THREAT ARID PULSES

INCIDENCE OF RODENT PESTS AND THEIR MANAGEMENT IN PULSE CROPS UNDER ARID AGRO ECOSYSTEM

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ABSTRACT

Rodent pest species complex of *Meriones hurrianae-Tatera indica* (on sandy plains) and *M. hurrianae-Gerbillus gleadowi* (sandy hummocks/dunes) was observed to infest the rainfed pulse crops (moong and moth bean) in the Western Rajasthan. The pest species pose a continuous threat to the arid pulses from sowing to harvest, but seedling and pod formation stage were noticed to suffer the most due to rodent depredation. Live burrow baiting with zinc phosphide (2%) followed by bromadiolone (0.005%) provided sustained protection (69.0-81.1 per cent control success) from rodent pest attack.

KEY WORDS: Rodent Threat, Pulses, Arid Zones.

INTRODUCTION

RODENT pests are known to cause immense losses to various production systems of arid ecosystem. Eighteen species of rodents have been recorded to inhabit the Indian arid zone (Tripathi *et al.*, 1992), however, a complex of 2-3 species are generally encountered in various arable cropping systems of the region.

Extent of damage, yield losses by pest rodents and their management in cereals, vegetable and fruit crops under arid agro-ecosystem have been reported by Advani *et al.*, 1982; Advani and Mathur, 1992; Prakash and Mathur, 1987; Tripathi *et al.*, 1992 and Patel *et al.*, 1995, but such information is lacking for arid legumes. The present work is an attempt to study the impact and infestation pattern of rodent pests on two important arid pulse crops, *viz.*, moong bean and moth bean and to plan the strategies for their management.

MATERIAL AND METHODS

Species composition: Sherman traps were laid for 3 nights in the moong-moth crop fields at different crop growth stages grown under rain-fed conditions. Two types of crop fields, one on sandy plain, and the other on hummocky/duny terrain were selected for this study. The trapped rodents were identified and trap index was worked out to understand the pest species composition in these crops. Live burrow count method was also employed to know the extent and pattern of infestation at different crop growth stages.

Rodent damage: The observation on crop damage was recorded at seedling stage (15-20-day-old plants) and at pod formation/maturity stage. In 15 days-old crop the number of cut and healthy seedlings were counted per m^2 area for assessing the loss in plant stand in peripheral regions due to infestation of rodents. Similarly, at a later stage, the number of damaged and healthy pods was accounted for working out per cent pod damage. At both the stages, observations were recorded in 6 plots of one m^2 each following diagonal transact method (AICRP RC, 1981).

Rodenticidal evaluation: Three rodenticides, *viz.*, zinc phosphide (2.0%), bromadiolone (0.005%) and brodifacoum (0.005%) were evaluated as solo treatments in moong bean fields only. The fourth treatment consisted of two

Table 1

Distribution pattern of live rodent burrow in *moong* bean fields

Mean live borrow counts at different crop growth stages/ha (Nos)				
3 days before sowing		After sowing (in crop fields)		
Surrounding fallows	Tilled fields	15 DAS	30 DAS	60 DAS
62-95	5-20	158-169 (All the burrows in peripheral region)	170-195 (All the burrows in peripheral (region)	210-285 (Spread in central region also)

DAS-Days after sowing.

Table 2

Rodent damage to arid legumes (*moong* and *moth* bean) at different crop growth stage

Crops	Seedling stage			Pod formation/maturity stage
	Damage at a burrow density of 1-2/m^2 (%)	Damage at a burrow density of 3-5/m^2 (%)	Per cent plant reduction	Pod damage (%)
Moong	80.00	100.00	77.20	3.12±1.08
Moth	60.70	100.00	83.00	2.80±0.72

rodenticides, *viz.*, zinc phosphide (2.0%) followed by bromadiolone (0.005%) after a week. The treatments were given in live rodent burrows in two-week-old crop. Treatment of zinc phosphide, an acute rodenticide, was given after pre-baiting with pearl millet grains for one day. The observation on live burrow counts, before and after treatments (4, 10 and 30 days) were recorded for computing the control success.

RESULTS AND DISCUSSION

Species composition: Trapping and live burrow counts revealed predominance of Indian desert gerbil, *Meriones hurrianae* in arid pulses grown in both the study sites i.e., sandy plains (80.0%) and hummock/dunes (60.0%). The other species encountered in these crops were Indian gerbil, *Tatera indica* and hairy-footed gerbil, *Gerbillus gleadowi*. The former species was trapped exclusively from fields located on the sandy plains, whereas, the latter one was captured exclusively from duny/hummocky fields.

