

Evaluation of botanical and other extracts against plant hoppers in rice

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ABSTRACT

A field experiment was conducted to determine the comparative efficacy of ten botanical leaf aqueous extracts, panchagavya, acephate as standard check and untreated control against hoppers in rice during *kharif* 2009-2010 and 2010-2011. The treatments include: Aqueous leaf extract of *Vitex*, *Pongamia*, Custard, *Calotropis* at 5 and 7.5% concentration, Neem Seed Kernel Extract (NSKE) at 5 and 7.5% concentration, panchagavya at 5 and 7.5% concentration, acephate 75%SP @ 1.5 g/lit and untreated control. The cumulative data reveals that the standard check-Acephate 75 SP @ 1.5 g/lit recorded significantly higher mean % reduction of hoppers and higher grain yield over all the other treatments. Among the botanical extracts, NSKE at 7.5% concentration recorded higher efficacy against hoppers by recording 49.4% mean reduction with a mean grain yield of 4775 kg/ha and found to be at par with some of the other botanical extracts. The Panchagavya and Custard leaf extracts at both the concentration shown significantly lower efficacy. Except Acephate and NSKE at 7.5% concentration, all the other treatments were found to be at par with each other in terms of grain yield.

Key words: Botanical extracts, hoppers, panchagavya, rice, yield

INTRODUCTION

Rice (*Oryza sativa L.*) is one of the world's most important crops providing a staple food for nearly half of the global population (FAO, 2004) and for 2.7 billion people in developing countries in Asia (FAO, 1995; PARC, 2003). The rice crop is subjected to sustain a considerable damage by a number of insect pests. More than 100 insect species cause significant economic loss in rice (Pathak and Khan, 1994). Among them, plant hoppers consisting of brown plant hoppers and white backed plant hoppers are the principle devastators during *kharif* season in Andhra Pradesh, which are responsible for major economic crops losses (Alice P. Sujeetha, 2008). The yield losses due to hoppers ranges from 10 to 90 percent and almost 50% of the insecticides used in rice are targeted against this pest alone. The insect attacks the crop from panicle initiation stage to grains hardening stage. Hopper burn symptoms are produced when the insect attacks at reproductive stage. Synthetic insecticides are still major method to control insect pests particularly hoppers in rice (Mishra, 2006). The use of insecticides can be environmentally disruptive and can result in

elimination of beneficial insects and accumulation of residues in the harvested produce (Chinnaiah *et al.*, 1998; Anand Prakash *et al.*, 2008). Botanical insecticides have long been touted as attractive alternatives to synthetic chemical insecticides for pest management (Isman *et al.*, 2006; Echereobia *et al.*, 2010). Botanical pesticides are ecofriendly, economic, target-specific and biodegradable. Their greatest strength is their specificity as most are essentially nontoxic and non-pathogenic to animals and humans. Considering the importance of ecofriendly approaches to manage the pests, the experiment was designed to determine relative efficacy of different botanical extracts and other extracts against hopper.

MATERIALS AND METHODS

The experiment was conducted in the experimental farm of Regional Agricultural Research Station, Warangal district, Andhra Pradesh, during *kharif* 2009-2010 and 2010-2011 in Randomized Block Design (RBD), having 14 treatments which were replicated twice in a net experimental area of 50 m²

each. Nursery of rice variety BPT-5204 was sown in the last week of June and transplanting was done during last week of July at 20 x 15 cm hill spacing. The treatments were : T1-*Vitex* leaf extract (5.0%); T2-*Vitex* leaf extract (7.5%); T3- *Pongamia* leaf extract (5.0%); T4-*Pongamia* leaf extract (7.5%); T5- Custard apple leaf extract (5.0%); T6-Custard apple leaf extract (7.5%); T7-*Calotropis* leaf extract (5.0%); T8-*Calotropis* leaf extract (7.5%); T9- Neem Seed Kernel Extract (NSKE) (5.0%); T10-Neem Seed Kernel Extract (NSKE) (7.5%); T11-Panchagavya (5.0%); T12- Panchagavya (7.5%); T13- Acephate 75% SP (1.5 g/L) (Standard check) and T14- untreated control.

