

Short Communication / Kısa Bilimsel Çalışma

First investigation on vectorial potential of *Blattella germanica* in Turkey

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Summary: Cockroaches are claimed to be mechanical vectors of microorganisms such as intestinal parasites, bacteria, fungi, and viruses. This study was conducted to determine the potential role of cockroaches as carriers of parasites having medical importance in Van province, Turkey. One hundred and thirty-eight cockroaches were collected from different parts of apartments and houses between March and April 2014. All of the collected cockroaches were identified as *Blattella germanica*. They were examined for isolation and identification of intestinal parasites from external surface. The results showed that 66 (48%) of the cockroaches harbored parasitic organisms. Of these, 96.6% were protozoon and the remaining 3.4% were helminthes. Isolated helminth, species were *Toxocara* sp. (3%), *Ascaris lumbricoides* (3%), *Trichostrongylus* sp. (1.5%), *Trichuris trichiura* (1.5%) and unidentified nematode egg samples (3%). The protozoon identified during the study were *Endolimax nana* (7.6%), *Blastocystis hominis* (41%), *Entamoeba histolytica/E. dispar* (16.7%), unsporulated coccidial oocyst (7.6%), *Chilomastix mesnilli* (4.5%), *Entamoeba coli* (35%), *Giardia* sp. (13.6%) and *Iodamoeba butschlii* (7.6%). In conclusion, *Blattella germanica* was found to harbor intestinal parasites of public health importance. Hence, awareness on the potential role of cockroaches in the mechanical transmission of intestinal parasites needs to be further investigated. Control of cockroaches will substantially minimize the spread of diseases caused by helminths and protozoons in our environment.

Keywords: *Blattella germanica*, human parasites, mechanical vector.

Türkiye’de *Blattella germanica*’nın vektörlük potansiyeli üzerine ilk araştırma

Özet: Hamam böceklerinin barsak parazitleri, bakteri, mantar ve virüs gibi mikroorganizmaların sebep olduğu hastalık etkenlerinin mekanik taşıyıcıları olduğu iddia edilir. Bu çalışma, Van’da medikal öneme sahip parazitlerin potansiyel taşıyıcısı olarak hamam böceklerinin rolünü belirlemek için yapıldı. Bölgedeki apartman ve evlerin farklı kısımlarından 2014 yılının Mart ve Nisan aylarında 138 hamam böceği toplandı. Toplanan hamam böceklerinin hepsi *Blattella germanica* olarak teşhis edildi. Hamam böcekleri external yüzeylerindeki insan barsak parazitlerinin izolasyonu ve identifikasyonu için muayene edildi. Muayene edilen hamam böceklerinden 66’sının (%48) parazit yumurta veya ookisti taşıdığı görüldü. Bunların %96.6’sı protozoon, %3.4’ü helmintlere ait olduğu tespit edildi. Teşhis edilen helmintlerin tür ve oranları sırasıyla; *Toxocara* sp. (%3), *Ascaris lumbricoides* (%3), *Trichostrongylus* spp. (%1.5), *Trichuris trichiura* (%1.5), protozoonların tür ve oranları ise; *Endolimax nana* (%7.6), *Blastocystis hominis* (%41), *Entamoeba histolytica/E. dispar* (%16.7), sporlanmamış coccidia ookisti (%7.6), *Chilomastix mesnilli* (%4.5), *Entamoeba coli* (%35), *Giardia* sp. (%13.6), *Iodamoeba butschlii* (%7.6) olarak tespit edildi. İki adet nematod yumurtası teşhis edilemedi. Sonuç olarak, *Blattella germanica*’nın halk sağlığı açısından önemli barsak parazitlerinin taşıyıcısı olduğu belirlendi. Bu nedenle, bağırsak parazitlerinin mekanik taşınmasında hamam böceklerinin potansiyel rolü üzerine farkındalığın oluşturulması gerekir. Hamam böceklerinin kontrolü çevremizde helmint ve protozoon hastalıklarının yayılmasını önemli ölçüde azaltacaktır.

