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Screening out effects of plant extracts on management of Sogotella Furcifera in rice

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Abstract

A field experiment was conducted to screen out possible positive effects of plant extracts on controlling and management of White backed plant hopper *S. Furcifera* in cultivated field. This research study was primarily aimed to determine and explore biological management of *S. Furcifera*. In this study, plant extracts of different nature were used. The study revealed that each kind of plant extracts had significant effects on controlling of population of White backed plant hopper with varying differences. Comparatively, T13-Buprofezin 15% +Acephate 35% WP (1.5g/L) showed most significantly controlled population of *S. Furcifera* that roughly reduced by 85% in all years of experiment. Moreover, in plots treated with Jimsonweed extract (7.5%) also controlled around 50% population followed by Neem Seed Kernel Extract (NSKE) (7.5%) and Seed Kernel Extract (NSKE) (5.0%), where reduction% was recorded by 46% and 45% respectively. However, minimum reduction% was recorded in Euclyptus leaf extract (5.0%) and Custard apple leaf extract (5.0%) that reduced by 18% and 20% respectively. The highest yield production was also achieved in plot where-Buprofezin 15% +Acephate 35% WP (1.5g/L) was used. So, application of plant extracts against *S. Furcifera* can give provide better way in controlling population below injury level.

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Introduction

Rice, technically known as (*Oryza sativa* L.) is one of the main cereal growing crop of global world and meeting the food requirement of almost half of the global population (FAO, 2004) and nearly 2.7 billion population of Asian countries are dependent on rice production as a basic source of food (FAO, 1995; PARC, 2003). The rice crop is under threat of many different insect pests that lead to serious yield production damage annually. According to studies that around 100 different insect species attack on rice crop and can impact seriously to average crop productivity (Pathak and Khan, 1994). Among them, plant hoppers such as white backed plant hopper and brown plant hopper are potentially mass devastator in rice crop (Alice P. Sujeetha, 2008). The yield reduction due to these plant hoppers may reach 10 to 90% and around 50% insecticides are only used to control these species in rice fields. Panicle and hardening growth stages of rice crops are critical for attacking of these plant hoppers. Currently, chemically synthetic insecticides are still prominent options to suppress the population of plant hoppers (Mishra, 2006). But after all, continuous indiscriminate use of insecticides is increasing environmental concerns because of their negative impacts on other eco-system mechanisms particularly on host insect and as a result biological control is under threat (Chinnaiah *et al.*, 1998; Anand Prakash *et al.*, 2008). Since last few years, uses of botanical insecticides are getting much attention by researchers and progressive growers to manage insect pests caused by plant hoppers (Isman *et al.*, 2006; Echereobia *et al.*, 2010). Unfortunately, the issues of insect pest have sharply increased in rice production areas that have further intensified over dependence on insecticides as a convenient way to control insect population. On roughly estimation 200 million tons of rice is annually damaged through insect pest and environmental changes (Khan *et al.*, 1991).The botanical pesticides are nature loving and environmental friendly that successfully catch target insect and are biodegradable. In recent years, the use of botanical pesticides and plant extracts for managing and controlling sucking plant insects are getting attention (Sorby *et al.*, 2003). Similarly, the aim of present study is also linked with environmental friendly management of WBPH in rice field with special focusing on screening out best possible biological parameters in terms of biological produced extracts that may be within ecological system and can give alternate methods to control WBPH rather than over-dependence on insecticides.

Materials and methods

For this research study, an experiment was carried out in the experimental farm of Rice Research Institute Dokri, District Larkana, Sindh in the season of kharif 2015 and 2016 respectively. This experiment was done through Randomized Complete Block Design (RCBD) with fourteen treatments and three replications spread over 50 acre of field. In this study, potential efficacy of pant extract against the controlling of White Backed Plant Hopper was tried to investigate. The Nursery of IRRI 8 was grown in the last week of June and consequently during last week of July, nursery was transplanted in experimental area while maintaining at hill spacing of 20 x 15cm. The treatments were consisted on: T1- Jimsonweed (Datura) leaf extract (5.0%); T2- Jimsonweed extract (7.5%); T3- Euclyptus leaf extract (5.0%); T4- Euclyptus 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- Asafoetida (Heeng) (5.0%); T12- Asafoetida (7.5%); T13- Buprofezin 15% +Acephate 35% WP (1.5g/L) (Standard check) and T14- untreated control. The preparation of Botanical leaf extracts were based on the following manner. Leaves of Jimsonweed, Calotropis, Custard apple and Euclyptus were first gathered and then subsequently chopped into very small pieces. To achieve 5 and 7.5% concentration levels, the chopped leaves 0.5 kg and 0.75 kg of each plant were kept in to 10 liters of water separately and then boiled for 30-50 minutes respectively. Besides, the received concentration of each level of each plant was left for about 2 hours to cool then it was further filtered through muslin cloth. Similarly, to have 5 and 7.5% concentration of Neem Seed Kernel extract (NSKE) and Asafoetida, the

