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Population Dynamics of Rodent Community in Organically Cultivated Ragi and Field Bean-Based Croplands

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ABSTRACT

Rodents are considered as critical vertebrate pests in croplands, for effective rodent management data on population structure and species composition is essential. The studies on rodent population dynamics and species composition in organically cultivated ragi and field bean-based croplands at farmers' field of Tippagondanahalli village during 2019 revealed that the *Bandicota bengalensis* (Gray) followed by *Mus platythrix* (Bennet) and *Mus booduga* (Gray) was the predominant species recorded. The trap index data indicated the presence of rodents throughout the year, with a mean trap index of 6.37±1.78.The rodent population was female-biased and the adults out numbered the sub-adults.

Keywords Organic, Population dynamics, Rodents, Ragi, Field bean.

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INTRODUCTION

Rodents have been considered critical vertebrate pests in field storage and poultry structures and have attained conventional pests' status (Sridhara 2006). Rodents affect almost every crop in the field and due to this, food security has been affected on the global scale (Meerburg *et al.* 2009). Crops like cereals, vegetables, oilseeds, flowers are damaged in crucial stages of the crop and are responsible for 5-10% loss of food grains annually during production, processing, storage and transport, accounting for a loss of about 10 to 17 metric tonnes of food grains annually (Hazra *et al*. 2017). A study by Indian Grain Storage Management and Research Institute showed total post-harvest damage of 4.7% to wheat grains by rodents (Rao 2003). Overall losses of grains at pre- and post-harvest stages are 25-30% in India, bringing the loss to at least US$ 5 billion annually (Hart 2002). Due to this huge amount of crop and food losses caused, rodents play a significant role in influencing food security and poverty alleviation programs for the rural poor in Asia (Sridhara 2006, Fayenuwo *et al.* 2007). In the present scenario in southern districts of Karnataka ragi followed by field bean cropping is predominantely practiced and knowledge on population dynamics of rodents in organically cultivated ragi and field bean is lacking and for effective management of rodents, detailed data on population dynamics is essential. Hence, in this study, the emphasis was given to study population dynamics, sex ratio and the age structure of field rodents in organically cultivated ragi and field bean-based croplands.

MATERIALS AND METHODS

The study on population dynamics of field rodents inhabiting ragi field bean-based crop lands was conducted throughout the year 2019 in ragi field bean ecosystem at farmers agricultural plots of Tippagondanahalli village, Bangalore south taluk, Bangalore district. A total of five-hectare area of field bean (*Lablab purpureus*) and ragi (*Eleucine coracana*) ecosystem was selected. Trapping of rodents at fortnight interval was conducted to estimate the rodent population for twelve months from January 2019 onwards. The traps (box trap) (17cm × 9 cm) @ 54 traps per hectare were used to sample and estimate the population. The fresh coconut or vada was used as the bait for the trap. The traps were laid in two parallel lines along the length of the borders at equal distances in an area of five hectares. The traps were pre-baited for two continuous days before actual trapping. On the third day late evening again, traps were set for actual rodent trapping and the rodents about sunrise. During the monsoon, the traps were placed under the bait station.

The data on the rodent population was recorded at the fortnightly interval. Each captured rat was identified up to a species level. The data on sex and age structure were also recorded. The trapped rats were classified based on their size and weight into sub-adults and adults (Khanam *et al*. 2017).

The rats trapped were removed once in a fortnight and the rodents trapped per day per trap were estimated by applying the trap index method as suggested by (Jain *et al.* 1993) and to compare the populations, a trap index (I) was calculated as mentioned, below.

$$\text{Trap index (I)} = \{ (M/NT) \} \times 100$$

Where

N = No. of traps used in trap line,

Table1. Population of rodents in organically cultivated ragi-field bean ecosystem (2019). B.b=*Bandicota bengalensis;* M.me=*Millardia meltada*; M.p=*Mus platythrix*; M.b=*Mus booduga;* T.i=T*atera indica*; R.r=*Rattus rattus*.

Month	Fortnight capture	Number of rodents trapped / five ha						Fortnight total	Trap index	Monthly total
		B.b	M.me	M.p	M.b	T.i	R.r			
January	1	6	0	6	8	2	1	23	08.52	
	2	5	2	4	8	0	0	19	07.04	42
February	1	0	4	5	7	0	1	17	06.30	
	2	4	1	1	0	1	1	8	03.72	35
March	1	6	0	4	6	2	0	18	06.67	
	2	4	0	2	2	1	2	11	04.07	29
April	1	5	0	1	0	2	1	9	03.70	
	2	1	3	3	0	3	4	14	05.93	23
May	1	8	0	4	5	0	1	18	06.67	
	2	6	0	0	4	2	0	12	04.81	30
June	1	5	2	2	3	4	2	18	07.78	
	2	0	5	5	3	0	0	13	05.56	31
July	1	7	0	6	4	3	0	20	07.41	
	2	8	0	4	0	2	3	17	06.30	37
August	1	7	3	5	1	0	3	19	07.04	
	2	5	0	3	4	4	0	16	05.93	35
September	1	1	4	3	0	1	2	11	05.19	
	2	8	3	6	3	0	4	24	08.89	35
October	1	9	6	3	6	3	0	27	10.74	
	2	9	0	0	0	1	3	13	04.81	40
November	1	6	0	7	4	3	0	20	08.15	
	2	1	4	4	0	0	0	9	04.44	29
December	1	4	0	8	6	3	0	21	07.78	
	2	7	0	0	6	0	1	14	05.19	35
Mean ± SD		5.08±2.76	1.54±1.96	3.58±2.22	3.33±2.76	1.54±1.38	1.21±1.35	16.30 ± 4.78	6.37±1.78	32.59±5.26

T = No. of nights traps were set,
M = Total number of rodents trapped.

