species recorded in bird nests

From 40 nests, we collected 701 arthropods and 6 species of mites, with a dominance of *Ornithonyssus bursa* (58.5%) (Fig. 2), followed by *Dermanyssus gallinae* (11.4%) and only one species of lice *Menacanthus stramineus* 11.8 % are identified. On the one hand, on the one hand, we recorded a total absence of fleas and ticks in our samples. The values of the total wealth of ectoparasites species found in bird nests are outlined in Table 1. The total wealth of species of ectoparasites collected from nests It was as follows: Black robin 06 species; the hybrid sparrow 05 species and the Europe Greenfinch 04 species in the Rock dove. Thus, the hybrid Sparrow, black robin, and Europe Greenfinch can be vectors of pathogens because of the large number of ectoparasites found in their nests.

The arthropods recorded in the host birds.

Black robin

The most abundant ectoparasite in the nests of Black robin is O. bursa with (54.8%) (Fig. 3). Then The oribatid mite with (12.5%). then followed by *Menacanthus stramineus* (12.2%), and then indefinite species 1 (11.2%) followed by *Dermanyssus gallinae* (8.6%). finally, indefinite case 2 is less abundant (0.7%).

Hybrid Sparrow

Menacanthus stramineus (56%) is the most abundant species in the 10 hybrid Sparrow nests. It is followed by oribatid mites (17.3%). *Ornithonyssus bursa* (12%) is in the third position (Fig. 4). While No species of

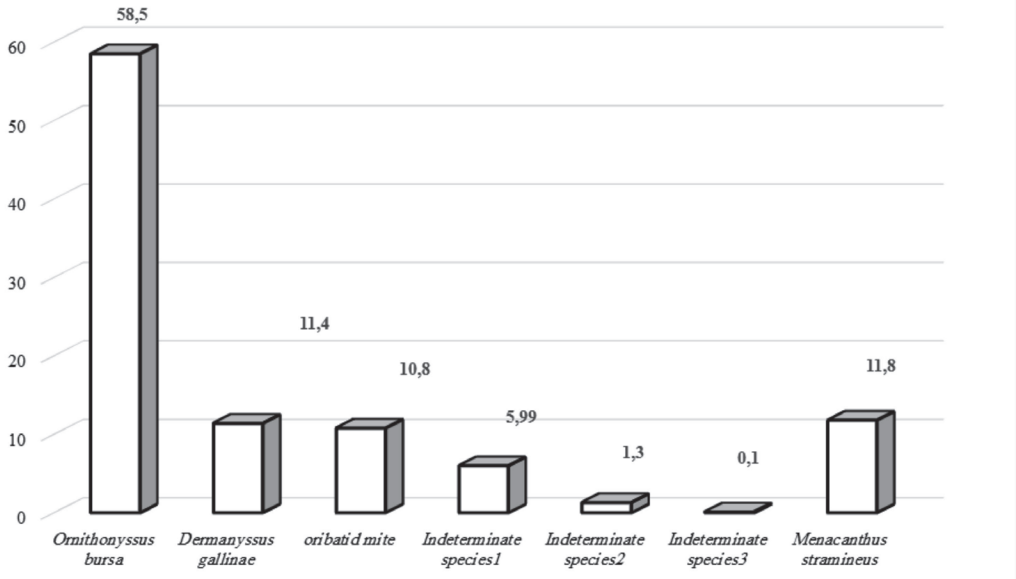


Fig. 2. Relative abundance of ectoparasites found in bird nests

Table 1. Total Wealth of ectoparasites found in 40 nests.

Nests	black robin	Hybrid sparrow	Europe Greenfinch	rock dove
S. ectoparasites	6	6	5	4

