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Effects of Biotic Factors on Population Fluctuations in Sympatric Field Murids

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Abstract The relative population density of various murids occurring in the agro-ecosystem of village Kakrod, Jind (Haryana) was estimated in *Kharif* and *rabi* crops. The structure divulged a combination of *Millardia meltada, Bandicota bengalensis. Mus booduga, Rattus rattus* and *Mus musculus*. A low population density of murids was recorded at the seedling stage of each crop which enhanced with the advancement of the crop growth reaching its peak at the maturity stage. The influence of various biotic factors on the wavering mechanisms of murids has been discussed.

Key words Murids, Population, Biotic –factors.

The availability of continuous and dense shelter and plenty of succulent food to the field rodents are helpful to them in escaping from the attack of the enemy and are also conducive to their increased reproduction. Economic losses caused by the field rodents are in direct proportion with their population numbers. The present agricultural situation, thus, necessitates more insight of rodent behaviour and ecological aspects for their effective management. An endeavour has, therefore, been made to understand the influence of various biotic factors over the population density of the field murids.

Materials and Methods

The present explorations were carried out in village Kakrod of district Jind. Monthly population fluctuations of sympatric murids for the period from May 1989 to April 1990 were recorded. 'Lincoln index' was calculated following CMR method given by Davis (1964). Following Prakash (1962) 'Trap index' was estimated by trapping murids on lines across the area under study. The relative preference of murids to the crop and crop stages was determined and their relative density was recorded during each growth stage of the crop viz., seedling, growth and maturity. Four kharif crops, cotton (*Gossypium hirsutum*), jowar (*Sorghum vulgare*), bajra (*Pennisetum typhoides*), guar (*Cyamopsis tetragonoloba*) were undertaken for estimation of density fluctuations. An area of 0.24 ha was reckoned and 24 numbers of wonder traps were utilized in each crop. Consequently, at per unit time a total of 96 traps were employed covering an overall area of 1.35 ha in the fields. Similar recordings were made for two rabi crops i.e. wheat (*Triticum aestivum*) and gram (*Cicer arietinum*) wherein an area of 0.68 ha per crop was computed. However, the total area in the fields under investigations was kept constant. Forty two wonder traps were utilized in each crop. Coarsely ground wheat, bajra and gram mixed with additives like cooking oil or peanut butter was used as a bait material.

Results and Discussion

Population

The population analysis revealed the co-existence of *Millardia meltada, Tatera indica, Bandicota bengalensis, Mus booduga, Rattus rattus* and *Mus musculus*. The relative percentage occurrence of these murids in all the crops available during the year 1989-90 in an area of 1.35 ha was estimated to be 39.14, 33.53, 14.43, 12.68, 0.15, and 0.07 respectively (Fig1). The population density depicted a bimodal cycle i.e. a peak in the population density during the month of September while another peak during the month of April. *M. meltada* and *T. indica* were abundant in all the crops, while *B. bengalensis* was trapped only in wheat and jowar fields. The trapability of *M. meltada* and *T. indica* was comparatively higher, followed by *B.bengalensis* > *M.booduga* > *R.rattus* *M.musculus*

Intra-and interspecific combinations were often encountered within a range of 1 to 9 individuals per cage. The recapturing frequency of murids (Table 1) instituted to have the following

Table 1 *Monthly fluctuations in recapturing frequency of sympatric field murids.*

