Gayana 82(1): 94-97, 2018.
Short Communication
ISSN 0717-652X

Ectoparasites of the endemic rodent *Abrocoma bennetti* (Hystricomorpha: Abrocomidae) from semiarid Chile

Ectoparásitos del roedor endémico *Abrocoma bennetti* (Hystricomorpha: Abrocomidae) en Chile semiárido

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ABSTRACT

A total of 13 individuals of the rodent *Abrocoma bennetti* were captured and 354 ectoparasites belonging to 10 different species were collected and analyzed. The most abundant species was the Phthiraptera *Monogyropus longus* (61.54%), followed by the Siphonaptera *Neotyphloceras chilensis* (38.46%). In this study *Gyropus distinctus* (15.38%) is reported as new record for *A. bennetti*, previously described for *Octodon degus*, a rodent usually living in sympatry with *A. bennetti.* For the first time the flea *Delostichus smiti*, and the mites *Ornithonyssus* sp. and *Androlaelaps fahrenholzi* are recorded in this rodent species.

RESUMEN

Se capturó un total de 13 individuos del roedor *Abrocoma bennetti* y 354 ectoparásitos de 10 especies diferentes fueron recolectados y analizados. La especie más abundante fue el phthiraptero *Monogyropus longus* (61,54%), seguido por el sifonáptero *Neotyphloceras chilensis* (38,46%). En este estudio *Gyropus distinctus* (15,38%) es reportado como nuevo registro para *A. bennetti*, descrito previamente en *Octodon degus*, un roedor que usualmente vive en simpatría con *A. bennetti.* Se registran por primera vez la pulga *Delostichus smiti* y los ácaros *Ornithonyssus* sp. y *Androlaelaps farhenholzi* en esta especie de roedor.

The Bennett's Chinchilla Rat or *Abrocoma bennetti* Waterhouse 1837 is a medium-sized endemic rodent, widely distributed in Chile, from Copiapó Valley (27º18'S, 70º29'W) to Biobío River (36°49'S, 73°10'W) and from sea level up to 2000 masl (Muñoz-Pedreros & Gil 2009). Its parasitic fauna as well as other biological interactions are scarcely reported in the literature, probably due to its low abundance with high variability among years. Some few reports have documented the presence of five lice species: *Monogyropus longus* Ewing 1924*, Phtheiropoios pearsoni* Werneck 1948, *Eulinognatus chilensis* Gómez 1998*, Abrocomophaga chilensis* Emerson and Price 1976*, Abrocomaphthirus hoplai* Durden and Webb 1999 (Ewing 1924; Gómez 1998; Moreno *et al.* 2005); two ticks: *Ixodes abrocomae* Lahille 1916 and *I. sigelos* Keirans, Clifford and Corwin 1976 (González-Acuña *et al*. 2004), and eight fleas: *Tetrapsyllus tantillus* (Jordan & Rothschild 1923)*, T. corfidii* (Rothschild 1904)*, Delostichus coxalis* (Rothschild 1909)*, D. degus* Beaucournu, Moreno and González-Acuña 2011, *Ectinorus chilensis* Lewis 1976, *E. cocyti* (Rothschild 1904)*, Neotyphloceras chilensis* Jordan 1936 and *Hectopsylla gemina* Jordan 1939 (Beaucournu *et al.* 2014). There are not recorded mites. However, these evidences are fragmented in space and time, and they are entirely circumscribed to instantaneous recordings. In this study, we characterized the ectoparasitic fauna of *A. bennetti,* an endemic rodent, in a protected area for five consecutive summers.