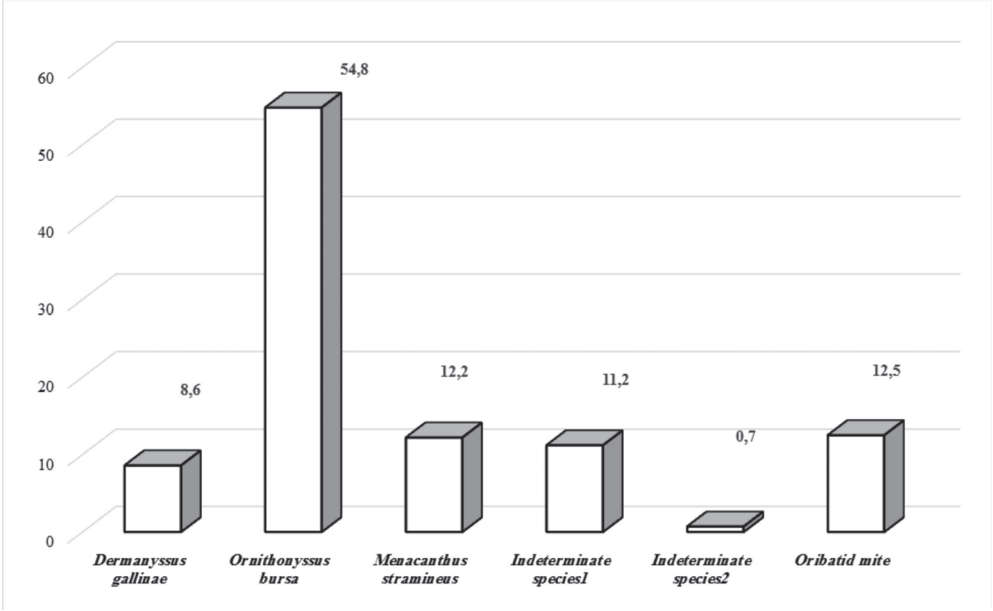


Fig. 3. Relative abundance of ectoparasites found in the nests of *Turdus merula*

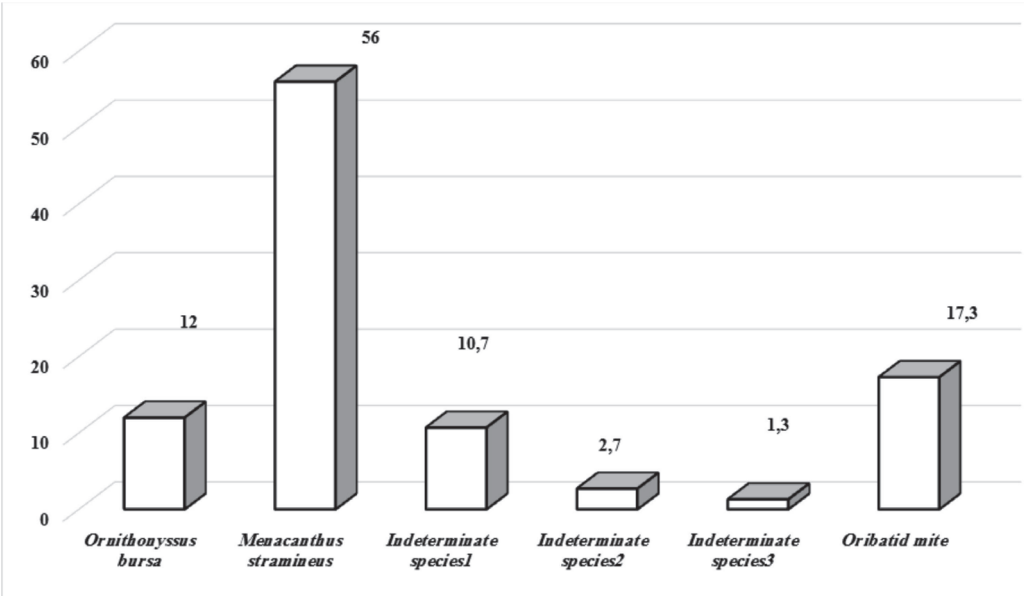


Fig. 4. Relative abundance of ectoparasites found in nest of hybrid Sparow

Dermanyssus gallinae is identified in these nests.

Europe Greenfinch

Within 6 nests of Europe Greenfinch a high percentage is noted in *Ornythonyssus bursa* (55.9 %) (Fig. 5). It is followed by *Dermanyssus gallinae* (24.9%), and oribatid mites (14.9%). *Menacanthus stramineus* (2.5 %), and indeterminate species 2 (1.9%) are poorly presented

Rock Dove

Regarding the 10 rock dove's nests analyzed, there is a predominance of *Ornythonyssus bursa* (89.5%) of the total ectoparasites. It is followed by *Dermanyssus gallinae* (8.6%), 2 of undetermined species (1.2%) and oribatid mites (0.6%). while there is a total absence of *Menacanthus stramineus* in these nests (Fig. 6).