M. hurrianae is a diurnal rodent, whereas, the other two species are nocturnal. Except *T. indica*, the other two species are truly xeric in habitat. *M. hurrianae* is distributed in arid regions of Rajasthan, Gujarat, Haryana and Punjab, whereas, *G. gleadowi* is found on duny/hummocky habitats in extreme arid regions of Rajasthan only (Prakash & Mathur, 1987 and Tripathi *et al.* 2002).

Among the three rodent species trapped during the study, *T. indica* was seen to inhabit the peripheral bunds covered with thorny bushes, where their runways and live burrows could be observed. The burrow density of *T. indica* per 10 m long such bunds ranged between 2-6 and their runways extended from 0.5 to 3.0 m length inter connecting the burrow openings and even reaching up to sown crop fields. Similarly, burrows of *M. hurrianae* and *G. gleadowi* were mostly concentrated on the peripheral regions of the crop fields.

Infestation patterns: During May-June the rodents thrive on the roots/rhizomes of various desert vegetation (Prakash, 1981 and Tripathi *et al.* 1992). As soon as the seeds are sown the native rodents immigrate to the crop fields and pin-pointedly pick the sown seeds causing poor germination. Considering the stresses of low moisture regimes in arid regions, the farmers generally maintain a higher seed rate for these rain fed crops.

This practice helps them tide over the problem of rodent damage to sown seeds also. Present investigation revealed that rodent pest population in the pulse fields varied with the stage of crop. Just after the land preparation for sowing, the live burrow density in the crop fields was 5-20/ha, whereas the same was 62-95/ha in the surrounding fallow lands. With the initiation of germination and further vegetative growth of the crops the pest rodents from surrounding fallow lands enter the crop fields and initially inhabited the peripheral regions (5-10m strip) recording a burrow density of 158-169/ha at 15 days after sowing and 170-195/ha in one month old crop.

At pod formation and maturity stage, the pest population records further increase (210-285 burrows/ha) (*Table 1*). At this stage the burrows were distributed even in central portion of crop

Table 3

Evaluation of rodenticidal treatments in *moong* crop

Treatment	Pre-Treatment Live burrows (Nos/ha)	Control Success (%) 4 days after treatment	14 days after treatment	30 days after treatment
Zinc phosphide (2%)	181.00	74.58	69.61	49.72
Brodifacoum (0.005%)	159.00	13.20	87.74	76.10
Bromadiolone (0.005%)	193.00	14.50	84.97	72.00
Zinc phosphide (2%) followed by Bromadiolone (0.005%)	168.00	69.04	85.17	82.14

fields. During monsoon season the breeding activity of the desert rodents attains a peak (Kaul and Ramaswamy, 1969 and Jain 1970) that coincides with the flowering stage of the *kharif* pulses. At pod formation stage the rodent pests confined to the peripheral regions, started migrating in the central region of the crop fields also, because of cessation of inter-culture operations.

In view of the above it can be inferred that the rodents pester the arid pulses throughout the crop growth period, and their infestation causes serious concern only at two stages, i.e., seedling and pod formation/maturity stage.

Rodent damage: Observations revealed that at seedling stage the rodent depredation is localized and concentrated at peripheral regions only. At a live burrow density of 3-5/m^2 there was complete removal of seedlings of both the pulses resulting in total loss of plant stand, whereas at 1-2 burrows/m^2, 80.0 and 60.7 per cent seedlings of *moong* and *moth* bean were destroyed by the desert rodents mainly desert gerbils, respectively.

At such a high pest population density overall loss in terms of reduction in plant stand due to rodent infestation in two-week-old crops reached 77.2 (*moong* bean) and 83.0% (*moth* bean) in the peripheral regions (5-10 m strip).

At pod formation/maturity stage the pest rodents had an opportunity to feed on leaves, stem and pods, but showed greater preference for pods. Damage to the pods due to rodent depredation was 3.12 ± 1.08 (*moong* bean) and 2.80 ± 0.72 (*moth* bean) (*Table 2*). This data only represents the number of damaged pods attached to the bunch and does not account for the pods completely removed by the rodents and taken to their burrows. Cut pods, leaves and stem were clearly visible near all the burrow openings.