This study was carried out in Las Chinchillas National Reserve (31°28'S 71°03'W; Coquimbo Region), immersed in a semiarid-Mediterranean ecosystem with fluctuating temperatures between 15° and 30°C. Vegetation is mainly dominated by cactaceae on north face slopes, and shrubs on south face slopes, giving refuge to endemic small mammal species (Cortés *et al*. 1994). *Abrocoma bennetti* collection was carried out in five consecutive years (2009 - 2013) during the summer (January). To this end, specimens were collected

using folding wire mesh live-animal-traps (trap dimension: 24 cm × 8 cm × 9 cm; FORMA: Products and Services, Santiago, Chile) baited with rolled oats and equipped with cotton bedding. Traps were set on three locations within the reserve using two parallel linear transects (except in 2009 when only one location was sampled). Each transect consisted of 50 traps set 10 m apart, with the same distance between lines. Collection was carried out during five nights from 19:00 to 09:00 h. Captured rodents were weighed, measured, sexed and ear-tagged under short-term isoflurane anaesthesia. Their ectoparasites were collected by strongly brushing against hair above a white surface and placed them in individual vials with 70% alcohol. After recovering from anesthesia, specimens were released at the capture point. All manipulations were performed following the three Rs proposed by Goldberg (2010) and authorized by the Ethical Committee of Facultad de Ciencias (Universidad de Chile), the Chilean Agriculture and Livestock Bureau (SAG), and the Chilean National Forestry Corporation (CONAF).

In the laboratory, samples were prepared by conventional techniques and mounted on glass slides in Canada balsam for fleas and lice, and in Berlese for mites. Each sample was observed through classical microscopy and taxonomically determined following bibliographic material, keys and descriptions (Ewing 1924; Lewis 1976; Price & Timm 2000; Castro & Cicchino 2002; Krantz & Walter 2009; Sánchez *et al*. 2012) and collections from Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile.

With this information prevalence was calculated (P: number of individuals of a host species infected with a particular parasite species/number of hosts examined ×100), frequency (F: number of infected hosts), mean intensity (MI: total number of individuals from a particular parasite species in a sample of a host species/number of infected individual from host species in the sample), and mean abundance (MA: number of isolated parasite /total number of hosts analyzed) from ectoparasite species collected. The confidence intervals were calculated with bootstrap (5000 replicates). We used the free access software R project 3.0.2 (R Development Core Team 2009).

During the sampling period (2009 and 2013) a total of 13 individuals of *A. bennetti* were captured and processed. Overall, 354 ectoparasites were collected, mounted and identified, and they belonged to 10 species: three lice (Phthiraptera), five fleas (Siphonaptera) and two mites (Mesostigmata) (Table 1). No ticks were collected. Total prevalence was 84.6%. The lice *M. longus* was the most prevalent and abundant ectoparasite (P = 61.53%, MA = 18.38), followed by the flea *Neotyphloceras chilensis* (P = 38.46%, MA = 1.15).

Monogyropus longus and *A. chilensis* had been previously described in association with *A. bennetti* (Ewing 1924; Emerson & Price 1976; Valim 2010). However, *Gyropus distinctus* Castro & Cicchino 2002 had been recorded only for the rodents *Octodon degus* Molina 1782 and *O. lunatus* Osgood 1943 (Castro & Cicchino 2002). Therefore, this finding in *A. bennetti* is a new record. This new association could be a secondary infestation from *O. degus* to *A. bennetti*, since they share similar habitats, but we cannot discard this could be a first step for a new parasite-host interaction or simply a rare interaction.

Regarding fleas, five species were reported (Table 1). All species reported in this study, except for *D. smiti*, had been previously reported in *A. bennetti*. *Delostichus smiti* had been isolated from *O. degus* and *A. longipilis*, rodents with which *A. bennetti* shares habitat. This flea has low specificity with respect to their hosts, and the presence in

Table 1. Ectoparasites collected from *Abrocoma bennetti*. N: total parasites; F: number of infected hosts, P: percentage of infected host, MI: mean intensity, MA: mean abundance, CI: confidence interval. / Ectoparásitos colectados desde *Abrocoma bennetti*. N: parásitos totales; F: numero de hospedadores infectados; P: porcentaje de hospedadores infectados; MI: intensidad media; MA: abundancia media; CI: intervalo de confianza.