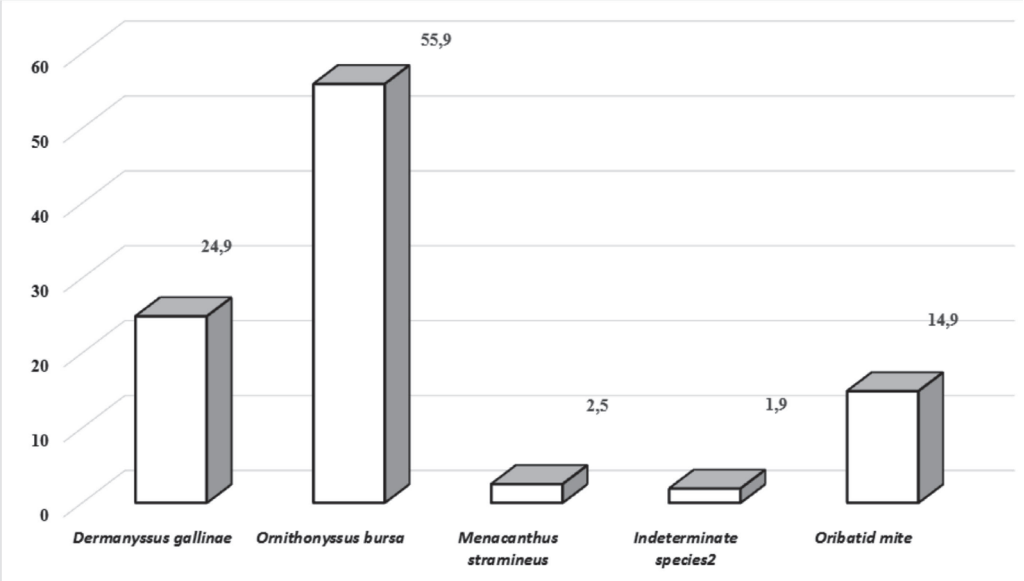


Fig. 5. Relative abundance of ectoparasites found in the Greenfinch nests

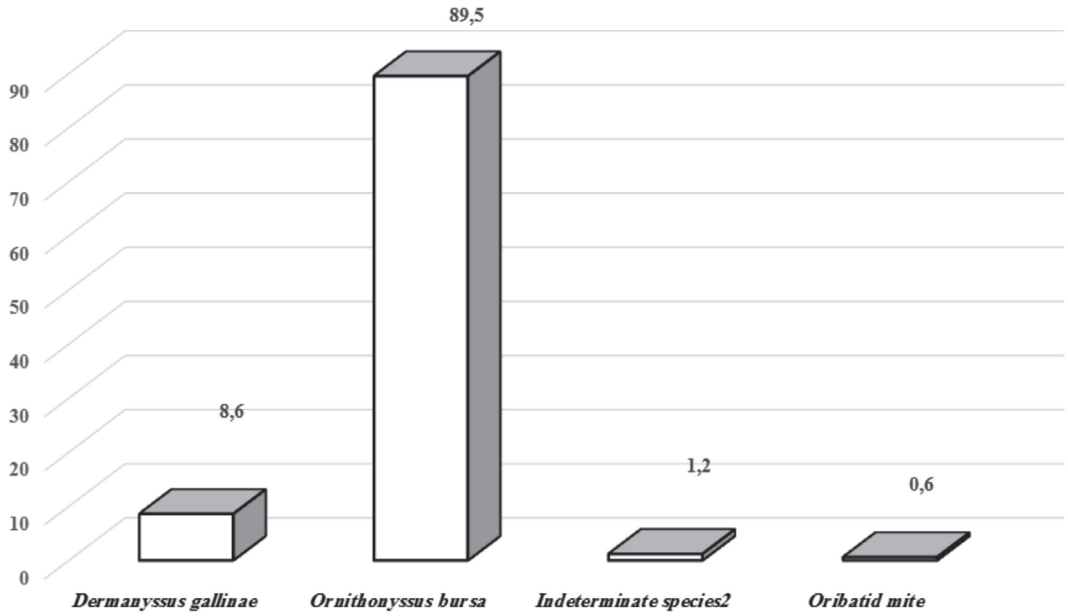


Fig. 6. Relative abundance of ectoparasites found in the *Columba livia* nests

Analysis by PCR

PCR analysis revealed 2 lice and 1 positive moth Borrelia sp after visualization of the DNA bands during the migration on agarose gel 1.5%.

