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Research Article

EVALUATION OF BOTANICALS AGAINST RODENT PESTS IN IRRIGATED PADDY

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ABSTRACT: Rodents are the major limiting factor right from nursery to harvest stage in paddy. Repeated application of rodenticides for managing rodent damage may lead to development of resistance among rodents, environment risks and human health hazards. Hence, Field experiments were carried out to evaluate the efficacy of various botanicals as alternatives against rodent pests instead of continuous application of rodenticides in irrigated rice ecosystem during *kharif* and *rabi* seasons of 2011-12. The efficacy of botanicals was assessed by live burrow count before and after imposition of treatments at 7 and 15 days after treatment during tillering and panicle initiation stage of the rice crop. Among all the botanicals evaluated for their efficacy against rodent pests the commercial castor based product, Ecodon recorded highest percent control success ranging from 44.36 to 59.20 % followed by crude castor oil (10%). The Crude castor oil (10%) was also proven to be superior next to Ecodon in order of efficacy against rodent pests. The other botanicals like pongamia oil, neem oil and papaya extract shown no significant control success in suppression of rodent pests. It is inferred from the present study that botanicals cannot substitute the rodenticides in rodent management but can be used in combinations and alternate applications in minimizing their incidence in irrigated paddy.

Keywords: Rodents, Botanicals, Ecodon, Rice

INTRODUCTION

In paddy cultivation one of the major limiting problems irrespective of system of cultivation right from nursery to harvest is the rodent pests (Srinivasa Rao and Nanda kishore, 2010). Rodents inflict 0.44 to 60 percent tiller damage in paddy which accounts for 5-10 percent total grain yield losses in pre harvested rice (Parshad *et al*., 2007). Among the various rodent control methods, the use of rodenticides is the most common and expedient method to control rodent pests (Buckle, 1999 and Makundi 2005). But, due to lack of proper knowledge among farmers in proportion of toxicant, preparation of poison baits and repeated application of the rodenticides leads to bait shyness and development of resistance to chemicals among the rodents. Besides posing menace to environment and human health. Resistance to rodenticide acts as a problem when the proportion of resistant phenotypes in the targeted rodent population increases to where the rodenticide cannot control effectively the rodent infestation. The application of anticoagulant rodenticides for rodent control also has showed a decrease in effectiveness through time because of the development of resistant populations and the development of aversion behavior among rodents (Guidobono et al., 2009). Hence there is a need for use of alternatives instead of rodenticides. Botanical insecticides have long been touted as attractive alternatives to synthetic chemical insecticides for pest management in field crops (Murray, 2005). They possess an array of properties including toxicity to the pest, repellency, antifeedance, insect growth regulatory activities against pests of agricultural importance (Prakash and Rao, 2003). Botanicals like Datura leaf extract, crude castor oil, neem seed kernel extract, different formulations of neem and castor based product Ecodon reported to have antifeedant properties against rodents (Gupta and Sharma 2005; Nilesh and Rao 2009, Baglari and Borah 2014). In the present investigation various plant products were evaluated for their bio efficacy against rodents infesting paddy.

MATERIALS AND METHODS

Study area

The present study was carried out to evaluate the field efficacies of various botanicals against rodent pests in irrigated rice (Table 1). Field trials were conducted at Lankalakoderu village of Palakol Mandal, West Godavari district, Andhra Pradesh, India in rice-rice-fallow/pulses cropping system for *kharif* and *rabi* seasons of 2011-12. An area of about 45 ha having fairly good infestation of rodent pests with no previous record of rodenticides treatment for at least one season was selected. The study sites (45 ha) were divided into three blocks following randomized block design (RBD). Each block (15 ha) represents one replication and consisted of ten plots of 1 ha area for each treatment. These plots were separated by a distance of 0.45-0.50 ha between the plots as boarder area.

Treatments imposed

The field experiments were laid out in the paddy fields with ten treatments that were replicated thrice. Bunds with uniform range of burrow infestation were taken for imposing treatments. The treatments include botanicals like neem oil (5 &10 per cent), pongamia oil (5 &10 per cent) papaya extract (5 &10 per cent), castor oil (5 &10 per cent) and Ecodon (1:100), a castor based commercial rodent repellent product. Pre treatment counts on rodent live burrows were recorded. Foliar sprays of 5 l spray fluid of each treatment were applied on every bund of the paddy fields in all the three replications during tillering and Panicle initiation stage of the crop. Post treatment counts on rodent live burrows at 7 and 15 days after imposition of treatment was recorded.