Ectoparasite	N	F	P	MI (CI)	MA (CI)
Phthiraptera					
Monogyropus longus	239	8	61.54	29.87 (13.25-47.12)	18.34 (5.9-32.76)
Gyropus distinctus	10	2	15.38	5 (1-9)	0.76 (0-2.15)
Abrocomophaga chilensis	13	4	30.76	3.25 (1.75-4.5)	1 (0.15-2.00)
Siphonaptera					
Neotyphloceras chilensis	15	5	38.46 (1.2-4.8)	3 (1.2-4.8)	1.15 (0.23-2.31)
Delostichus smiti	22	4	30.77	5.5 (1.6-9.4)	1.69 (0.15-4.07)
Tetrapsyllus corfidii	15	3	23.08	5 (1-7)	1.15 (0-2.77)
Ectinorus chilensis	10	3	23.08	3.33 (1-8)	0.5 (0-2.08)
Hectopsylla gemina	2	1	7.69	2	0.15
Mesostigmata					
Ornithonyssus sp.	1	1	7.69	1	0.07
Androlaelaps fahrenholzi	1	1	7.69	1	0.07

A. bennetti could be a secondary infestation. *Delostichus smiti* would correspond to a new parasitic host association. The other species found had been recorded in some of the rodents living in sympatry with *A. bennetti* (e.g., *O. degus, A. longipilis, A. olivaceus* and *P. darwini*) (Beaucornu *et al*. 2014). *Octodon degus* is the rodent that shared the largest number of flea species (4 of the 5 found) with *A. bennetti*, which could be explained because these species share burrows, which would facilitate the parasite transmission between these two species (Fulk 1976).

Androlaelaps fahrenholzi Fonseca 1959 had been recorded on mammals of the orders Rodentia, Didelphimorphia, Microbiotheria, Xenarthra and Chiroptera (Till 1963; Tipton *et al*. 1966; Furman 1972; Lareschi & Mauri 1998). In Chile, it has been reported in the marsupial *Thylamys elegans* from Las Chinchillas National Reserve (Plaza 2013) and the rodents *Eligmodontia puerulus*, *Phyllotis xanthopygus* and *Phyllotis darwini* (Silva de la Fuente 2014). *Tylamys elegans* and *P. darwini* live in sympatry with *A. bennetti*, and the finding of *A. fahrenholzi* reflects some degree of interaction between them. Whereas *Ornithonyssus* is a cosmopolitan mite associated with rodents such as *Mus musculus*, *Rattus norvegicus* and *R. rattus* (Baumstark *et al*. 2007). Likewise, the presence of *Ornithonyssus* and *A. fahrenholzi* mites represents a new record.

Abrocoma bennetti shares 50% of the parasite assemblage with *O. degus*, but only 20% with other sympatric species (Beaucornu *et al*. 2014). This result could be explained due to the phylogenetic closeness between *A. bennetti* and *O. degus* (Blanga-Kanfi *et al*. 2009). However, it should also be considered that these species can share burrows and nests, which favors parasite transfer (Fulk 1976).

The high ectoparasite prevalence detected in *A. bennetti* (84.6%) could be explained by their gregarious behavior; therefore, ectoparasite exchange between hosts would be facilitated by direct contact. *Abrocoma bennetti* collection was carried out during the mating period of this species (Muñoz-Pedreros & Gil 2009), an energetically demanding time, hence the high overall prevalence detected (mostly lice) may be explained, at least in part, by sampling bias. In fact, it has been described that immunocompromised animals and/or with low body condition would be more susceptible to infestation by ectoparasites, more specifically with lice, which complete their life cycle on the host, unlike fleas that are not tightly associated to host's condition. Therefore, it is necessary to conduct studies in other seasons to examine the assembly stability and to complete the taxonomic catalog of ectoparasites from small mammal species.

ACKNOWLEDGEMENTS

We thank C. Silva de la Fuente for her help with mite species and Dr. A. Cicchino for louse processing. FONDECYT 11090086, 1170367 and 11150875 provided funds for this study. AYM was supported by a CONICYT-Scholarship for Master's studies.

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Recibido: 12.04.2018
Aceptado: 28.05.2018