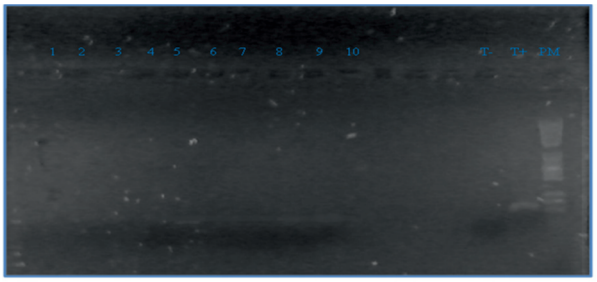
Detection of *Bartonella* sp.

The captures are shown from left to right respectively: the 20 samples analyzed, the negative control, the positive control (*Bartonella* sp.) And then the molecular weight marker (Fig. 7). Of 22 tubes tested and on the Bartonella gel, no band is illustrated except that the positive control.

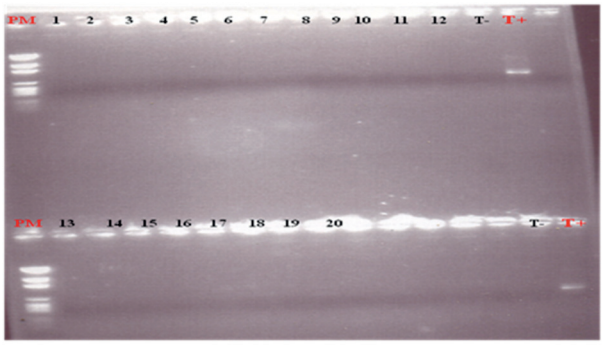
Detection of *Rickettsia* sp

The first gel well represents the molecular weight marker followed by sinks containers the samples analyzed and the negative control and the positive

control (Rickettsia sp.). On the freezing of the bacteria of the genus Rickettsia detection, no positive results have been obtained the only visible band is that of the positive control.



T+ : positive control. T- : Negative control. PM : molecular weight marker Original photo

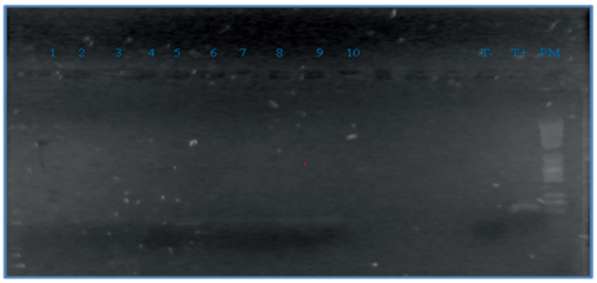


T+ : positive control. T- : Negative control. PM : molecular weight marker. Original photo

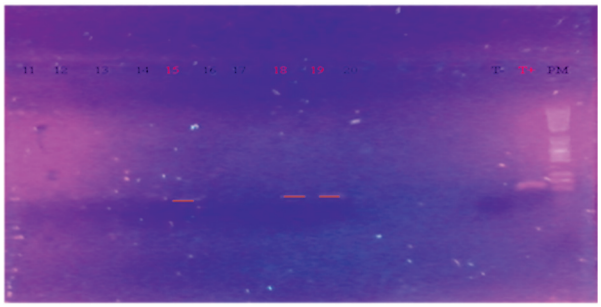
Fig. 7. Gel PCR of *Bartonella* sp.

Detection of *Borrelia* sp.