Murid Species	Recapturing frequency of each murid during												Annual average recapturing frequency
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	
M.meltada	35.7	33.3	49.7	33.3	46.4	27.3	46.6	66.7	57.1	50.0	46.4	43.2	44.6
M.booduga	37.5	42.8	49.3	66.7	55.9	33.3	00.0	00.0	00.0	50.0	41.7	16.7	32.8
B. bengalensis	16.7	33.3	34.3	40.0	34.9	00.0	50.0	40.0	42.9	16.7	37.5	32.5	31.5
T.indica	16.7	25.0	26.8	35.7	26.8	22.2	22.6	33.3	50.0	28.6	28.2	41.5	29.8

order : *M.meltada* > *M.booduga* > *B.bengalensis* > *T.indica*

Table 2 *Trap index of murid population in various crops at maturity*

Crop	Trap index
Cotton	0.17
Jowar	0.26
Bajra	0.15
Guar	0.19
Wheat	0.29
Gram	0.16

The 'trap index' (Table 2) conforming Sabhlok and Pasahan (1989), ranged between 0.15 and 0.29, obviously indicating the population to be well under manageable extent.

Population fluctuation : The analysis of the preference of murids to the crop and crop stages of cotton revealed an average population density of 5.5 murids during the seedling stage (Fig. 2). It raised to 19.5 during growth period of the crop and by the time the crop entered its ultimate week of maturity, the population got enhanced to 42 murids. This substantial increase was found probably correlated with the harvesting of the neighbouring crops like jowar and bajra.

Jowar crop remained available in the fields from the later half of June to early October. At seedling stage an average population density of 11.17 murids (Fig.2) was estimated which increased to 29.7 during the growth period of the crop. At maturity stage a further increase in the average population density was recorded to be 41 murids. *M. booduga,* however, appeared only during the last stage of the crop and being light weighed was often found climbing the mature plants attacking inflorescence.

Bajra crop has an approximate existence of three months from the second week of July to the end of September. A low population density of 8.7 murids (Fig 2) was estimated at the seedling stage which increased to an average of 24.5 individuals during the growth period. This high figure at the growth stage probably indicated preference of animals towards greater soil moisture content available inside the crop during these months. The maturity stage, however, revealed an average population density of 24 individuals. *M.booduga* again depicted specificity of the crop stage as seen in jowar crop.

Guar crop existed in the agro-ecosystem from mid July to the end of October. Catch in the seedling stage revealed an average population of 7.5 murids (Fig.2) which increased to 33.8 during the growth period and reached to the maximum of 37.3 individuals during the maturity stage of the crop.

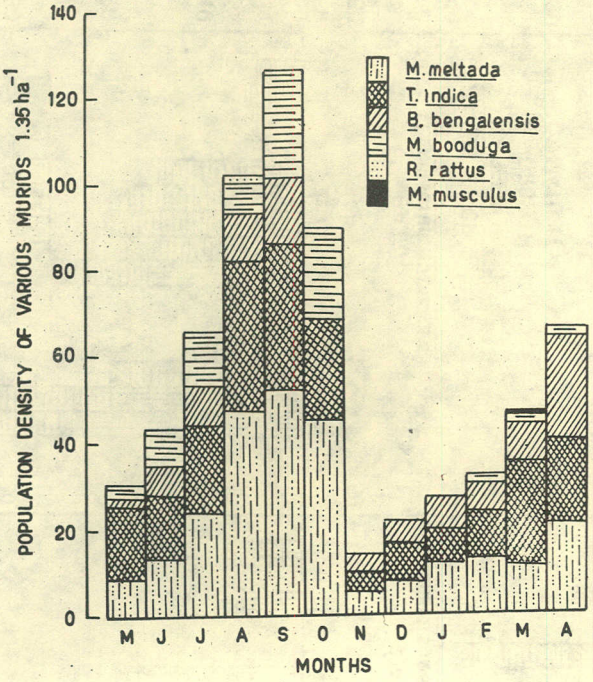

Fig. 1 Monthly population fluctuation of sympatric murids in agro-ecosystem of village Kakrod

Wheat has approximately a duration of six months and was available in the fields from the 3rd week of November to the end of April. Comparatively low population density (3.5) was recorded at the seedling stage of the crop (Fig.2). Movements of the animals was recorded highest during maturity stage of the crop which touched to an average population density of 48 murids. This obviously depict a strong preference of rodents for maturing earheads of wheat crop.

