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MOVEMENT OF THE RICEFIELD RAT, RATTUS RATTUS MINDANENSIS, IN RESPONSE TO FLOODING AND PLOWING AS SHOWN BY FLUORESCENT BONE LABELING

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MOVEMENT OF THE RICEFIELD RAT, *RATTUS RATTUS MINDANENSIS*, IN RESPONSE TO FLOODING AND PLOWING AS SHOWN BY FLUORESCENT BONE LABELING[1]

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In laboratory studies acceptance and marking ability of demethychlortetracycline (DMCT) as a bone-labeling compound were found excellent for *Rattus rattus mindanensis*. DMCT-induced flourescence in the lower mandible degraded in formalin but persisted up to 6 months in frozen storage.

A 15-hectare area in Central Luzon was baited with DMCT on polished rice; bait consumption was good. Five weeks later, immediately after flooding and plowing the baited area, animals were snap-trapped at distances up to 400 meters away. Thirty-two percent of the rats trapped were positive for DMCT and 74 percent of these were trapped within 100 meters of the baited area. These results indicate that land preparation displaces rats, but that most do not move far.

INTRODUCTION

Movement studies dealing with any of the several species of rats commonly found in ricefields of Southeast Asia are few. Using capture and recapture methods, Harrison (1957) reported an area of activity of less than 100 meters for *Rattus argentiventer* and *R. exulans* in Malaysia. Our findings in other studies using the capture-recapture technique indicated a similar home range or area of activity for *Rattus rattus mindanensis* in the ricefields of Central Luzon (unpublished).

The distribution of ricefield rats displaced by flooding and plowing before rice planting has not yet been investigated. Information of this kind is needed to develop effective plant protection techniques.

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The disadvantages of mark and release methods for such a study are many, not the least of which is poor trap success with live traps. The success of a fluorescent bone labeling technique with demethychlortetracycline (DMCT) by Linhart and Kennelly (1967) in their work with coyotes demonstrated the feasibility of marking a large percentage of a mammal population without disturbing it. Studies by Crier (1970) showed that a single feeding of DMCT at 50 mg/kg labeled laboratory rats for as long as 6 months and that fluorescence persisted for 6 months in bones kept in frozen storage. Fluorescent bone labeling with DMCT was effective in field studies to determine bait acceptance by rats residing in gulches adjacent to sugarcane fields in Hawaii (Nass et al., 1971).

MATERIALS AND METHODS

Acceptance and marking bioassays with DMCT at three concentrations were conducted in the laboratory with adult *Rattus rattus mindanensis.* In each bioassay, 10 individually-caged animals were each offered 5 grams of DMCT-treated rice; untreated vegetables were also available. The 30 test animals were killed 4 days later and examined for DMCT following the method described by Crier (1970). Lower mandibles were removed, cleaned and examined for fluorescence under ultra-violet light. Since we were also interested in the persistence of fluorescence in cleaned mandibles during storage, the samples were divided into two groups of 15 each. One group was placed in formalin and the other was wrapped in bond paper and stored in a freezer at -6°C.

A field study site was selected in the province of Nueva Ecija, Central Luzon. The site consisted of a 50-hectare irrigated rice field adjacent to a rain-fed field of 150 hectares. The areas were separated by a large main dike approximately 15 meters wide and 3 meters high. The rain-fed field produces one rice crop annually and was densely vegetated with annual grasses and forbs when the study was initiated. The irrigated field produces three rice crops annually. During the period of the study this field was planted with Seraup Bezar 15 variety rice in the vegetative stage, with the exception of two small sections. One section which was 300 meters away from the main dike was planted with IR-5 variety in the vegetative stage. The other section 400 meters from the main dike, had recently been harvested. Each area (rain-fed and irrigated) and the main dike between was snap-trapped for one night with 50 traps to determine species composition and relative animal density. Only *R. r. mindanensis* and one species of shrew (*Suncus luzoniensis*) were trapped—seven rats and three shrews in the

rain-fed area, and three rats and one shrew in the main dike. No rats were caught in the irrigated rice field.

Before the rain-fed field was flooded and plowed, a 15-hectare central portion of it adjoining the irrigated area was baited at 0.5 kg per hectare with C-4 polished rice treated with 0.5 percent DMCT. Bait was dispensed in waterproof "packets" consisting of 5 grams of bait wrapped in small sections of banana leaf and tied with a sliver of leaf (Fig. 1). Five days after baiting, two trap lines of 25 snap-traps each were set in a portion of the baited area to determine bait acceptance and marking success. Traps were not set in the irrigated field, since no rats were caught in the earlier trapping and conditions had not changed.

Four weeks after baiting, the rain-fed field was flooded and plowed. One week later, four lines of 50 snap-traps each were set in the central portion of the irrigated field at 0, 50, 100, and 200 meters from the baited area. Two days after trapping had begun, an additional transect of 68 traps was set at 400 meters from the baited area. This was the maximum distance from the main dike we could sample and still remain within the irrigated field.

RESULTS AND DISCUSSION

The laboratory studies indicate that DMCT is well accepted and is an efficient marking agent for *R. r. mindanensis*. No differences in acceptance were found among the three concentrations tested (0.25, 0.50, and 1.00 percent by wt.). Each of the 30 animals consumed the 5 grams of treated rice offered, for a mean consumption of 95.7, 207.7, and 405.2 mg/kg DMCT, respectively. Four areas of the lower mandible and two external areas, the tail and feet, were examined for fluorescence (Table 1). There was no distinguishable difference between the 0.5 and 1.0 percent concentrations in marking any of the four mandible areas examined, but the 0.25 percent material was slightly less efficient in marking the incisor base, lingual area, and the tail and feet.

