J. Agrofor. Environ. 3 (1): 151-154, 2009 ISSN 1995-6983

Field damage assessment of *Bandicota bengalensis* (Gray) and *Bandicota indica* (Bechstein) in boro rice and its non-chemical control

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Abstract: A field experiment was conducted to assess the damage caused by *Bandicota bengalensis* (Gray) and *Bandicota indica* (Bechstein) in boro rice and its non-chemical control at three locations in Comilla district, Bangladesh during 2002-2003.The damage caused by these species in boro rice was assessed at different growth stages such as tillering stage, booting stage, dough stage and mature stage. The intensity of damage was highly related with the growth stages of the crop. The density of live burrow of the rat increased with the progressive growth stage resulting the maximum damage to the crop towards the mature stage. The highest abundance of both species was found during land the land preparation and then the harvesting period of the crop. The average trap success of both the species was 4.46 and 1.32 percent respectively.
Key words: *Bandicota bengalensis*, *Bandicota indica*, non-chemical control, damage assessment

Introduction

Bangladesh is an agricultural country, where about 80% people live in the rural areas and are associated with crop production. Rice is the main crop and cultivated over approximately 10.12 million hectares of land (BBS, 1999). A little is known worldwide about the amount and value of damage inflicted annually by rodents (Rennison and Buckle,1987).According to Food and Agricultural Organization of the United Nations (FAO,1967), rodent consume or contaminate agricultural product worth about US $ 30,000 million per year. Rodent damage is observed in all the field crops but mainly in the rice and the wheat. About 4% of the field crops are damaged by rodent (Temme, 1981). Every year the losses due to rats infestation were estimated to 13 million tons of rice grain in Bangladesh by the infestation of rats. Karim (1988) reported that damage caused by rodent were 4.86%, 3.74% and 2.25% in wheat, boro and T. aman, respectively. Rats consume food almost 10 % of their body weight, in some cases it reaches 10-20 kg per year; while Greaves *el al.*, (1975) estimated 10 % of rice crop damaged by rats. Thus, the present study was carried out to determine the abundance and extent of damage at the different stage of boro rice by bandicoot species.

Materials and Methods

The damage assessment of rat in boro rice field was carried out at sadar upazilla of Comilla district in Bangladesh. The study was conducted from December to mid May, 2003. Comilla district is about 95 km east of Dhaka and the three different stations namely Jakunipara, Soara and Anandapur are about 6 to 10 km south of sadar upazilla. Three were selected by random sampling procedure for the purpose of rat damage assessment to rice fields. To assess the percent tiller damage of rice, a total of 10x3x4=120 m^3 fields were selected for the same. Equal number of plots, was taken from three study villages during the tillering, booting, dough and mature stages for both the species. All cultural practices were done as per schedule.

Within each experimental field, the nearest corner was chosen and a diagonal line to the opposite corner was followed. Ten steps interval along this diagonal line 100x100 cm wooden frame was used to take the samples. Cut, uncut and the total stems were counted within the frame. The data were recorded and the damage percentage was calculated. When the first sample was finished, the remaining was carried out in the same manner. Similar procedures were followed for the rest of the fields. Due to frequent animal damage the outer 2 meter of each rice field was eliminated.

Data were analyzed to determine percent of crop damage using the following formula:

$$\text{Percent damage} = \frac{\text{Cut stem}}{\text{Total stem (cut stem + uncut stem)}} \times 100$$

Same locations were selected to determine the abundance of *B. bengalensis* and *B. indica* by trapping. The bandicoot rats (*B. bengalensis* and *B. indica*) were captured with single capture wire-case live traps. Live trapping for rats was implemented every month from December 2002 to mid May 2003 baited with dry fish. Ten traps were set for four nights in each of the three villages for two times in a month. Trapping was conducted at least 500 meter away from damage assessment sites. There were 240 trap nights per month. Traps were placed at least 10 meter interval in the rice field along the bunds. Captured rats were transported immediately to the laboratory for examination. The rats of different species were separated and accurate identification was made with the help of identifying characters and then counted. Each captured rat was marked with an ear punch for its identification. All rats were released at the site of capture after ear punch. Total number of bandicoot rats *(B. bengalensis and B. indica)* trapped in a month were recorded. Percent trap success of each rat species was calculated. Trapping was made every first and third week of each month. Traps were placed randomly near active bandicoot rat burrows in rice fields. Traps were set in the field in the evening and checked in the next morning (7.00-8.30 A.M).

Results and Discussion

Rat damage occurs from the tillering to harvesting stage in the rice field. The intensity of damage varied from field to field depending on high yielding varieties, soil type, age and density of crop and water content of the crop field. In general, as the number of stem in the field increased, the rat damage also increased concomitantly. Damage of rice stems by bandicoot rats was of two types. In one type, the stems were bent over and cut at the base of the panicle while in the other case the stem were cut about 4-20 cm above the ground level, as a result the plant fell down and panicle was removed and stored in the burrows.

The mean damage caused by *B. bengalensis* in the boro rice field was 2.02 %. The maximum damage was within 2.5 meter of the burrow system and the damage decreased sharply beyond 6.3 meters. In the dough stage the average damage of stem was 2.05 %. During the maturing stage the damage of stem was 4.28% (Table1) which was highest damage caused to boro rice at different growth stages. Barnett and Prakash (1975) found 5.56% of rice damaged by rodents while Fulk and Aktar (1981) found 6.1% and Lavoie *et al.,* (1970) found 4.1 % damage in the Philippines. As the rice ripened and water was drained out from the plots, number of rodents increased rapidly. Similar influxes of rodents were reported by Fulk (1977) in Pakistan. The highest tiller damage was at Anandapur village than other two experimental locations.