Assessment of efficacy of the botanicals

The relative bio efficacy of the treatments was assessed in terms of per cent reduction in the rodent population over control at tillering and panicle initiation stage of the crop. The rodent population was assessed by live burrow count method (LBC), for which all the burrows in the study area are plugged a day before and freshly opened burrows in the next morning were counted. These active burrows were considered as index for rodent population (Pic. 1)

The rodent population in the study area before and after imposition of treatments was recorded for each treatment and the percent rodent control success for each treatment at tillering and panicle initiation stage of the crop were worked out (Mathur and Prakash, 1984).

Percent control success = 100 (1- ((T2 X C1)/ (T1 X C2))

Where,

T1- pre treatment population of rodents (LBC)
T2- post treatment population of rodents (LBC)
C1- pre treatment population of rodents (LBC) in control plot (T10)
C2 - post treatment population of rodents (LBC) in control plot (T10)

RESULTS

Relative efficacy of botanicals on rodent live burrow count during tillering stage

The percent rodent control success in tillering stage by application of botanicals ranged from zero to 51.7 percent. Among all the botanicals tested in minimizing the rodent population, T9 (Ecodon) was proven to be significantly superior to remaining treatments 7 and 15 days after treatment with 44.36 and 48.72 % control success during *kharif* 2011 and with 45.88 and 51.77 % control success during *rabi* 2011-12 respectively. The next better treatment in suppression of rodent live burrows at 7 and 15 days after treatment was observed to be castor oil (10%) with 30.89, 37.74 and 31.90 and 36.76 per cent control success during *kharif* and *rabi* 2011-12 respectively (Table 1 & Fig 1).

Relative efficacy of botanicals on rodent live burrow count during Panicle Initiation stage

The relative efficacy of botanicals in terms of percent rodent control success during panicle initiation stage of both *kharif* and *rabi* 2011-12 ranged from zero to 59.2 percent. Observations on efficacy of botanicals in reducing the population of rodents in terms of LBC indicated that Ecodon (T9) was significantly superior to all other botanicals at 7 and 15 days after treatment with 53.9 and 55.37 per cent control success during *kharif* 2011 and 56.88 and 59.20 % control success during *rabi* 2011-12 respectively. The second better botanical was observed to be castor oil (10%) similar as in the case at tillering stage (Table 2 & Fig 2).

The other botanicals like neem oil, pongamia oil and papaya extract were observed to be not significantly superior to control in suppression of rodent live burrow count.

Table 1. Efficacy of botanicals against rodents at tillering stage

Treatments	Mean Per cent LBC/ha									
	Kharif 2011					Rabi 2011-12				
	1 DBT	7DAT	% Control Success	15DAT	% Control Success	1 DBT	7DAT	% Control Success	15DAT	% Control Success
T1-Neem oil 5%	25.5	25.2	5.12(13.08)	24.4	6.37(14.62)	26.8	26.4	9.37(17.82)	26.6	14.64(22.50)
T2-Neem oil 10%	26.8	26.3	5.79(13.92)	26.3	15.47(23.16)	27.3	27.0	9.01(17.47)	27.2	14.31(22.23)
T3-Pongamia oil 5%	19.3	16.2	18.92(25.78)	21.8	24.02(29.35)	18.2	15.1	23.67(29.11)	15.5	26.75(31.14)
T4-Pongamia oil 10%	26.2	22.3	18.29(25.32)	12.6	21.08(19.28)	21.4	18.3	21.32(27.50)	18.5	25.65(30.43)
T5-Papaya extract 5%	30.1	29.9	4.36(12.05)	32.4	0	28.3	27.2	11.57(19.89)	28.8	0
T6-Papaya extract 10%	21.6	19.6	12.88(21.03)	21.9	19.49(26.20)	18.6	17.4	14.43(22.33)	18.2	15.84(23.45)
T7-Castor oil 5%	18.3	16.5	13.44(21.51)	25.9	13.70(21.72)	17.1	15.5	16.61(24.05)	16.1	19.02(25.86)
T8-Castor oil 10%	23.2	16.7	30.89(33.76)	22.6	37.74(37.90)	20.4	15.1	31.90(34.39)	15.0	36.76(37.32)
T9-Ecodon	**17.6**	**10.2**	**44.36(41.76)**	**11.7**	**48.72(44.27)**	**18.7**	**11.1**	**45.88**(42.64)	**10.5**	**51.71**(45.98)
T10-Control	31.0	32.2	-	24.2	-	26.2	28.4	-	30.5	
CD 5%	NS	4.06		4.26		NS	3.21		2.72	

