

# The field rats and field mouse in Malaysia and Southeast Asia

For at least as long as man has attempted to cultivate crops, rats have competed for a share of the products. Five species of field rats have been identified as serious pests of ricefields, oil palm plantations and other field crops in Malaysia.

By Lim Boo Liat

**T**he rice-field rat, the Malayan wood rat, the greater bandicoot, the lesser bandicoot and the rice-field mouse are serious pests of ricefields, oil palm plantations and other field crops in Malaysia. These same five species are distributed throughout Southeast Asia.

The ricefield rat and the Malaysian wood rat used to be treated as subspecies of *Rattus rattus* and were known as *Rattus rattus argentiventer* and *Rattus rattus jalorensis*. They are now recognized as separate species—*Rattus argentiventer* and *Rattus tiomanensis* respectively.

The bandicoots are large ground rats that build extensive burrows. In Malaysia two species occur—they are the greater bandicoot (*Bandicota indica*) and the lesser bandicoot (*B. bengalensis*).

The fifth species is the field mouse (*Mus caroli*) similar to the house mouse (*Mus musculus*) in size.

## The ricefield rat (*Rattus argentiventer*)

A medium sized rat with head and body (HB) 140–220 mm, hindfoot (HF) 35–38 mm, tail (T) 130–220 mm and uniformly dark. Its fur is coarse but not rough. Upperparts (dorsum) olive brown with black hairs intermixed among the brown; underparts (belly) silvery grey with or without a darker streak in the middle. One of the best



The ricefield rat

Photo: Boonsong Lekagul

characters is found in the pads on the soles of the hind feet (HF). Those of *R. argentiventer* are generally smaller and only slightly raised above the surrounding surface and the lamellae on the plantar pads are weakly developed in contrast to those of *R. tiomanicus*. These differences are presumably associated with the original habitats: grassland for *R. argentiventer* and scrub and plantation forest for *R. tiomanicus*. *R. argentiventer* has larger HF and 12 mammary tits.

**Distribution and status:** The ricefield rat is widespread throughout Malaysia and present in all Southeast Asian countries except Singapore where it has yet to be discovered.

**Ecology and habitat:** *R. argentiventer* is confined to grassland and rice fields. Before the 1960s, lalang (*Imperata cylindrica*) fields large and small, and rice fields were common sights





Rice field

**Distribution and status:** Widespread throughout Malaysia. It is also found in Thailand, Indonesia, Philippines and Singapore.

**Ecology and habitat:** Nocturnal and semi-arboreal. On the mainland in Malaysia, this rat is found more in oil palm plantations. It is also found in scattered communities in other habitats ranging from grassland, gardens, orchards to scrub and disturbed secondary forest, but not in primary forest. On some islands (e.g. Pulau Tioman) it ranges from lowland to hill forests. It climbs well and being semi-arboreal spends much of time in trees during the day and on the ground at night. In oil palm plantations it shelters in piles of cut palm fronds and in the crowns of palms. In scrub and woodland forest, its nest is built in holes in tree stumps, fallen logs and in thick bushes. It is omnivorous and its diet generally includes insects, land molluscs, roots, and fruits. It has become a very serious pest in oil palm estates.

**The greater bandicoot (*Bandicota indica*)**

This is a very large rat with HB length 200–350 mm, T 180–290 mm, and dark brown with relatively large scales. HF 40–60 mm, blackish with long whitish claws. Weight (Wt) 350–600 g. Upperparts blackish-brown with long black guard hairs. Underparts dark brownish grey, giving a shaggy appearance. Mammary tits 12.

**Distribution and status:** In Malaysia, this rat was first recorded as pests in rice fields of Kedah and Perlis in 1946. In Southeast Asian countries it is found in Myanmar, Thailand, Vietnam, Laos, Cambodia, Indonesia (Java, Sumatra) and the Philippines. The species was introduced to Southeast Asia from East Asia.

