



Periplaneta americana as a Host for *Demodex* spp. First Report

Alba Romero José de Jesús^{1,2}, Sánchez Manzano Rosa María³, Noguera Torres Benjamín³, Chávez Barron Almendra Julieta¹ and Guillén Rangel Guadalupe Concepción^{1*}

¹Division of Graduate Studies and Research, Faculty of Chemical Sciences, Gómez Palacio Campus, Juárez University of the State of Durango (UJED), Article 123 s/n, Filadelfia Subdivision, 35019 Gómez Palacio, Dgo, Mexico

²Specialized Clinical Laboratory Consultants, La Laguna, C. Juárez 142 ote, Colonia Centro, 35000 Gómez Palacio, Dgo, Mexico

³Helminthology Laboratory, National School of Biological Sciences, National Polytechnic Institute, Prolongación de Carpio y Plan de Ayala s/n, Col, Santo Tomás, C.P. 11340, Miguel Hidalgo Borough, Mexico City, Mexico

***Corresponding Author:** Guillén Rangel Guadalupe Concepción, Division of Graduate Studies and Research, Faculty of Chemical Sciences, Gómez Palacio Campus, Juárez University of the State of Durango (UJED), Article 123 s/n, Filadelfia Subdivision, 35019 Gómez Palacio, Dgo, Mexico.

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Abstract

Mites were first described in human hair follicles in 1841 by Henle and Berger, and classified into two distinct species, folliculorum and brevis, in 1963. *Demodex* spp. mites are considered part of the normal skin microbiota and reside in the pilosebaceous unit. The hosts of *Demodex* spp. mites are mammals, with specific species for each animal, such as dogs (*Demodex canis*), cats (*Demodex cati*), and horses (*Demodex equi*), in addition to humans (*Demodex folliculorum* and *Demodex brevis*). *Demodex* conditions occur when there is excessive growth of these mites on the skin and can cause symptoms such as redness, itching, burning sensation, papules, pustules, scaling, or rough skin texture. They are associated with skin problems such as rosacea, blepharitis (inflammation of the eyelids), folliculitis (inflammation of the hair follicles), and perioral dermatitis. Cockroach species (*Periplaneta americana*) were studied to search for parasites (mainly *L. blattarum*) and medically important bacteria. The cockroaches were dissected by removing the legs, thorax, and wings; only the abdominal cavity was analyzed. The results showed the presence of various parasites, including, for the first time in the abdominal cavity of cockroaches, mites of the genus *Demodex* spp. It was concluded that cockroaches are a host for *Demodex* spp mites and are a source of contamination and high risk to humans.

Keywords: Cockroach; Demodex; Mites; Skin Problems

Introduction

The American cockroach, *Periplaneta americana* (*P. americana*), is a cosmopolitan insect known for thriving in human environments, undeterred by attempts to eradicate it. It is considered an opportunistic pest; its long lifespan, neurosensory capabilities, and diverse nutritional capacity also make *P. americana* an excellent invertebrate model organism with a long history in neuroscience and physiological research [1]. Allergic diseases are becoming increasingly prevalent worldwide, particularly those caused by cockroach allergens; these diseases generate a growing demand for medical and health services. Patients with allergies experience a poor quality of life and cognitive impairment. Adult patients have reduced work efficiency, while affected children perform less effectively in school, exhibit frequent school absenteeism, and require greater care from their caregivers [2]. Respiratory allergy to the American cockroach (*P. americana*) is prominent in subtropical and tropical areas. However, coexisting perennial indoor inhalant allergies frequently complicate the clinical diagnosis of cockroach allergy [3]. It has been reported that one of the most common cockroach species in urban areas, the American cockroach (*P. americana*), carries a higher risk of allergies and asthma, making the high-quality genome and proteome of *P. americana* highly useful for the molecular-level study of cockroach allergens, through which seven new allergen groups and one isoallergen have been identified [4]. They are considered mechanical vectors of infectious diseases, posing a threat to human health because they can serve as hosts for viruses, bacteria, fungi, and parasites. Previous studies have detected eight intestinal pathogens, including enteroviruses and sapoviruses—the most detected in *Blattella germanica* or nymphs—Shiga toxin-producing *Escherichia coli* (STEC), and *Blastocystis hominis*, which had the highest isolation rate. Twelve pathogens causing diarrheal diseases to have also been isolated [5]. Another frequently isolated microorganism associated with lung diseases is *Lophomonas blattarum*, a protozoan considered a commensal in the intestinal cavity of cockroaches. This parasite is frequently found not only in cockroaches but also in termites, bustards, and mites [6]. *Demodex* mites are microscopic arachnids found on the normal skin of many mammals. In humans, it is well established that the density of *Demodex* mites is higher in patients with rosacea, a skin condition [7]. *Demodex* mites have been described in various mammals such as dogs, cats, pigs, wolves, and humans; however, cockroaches have not been described as a host. *Demodex* includes species of im-