RESULTS AND DISCUSSION

Trap index

The trap index data revealed that the highest trap index was recorded in the first fortnight of October (10.74) and it was followed by second fortnight of September (8.89) and the first fortnight of November (8.15) (Table 1). Similarly, the lowest trap index of 3.70 was recorded in April and it was followed by the second fortnight of February (3.72) and the second fortnight of March 2019 (4.07). However, the trap index data suggest that the rodent activity was observed throughout the year with the mean monthly rodent trap catch of 32.59 ±5.26 and mean trap index of 6.37 ±1.78.

Species composition

The fortnight trapping of rodents in the study area indicated that *Bandicota bengalensis* (Gray) was the predominant rodent species with the mean trap of 5.17 ± 2.85 and it was followed by *Mus platythrix* (Bennet) (3.58 ± 2.22), *Mus booduga* (Gray) (3.33± 2.76), *Tatera indica* (1.63 ±1.50), *Millardiameltada* (Gray) (1.54 ± 1.96) and *Rattus rattus* (Linnaeus) (1.21 ± 1.35). However, the trapping of *Rattus rattus* was very negligible in the study area (Table 1). In the present studies the results were on par with studies conducted by Sridhara and Tripathi (2005) and Naik *et al*. (2015) the study area belongs to the eastern dry zone of Karnataka as per the studies conducted by AINP (2018) the rodent activity was recorded throughout the crop cycle and in ragi pulses, ecosystem the species recorded were *B. bengalensis* followed by *M. booduga, M. platythrix* and *T. indica.*

Sex ratio

In the present studies, the rodent population was female-biased, the live trapping of rodents revealed in the case of *B. bengalensis* 73 females and 49 males were captured with the female-male sex ratio of 1:0.67. While in *M. platythrix* and *M. booduga* 48, 44 and 38, 36 were trapped respectively with a ratio of 1:0.76 and 1:0.79 (Table 2). In a year, total of females 21, 20 and 16, 17 males were recorded in case of *M. meltada* and *T. indica* respectively, with the female male ratio of 1:0.76 and 1:0.85. However, though *R. rattus* was captured in negligible number a total of 17 females and 12 males were captured throughout the year with a ratio of 1:0.71 (Table 2). In the present study the female-biased population indicates that females are indulged in fetching food than the males. During reproductive and breeding the activity of females is restricted compared to that of males (Betancourt *et al.* 2003,Verma *et al.* 2021). However, during mating seasons, females are supposed to forage for food and breeding sites actively which probably increases the chances of being trapped and the territorial behavior among males could also account for the female-biased sex ratio in the population (Andreassen *et al.* 2021).

Adults V/s sub adults

The live trapping data for the twelve months revealed that the adults were trapped more than the sub-adults with an overall ratio of 1:0.27. Whereas, among the

Table 2. Sex ratio and adult sub adult ratio of rodent species trapped in organically cultivated ragi-field bean ecosystem.

Rodent species	No. of rodents trapped in a year		Sex ratio (F:M)	No. of rodents trapped in a year		A:S ratio
	Female	Male		Adult (A)	Subadult (s)	
Bandicota bengalensis	73	49	1:0.67	98	24	1:0.24
Millardia meltada	21	16	1:0.76	29	8	1:0.28
Mus platythrix	48	38	1:0.79	67	19	1:0.27
Mus booduga	44	36	1:0.82	69	11	1:0.16
Taterai ndica	20	17	1:0.85	26	11	1:0.42
Rattus rattus	17	12	1:0.71	21	8	1:0.38
Total	223	168	1:0.74	310	81	1:0.26

different rodent species an ratio of 1: 0.22 was recorded in case of *B. bengalensis*, 1:0.28 in *M. meltada,* 1:0.27 in *M. platythrix,* 1:0.16 in *M. booduga,* 1:0.42 in *T. indica* and 1:0.38 in *R. rattus* (Table 2). The study conveys that adults were present throughout the year and sub adults were recorded only during certain months only. The presence of meagre number of sub adults in the present study could be due to the high rate of mortality or dispersal of sub adults (Makundi *et al.*2009). According to Mulungu *et al*. (2013) differences in capture rates of adults and sub adults could be due to heterogeneous response to trapping due to aggressive behavior and active search for resources and mates by the adults which resulted in the predominance of adults in the population (Panti *et al.* 2012).

CONCLUSION

The study conveys that in organically cultivated ragi and field bean-based croplands *B. bengalensis*, *M. booduga* and *M. platythrix* were the predominant rodent species recorded. The trap index data indicated the presence of rodents throughout the year with a mean trap index of 6.37± 1.78. The population was female-biased and adults out numbered the sub adults. The present study conveys that the rodent population depends on the available food resource and out breaks at critical stages of the crop hence the management practices have to be initiated before the outbreak of the rodent population to mitigate the crop losses.

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