Table 2. Efficacy of botanicals against rodents at Panicle initiation stage

Treatments	Mean Per cent LBC/ha									
	Kharif 2011					Rabi 2011-12				
	1 DBT	7DAT	% Control Success	15DAT	% Control Success	1 DBT	7DAT	% Control Success	15DAT	% Control Success
T1-Neem oil 5%	33.2	32.4	7.28(15.65)	33.1	5.28(13.28)	30.1	29.5	8.85(17.31)	30.0	12.29(20.52)
T2-Neem oil 10%	28.4	27.6	7.67(16.08)	24.5	18.01(25.11)	29.4	29.0	8.26(16.70)	29.2	12.59(20.78)
T3-Pongamia oil 5%	26.3	21.4	22.6(28.38)	20.5	25.95(30.62)	26.0	20.5	26.67(31.09)	21.0	28.9(32.52)
T4-Pongamia oil 10%	31.2	23.4	28.75(32.42)	14.6	20.32(19.42)	25.5	18.6	32.16(34.55)	19.5	32.70(34.88)
T5-Papaya extract 5%	28.6	28.4	6.65(14.94)	28.9	0	21.0	20.5	9.21(17.67)	22.0	0
T6-Papaya extract 10%	30.3	27.6	13.46(21.52)	26.7	16.28(23.80)	25.5	25.3	7.72(16.13)	25.0	13.72(21.74)
T7-Castor oil 5%	29.4	22.7	26.64(31.07)	23	25.68(30.45)	20.1	16.6	23.19(28.79)	14.0	25.78(30.51)
T8-Castor oil 10%	21.8	15.4	32.88(34.99)	13.5	41.16(39.91)	18.7	12.4	38.33(38.25)	11.0	18.23(25.28)
T9-Ecodon	**26.4**	**12.8**	**53.9(47.24)**	**12.4**	**55.37(48.08)**	**30.2**	**14.0**	**56.88**(48.95)	**14.0**	**59.20**(50.30)
T10-Control	31.2	32.3	-	32.8	-	27.3	29.2		31.0	
CD 5%	NS	3.37		2.56		NS	3.71		2.84	

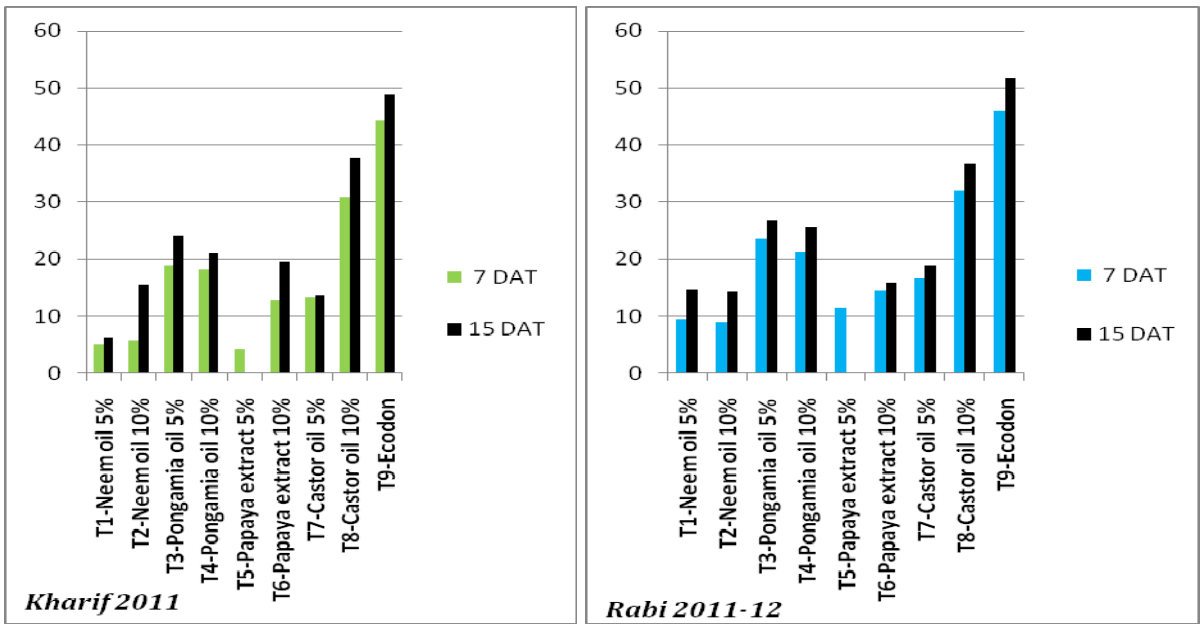

Fig.1 Efficacy of botanicals against rodent pests infesting paddy in terms of percent rodent control success at 7 and 15 days after treatment during tillering stage of kharif and rabi 2011-12