Rodenticidal evaluation: Among the various rodenticides treatments, acute poison, zinc phosphide (2%) as solo treatment recorded more than 80% control success on 4th day of treatment which decreased to 69.4 and 50.0% on 14th and 30th day. Single dose anticoagulants, *viz.*, brodifacoum (0.005%) and bromadiolone (0.005%) fetched only 13.0 and 14.3% success on 4th of treatment. However, on 14th day both the anticoagulants proved significantly at par yielding 87.8 and 84.9% success which remained above 70% even one month after treatment (*Table 3*).

Anticoagulants being chronic poison resulted in effective mortality of pest rodents between 3-10 days after baiting. The combination treatment of zinc phosphide (2.0%) followed by bromadiolone (0.005%) provided 69.04, 85.17 and 82.14 per cent control success on 4, 14 and 30th day of treatment. This treatment combined the quick knockdown effect of zinc phosphide and sustained effect of chronic bromadiolone yielding sustained protection of crop from the ravages of rodent pests (*Table 3*).

Mathur *et al.* (1992) has also reported that bromadiolone and brodifacoum at 0.005% yielded 62-100% rodent control success in various crops. Based on these studies, poison baiting with zinc phosphide (2.0%) followed by bromadiolone (0.005%) may be recommended for managing the pest rodents in arid legumes.

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For Finding Land Mines, Call In the Giant Rats

In Gondola, Mozambique, just about every method of detecting land mines has a drawback. Metal detectors cannot tell a mine from an 8-centimeter nail. Armored bulldozers work well only on level ground. Mine-sniffing dogs get bored, and if they make mistakes, they get blown up. The Gambian giant pouched rat has a drawback, too: It has trouble getting back to work on Monday mornings. Other than that, it may be the best mine detector known to man.

One morning, on a large patch of earth in the Mozambican countryside, Frank Weetjens and his squad of 16 giant pouched rats are proving it. Outfitted in tiny harnesses and hitched to 9-meter clotheslines, their long tails whipping to and fro, the rats lope up and down the lines. Wanjiro, a sleek 2-year-old female in a bright red harness, pauses halfway down the line, sniffs, turns back, then sniffs again. She gives the red clay a decisive scratch with both forepaws. Her trainer, Kassim Mgaza, snaps a metal clicker twice, and Wanjiro waddles to him for her reward – a mouthful of banana and an affectionate pat.

"What Pavlov did with his dogs is exactly what we're doing here – very basic conditioning," said Mr. Weetjens, a tall, 42-year-old Belgian who works for an Antwerp mine-removal group named Apopo. "TNT means food. TNT means clicking sound, means food. That's how we communicate." Wanjiro was rewarded for sniffing out a TNT-filled land mine, one of scores buried a few centimeters below ground in the training field where she works out five days a week. Like all the training mines, this one was defused. But if the Mozambican authorities approve, she and her companions will move at year's end to live minefields – the world's first certified, professional mine-detecting rats.

A giant rat was rewarded with a piece of banana after finding a land mine.

Rats are abundant, cheap and easily transported. Weighing about one kilogram, they are too light to detonate mines accidentally, and they are relentlessly single-minded. Plenty of work awaits them. The International Campaign to Ban Land Mines estimates that 100 million mines have been laid worldwide.

Mine-sniffing rats are the sole focus of Apopo. The group is the brainchild of Mr. Weetjens' brother Bart; a college friend, Christophe Cox; and a University of Antwerp professor, Mic Billet, now Apopo's chairman. The three decided in the 1990's that so-called boisensor animals with great noses were the future of landmine detection, but that there must be creatures better suited for the task than dogs.

After much research, they settled on *Cricetomys gambianus*, also known as the Gambian and African giant pouched rat, so named because it stores food in its cheeks. It measures up to 76 centimeters long and thrives in most of sub-Saharan Africa. It is "savage" in the wild, Mr. Weetjens says, but docile when bred. Most important, the nose of the pouched rat has been honed by eons of searching for buried food. Each rat gets to sweep a 10-by-10-meter square of land on which two defused mines or TNT scents have been hidden. Finding the mine or scent earns a click and a bite of banana or peanuts. Bananas and peanuts, after all, are what drives giant pouched rats to excel. Which is why they are often at their worst on Monday morning. "During the week, they're on a diet; they have to work for their food," Mr. Weetjens said. "But on weekends, they get to eat as much as they want. On Mondays, they just aren't as hungry."