Anahtar sözcükler: *Blattella germanica*, insan parazitleri, mekanik vektör.

Cockroaches have been on earth for about 300 million years, and are the world's most common insects. Today, there are about 4,500 species of cockroaches that can be found in every part of the world. Thirty species are associated with human habitations, but only a few of these species inhabit human dwellings. The most common of these are the American cockroach (*Periplaneta americana*) and the German cockroach (*Blattella germanica*) (18, 25).

The majority of these species live in tropical and subtropical area, but are not pests (26). The cockroaches are found in abundance near areas where there is frequently standing water or areas where continued moist such as toilets, kitchen and draining water. Such places serve as a migration routes of the cockroach from place to place (20). Cockroaches frequently feed on human feces, garbage and sewage, therefore they have copious

opportunity to disseminate pathogenic agents (24). They are known as one of the most important agents in transmission and distribution of many different bacteria, viruses, protozoa and fungi, and they are intermediate hosts for some pathogenic intestinal worms (6). Therefore, these insects are considered as vectors of important diseases which can be transmitted by both mechanical and biological routes (10, 11, 23).

Despite the abundance of cockroaches in residential areas in Van, Turkey (13, 15) and the high prevalence of intestinal parasites in this province (3, 27, 28, 29), there is no documented data on the role of cockroaches as carriers of intestinal parasites in this region. Thus, the aim of the present study was to isolate and identify parasites from external surface of the cockroaches which were collected from houses and apartments in Van province.

One hundred and thirty-eight adult cockroaches were collected between March and April 2014. Seventy-five cockroaches were trapped from different parts of apartments and sixty-three from some houses. Samples were transported alive to the laboratory where they were immobilized by freezing at 0°C for 10 min. The cockroaches were identified using standard taxonomic keys (17, 22). Only adult cockroaches that were caught alive and without missing any body parts were used in this study. After identification, each cockroach was placed in a test tube containing 2 ml of 0.9% sodium chloride (NaCl). The test tube was shaken strongly for two minutes to detach any parasite or their stages from the external body of the cockroach. Then, the liquid was transferred to a centrifuge tube and centrifuged at 3000 rpm for 5 minutes. After remaining supernatant, the residual deposit was placed on a clean glass slide, covered with a cover slip and stained with Lugol's iodine. Then examined under x 40 objective using light microscope. The parasites and/or their stages encountered were identified and counted using keys of Cheesbrough (5).

A total of 138 cockroaches were studied, all were identified as *Blattella germanica*. In this study, 66 of the 138 cockroaches that were collected from four houses and two apartments in Van had helminthes and protozoa on their external surfaces, indicating that they are carriers and capable of mechanically transmitting these parasitic organisms (Table 1). The parasitological examination revealed that 66 (48%) out of 138. Cockroaches were infected with one or more of parasite. The parasites that were identified included protozoa (96.6%) and helminthes (3.4%). The helminthes included *Toxocara* sp. (3%), *Ascaris lumbricoides* (3%), *Trichostrongylus* sp. (1.5%), *Trichuris trichiura* (1.5%) and unidentified nematode egg samples (3%). Interestingly, most of the identified protozoa were opportunistic, and they were as follows: *Endolimax nana* (7.6%), *B. hominis* (41%), *Entamoeba histolytica/E. dispar* (16.7 %), unsporulated coccidial

oocyst (7.6%), *Chilomastix mesnilli* (4.5%), *Entamoeba coli* (35%), *Giardia* sp. (13.6%) and *Iodamoeba butschlii* (7.6%). Also unlike parasite eggs, unidentified eggs were encountered in some samples.