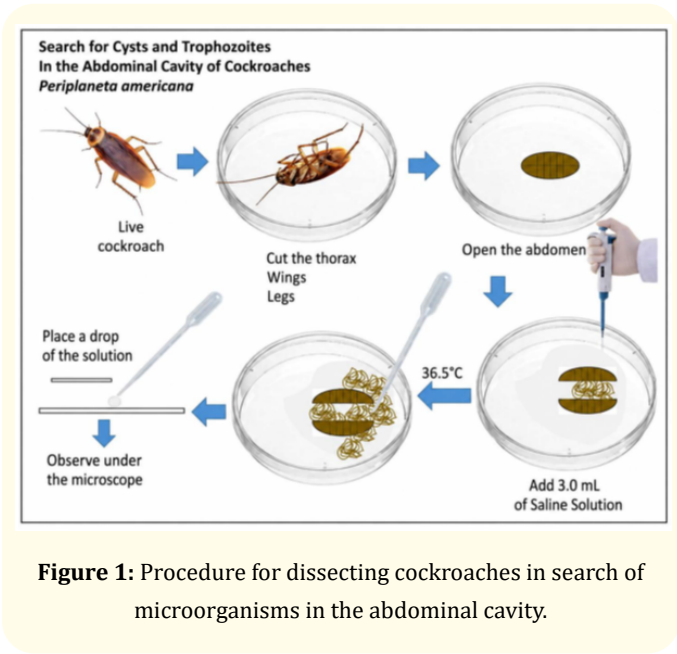
portance to humans, *Demodex folliculorum* and *Demodex brevis*, which are ectoparasites with a striking prevalence of 100% in patients aged 70 years or older. It is estimated that each person in this age group carries a colony of 1,000 to 2,000 mites. Given its high prevalence, little attention has been paid to this mite among eye care professionals [8]. Another very common condition is *Demodex blepharitis*, a common eyelid disease affecting approximately 25 million Americans; risk factors for *Demodex* blepharitis include advanced age, rosacea, and diabetes. The presence of collarettes is pathognomonic of *Demodex* blepharitis; redness, dryness, discomfort, a foreign body sensation, eyelash abnormalities, and itching are also characteristic of the disease [9]. Although symptoms may include others besides those already mentioned, such as crusts and itchy eyelids, the diagnosis can be made through a simple examination of the eyelashes [10]. The presence of a waste product from the *Demodex* mite, known as collarettes, at the base of the eyelashes is a pathognomonic sign of *Demodex* blepharitis [11]. The objective of this study is to describe a new host of the *Demodex* genus, which has not been previously described.

Materials and Methods

Five cockroaches of the genus *P. americana* were analyzed daily for 12 months from different geographic locations in a city in northern Mexico to describe the main parasites and bacteria present in the abdominal cavity. To do this, the cockroaches were dissected by removing the thorax, legs, and wings, leaving only the abdominal cavity intact. Using a No. 22 scalpel, the abdomen was cut in half to allow the abdominal contents to be removed. In a 15-mm Petri dish, 3–5 mL of 0.89% saline solution was added, and the dish was placed in an incubator at 37°C for 15–20 minutes to stabilize the solution's temperature. Next, a drop (35–40 µL) of the suspension (saline solution–intestinal contents) is taken and placed on a slide, covered with a 22×22 cover slip, and observed under a microscope using a 10× objective and subsequently a 40× objective, Figure 1. Additionally, a Ziehl-Neelsen stain was performed to search for bacteria.

Results and Discussion

The results of the fresh specimens and stained specimens are described in Table 1. The observations of *Demodex* spp. found in the body cavities of the cockroaches are shown in Figure 2a and 2b.



This research study analyzed the abdominal cavity of American cockroaches (*P. americana*) to identify clinically significant parasites and bacteria. This type of research is important given the impact that cockroaches have due to their global distribution and, above all, on human health; Nasirian H. (2019) reported that at least 78 bacterial species and 42 genera from 24 families and 11 orders of bacteria contaminate cockroaches, which can result in the spread of opportunistic or pathogenic infections, particularly healthcare-associated infections (HAIs) and foodborne infections. The search for infectious microorganisms was the objective of the research project; however, upon examining samples extracted from the abdominal cavity under a microscope, helminthic parasites, protozoa, bacteria, and yeasts were found; Using the same methodology, Hanrahan., *et al.* (2024) identified medically significant bacteria and their association with HAI, establishing the potential role these insects play in the transmission of pathogens in hospitals—a role that must be considered when investigating outbreaks. In addition to finding clinically significant microorganisms, mites of the genus *Demodex* spp. were found in the body cavities of some cockroaches; this finding is of utmost importance due to its impact on the health of the general population, but especially on the elderly (Erdal and Albayrak, 2022). Paichitrojjana A. and Chalermchai, T. (2024) state that *Demodex* can cause various skin conditions, ranging from nonspecific dermatitis to conditions that mimic other diseases, making accurate diagnosis difficult. *Demodex* mites were