The two plates 1 and 2 are shown from left to right respectively the 10 samples tested, the *Borrelia sp*. negative control and the positive control. Then the molecular weight marker . The migration gel shows that the sample wells 15, 18 and 19 are positive, and the remaining bands are not visible. So the 50 moth species *Dermanyssus gallinae* analyzed, only one pathogen *Borrelia* is detected. Thus on the 50 species of lice *Menacanthus stramineus* two *Borrelia* pathogens are detected. *Borrelia sp*. is detected for the first time in Algeria in the DNA of a *Dermanyssus gallinae* collected from nests of Greenfinch. We have marked the presence of this bacterium in lice *Menacanthus stramineus* collected on hybrid Sparrows nests and European Greenfinch during our study (Fig. 8).



T+ : positive control. T- : Negative control. PM : molecular weight marker. Original photo



T+ : positive control. T- : Negative control. PM : molecular weight marker Original photo

Fig. 8. *Borrelia sp*. PCR Gel

Discussion

Ornithonyssus bursa is a tropical poultry mite that is commonly found especially on nesting birds (Denmark and Cromroy, 2009). At the end of the breeding season, the birds abandon their nests, the mites Moving into urban areas, causing irritation to the population They cause itching and prolonged painful dermatitis (Denmark and Cromroy, 2009). While the *Dermanyssus gallinae* becomes in the second position from the total nests analyzed. This parasite species is domesticated poultry (Kettle, 1993), can become a serious pest, causing irritation and anemia, and in some cases even the death of its host (Kirkwood, 1967). *D. gallinae* feeds on domestic poultry blood cage birds and doves and wild birds (McGarry, and Trees, 1991), and it can temporarily attack mammals, including humans (Duncan, 1957) and (Hoffman, 1987). Where the Mites remain on the host for food, and they need a blood meal to lie eggs (Hearle, 1938). Under favorable conditions, the parasite life cycle can be completed in a week. Only one species of lice *Menacanthus stramineus* found in the nests of black robin (12.2%), hybrid Sparrow (56%) and European Greenfinch (2.5%). Lice are widespread ectoparasites found in domestic and wild birds (Morariu et al., 2008). This louse is incriminated in the transmission of The PCR gel of *Bartonella sp*. is negative in birds in this present work; no band is illustrated by that of the positive

control. These results confirm those of Boulouis (2007). These authors report no *Bartonella sp*. in birds. They also report animal reservoir species of this pathogen mainly belong to three mammalian groups: carnivores, ruminants, and rodents. The transmission of Bartonella sp. is made by hematophagous arthropod vectors especially fleas' encephalomyelitis virus (Hoelscher, 1997). according to Renvoisé and Raoult (2009), Rickettsia are responsible for many emerging diseases, they are inoculated by ticks, fleas, mites, and lice. Indeed in Algeria specifically in Ghardaia and Medea (Ben Amrane and Rebouh, 2010) reported the presence of the pathogen of the Mediterranean spotted fever *Rickettsia connorii* in ticks. *Borrelia sp*. is detected for the first time in Algeria in the DNA of a *Dermanyssus gallinae* collected from nests of Greenfinch labeled the presence of this bacterium in louse *Menacanthus stramineus* collected on hybrid Sparrow nests and Europe Greenfinch. in Australia, *Dermanyssus gallina* is a vector of *Borrelia anserina* agent of an avian spirochetose (Acha and Boris, 2005).

Conclusion

in the present study Has been Identifying 701 ectoparasites collected from the 40 nests, that allowed to highlighting three vector species pathogenic agent: 2 species of mite *Dermanyssus gallinae* (11.41%) and *Ornithonyssus bursa* (58.49%) respectively which have the predominance, and a single species of louse *Menacanthus stramineus* (11.84%) specific bird On the one hand and on the other hand The absence of ticks and fleas is noted.

The PCR results showed that *Dermanyssus gallinae* and *Menacanthus stramineus* are vectors of Borrelia sp in the study area, while whose reservoirs are hybrid Sparrow and Europe Greenfinch. Finally, we can conclude that the study area is endemic to borreliosis and the climate conditions of this region are favorable for the multiplication of several vectors of *Borrelia sp* as *Dermanyssus gallinae* and *Menacanthus stramineus*. It should be noted that the presence of these nests in the vicinity of houses causes a risk to human health.

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