Toxic Birds: Defence against Parasites?

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Toxic birds: defence against parasites?

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Recently, three New Guinean passerine birds, all belonging to the genus *Pitohui*, were discovered to be poisonous (Dumbacher et al. 1992). The toxic substance, located primarily in the skin and feathers of the birds, was isolated and identified as homobatrachotoxin, a steroid alkaloid with the ability of depolarizing Na^+ channels, known only from neotropical poison-dart frogs of the genus *Phyllobates*. The exceptional phenomenon of toxicity in *Pitohui* was hypothesized to serve as a chemical defence against predators, such as snakes, raptors and some arboreal marsupials.

As an alternative to this predation explanation, we hypothesize here that the skin/feather toxicity in *Pitohui* functions as a defence against ectoparasites. Support for this parasite-defence hypothesis comes from recent studies, showing that batrachotoxin is poisonous for distantly related orders of insects (Dwivedy 1988, Soderlund et al. 1989). This suggests that batrachotoxin may well be effective against a broad spectrum of ectoparasitic arthropods.

In birds, ectoparasites have been shown to increase the cost of reproduction in terms of time and energy and to decrease fecundity (Duffy 1983, Møller 1993). Hence, selection for genes expressing a high resistance against parasites is to be expected. Consistent with this scenario is the growing evidence that secondary sexual characters in birds reflect their ability to resist parasites, suggesting parasites to be an important evolutionary force in sexual selection (Hamilton and Zuk 1982, Møller 1990). Anti-parasite toxins in skin and feathers will thus provide an obvious fitness advantage, both by direct reduction of the load of ectoparasites, and by reducing the risk of infection by vector-borne pathogens. If so, individual *Pitohui* are expected to communicate the amount of anti-parasitic chemicals in their skin and feathers to potential mates, in order to advertise their ability to resist infestations. The observed sour odour of *Pitohui*, apparently related to the presence of homobatrachotoxin (Dumbacher et al. 1992), could function as such a quantitative as well as an honest signal for parasite repelling properties to potential mates.

One critical test of our parasite-defence hypothesis is to compare the parasite loads among known New Gui-

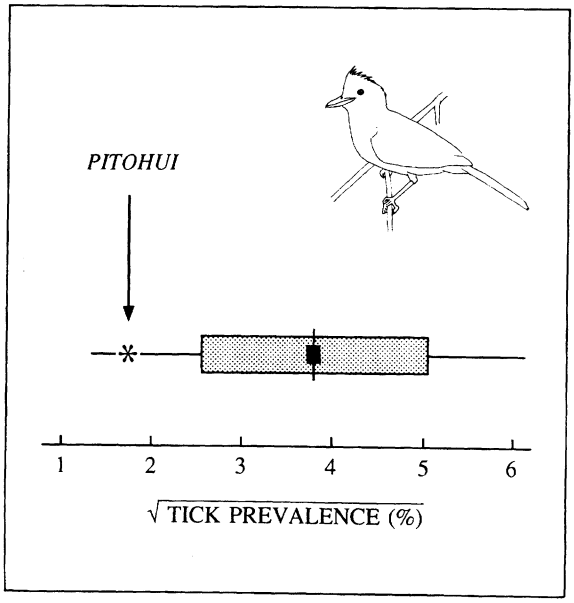

Fig. 1. The mean value (■) of square root transformed prevalence of tick infestation (%) in thirty genera of New Guinean passerine birds. The horizontal bar and line indicate the standard deviation and range, respectively. * denotes the prevalence of ticks in *Pitohui*. Median tick prevalence of untransformed data was 12.6% within the range of 1.7–37.9%. In order to minimize the risk of zero-prevalence due to too few examined birds, passerine genera with less than twenty individuals examined for the presence of ticks were excluded from the analysis. The data on the remaining thirty genera were square root transformed to obtain normalized data.

nean passerine birds, expecting the prevalence of ectoparasites in *Pitohui* to be relatively low. Unfortunately, exhaustive data for verification of this prediction are not available. However, previously reported data on prevalence of ticks (Acarina) in New Guinean passerines (Preutt-Jones and Preutt-Jones 1991), including two species of *Pitohui* (*P. dicrous* which is known to be poisonous, and *P. nigrescens* of unknown status regarding toxicity), may be suggestive. Reexamination of these data clearly demonstrate a low tick prevalence in *Pitohui* in comparison with other genera of passerines (Fig. 1). In fact, *Pitohui* exhibited the second lowest infection rate (3.1%, n = 32) among the thirty passerine genera examined.

As the two explanations are not mutually exclusive, we recommend that both predation and ectoparasites are included in further studies on the functional significance of toxicity in *Pitohui*.

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