Gram crop was available in the fields from the last week of October to the end of March. An average of 7 murids were captured at the seedling stage (Fig 2). The growth stage revealed a population of 12 individuals which further increased to 20.5 at the maturity.

Invariably both during *kharif* and *rabi* seasons a low density of murids has been reckoned at the seedling stage which gradually increased with the growth of the crop and reached to its maximum at the maturity stage (Fig 2), This, thus, obviously portrays that the murids migrate quite systematically from their permanent peripheral abode to inside the crop as soon as the latter is sown. Hence, there is a low level of damage to the crop at the seedling stage and a comparatively higher degree of damage at the maturity stage (Sood & Ubi 1975, Sood & Dilber 1977, Chopra & Sood 1982). Since murids reproduce and live for most of their life in the permanent peripheries of crop fields and move inside only with the advancement of crop growth, it is always advisable to execute their control from the peripheral areas at the pre-sowing and post-harvesting periods.

Reproductive periods

During the months of May and June a low population of murids was recorded but with the gradual increase in the number of young ones of all species the population reached its highest during the month of September. The population then

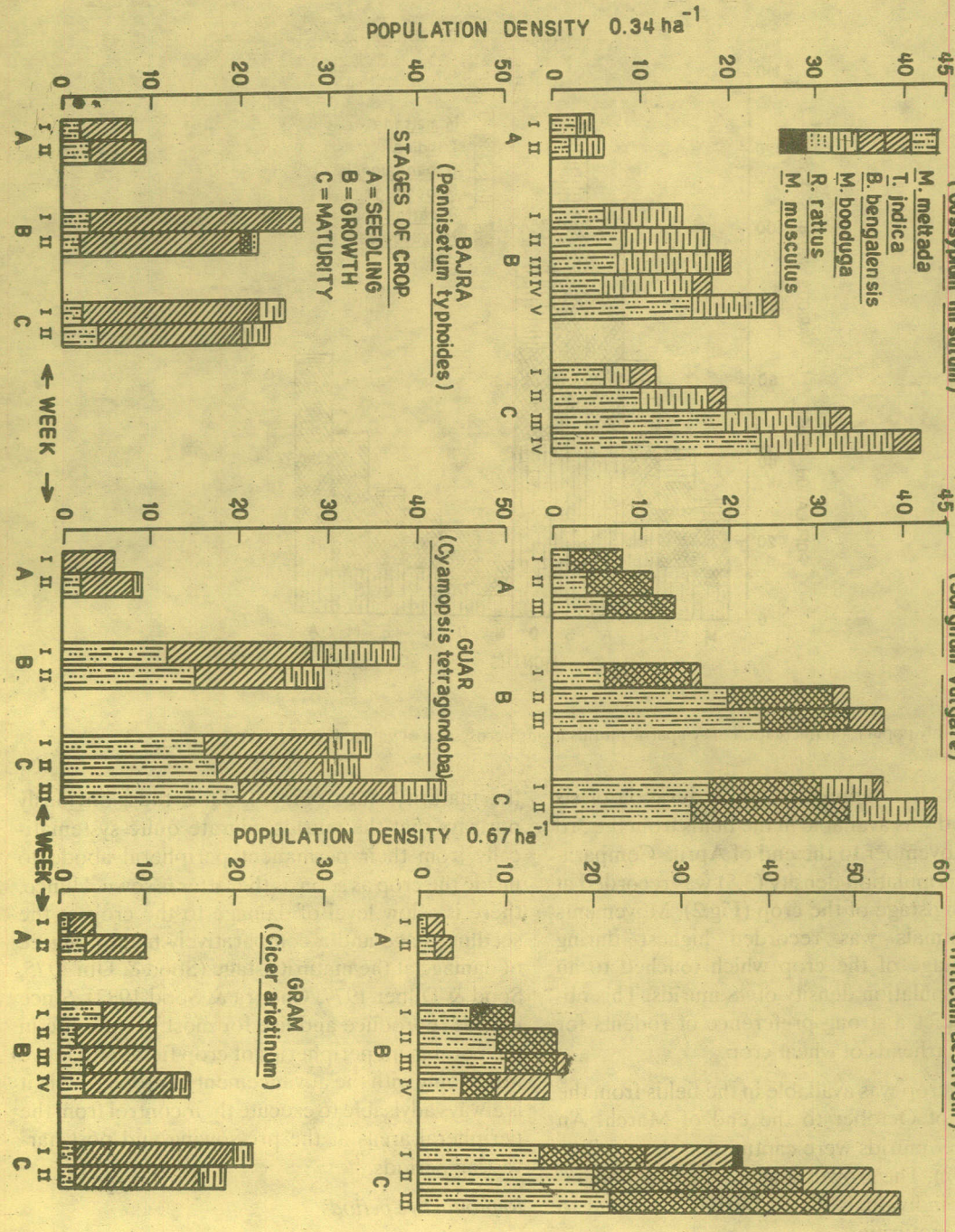

Fig. 2 Population fluctuation of Sympatric murids in relation to growth stages of crops. Seedling (A), Growth (B) and Maturity (C) stages of crops

showed an abrupt decline during the months of Novebmer and continued till February as only a few young ones were trapped during these months. Again the population increased during the months of March and April. Thus, an overall increase in the murid population was observed first from July to October and then from March to April. The maximum being, however, in the month of September when all the four kharif crops (Cotton, jowar, bajra and guar) were in mature stage and thus provided enough food and shelter to the animals. Almost a similar type of trend in increase of murid population was observed by Sood and Ubi (1975) in groundnut, maize and sugarcane crops. It seems, therefore, that murids have some periodicity of reproduction depending on the availability of food and shelter.

Intra-and inter–specific competition