Table 1. Mean damage of four stages of boro rice by *B. bengalensis* at three experimental locations

Experimental locations	Percent tiller damage				Mean damage of 4 stages (%)
	Tillering stage	Booting stage	Dough stage	Mature stage	
Jakunipara	0.298	1.27	1.52	4.02	2.02
Soara	0.287	1.20	1.48	3.98	
Anandapur	0.305	1.90	2.07	4.83	
Average	0.296	1.45	2.05	4.28	

The mean damage caused by *B. indica* in boro rice field was 1.29%. During the tillering stage, the damage was 0.293% of stems. At the booting stage, the damage increase up to 1.11%. During the dough stage, the average damage of rice stem was 1.20 %. At the mature stage, the average damage of rice stem was 2.56% (Table 2) which was the highest damage caused to boro rice at different growth stages. Khokhar (1993) found 1.93% damage of boro rice in Pakistan. The highest tiller damage was at Anandapur village than other two experimental locations. In the study, rat damage in boro rice was found depends upon soil type; stem density, field condition, rice varieties, fertilizer application, irrigation and drainage and intercultural operation. The amount of rodent damage varies from country to country depending on the climatic conditions, rodent species and food crop involved (Hoque,1986).

Table 2. Mean damage of four stages of boro rice by *B. indica* at three experimental locations

Experimental locations	Percent tiller damage				Mean damage of 4 stages (%)
	Tillering stage	Booting stage	Dough stage	Mature stage	
Jakunipara	0.285	0.92	1.04	2.34	1.29
Soara	0.289	1.01	1.05	2.22	
Anandapur	0.306	1.40	1.51	3.13	
Average	0.293	1.11	1.20	2.56	

Analysis of variance revealed that there is no significant difference in crop damage by both rat species among the three experimental locations. But incase of growth stages, damage was significantly different ($P<0.05$) (Table 3 and 4). When the four stages were compared by DMRT, it revealed that the damage at booting stage and dough stage was statistically identical.

Table 3. Damage assessment of boro rice at different growth stages by *B. bengalensis*

Stage	Average no. of tillers/m^2		Total no. of Tiller/sq.m	Percent Tiller damage
	Uncut	Cut		
Tillering	336.76	1.00 c	337.47	0.296 c
Booting	349.33	5.2 b	354.50	1.45 b
Dough	362.63	6.23 b	370.23	2.05 b
Mature	374.56	16.74 a	391.31	4.28 a
LSD(%	NS	0.8979	NS	0.922
CV(%)	11.41	6.17	10.37	22.86
Sx	2.8965	0.256	2.8773	0.266

Mean followed by the same letter(s) in each column with in each group are not statistically different at 5% level of significance by DMRT,
NS = Non-significant

Table 4. Damage assessment of boro rice at different growth stages by *B. indica*

Stage	Average no. of tillers/m^2		Total no. of Tiller/sq.m	Percent Tiller damage
	Uncut	Cut		
Tillering	335.73	0.99 c	336.75	0.293 c
Booting	352.4	3.97 b	356.36	1.11 b
Dough	365.13	4.43 b	369.57	1.20 b
Mature	382.03	10.09 a	392.10	2.56 a
LSD(%	NS	2.194	NS	0.3030
CV (%)	8.487	22.53	9.70	11.63
Sx	0.9987	0.6341	1.4602	0.0866

Mean followed by the same letter(s) in each column with in each group are not statistically different at 5% level of significance by DMRT.
NS = Non-significant

There were two peaks for abundance of bandicoot rats in the rice field. The first at the harvest of the aman rice and second at the harvest of boro rice. Captures of rats were lowest in February and March during the early growth stage of boro rice. The abundance of Bandicoot species was higher during December, 2002 and May, 2003 compared to other months as there have relationship between seasonal periodicity in breeding activity and food availability. These biotic factors have been found to be considerable importance in the regulation of population abundance of many rodent species (Bindra and Sagar, 1968; Prakash, *et al.,* 1975). Insufficiency of food and shelter, rodent population declined. The similar result also found by Prakash, *el al.,* (1975).The abundance in May coinsided with the damage observed in field. At that time, *B. bengalensis* was more common that and *B. indica* in the boro season. No marked rats were recaptured. In case of *B. bengalensis*, trap success (2.91%) during March. The average trap success was 4.86% (Table 5). The highest number of rats caught at fallow and land preparation was the probably due to increased movements activity of rats during and after the disturbance by harvest (Leung *et al.,* 1999). Harvesting of rice not only removes food, it also removes shelter (Singleton, 2001).

Table 5. Monthly variation in the abundance of rat species based on rat captured in boro rice fields from December 2002 to May 2003

Year	Month	Traps/night	*B. bengalensis*			*B. indica*		
			Total no. of rats trapped	Mean rats trapped per village	Trap success (%)	Total no. of rats trapped	Mean rats trapped per village	Trap success (%)
2002	December	240	17	5.66	7.08	7	2.33	2.92
2003	January	240	12	4.00	5.00	2	0.67	0.83
2003	February	240	9	3.00	3.75	1	0.33	0.42
2003	March	240	7	2.33	2.91	1	0.33	0.42
2003	April	240	11	3.67	4.58	3	1.00	1.25
2003	May	240	14	4.67	5.83	5	1.67	2.08
Average		240	11.66	3.89	4.86	3.17	1.06	1.32

In case of *B. indica* the highest trap success was 2.92%) in December and the lowest trap success was 0.42% in February and March. The average trap success was 1.32% (Table 5).

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