**Ecology and Habitat:** Nocturnal, terrestrial and omnivorous. The natural diet is plant material, insects, earthworms, mollusks and crustaceans. Some individuals have been found with remnants of skeletons, probably tiny lizards,



Grassland

and scales of fish. It builds extensive burrows, leaving piles of earth mounds on the surface. Sometimes, the burrow is occupied by several pairs of adults and young together. Nests have also been found in termite mounds. It has a habit of a hoarder, storing young rice plants and other food materials inside its burrows. It lives near human activity and swims well.

**The lesser bandicoot (*Bandicota bengalensis*)**

This is a medium sized rat with HB 150–210 mm, T 110–160 mm uniformly brownish, HF 34–38 mm brownish, Weight 200–350 g. Upperparts of body brown intermixed with long dark guard hairs, giving a shaggy appearance. Underparts grayish-white to brownish. The mammary tits vary from 12–20, arranged in a continuous row down each side of the body, and not always the same number on each side. The description of this rat is based on specimens collected in Penang island.

**Distribution and status:** In Malaysia, the lesser bandicoot rat is found in Penang island. It is also present in Myanmar, Thailand and Indonesia. The species was introduced into the Southeast Asian countries from East Asia.

**Ecology and habitat:** Nocturnal, terrestrial and omnivorous. In Penang, this rat is associated with human surroundings and is found as an outdoor resident in towns and villages. It is a scavenger like the Norway rat (*Rattus norvegicus*) wherever food is available. It builds an extensive burrow system like the greater bandicoot rat, sometimes with large families living together and it often stores food. It lives outdoors probably because of competition with the common house rat (*Rattus rattus diardii*) which dominates indoors.



Oil palm estate

### **The ricefield mouse (*Mus caroli*)**

This is a tiny mouse with HB 60–85 mm, HF 15–19 mm, T 60–95 mm, Weight 8–15 g. Hairs short and smooth. The tail is bicolored, dark gray above and whitish below. Upperparts of body brownish gray with the underparts whitish. Feet dark gray to whitish. In size and structure, it is similar to the house mouse (*Mus musculus*), but differs by coloration. Mammary tits 10.

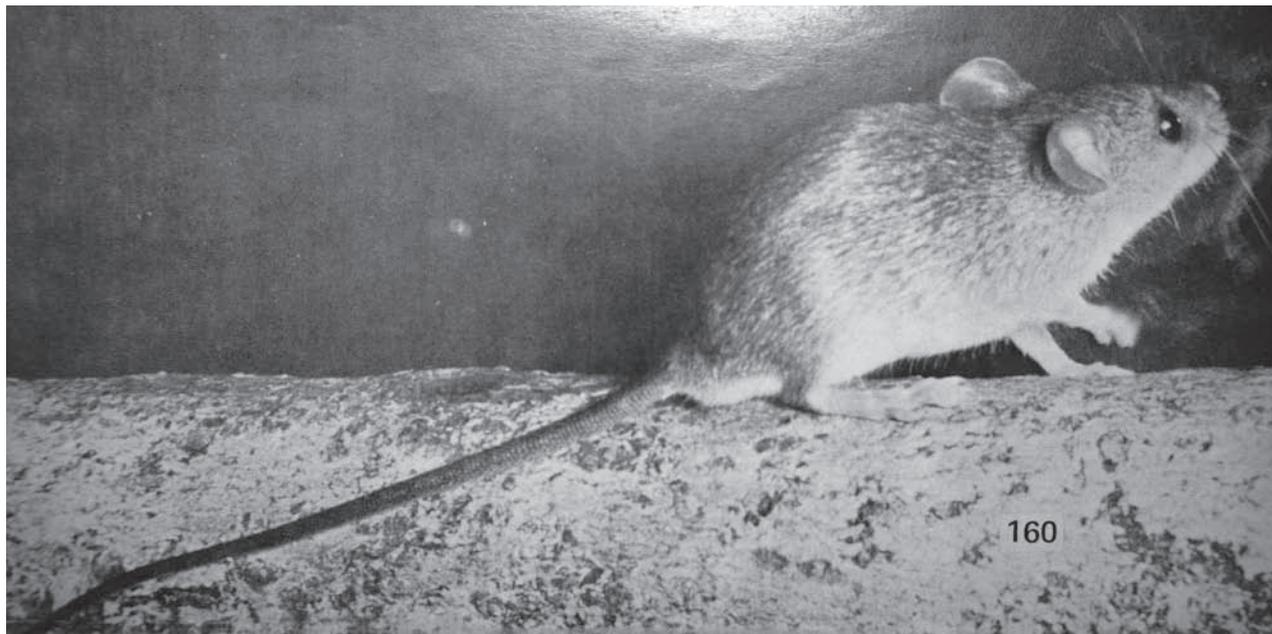
**Distribution and status:** In Malaysia, it is an introduced species found in rice fields in Kedah. Among the Southeast Asian countries, the species is known in Myanmar, Vietnam, Laos, Cambodia, Thailand and Indonesia. The species is common in East Asia.

