First Report of Chewing Lice *Heterodoxus spiniger* (Enderlein, 1909) and *Trichodectes canis* (De Geer, 1778) on Domestic Dogs at Tabasco, Mexico

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First Report of Chewing Lice *Heterodoxus spiniger* (Enderlein, 1909) and *Trichodectes canis* (De Geer, 1778) on Domestic Dogs at Tabasco, Mexico

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Abstract. Lice are small wingless insects in the order Phthiraptera. Historically, the chewing louse *Heterodoxus spiniger* (Enderlein) was described from marsupials to the domestic dog (*Canis lupus familiaris* L.). Clinical manifestations of infestations by chewing lice are characterized by intense irritation and inflammation of the skin. We found six of 337 domiciled dogs from Tabasco State, Southeastern Mexico infested by chewing lice. Dogs were systematically examined, and ectoparasites were removed using a fine-toothed comb. Lice were deposited on a white sheet of paper and placed into plastic containers. The dog houses sampled were typically small and built of cement, and most inhabitants lived in vulnerable conditions. This is the first record of *H. spiniger* and the dog biting louse, *Trichodectes canis* (De Geer), infesting domestic dogs in Mexico. *H. spiniger* was present in the six dogs infested by lice, and *T. canis* co-infested one of them. Therefore, six infested dogs (100%) were positive for *H. spiniger* and one (17%) for *T. canis*. The importance of this report is that both ectoparasites are recognized as vectors of zoonotic diseases. Further studies are needed to clarify lice distribution, prevalence, and vectorial importance of neglected parasitic infections in Southeast Mexico.

Introduction

Lice are small wingless insects in the order Phthiraptera. Modern classifications divide Phthiraptera into four suborders: Amblycera, Ischnocera, Rhynchophthirina, and Anoplura (Johnson and Clayton 2003, Price et al. 2003). According to their feeding habits, the first three suborders are known as chewing lice or Mallophaga because of the presence of mandibulate mouthparts used for shearing and scraping feathers or skin during feeding (Johnson and Clayton 2003). There are 4,500 species of chewing lice distributed worldwide, of which 3,120 belong to Ischnocera and 1,341 to Amblycera (Price et al. 2003). There is no current list of species of Mallophaga in Mexico. Most studies of lice have focused on the suborder Anoplura. Recent records of the suborder included 44 species of

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Historically, *H. spiniger* was described as a louse of marsupials in Australasia. Forced adaptation transferred the lice to wild dingoes (*Canis lupus dingo* Meyer) and then to the domestic dog (*Canis lupus familiaris* Linnaeus) (Price and Graham 1997). *H. spiniger* has been reported infesting domestic or stray dogs (Vogelsang 1954, Dantas-Torres and Figueredo 2007, Dantas-Torres et al. 2009, Venzal et al. 2012, Sultan and Khalafalla 2014) and cats (Amin et al. 1973, Norhidayu et al. 2012) in several countries. *T. canis* has been found on domestic dogs (Chee et al. 2008, Xhaxhiu et al. 2009, Bermúdez and Miranda 2011, Troyo et al. 2012) and wild hosts such as raccoon dog (*Nyctereutes procyonoides* Gray) (Bádr et al. 2005), coyote (*Canis latrans* Say), gray wolf (*Canis lupus* Linnaeus) (Mech et al. 1985), and Darwin’s fox (*Pseudalopex fulvipes* Martin) (González-Acuña et al. 2007).

Clinical manifestations of infestations by chewing lice are characterized by intense irritation, inflammation of the skin, and intensified long-lasting pruritus in the hosts. Severe scratching, secondary bacterial infection, skin abrasion, and pyoderma also were observed (Price and Graham 1997). From a public health point of view, *H. spiniger* and *T. canis* are important vectors of dog tapeworm *Dipylidium caninum* (Linnaeus), and filarial nematode *Acanthocheilonema reconditum* (Grassi) (Nelson 1962). *D. caninum* also is known to severely affect the gastrointestinal tract of children and immunocompromised patients (Narasimham et al. 2013). *A. reconditum* was recently described as a culprit of a potential debilitating disease of humans because it affects the integrity of the eyeball and subconjunctival tissue (Huynh et al. 2001, John et al. 2012).

Not only are both the ectoparasites *H. spiniger* and *T. canis* of great importance in veterinary medicine, but they also are directly implicated in the life cycle of zoonotic parasites that affect public health. Surveillance and control must be considered in basic programs for healthcare and strategic plans of parasitic diseases and vector control. The purpose of this paper was not only to record *H. spiniger* and *T. canis* infesting domestic dogs, but also to describe the role of the ectoparasites as potential contributors in the transmission and maintenance of neglected tropical parasites in southeastern Mexico.