Botanical leaf extracts were prepared in the following manner. Leaves of *Vitex negundo*, *Pongamia pinnata*, Custard apple and *Calotropis* were collected and cut into small pieces. The cut leaves were mixed with water at 5 and 7.5% concentration level *i.e.*, 0.5 kg and 0.75 kg leaves per 10 liters of water and boiled for 30-50 minutes and afterward was allowed to cool for about 2 hours and was then filtered through muslin cloth. The Neem Seed Kernel extract (NSKE) was prepared by mixing 0.5 and 0.75 kg of neem seed kernel powder per 10 liters of water to get 5 and 7.5% concentration respectively and soaked for overnight and afterward filtered through muslin cloth.

Panchagavya was prepared at two concentrations *i.e.*, 5 and 7.5% using cow urine, cow dung, ghee, curd and cow milk. 0.5 kg cow dung, 0.5 liters cow urine, 0.5kg ghee, 0.5 kg curd, 0.5 kg milk and 15g of lime and 0.75 kg cow dung, 0.75 liters cow urine, 0.75 kg ghee, 0.75 kg curd, 0.75 kg milk and 15 g of lime were added to 10 liters of water in an earthen pot sealed with a thick cloth to get 5 and 7.5% concentration of Panchagavya respectively. The mixture was allowed for about ten days time till ammonia smell comes out. Then 10g of detergent powder was added and filtered through muslin cloth.

The extracts were sprayed on the crop when the hopper population reached above Economic Threshold Level (ETL). A total of 3 sprays at weekly interval were given using knap sack sprayer at the rate of 500 liters spray fluid per hectare. The

hopper population per hill was recorded before spray and 7 days after each spray and percent reduction of hoppers over control was calculated. Finally the grain yield was also recorded and expressed as kg/ha.

RESULTS

The cumulative data of 2009-10 and 2010-11 pertaining to mean percent reduction of hoppers reveals that, among all the treatments, the check treatment - T13 was recorded to be significantly superior in efficacy against plant hoppers, as it recorded highest mean % reduction of hoppers. However, among the botanical extracts, T10 was the best treatment against hoppers by recording 49.4 % reduction and was found to be on par with T9, T2, T7 and T8 and T3 and T4. The Panchagavya and custard leaf extract at 5 and 7.5% concentrations were found to be least in efficacy against hoppers, however better over untreated control.

With regards to yield, acephate 75 SP @ 1.5g/L recorded significantly highest yield of 5555 Kg/ha followed by NSKE at 7.5% concentration (4775 Kg/ha). All the other treatments recorded significantly lower yields, and were found to be at par with each other, but significantly superior over control.

DISCUSSION

In the present study it was found that the standard check - Acephate 75% SP @ 1.5g/lit. proved to be the better treatment against hoppers by recording highest mean percent reduction of 86.2% and highest grain yield of 5555 kg/ha . The superior efficacy of Acephate against hoppers was well documented by several workers (Bhavani and Rao 2005; Ching-Huan Cheng, 1984; Fabellar and Heinrichs, 2003). However, among the botanical extracts Neem Seed Kernel Extract (NSKE) at 7.5% concentration was recorded to be the next best treatment against plant hoppers. The efficacy of Neem Seed Kernel Extract against plant hoppers in rice was reported by several other workers and the results of the present study was in conformity with the these findings. Sujeetha (2008) reported higher efficacy of NSKE at 5% against