**Ecology and habitat:** Nocturnal and terrestrial. It inhabits rice fields and grasslands adjacent to rice fields. It digs small holes in mud banks for nests. Its diet is mainly plant material but also includes insects.

### **Reproductive capacity**

In Selangor and Negri Sembilan, in the period 1948–1952, 250 mature females of the ricefield rat and the Malaysian wood rats were examined. Pregnant females made up 14% of the ricefield rat and 12.5% of the Malaysian wood rat. In all quarters of the year, without significant seasonal variation in number. Litter size was 5–8, mean 7 for the ricefield rats, and 4–10, mean 6 for the Malaysian wood rat. Similar to the house rats (*Rattus rattus diardii*, *R. norvegicus*, *R. exulans*) sexual maturity of young ricefield and Malaysian wood rat is reached in about 90 days of age, and the rats are reproductive by the fourth month. Studies by Harrison indicated a mean length of life in the wild for *R. argentiventer* of 6.2 months and for *R. tiomanicus* of 3.6 months.

Pregnant females of *Bandicoota indica* from Kedah and Perlis (three instances), were found to have litter size of 5–10. The litter size of *B. bengalensis* (four instances) from Penang was



The ricefield mouse

Photo: Jeffrey A. McNeely

7–11. *B. indica* in Vietnam 3–8, Thailand 4–9. *B. bengalensis* in Vietnam 2–12 and Burma 6–11. Males attain sexual maturity at body weight of 284 g, females at 186 g for *B. indica*. Pregnant females of *Mus caroli* have been recorded with litter size 5–6 in Vietnam.

### Rats as sources of food

During World War II, when meat was not easily available, large forest and field rats of 250 g and above were trapped for food. Among the field rats, the greater bandicoot rat (*Bandicota indica*) in the ricefields were the prime choice for consumption by some ethnic groups in Thailand, Vietnam, Cambodia, Myanmar, China and India. In our field activity J.R. Audy, J.L. Harrison and I tasted some properly boiled meat of the forest giant rats including the greater bandicoot rat, and found the meat to be bland in contrast with that of domesticated mammals.

### Rodent-borne diseases

The four species of field rats with the exception of the field mouse, like the house rats, are reservoir hosts of diseases to man; such as water-borne diseases (leptospirosis), bacterial diseases (plague), rickettsia diseases (scrub and murine typhus), helminthic diseases (angiostrongyliasis, echinostomiasis, hymenolepiasis, trichinellosis) and viral diseases (haemorrhagic fever with renal syndrome, rat-bite fever). Among these diseases, leptospirosis is the most prevalent among the field rats. As for the field mouse, information of its public health importance is not available.

