5.9. Ectoparasites

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Abstract

Although the importance of disease in the regulation of wildlife populations is well recognized and outbreaks of disease have been implicated in the decline or extinction of endangered species (Viggers *et al.*, 1993), there is a paucity of data about the prevalence and impact of pathogens and parasites on wildlife. This paper reports the preliminary findings regarding the ectoparasites of the woylie and sympatric species. New host records for two fleas are noted. A tick found on a number of woylies and one koomal appears to be a new species of *Ixodes.* Further work planned will examine host-parasite dynamics and some of the potentially pathogenic organisms carried by the ectoparasites such as trypanosomes and *Rickettsia*.

5.9.1. Introduction

Ectoparasites can have a variety of detrimental effects on host survival or fecundity through such diverse mechanisms as blood and energy loss (Khokhlova *et al.*, 2002), indirect changes to aspects of behaviour such as territoriality and territory size (Hoodless *et al.*, 2002; Whiteman and Parker, 2004) and the transmission of pathogens such as trypanosomes (Hamilton et. al., 2005, Laaakonen *et al.*, 2002) and *Rickettsia*. This project aims to describe the biodiversity of the ectoparasites of woylies and sympatric species, some features of the host-parasite relationship and investigate some of the pathogens they act as vectors for. This research is done within the context of understanding what role ectoparasites might play in the recent woylie declines.

5.9.2. Methods

Ectoparasites were collected from woylies and other mammals trapped in Western Australia as part of the Woylie Conservation Research Project. The sampling regime covered different seasons and habitat types. Ectoparasite burden was recorded by type (fleas, ticks, lice, mites). Small numbers of parasites were counted exactly and numbers of more abundant ectoparasites recorded semi-quantitatively using an ordinal scale. Ectoparasites were collected directly from animals into plain vials, which were transported chilled to Murdoch for live processing before fixing in 70% alcohol. Handling bags were shaken out between animals to reduce the possibility of mobile ectoparasites moving between animals. In later trapping sessions the technique was altered to include the use of a cotton liner bag where hessian handling bags are used so as to reduce the risk of transfer of ectoparasites.

5.9.3. Results

The fleas and ticks from a total of 103 animals have been examined and are detailed in Table 5.9.1. Two woylies had two species of flea; all other records were of single-species infestations of fleas and/or ticks. Most samples examined to date have come from woylies (*Bettongia penicillata ogilbyi*). A small number of samples from chuditch (*Dasyuris geoffroii*), quenda (*Isoodon obesulus*) and koomals (*Trichosurus vulpecula*) have also been examined. The flea species identified using a key from Dunnet and Mardon (1974) have been *Echidnophaga myrmecobii, Stephanocircus dasyuri and Pygiopsylla hilli.* The records of *E. myrmecobii* on one woylie and *S. dasyuri* on the koomal are new host records. Tick samples have been dominated by an *Ixodes* tick that appears not to have been described before; as well as *Ixodes tasmani, I. australiensis and I. myrmecobii.* The reference used for tick identification is Roberts (1970). Ectoparasite host records have been checked at the Australian Faunal Directory (ABRS, 2007) online.

Tables 5.9.2 and 5.9.3 list the locations of the ectoparasite samples examined to date for woylies and koomals.

Table 5.9.1. Ectoparasite list by host.

Ectoparasite species	Number of hosts with ectoparasites			
	Bettongia penicillata	*Isoodon obesulus*	*Trichosurus vulpecula*	*Dasyurus geoffroii*
Siphonaptera				
Pulicidae				
*Echidnophaga myrmecobii (*Rothschild, 1909)	1*	1	16	2
Stephanocircidae				
*Stephanocircus dasyuri (*Skuse, 1893)	21	0	1*	1
Pygiopsyllidae				
*Pygiopsylla hilli (*Rothschild, 1904)	42	0	0	0
Arachnida				
Ixodidae				
Ixodes tasmani (Neumann, 1899)	0	0	3	0
Ixodes australiensis (Neumann, 1904)	2	0	0	0
Ixodes myrmecobii (Roberts, 1962)	2	0	0	0
Ixodes spp (new)	14	0	1	0

(*represents new host record)

Table 5.9.2. Ectoparasites by location and number of animals (n) in koomals.

Site	Ectoparasite species
Balban	*Echidnophaga myrmecobii (1), Ixodes tasmani (1)*
Corbal	*Stephanocircus dasyuri (1)*
Boyicup	*Echidnophaga myrmecobii (1)*
Chariup	*Echidnophaga myrmecobii (2)*
Keninup	*Echidnophaga myrmecobii (1)*
Yendicup	*Echidnophaga myrmecobii (1)*

Table 5.9.3. Ectoparasites by location and number of animals (n) in woylies.