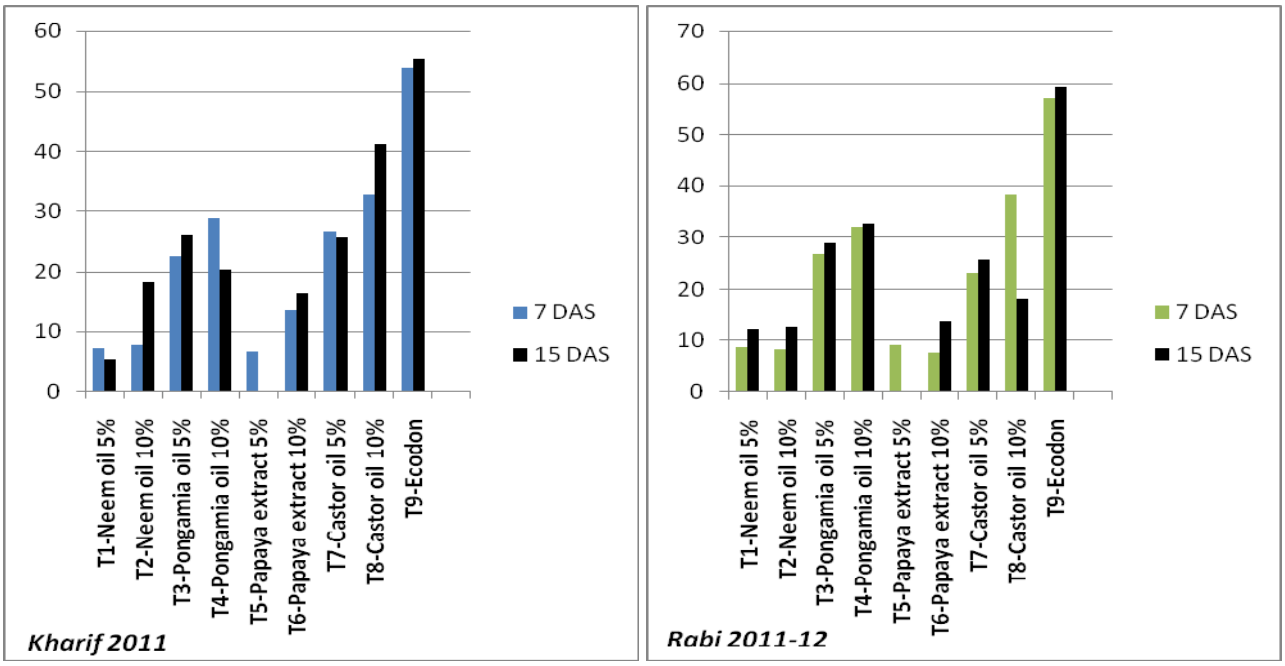

Fig.2 Efficacy of botanicals against rodent pests infesting paddy in terms of percent rodent control success at 7 and 15 days after treatment during Panicle initiation stage of kharif and rabi 2011-12

PIC.1 representing live burrow of rodent

DISCUSSION

In the present studies, it is revealed that among different botanicals evaluated for their efficacy against rodent pests, a commercial castor based product, Ecodon recorded highest per cent control success in comparison to other treatments. This is in agreement with the studies of Gupta and Sharma 2005, Nilesh and Rao 2009, Baglari and Borah 2014 who expressed that the antifeedant activity of Ecodon resulted in suppression of rodent population by 50-65 percent.

The castor oil has also shown significant reduction in rodent live burrow count which is similar to the findings of Stoll 2000 who found some indigenous technologies adopted by farmers like crude castor oil application among filed bunds resulted in control of rodents.

The Pongamia oil also shown noticeable control success in rodents which is in accordance with the work of Smitha et al 2010 who find the antiinflammatory activity of *Pongamia pinnata* stem bark in rats. The similar finding were also noted by Prabha et al 2009 who stated that the pongamia oil has influence on mucosal offensive and defensive factors in rats. The neem oil has shown low per cent control success over control in suppression of rodent population and the per cent success rate ranged from 5.12-14.64 percent when 5% neem oil was applied and with 10% application the range of success is observed to be 5.79-18.01 percent. This is in contrast with the observations of Moyin 2010 and research achievements of CAZRI 2012 who stated that neem oil has antifeedant activity ranging from 45-50 percent on rodents.

The papaya extract has no effect on rodent population in the present finding. However, Stoll 2000 and Sridhar *et al* 2002 has found some indigenous technologies adopted by farmers in control of rodents at field level.

CONCLUSION

The results obtained in the present studies suggest that although rodenticide application results in acute posing of rodents and decrease in rodent incidence and their damage, keeping in view the aversion behavior and development of resistance to chemicals by rodents, environment and human health risks, use of the commercial castor based product Ecodon with rodenticide as alternate application can be used effectively against rodent pests infesting paddy.

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