In Malaysia, the ricefield rat (*Rattus argentiventer*), greater bandicoot rat (*Bandicota indica*) and the ricefield mouse (*Mus caroli*) are habitat-specific and major rice field pests. The latter two species *B. indica* and *M. caroli* are confined to the northern parts of Peninsular Malaysia only, thus damage to rice production

is restricted. *R. argentiventer* is widely distributed through all the states of Malaysia, and the destruction to the productivity of rice is thirteen fold that of the other two species. The Malaysian wood rat (*R. tiomanicus*) is non habitat-specific, but with preference for oil palm and is a major pest in oil palm estates. This rat and the house rats, like *Rattus rattus diardii*, *R. norvegicus* and *R. exulans* are also intermittent visitors to ricefields. The lesser bandicoot rat (*B. bengalensis*), on the other hand, is restricted to Penang island. It is an outdoor resident in urban and suburban areas, and has yet been trapped in ricefield plots despite several fauna inventories by IMR in the 60's and 70's, and DWNP (Department of Wildlife and National Parks) in the 1990s.

During the period 1950-1970, bio-ecological studies on the house and field rodents were conducted in Peninsular Malaysia (then Malaya) by four research organizations. The Institute for Medical Research (IMR) hosted two research units: the Scrub Typhus Unit headed by Professor J.L. Harrison, and the U. S. Army Medical Research Unit headed by Colonel R. Traub of the Walter Reed Medical School, U.S.A. These two units were working

on the scrub typhus disease of which house and field rodents are reservoir hosts. In the latter part of this period, Mr. Brian J. Wood of the Sime Darby organization carried out studies on rodent pests in oil palm plantations, while the Agriculture Department in Serdang under Dr. W.P. Ting worked on rodent pests in rice fields, orchards and plantations. These pioneer researchers developed various control methods on rodent pests particularly in oil palm estates, and also paved the way for bio-medical studies on rodent-borne diseases by research scientists in the universities.

Since the late 1960s, deforestation has been rampant for the expansion of oil palm. At the same time, large plots of rice and rubber have been converted to oil palm. This has resulted in changes in the behavior of fauna. A good example is the common tree-shrew (*Tupaia glis*), once confined to forest and forest fringe habitats, now well-adapted to plantations. It has also become a common animal in urban parks and gardens. Similar adaptation by some rodent species (rats, squirrels, small carnivores) and other vertebrate species such as amphibians and reptiles to plantations, particularly oil palm plantations, is to be expected.

**Key to the identification of field rats.**

1. Tail is uniformly dark.....2  
 Tail is bicolored, dark above and whitish below. Tiny-sized mouse. HB 60–85 mm, T 60– 95 mm, HF 15–19 mm, Wt 8–15 g. Color of body brownish gray with the belly whitish. Mammary tits 10.....ricefield mouse (*Mus caroli*).
2. Pads at the bases of the outer toes of hindfoot round; upper incisors broad, the width of the two incisors together measured near the tip is 4 mm or more.....3  
 Pads at the bases of the outer toes elongated, heart or kidney-shaped; upper incisors rarely more than 3 mm.....4

3. Large sized. HB 250–350 mm, T 180–290 mm, HF 43–60 mm, Wt 350–600 g. Color of body blackish gray with long black guard hairs, and the belly gray. Mammary tits 12 ..... greater bandicoot rat (*Bandicota indica*)

Smaller-sized. HB 150–210 mm, T 110–120 mm, HF 34–38 mm, Wt 200–350 gm. Body is brownish intermixed with long dark guard hairs, grayish white to light brown. Mammary tits 5–17.....lesser bandicoot rat (*Bandicota bengalensis*)

4. Larger. HB 140–220 mm, T 130–222 mm, HF 35–38 mm.

The body is olive brown intermixed with dark soft guard hairs. Belly silvery gray. Mammary tits 12.....ricefield rat (*Rattus argentiventer*)

Smaller. HB 85–170 mm, T 85–170 mm, HF 27–34 mm. The body is brownish intermixed with soft spiny guard hairs. Belly is pure white to yellowish. Mammary tits 10.....Malaysian wood rat (*Rattus tiomanicus*)

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