Site	Ectoparasite species
Balban	*Stephanocircus dasyuri (3), Pygiopsylla hilli (11), Ixodes spp (2),*
Boyicup	*Stephanocircus dasyuri (1)*
Chariup	*Stephanocircus dasyuri (1)*
Keninup	*Stephanocircus dasyuri (15), Pygiopsylla hilli (20), Ixodes spp (12))*
Warrup	*Pygiopsylla hilli (5)*
Yendicup	*Stephanocircus dasyuri (1), Echidnophaga myrmecobii (1)*
Winnejup	*Pygiopsylla hilli (1)*
Karakamia	*Ixodes spp (3)*

5.9.4. Discussion

This study has added to the host records for a number of ectoparasite species. The helmeted flea *Stephanocircus dasyuri* has been described from more than 30 mammal species in Australia; mostly small marsupials. It has been recorded on *Bettongia penicillata* in WA and *Isoodon obesulus*, *Dasyurus and Pseudocheirus* species in eastern Australia (Dunnett and Mardon, 1974) but not to our knowledge in *Trichosurus vulpecula*. The sampling of mobile ectoparasites contains potential error where handling bags are re-used between animals and traps are re-used day after day. Examination of the trapping records showed that all previous animals handled that day and trapped in that location during the trapping session were koomals therefore it is unlikely that this new host record reflects transference; rather that is indeed a new host record. Alteration to the trapping technique have included the use of a cotton liner bag where Hessian handling bags are used and a careful examination and shaking out of handling bags between animals to reduce transference of ectoparasites.

The stickfast flea *Echidnophaga myrmecobii* has a wide range of hosts in Australia including *Bettongia lesueur* from Kojonup in 1904 (Dunnett and Mardon, 1974) *Trichosurus vulpecula* (Viggers and Spratt, 1995), rodents and the European fox but not *Bettongia penicillata*. In contrast, *Pygiopsylla hilli* is confined to coastal southwestern WA and has been described from two hosts: *Bettongia penicillata* and the ngwayir, *Pseudocheirus occidentalis (*Dunnet and Mardon, 1974).

Using the tick key developed by Roberts (1970) the unidentified *Ixodes* tick keys out as *Ixodes victoriensis,* however it differs in several features from this tick in particular in the shape of the scutum, and *I victoriensis* has only been described from wombats in eastern Australia. The tick has armed (spurred) coxae and the enlarged first palp typical of female ticks of the endopalpiger subfamily. Work on identification has commenced. Of the other ticks to date, *Ixodes tasmani* is common and widespread across Australia, especially on Phalangeridae and dasyurids; *Ixodes australiensis* is described from hosts in Tasmania and southwest WA including *Bettongia* and *Ixodes myrmecobii* has been only been recorded from southwest WA, in domestic animals and *Bettongia penicillata.*

5.9.5. Future work

Several hundred specimens, including lice and mites, await identification to species level. Arrangements have been made to collect additional samples from populations in Karakamia, Dryandra, Batalling and South Australia to allow a more thorough description of ectoparasite biodiversity in the woylie and its co-habiting species. Ectoparasite burden is linked to negative effects on host fecundity, health and survival in many species of animals and birds and data from this project will be used to examine features of the host-parasite relationship in the woylie.

The pathogenicity of most haemoparasites of Australian mammals is not known (Clark, 2004), nor is the prevalence and impact of many other infectious agents. Many pathogens which have little or no effect on healthy animals in their normal host species may cause disease in individuals which are immunocompromised or stressed in some other fashion, and may have dramatic and devastating effects on naive populations. Trypanosomes and *Rickettsia* are both transmitted by ectoparasites and are proposed as the initial focus of interest as some species are pathogenic when they move beyond their normal host species or cause zoonosis (Graves *et al.*, 2006; Laakonen, 2002). Some of the authors are involved in a project examining the parasite fauna of a range of small mammals across the State. Trypanosomes have recently been detected in woylies in Karakamia as part of this sampling (unpublished data) and molecular characterisation has commenced. Further sampling will be necessary to elucidate the prevalence and nature of *Rickettsia* and trypanosomes in woylies and sympatric species before any role they may have had in the woylie decline is elucidated. DNA will be extracted from a variety of ectoparasites to examine for the presence of trypanosomes and *Rickettsia* to explore their modes of transmission.

5.9.6. Conclusion

Relatively little is known about the ectoparasite fauna of mammals in Western Australia and their potential to act as vectors of disease. The ectoparasite identification keys used were published more than 30 years ago and tend to reflect a sampling bias towards eastern Australia: (for example *Pygiopsylla hilli* was previously described from only 5 specimens collected from woylies and ngwayir in southwest WA). Host records are reflective of effort by researchers and the large

numbers of ectoparasite samples being collected make it likely that further new species of ectoparasites will be found and host records expanded. Information on ectoparasite biodiversity can help predict spread of novel vector-borne diseases including zoonosis, and can aid in translocation and reintroduction programs in animals such as woylies.

An examination of any role that disease may have had in the woylie decline is likely to unearth new infectious agents as relatively little is known about the pathogens of Australian mammals. An important first step is to survey for potentially pathogenic organisms in woylies and other mammals that share their environment to which end work on trypanosomes and *Rickettsia* has commenced.

5.9.7. Acknowledgments

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5.9.8. References

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