SHORT COMMUNICATION

The reinfestation of forest rats (*Maxomys musschenbroekii*) by epifaunistic arthropods in Sulawesi, Indonesia

LANCE A. DURDEN

Department of Cell Biology, Vanderbilt University School of Medicine, Nashville, Tennessee 37232, USA

KEY WORDS: ectoparasites, rats, reinfestations, Sulawesi.

Complete removal of arthropods epifaunistic on individual mammals with subsequent monitoring of host recolonization by arthropods has not previously been documented for rodents in primary tropical rain forest. As part of a survey of the ectoparasites and other arthropod associates of small mammals in the primary lowland tropical rain forests of Tamoa-Bone National Park, Sulawesi Utara, Indonesia in February/March 1985, some data were accumulated on arthropod reinfestations on cleaned, marked, recaptured *Maxomys musschenbroekii* (Jentink) forest rats.

*Maxomys musschenbroekii* is a fairly common murid rodent endemic to Sulawesi and occurring naturally from lowlands to mountain peaks (Musser 1981, Musser et al. 1979). This species was the most frequently trapped mammal in the present study and was recorded at all elevations surveyed (c. 220 m to c. 1300 m), although present data are from lowland forests between c. 220 m and c. 260 m. Rats were live-trapped using coconut and some forest fruits/nuts as bait; traps were set continuously but all *M. musschenbroekii* were taken when traps were checked in the early morning showing that this species is primarily nocturnal. Trapped individuals were processed immediately (in the forest) for epifauna removal, initially by ether anesthesia (in a polythene bag) and subsequently by prolonged systematic ketamine hydrochloride anesthesia. Arthropods (and their eggs, if present) from bags and examination trays were combined with those from meticulous pelage searches for each capture and stored in 70% ethanol prior to microscopical examination for group designation. All *M. musschenbroekii* individuals were ear and/or toe clipped for future identification and released at their capture site following full recovery from
anaesthesia. Recaptured individuals were administered anaesthesia and cleaned of arthropods in a similar manner.

Twenty-two *M. muschenbroekii* individuals were live-trapped and tugged during this survey. Table 1 shows the status and arthropod infestations by capture date for the three individuals that were recaptured. Arthropods are listed by groups in Table 1 but additional information on the constituents of some of these groups is given here. The Anoplura (sucking lice) are all assignable to a new species of *Hoplopleura* currently being described by the present author. All but one of the tick specimens are larvae belonging to the ixodid genera *Dermacentor* (Indocentor), *Amblyomma* and *Haemaphysalis*; the exception is a nymph of a new species of *Amblyoma* which will be described. Most of the mesostigmatid mites belong to the taxon *Laelaps* (Echinolaelaps); these large mites frequently carried phoretic *Histiostoma* species hypopial anoecid mites (Figure 1), with up to 14 anoecids recorded on a single *Laelaps* (Echinolaelaps) individual. The chigger mites all belong to a new species of *Schonthegastia* presently being described by Goff, Durden & Whitaker, and the listrophoroid mites are mainly *Listrophoroides kinabaluensis* Fain (Atopomeiidae), although a few *Afrolistrophorus maculatus* Fain (Listrophoroidae) are also present.

Table 1 shows that the numbers of fleas, mesostigmatid and (phoretic) anoecid mites did not necessarily decrease on successive host captures; indeed in some cases, numbers of these arthropods were higher on subsequent catches. Similar data have been presented by Evans & Freeman (1950), Glicken & Schwab (1980), Ryckman (1971) and Schwan (1975, 1984) for fleas and by Glicken & Schwab (1980) for mesostigmatid mites on temperate small mammals. Clearly, for these arthropods there is a focus visited fairly frequently by the hosts. The nest sites (and burrows to some extent) of many small mammals have previously been shown to harbour quite large epilithic arthropod populations, so these, almost certainly, are the source for repeated host infestations. Only the permanent ectoparasites will endeavour to remain attached to the host indefinitely while many other arthropods are true nidicoles and rarely attach. Between these two extremes are many (especially some fleas and mites) which normally spend some of their time on the host and some associated with its nest; the amount of time typically allocated to host versus nest will vary with the arthropod groups and species (and has been shown to be influenced by meteorological conditions in some cases).

Sucking lice are permanent ectoparasites and, barring accidental dislodgement from the host, are never found detached in the nest. It is not surprising therefore that Anoplura were not recorded as reinfesting cleaned hosts on subsequent captures in this survey; Glicken & Schwab (1980) recorded a similar situation for sucking lice on deer mice. However, the transfer of lice from one host to another in the field can be frequent (Durden 1983), so louse populations could ultimately reappear on cleaned hosts. Listrophoroid fur mites are also permanent ectoparasites but, contrary to the sucking lice, some reinfestations appeared to occur. These mites (and their ova) are quite small and, although the data obtained here could be explained in a number of ways, it is possible that mite/egg removal may not have been total during the cleaning process.

The life cycles of chiggers and ixodid ticks include free-living stages, and egg deposition by gravid adult females is often patchy within a habitat. Aggregations of the immature stages of these arthropods should be distributed more or less randomly (e.g. Drew & Samuel 1985), and infestation of each host individual should depend largely on chance encounters between the host and these aggregations. Host infestations should predictably be fairly clumped (with respect to numbers on different host individuals) and this indeed appears to best describe the data obtained for these two arthropod groups.

**Acknowledgements**

This paper is based on material collected whilst the author was a participant on Project Wallace, sponsored by the Royal Entomological Society of London and the Indonesian Institute of Sciences (Results of Project Wallace No. 02). I am grateful to the following for identifications: Drs A. Fain (listrophoroid and anoecid mites), M. L. Goff (chiggers), H. Hoogstraal (ticks), G. G. Musser (mammals), J. O. Whitaker, Jr (astigmatismit mites) and N. A. Wilson (mesostigmatid mites). Tim Lempka prepared material for scanning electron microscopy. Adrian Marshall offered comments on an earlier draft of this paper. Research was supported by grant No. 2946-84 from the Committee for Research and Exploration of the National Geographic Society.

**LITERATURE CITED**


SCHWAN, T. G. 1984. Sequential sampling to determine the minimum number of host examinations required to provide a reliable flea (Stenomastus) index. Journal of Medical Entomology 21:670-674.

Accepted 11 April 1986

Figure 1. Scanning electron micrograph of a hypoploid anserid mite (Flausiostoma species) attached phoretically to the posterior shield of a Loxops (Echinolaelaps) species mite. Specimen spattered coated with gold for 30 sec. Scale bar = 5 μm.