**Materials and Methods**

Dogs in this report were part of a larger study to identify the presence of blood zoonotic parasites at several localities in Tabasco State. Samples were collected between May and June 2015. Geographical characteristics of Tabasco State are average elevation of 10 m above sea level, tropical climate with rain falling year around (~2,550 mm), and average annual temperature of 26°C (INEGI 2015). Fig. 1 shows the localities where lice were collected. All the animals inspected were handled according to bioethics standards used in small animal practices. The study was approved by the Bioethics Committee at the Universidad Juárez Autónoma de Tabasco (N° 175/DACA).
Fig. 1. Localities where infested dogs with lice were found.
Dogs were visually examined in cranial-caudal and dorsal-ventral directions. A fine-toothed comb (flea comb) was used to remove ectoparasites onto a white paper strip. Lice on the paper strips were placed into transparent rigid plastic containers. The containers were transported carefully to maintain integrity of the lice bodies for further taxonomic classification. Specimens were frozen at -20°C.

Lice were identified using reported descriptions and taxonomic keys (Price and Graham 1997, Sultan and Khalafalla 2014, Venzal et al. 2012). Lice were viewed and photographed at 30X with the aid of a stereomicroscope (Carl Zeiss Microlmaging GmbH™ Jena, Germany) coupled to a digital camera (Scope Photo 3.1™ software).

Results

In total, 337 dogs were examined as part of this study to identify the presence of zoonotic blood-borne parasites in Tabasco State. Six dogs were positive for chewing lice. *H. spiniger* was present in the six dogs and *H. spiniger* and *T. canis* co-infested one dog; therefore, six infested dogs (100%) were positive for *H. spiniger* and one (17%) for *T. canis* (Table 1). Characteristic signs in the infested dogs were mild clinical manifestations such as dermatitis and slight presence of pyoderma; no clinical signs associated with severe dermatitis were observed during collection of ectoparasites. Infestation by lice was more frequent in male (83%) than female dogs (17%). The presence of lice was not related to fur color or thickness. Of the 27 arthropods collected from the six dogs, 23 chewing lice were classified as *H. spiniger* (85.1%), and four were *T. canis* (14.9%). Further analysis of the bodies of ectoparasites revealed that all specimens collected were adults. Sexual differences in parasites were recorded, with 14 females (60%) and nine males (40%). All four *T. canis* found were females.

<table>
<thead>
<tr>
<th>N°</th>
<th>Site</th>
<th>Sex</th>
<th>Age (years)</th>
<th>Hair color</th>
<th>Hair size</th>
<th>Breed</th>
<th>Ectoparasite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V</td>
<td>Male</td>
<td>4</td>
<td>White</td>
<td>Short</td>
<td>Mix</td>
<td><em>H. spiniger</em> (n=4)</td>
</tr>
<tr>
<td>2</td>
<td>IGGC</td>
<td>Male</td>
<td>3</td>
<td>Tawny</td>
<td>Short</td>
<td>Mix</td>
<td><em>H. spiniger</em> (n=3)</td>
</tr>
<tr>
<td>3</td>
<td>IGGC</td>
<td>Female</td>
<td>7</td>
<td>White</td>
<td>Large</td>
<td>Mix</td>
<td><em>H. spiniger</em> (n=6)</td>
</tr>
<tr>
<td>4</td>
<td>IAC</td>
<td>Male</td>
<td>5</td>
<td>Tawny</td>
<td>Short</td>
<td>Mix</td>
<td><em>H. spiniger</em> (n=3)</td>
</tr>
<tr>
<td>5</td>
<td>IAC</td>
<td>Male</td>
<td>7</td>
<td>Black</td>
<td>Short</td>
<td>Mix</td>
<td><em>H. spiniger</em> (n=3)</td>
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<tr>
<td>6</td>
<td>IAC</td>
<td>Male</td>
<td>4</td>
<td>White</td>
<td>Short</td>
<td>Mix</td>
<td><em>H. spiniger</em> (n=4)</td>
</tr>
</tbody>
</table>


Lice were observed with the aid of a stereomicroscope and identified by using previous descriptions (Price and Graham 1997, Venzal et al. 2012, Sultan and Khalafalla 2014). The main features observed on *H. spiniger* specimens were the subtriangular head with amber to brown color (Fig. 2A and B), rounded anterior margin, and slightly concave posterior margin. Post-palpal processes, characteristic of the family *Boopiiidae*, were present on the ventral side of the head immediately behind the maxillary palps (Fig. 2C). Maxillary palps were long and
slender; in contrast, the antennae were relatively short. The thorax was considerably longer than wide, while the head was wider than long. The abdomen was long and oval. Sexes of *H. spiniger* can be distinguished easily. In the male, the end of the abdomen was rounded, and in the female, the end of the abdomen was lobulated. Prominent male genitalia incorporating chitinized copulatory appendages further distinguished the sexes.

The *T. canis* head is flattened, somewhat quadrangular, and wider than long; it possesses short, thick antennae with three segments. The mouthparts include a pair of mandibles lacking maxillary palps. There is a single claw on each tarsus. Adults are yellowish with dark markings and 1 to 2 mm long (Fig. 3).