The intra–and inter–specific competitions were apparent in the fields from July to October and then from March to April as the population of various murids attained its peak during these months. Whenever two or more heterospecific murids were caught in the same trap, they always fought resulting in killing or injuring the 'weaker' animals. Cannibalism noticed in the traps in *M. meltada, T. indica and B.bengalensis.*

Interspecific killing or eating behaviour was pronouced in jowar crop from July to October and in wheat crop during the months of March and April. Of 38 cases presently recorded, whenever *B. benealensis* was trapped in the same cage it destroyed individuals of almost every species. Whenever, the more aggressive *B.bengalensis* was in higher density in the fields the relative abundance of other species of rats and mice experienced a crash in the area. The murids presently caught were found to have the following order of aggressiveness : *B.bengalensis* > *T.indica* > *M.meltada* > *M.booduga*

Jain (1984) reported that irrespective of any shortage of food and water, various rodent species exhibited partial to full cannibalistic activity on new born young ones. The shortage of food and shelter will, however, increase in intra-and inter-specific competitions and aggressiveness among rodents which may result in the decrease in population either through mortality or migration (Jain & Tripathi 1988). It appears, therefore, that intra and inter–specific competitions have great impact over the fluctuating mechanisms of the murid population in fields.

Prey-predator interactions

Predators play a vital role in regulating the population density of murids (Pearson 1963, Pingale *et al.* 1967). They, no doubt, have been described quite useful in maintaining the ecological balance in nature but have proved to be opportunists as they tend to prey on whatever is easily accessible (Jain & Tripathi 1988). During the present investigations, animals like dog, mongoose and musk shrew were visualised or caught in the fields preying upon or killing rats and mice. Monthly recordings have revealed a total of 46 numbers of predators in an area of 1.35 ha. A maximum of 7,5,8 and 6 predators were recorded during the months of May, June, October and November respectively. The drastic fall in murid density in the months of November and December may also be attributed to the predation of murids in previous months.

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