Table 1. Efficacy of certain botanicals and other extracts against plant hoppers

Treatments	Conc. (%)	No. hoppers / hill						Mean % reduction
		2009-2010			2010-2011			
		Before spray	After spray (7 DAS)	% reduction	Before spray	After spray (7 DAS)	% reduction	
T1	5.0	43.3	18.5	43.9	50.8	28.1	44.7	44.0
T2	7.5	38.2	24.3	51.5	50.3	28.5	43.3	47.6
T3	5.0	42.8	21.8	49.1	60.0	35.0	41.7	45.4
T4	7.5	40.1	21.3	46.9	49.7	27.3	45.1	46.0
T5	5.0	39.7	26.8	32.5	51.9	30.1	42.0	37.3
T6	7.5	40.0	27.3	31.8	44.4	27.8	43.7	37.8
T7	5.0	43.0	21.8	49.3	55.4	32.0	42.2	45.8
T8	7.5	45.3	23.2	48.8	53.1	30.4	42.7	45.8
T9	5.0	39.3	19.5	50.4	50.1	28.9	42.3	46.4
T10	7.5	41.8	19.3	53.8	49.8	25.4	49.0	49.4
T11	5.0	39.6	25.7	35.1	50.2	28.4	43.4	39.3
T12	7.5	45.9	28.4	38.1	52.9	30.7	42.0	40.1
T13	0.1	40.2	7.2	82.1	53.4	5.2	90.3	86.2
T14	-	40.7	31.4	-	48.3	67.1	-	-
CD (5%)		NS	9.2	5.2	NS	7.1	5.5	4.5
S.Em±			3.1	2.4		2.8	2.4	2.0

BPH in rice and noticed less survival, more developmental period, minimum growth index and lesser size and weight of adults of BPH. Krishnaiah, and Kalode (1990) also reported that, Neem Seed Kernel Water Extract (NSKWE) spray adversely effected the growth of BPH at 5000 ppm dose. Neem Seed Kernel Extract was reported to show Juvenile hormone mimic activity and reduced population of WBPH as reported by David (1986); Rajasekaran *et al.* (1987) and Mohan and Gopalan (1990). The superior efficacy of NSKE against hoppers could also be due to reduced emergence of BPH (Ramraju and Sundarababu, 1989) and effecting the biology of hoppers (Senthil Nathan *et al.*, 2007).

The efficacy of other plant leaf extracts such as *Vitex*, *Pongamia* and *Calotropis* were also found to be comparatively better against plant hoppers (Anand Prakash *et al.*, 2008). Rajappan *et al.* (2000) reported reduced hopper population when NSKE at 5% and *Vitex* leaf extracts were sprayed. Mariappan *et al.* (1988) reported reduced survival of green leaf hopper and reduced emergence of plant hoppers when pongamia leaf extract was sprayed. Sukumaran *et al.* (1987) observed pupal malformation in rice insect pests when exposed to *Vitex* leaf extract. Mahapatra *et al.* (2009) reported that *Vitex* leaf extract at 5% concentration showed good efficacy against the hoppers and leaf folder

under laboratory conditions.

Table 2. Effect of certain botanicals and other extracts on grain yield of rice

Treatments	Conc. (%)	Grain yield (kg/ha)		
		2009-10	2010-11	Mean
T1	5.0	4970	4170	4570
T2	7.5	4825	4025	4425
T3	5.0	5125	4325	4725
T4	7.5	4825	4025	4425
T5	5.0	5020	4020	4520
T6	7.5	5225	3925	4575
T7	5.0	4920	4120	4520
T8	7.5	5120	4320	4720
T9	5.0	4870	4070	4470
T10	7.5	5025	4525	4775
T11	5.0	5120	4320	4320
T12	7.5	5020	4220	4430
T13	0.1	5455	5655	5555
T14	-	3825	3635	3730
CD (5%)		328.5	305.0	305
S.Em±		109.4	148.0	136.7

Abdul Rehman and Soomro (2007) reported higher grain yield in rice when Neem Seed Kernel Extract was sprayed. Because botanical pesticides have many advantages over synthetic pesticides such as low mammalian toxicity, no risk of developing pest resistance, no adverse effect on plant growth, less expensive and easy availability, the botanical

extracts may be utilized as an alternative to synthetic insecticides especially in organic rice cultivation system. The results obtained in the present investigation can be very well utilized as alternative to synthetic insecticides for the management of hoppers in rice

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