first found in the abdominal cavity of cockroaches; the literature does not describe *P. americana* as a host of *Demodex* spp. Morán., *et al.* (2025) state that *Demodex* mites primarily affect the facial area and are caused by an imbalance in the immune system or prolonged use of topical corticosteroids, which promotes an increase in the mite population, particularly in individuals who have prolonged contact with pets such as cats or dogs. Based on the results, it is stated that the presence of *Demodex* spp. mites in cockroaches has not been previously described, which aligns with the findings reported by Thomson., *et al.* (2023), who noted that this type of mite is found in wild animal populations (such as foxes). Other authors, such as Moroni., *et al.* (2023), specifically describe where *Demodex* spp. mites are frequently found, they established that these mites were found in 36 carnivores—including 4 domestic cats, 1 dog (*Canis lupus familiaris*), 4 Eurasian lynxes, 23 red foxes (*Vulpes vulpes*), and 4 gray wolves (*Canis lupus lupus*)—from Italy, Switzerland, or France, but not in cockroaches. The discovery of this type of mite in cockroaches warrants further investigation using molecular methods to determine the prevalence of *Demodex* spp. in these insects and to provide greater scientific support for the notion that while microscopic observation is important, further evidence is required.

Bacteria and Parasites Found in the Abdominal Cavity of Cockroaches (<i>P. americana</i>)	
Bacteria	Parasites
<i>Salmonella</i>	Promastigotes of <i>Leptomonas</i> spp
<i>Shigella</i>	Trophozoite of <i>Entamoeba blattae</i>
<i>Pseudomonas aeruginosa</i>	Trophozoite of <i>Nyctotherus ovalis</i>
<i>Enterococcus faecalis</i>	Oocyst of <i>Cystoisospora</i> spp
<i>Klebsiella pneumoniae</i>	Egg of <i>Enterobius vermicularis</i>
<i>Peptostreptococcus</i>	Oocyst of <i>Cyclospora</i> spp
<i>Staphylococcus aureus</i>	Larva and egg of <i>Thelastoma</i> spp
<i>Streptococcus agalactiae</i>	Eggs and male of <i>Hammerschmidtella</i> spp
<i>Provotella</i>	Promastigotes of <i>Leptomonas</i> spp
<i>Propionibacterium</i>	Trophozoite of <i>Lophomonas striata</i>
<i>Fusobacterium</i>	Trophozoite of <i>Lophomonas blattarum</i>
Acid-fast bacilli	<i>Demodex</i> spp

Table 1: Major bacteria and parasites found in the body cavities of cockroaches (*P. americana*).

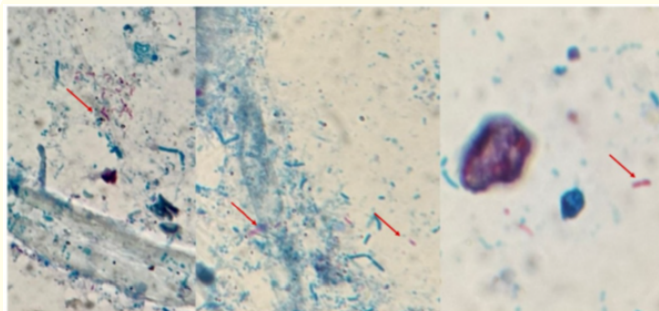


Figure 2 a: Acid-fast bacilli in the abdominal cavity of cockroaches (*P. americana*).

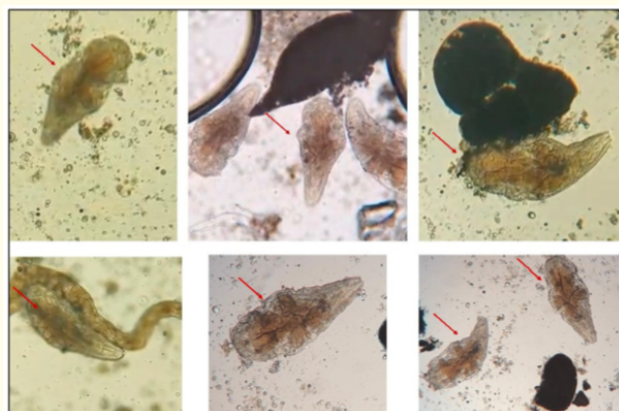


Figure 2 b: Observations of *Demodex* spp. mites in the abdominal cavity of cockroaches (*P. americana*).

Conclusion

Cockroaches (*P. americana*) are a major source of biological contamination for mammals and humans. The presence of *Demodex* spp. mites in the abdominal cavity of cockroaches increases the risk of acquiring skin infections, particularly on the face (cheeks, forehead, eyelids, and eyelashes); these infections are exacerbated when there is co-infection with bacteria that colonize the skin. Intensive screening for *Demodex* in cockroaches will help explain various allergic processes, especially in children. The contribution of this research is significant as it describes for the first time the presence of the genus *Demodex* spp. in cockroaches (*P. americana*) as a host.

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Conflict of Interest

The authors of this research firmly declare that they have no conflict of interest, and the assertions and statements are solely the result of the work carried out in the laboratories.

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