The mandibles preserved in formalin were examined after 1 month and found to be almost completely void of fluorescence. Mandibles stored in the freezer were examined at 2 and 6 months after treatment. At 2 months 3 of the 11 mandibles had lost fluorescence in the lingual area. After 6 months one mandible had lost fluorescence in the inferior ramus, and only 4 mandibles retained recognizable marking in the lingual area (Table 2).

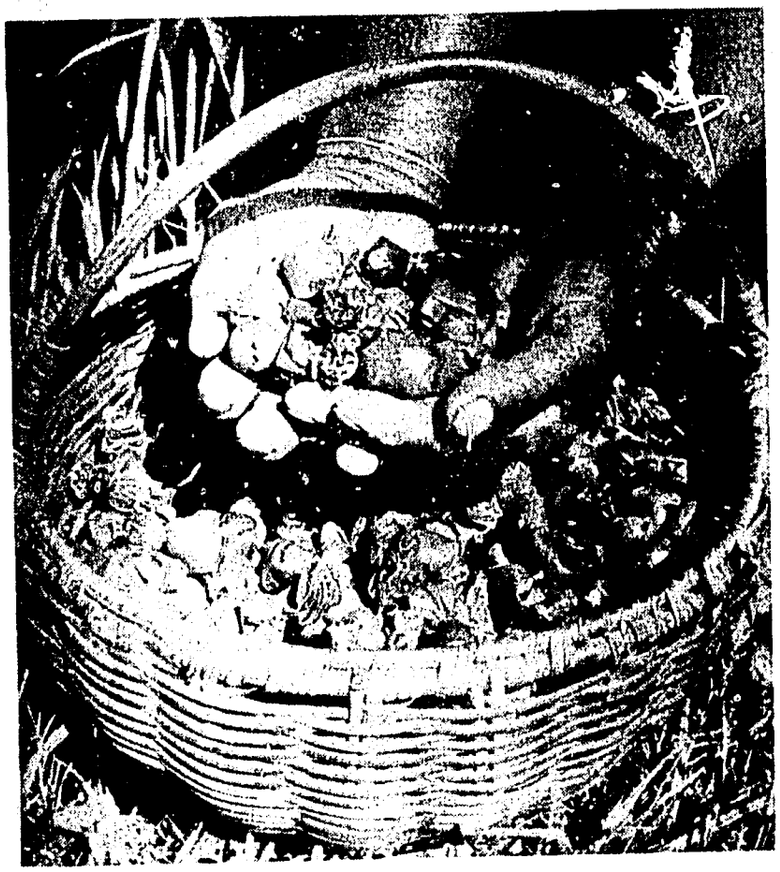

Figure 1. Bait "packets" wrapped in banana leaf and tied with grass.

Table 1. *Bioassay data for three concentrations of DMCT on* Rattus rattus mindamensis *examined 4 days after ingestion*

DMCT % Concentration*	PERCENT DMCT POSITIVE					
	Areas of lower mandible				External Areas	
	Superior ramus	Inferior ramus	Incisor base	Lingual area	Tail	Feet
0.25	100	100	90	50	90	50
0.50	100	100	100	70	100	60
1.00	100	100	100	70	100	60

* Ten animals per concentration.

Table 2. *Effect of cold storage on fluorescence in lower mandibles*

Months of Storage	PERCENT OF AREAS POSITIVE FOR DMCT (Sample Size)			
	Superior ramus (15)	Inferior ramus (15)	Incisor base (15)	Lingual area (11)
2	100	100	100	73
6	100	93	100	36

Initial trapping in the rain-fed field 5 days after baiting indicated good bait consumption under these conditions. Ten rats were caught and all proved positive for DMCT; 95 percent confidence limits indicated that between 68 and 100 percent of the population had accepted the baits and were marked.

After flooding and plowing of the rain-fed field, a total of 1,204 trap nights[3] for the five transects resulted in a catch of 108 rats from the irrigated field. All animals trapped were *R. r. mindanensis,* except for two *Rattus exulans* taken at the 0 meter transect. Thirty-two percent were positive for

[3] Trap night — one trap set in one night, e.g., 50 traps set in one night = 50 trap nights.

Table 3. *Disposition of marked ricefield rats after flooding and plowing of the marking area*

Trap Transect[1]	No. of Rats Trapped	Rats Positive for DMCT	
		Percent	95% Confidence Limit
0	12	75	57—94
50	31	52	34—70
100	34	20	8—37
200	19	20	6—43
400	12	33	10—65

[1] Distances in meters from treated area.

DMCT, and about three-fourths of these were trapped within 100 meters of the baited area (Table 3).

The high percentage of marked animals in the rain-fed field prior to flooding and plowing shows good bait acceptance under those conditions. Flooding and plowing forced evacuation but in most instances, the displaced rats moved less than 200 meters. These data indicate that control programs could be conducted just before land preparation in situations where forced movement might create a problem. The concentrations of rats in the peripheral zone adjacent to the disturbed area also suggest, if the situation warrants, a possibility for control programs after flooding.

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