Observations on the Monitor Lizard, *Varanus indicus* (Daudin) as a Rat Control Agent on Ifaluk, Western Caroline Islands*

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Two kinds of rats, i.e., roof rat, *Rattus rattus* (L.) and Polynesian rat, *Rattus exulans* (Peale) have become widespread among the islands of the Central and South Pacific. Coconuts are being subjected to extremely heavy rat damage. Not only is there ensuing economic loss, but rat-gnawed coconuts are intensively utilized as larval habitats by mosquitos including vectors of Bancroftian filariasis and dengue. Effective integrated rat control procedures are therefore of pressing importance to the Pacific Islands in general. Such procedures would call for the joint use, against an adequate background of ecological knowledge, of chemical and biological control measures. The latter might well involve the use of predators, and in this connexion it has been reported that *Varanus indicus* (Daudin), a large grey-green monitor lizard which has been introduced into certain Micronesian islands, is of local importance as a rat control agent.

To appraise whether this lizard merits consideration for introduction elsewhere in Micronesia and Polynesia for the purpose of decreasing rat damage to coconuts, the present study was thus undertaken on the atoll of Ifaluk (lat. 07°15′N, long. 144°27′E), Western Caroline Islands. While it was established that the monitor certainly makes some contribution to rat control, it is submitted that the data reported herein do not favour further consideration of an experimental introduction of this predator in the South Pacific area. The reasons for this are firstly, that the rat population density at Ifaluk still remains at least 100 per one hectare in spite of the abundance of monitors throughout the lengthy period (10 to 26 years) since their introduction; secondly, that experiments on these lizards' behaviour against captive rats revealed them to lack positiveness in attacking the latter; thirdly, that analysis of the stomach contents of monitors showed their rate of predation upon rats to be relatively low under natural conditions; and fourthly, that the islanders themselves proved prejudiced against the monitors because of their feeding upon useful animals (especially chickens and crabs) as well as rats.

It is concluded that a better candidate for a field trial against coconut-gnawing rats in the South Pacific would be the Japanese weasel, *Mustela sibirica itatsi* Temminck & Schlegel. Before introducing weasels into the tropics, however, the two following prerequisites must be carefully considered. The first question is whether the weasel is able to adapt itself to the natural features of the tropics. By stopping over in the Ryukyus on my way home from the Carolines, I was

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able to learn a good deal about the effectiveness of the weasels for the biological control of rats, and on the practicability of this procedure under tropical conditions. The southernmost island where a significant degree of rat control has already been achieved by introduction of the weasels, is Zamami-shima Island of the middle Ryukyus (lat. 26°14′N, long. 127°18′E). Since my visit to the Ryukyus in December 1965, the weasels have been introduced into some islands of the southern Ryukyus, i.e., Minami Daito-jima Island (lat. 25°50′N, long. 131°15′E) and Ishigaki-jima Island (lat. 24°25′N, long. 124°10′E), etc.

Even if the weasels prove capable of adapting themselves to tropical areas, a second question remains; this relates to possible harm being done to populations of animals other than rats by the weasels, and it raises issues that must be very carefully considered. There is no doubt that to some extent at least the weasels may make attacks on chickens, land crabs, coconut crabs and wild birds, all of which are useful to islanders as food. It seems quite certain, however, that this weasel is far more effective against rats than are monitors. Attention must therefore be directed to the difference in predatory efficiency between the two animals. The greatest care must, however, be taken for the proper conservation of endemic animals when considering introducing such a predator as a weasel which will be a terminal animal in a certain food chain.

The weighing up of the public health and economic advantages to be gained against possible adverse effects of predator introductions (e.g. attacks upon useful or endemic animals) is of course a matter that would require the most careful prior consideration by the authorities concerned and the islanders themselves. The decision would probably be influenced by the degree of development of the islands in question, and particularly by the local importance of the copra industry and filariasis incidence.

I wish to emphasize the great importance of this field trial in the southern Ryukyus as a preliminary to further experimental introductions elsewhere in the tropics; for perhaps the weasel may ultimately be felt to merit consideration as a candidate for biological control agent for trial in selected isolated oceanic islands of the Pacific.