The number of infected cockroaches and identified parasites eggs/cyst respectively: *Toxocara* sp. (2 - 6 eggs), *A. lumbricoides* (2 - 2 eggs), *Trichostrongylus* sp. (1 - 2 eggs), *T. trichiura* (1 - 1 eggs), *E. nana* (5 - 5 cysts), *B. hominis* (27 - 246 vacuolated form), *E. histolytica/E. dispar* (11 - 18 cysts), unsporulated coccidial oocyst (5 - 5 oocysts), *C. mesnilli* (3 - 5 cysts), *E. coli* (23 - 80 cysts), *Giardia* sp. (9 - 11 cysts) and *I. butschlii* (5 - 5 cysts) (Figure 1).

In this study, intestinal parasite species of medical importance were identified from the body surfaces of the cockroaches. The importance of cockroaches, as carriers of parasitic worms, cysts, or eggs, and the presence of parasitic forms on or in cockroaches was indicated in previous studies (8). The findings from present study revealed that *Blattella germanica* play a significant role in transmitting parasitic diseases and should be capable of transmitting parasites to humans or animals.

There are 3 species of cockroaches (*Blattella germanica*, *Blatta orientalis* and *Periplaneta americana*) in Turkey. In recent years, a number of studies have been carried out to determine the population dynamic of cockroaches in some hospitals and apartments in Turkey (13, 15). In these studies, it was found that among cockroaches caught in hospitals, *B. germanica* was the predominant species (13, 15). In this study, *B. germanica* was the only species identified, no other cockroaches were found to exist within the collected insects.

The contents of cockroaches gut and external body parts were examined for the presence of intestinal parasites in several studies. Percentage of parasitic carrier cockroaches was 54.1% in Thailand (4), 77.52% in Nigeria (2), 67% in Owerri, Nigeria (1), 98% in Egypt (7), 75.6% in Jimma Town, Southwestern Ethiopia (9), 8.9% in Hamadan city, Iran (21). The present finding in the prevalence of parasitic contamination in 48% is lower as compared to that reported by Chamavit et al. (4) (54.1%), Bala and Sule (2) (77.52%), Ajero et al. (1) (67%), El-Sherbini and El-Sherbini (7) (98%), Hamu et al. (9) (75.6%), but greater than that reported by Salehzadeh et al (21) (8.9%).

Blastocystis hominis is one of the most common intestinal parasite in humans and is also present in a wide range of animal hosts. *B. hominis* is a definite pathogen in immunosuppressed population. The second most common species was *Entamoeba coli*, with a prevalence rate of approximately 35%. The third common species was *E. histolytica/dispar*, which was detected in 16.7% of cockroaches.

Table 1. Enfection rate of cockroaches according to the study area.
Tablo 1. Hamam böceklerinin toplandığı yere göre enfeksiyon oranı.

Study Areas	No. Examined	No. Positive
Apartments	75	51 (68 %)
Houses	63	15 (24 %)
Total	138	66 (48 %)