Dogs infested by lice were treated for ethical consideration and promotion of animal welfare with one single dose of a combination of ivermectin at 300 μg/kg SC and fipronil at 9.7% (Fiprosol Spot On, Pet’s Pharma™ de Mexico, Netzahualtcoyotl, Estado de Mexico, Mexico).

**Discussion**

As part of surveillance for blood-borne pathogens in Tabasco State, Mexico, we recorded two species of lice that impact animal and human health. To the best of our knowledge, this is the first report of *H. spiniger* and *T. canis* in domestic dogs from Tabasco, southeastern, Mexico. *H. spiniger* was previously reported in several countries of the American Continent. The reports were from Venezuela (Vogelsang 1954), Chile (González-Acuña et al. 2005), Brazil (Dantas-Torres and Figueredo 2007, Dantas-Torres et al. 2009), Panama (Bermúdez and Miranda 2011), Costa Rica (Troyo et al. 2012), and Uruguay (Venzal et al. 2012).
Fig. 3. Female *T. canis*. A) Dorsal surface showing a head flattened, somewhat quadrangular, and wider than long. B) Ventral surface showing three antennal segments that extend laterally from head, a single claw at each tarsus, and long abdominal bristles arranged in single transverse rows on the ventral abdomen (at 30X magnification).

Previous studies showed variable prevalence for *H. spiniger*; the least prevalence in the studies were in Brazil and Malaysia (1.9%), and the greatest prevalence (22%) was in Egypt (Dantas-Torres and Aguiar-Figuereido 2007, Dantas-Torres et al. 2009, Norhidayu et al. 2012, Sultan and Khalafalla 2014). *T. canis* has previously been reported in dogs from several countries of Asia, Europe, and America, showing a variable range of prevalence from 1% in Korea (Chee et al. 2008) and Albania (Xhaxhiu et al. 2009), to 6% in dogs from Panama (Bermúdez and Miranda 2011) and Costa Rica (Troyo et al. 2012). Compared to previous reports, we detected low prevalence (1.8%) of both lice.

Variation in prevalence depends on several factors such as characteristics of the property where the dog was maintained as well as the care dogs received from their owners. Also important were close contact with free-ranging animals, weather conditions, and treatment for parasites. Reports by (Dantas-Torres and Otranto 2014, Torres-Chable et al. 2015) discussed the importance of cultural and social
conditions related to people living in poverty, resulting in inappropriate care of pets and few visits to veterinarians. During this survey, most dogs infested by lice belonged to people with low incomes, never visited a veterinarian, lived where humans and animals were overcrowded, and had free access to public streets. This last fact enabled close contact with local fauna that could be an important source of ectoparasites to infest domestic dogs.

Despite this being the first report of chewing lice infesting dogs in Mexico, we think lice might have been introduced into the country long ago, but lack of interest in studying the arthropods might have resulted in scarcity of previous reports. Lack of study caused a gap in knowledge of more detailed information in introduction and dissemination of chewing lice in Mexico and particularly in Tabasco State. Presumably, continuous contact of domestic animals with stray dogs could favor exchange of ectoparasites and different species of lice. It is arguable that the presence of these species of lice on the American Continent is related to human activities such as traveling to endemic areas or introducing unregulated pets from endemic countries as the main ways the lice were introduced into Mexico.

The main importance of this report is the fact that *H. spiniger* and *T. canis* are important participants in the cycle of the main zoonotic parasites, playing a major role in their transmission and maintenance. Both chewing lice have been described as intermediate hosts of *D. caninum* and *A. reconditum*. The two parasites have previously been associated with infection of dogs at Tabasco, Mexico (Torres-Chable et al. 2012, Torres-Chable et al. 2015). This information is relevant for public health, because the owners of dogs and domicile inhabitants such as infants or immunocompromised people in close contact with infested pets might be infected by accidentally ingesting a louse parasitized with a *D. caninum* cysticercoid. *D. caninum*, a tapeworm naturally found in dogs is capable of affecting humans, causing severe gastrointestinal disorders such as anal itching, diarrhea, vomiting, and recurrent abdominal pain (Narasimham et al. 2013). Another possibility of acquiring an important zoonotic parasite can occur when a person accidentally ingests a louse parasitized by *A. reconditum* (third larval stage) which is a filarial nematode capable of producing severe debilitating disease because of its ability to affect subcutaneous and subconjuntival tissues of human eyes.

Lice must be eliminated in domiciled dogs to improve sanitation of pets and directly prevent the likelihood of infection of humans in high-risk areas of Mexico. The presence of the lice in canines from southern Mexico implicates the generation of epidemiological surveillance related to dissemination of lice in canine and feline populations. But, most importantly, lice must be studied further for their implications as vectors of neglected tropical diseases in Mexico.

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