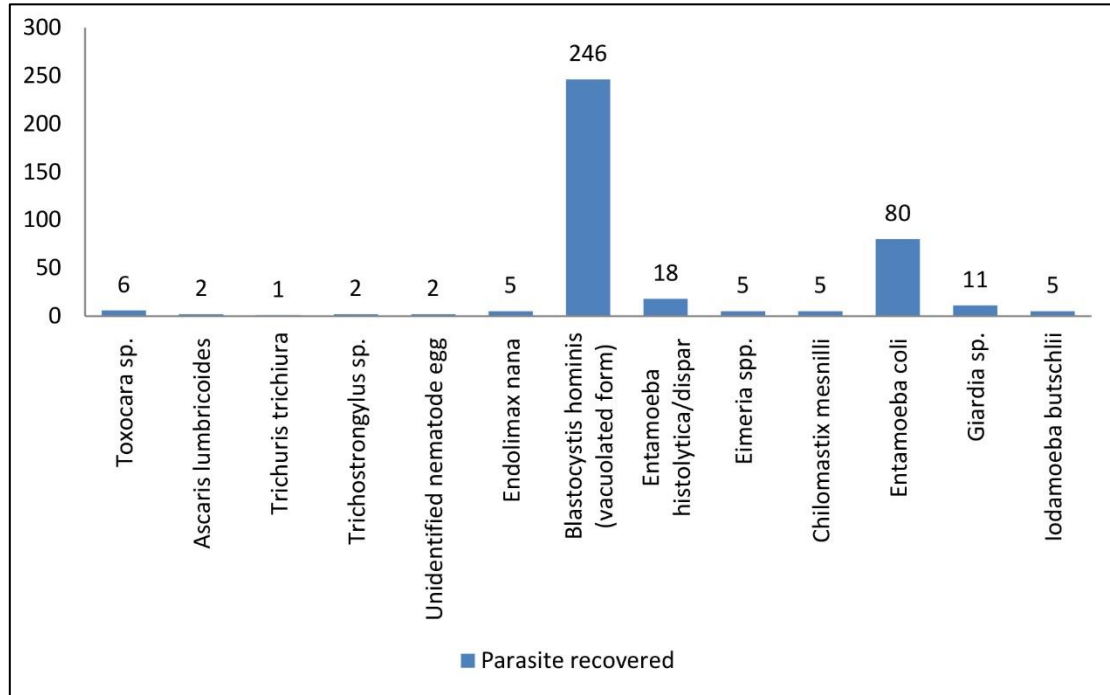


Figure 1. Cysts/eggs number of parasites in cockroaches (*Blattella germanica*) enfeeted.

Şekil 1. Enfeekte hamam böceklerinde (*Blatella germanica*) bulunan parazit yumurta/ kist sayıları.

In a previous study, the potential role of cockroaches in the mechanical transmission of *E. histolytica* (19) and *Giardia* spp. cysts (12) was demonstrated. Besides in another study, 10% of *B. germanica* and over 25% of *Periplaneta americana* harbored cysts of *Entamoeba histolytica/dispar/moshkovskii* on their cuticle and/or in the digestive tract (16).

Bala and Sule (2) reported that the high occurrence of *E. histolytica* might probably be because of the resistance conferred by the cyst wall, which makes the cysts to survive days to weeks in the external environment and probably be vectored by cockroaches and other synanthropic insects. In the same study, four species of intestinal helminthes, *A. lumbricoides*, *T. trichiura*, *Toxocara* spp., *Trichostrongylus* spp. and an unidentified nematodes-like parasite eggs, were isolated.

In this study, no oocysts of the coccidian parasites (*Balantidium coli*, *Cryptosporidium* sp., *Cyclospora* species, *Isospora belli*) and eggs of helminth parasites (*Taenia* sp., *Schistosoma mansoni*, *S. haematobium*, *Enterobius vermicularis*, *Strongyloides stercoralis*, *Hymenolips nana*) had been isolated from cockroach specimens in contrast to previous reports (1, 2, 4, 7, 9).

There was a significant difference in the prevalence of parasitic contamination between the study areas; the prevalence rate being higher in apartments (51%) than houses (15%). This disparity could emanate from the differences in the hygienic condition of the environments. Basement of apartments were exposed to higher levels of pollution caused by sewage overflow.

Van province has a low temperature and long winter season. Although these factors have a limiting effect on the parasites to be spread out, low socio-economic status and some other environmental factors have an important impact on the high prevalence and rich flora of parasites in this province (27). Intestinal parasites are relatively common among residents in Van (3, 14, 27, 28, 29). Examination of people who live around residential areas in the town also shows that these gastrointestinal parasites are very common (3, 27, 28, 29), probably due to poor human excreta disposal mechanism.

In conclusion, the results obtained from this study revealed that cockroaches were contaminated with many intestinal parasites. This may be caused by sewage overflow on the ground floor due to disturbances in the sewage system in the apartments and houses. After resting

and contaminating the environment with infective matter carried on the body surface, they can transmit the infection to the community. The finding of this study sheds light on the potential role of cockroaches in the mechanical transmission of intestinal parasites of public health importance; so, the control of cockroaches could considerably minimize the spread of infectious diseases.

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