powder of each i.e. NSKE and Asafoetida (0.5 and 0.75kg) was kept 10 liters of water separately in containers and soaked for overnight and thereafter the mixture was filtered through muslin cloth. Finally 10g of detergent powder as adhesive was added to each concentration except mixture of insecticides. The extracts were applied in each replication through napsak hand sprayer when the hopper population was found just crossing the Economic Threshold Level (ETL). During entire cropping season, three sprays at weekly interval were scheduled at the constant rate of 500 liters spray fluid per hectare. Before one day of spray and 7 days after each spray, the efficiency of plant extracts was monitored by counting hopper population per hill and% Population change of hoppers over control was calculated by using method given by (Flemings and Ratnakaran 1985) formula. Lastly, the grain yield was also described in kg/ha.

% Population change = (1 –PtTPTp/PrTPTp x PrTPCp/PtTPCp) x 100

Where:

PtTPTp= Post treatment population in treatment

PrTPTp= Pre treatment population in treatment

PrTPCp= Pre treatment population in control

PtTPCp= Post treatment population in control

Results

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

Treatments	Conc. (%)	No. of hoppers/hill						Mean% reduction
		2015			2016			
		Before spray	After spray (7 DAS)	% reduction	Before spray	After spray (7 DAS)	% reduction	
T1- Jimsonweed leaf extract	5	40.2	17.2	43.28	56.2	24.1	43.15	43.215
T2- Jimsonweed extract	7.5	41.2	15.9	48.84	49.52	18.5	50.48	49.66
T3- Euclyptus leaf extract	5	41.52	18.5	31.26	59.85	37	18.05	24.655
T4- Euclyptus leaf extract	7.5	34.52	15.4	40.65	48.52	25.3	30.88	35.765
T5- Custard apple leaf extract	5	38.4	23.11	20.22	50.2	30	20.78	20.5
T6- Custard apple leaf extract	7.5	39.5	22.9	23.15	43.5	21.4	34.79	28.97
T7- Calotropis leaf extract	5	43	20.8	35.88	50.9	29.9	22.13	29.005
T8- Calotropis leaf extract	7.5	44.01	20.8	37.35	50.1	24.4	35.44	36.395
T9- Neem Seed Kernel Extract	5	39.8	15.9	47.04	49.1	20.4	44.92	45.98
T10- Neem Seed Kernel Extract	7.5	40.1	13.5	55.37	46.52	18.7	46.71	51.04
T11- Asafoetida (Heeng)	5	38.5	24.5	15.64	49.2	27.6	25.64	20.64
T12- Asafoetida	7.5	42.5	29.7	7.22	50.9	24.2	36.98	22.1
T13- Buprofezin	0.1	42.9	6.13	81.05	50.4	4.2	88.95	85
T14- untreated control	--	39.5	29.8		41.3	60.1		
CD (5%)		NS	8.19	4.11	NS	8.1	6.5	5.5
S.Em±			2.8	2.54		3.01	3.4	3.1

Table 2. Effects of botanical and other plant extracts on yield of rice crop.

Treatments	Conc. (%)	Grain yield (kg/ha)		
		2015	2016	Mean
T1- Jimsonweed leaf extract	5.0	4560	4087	4323.5
T2- Jimsonweed extract	7.5	5280	4601	4940.5
T3- Euclyptu leaf extract	5.0	4806	4120	4463
T4- Euclyptus leaf extract	7.5	4980	4158	4569
T5- Custard apple leaf extract	5.0	3889	4050	3969.5
T6- Custard apple leaf extract	7.5	4650	4087	4368.5
T7- Calotropis leaf extract	5.0	4741	4259	4500
T8- Calotropis leaf extract	7.5	4803	4368	4585.5
T9- Neem Seed Kernel Extract	5.0	5130	4658	4894
T10- Neem Seed Kernel Extract	7.5	5182	4887	5034.5
T11- Asafoetida (Heeng)	5.0	4152	3983	4067.5
T12- Asafoetida	7.5	4882	4258	4570
T13- Buprofezin	0.1	5687	5869	5778
T14- untreated control	--	3887	3910	3898.5
CD (5%)		389.2	389.2	400.2
S.Em±		121.9	168.2	189.3

The Table revealed the combined data of 2015 and 2016 that pertains the percent population change of hoppers in all the treatments. The data indicated that the treatment - T13 Buprofezin 15% +Acephate 35% WP (1.5g/L) was the most effective and significantly reduced hoppers population by 85.00%. The data further revealed that T10-Seed Kernel Extract (NSKE) (7.5%) and T2- Jimson weed extract (7.5%) non-significantly reduced hopper population to 51.04 and 49.66 percent, respectively, these were found the best among plant extract. The solutions of leaves extract of Euclyptus, Custard apple, Calotropis and Asafoetida at the rate of 5 and 7.5% concentrations were considered to be inactive against the control of hoppers. However, their efficiency was much better at control (untreated). The plots treated with Buprofezin 15% + Acephate 35% WP (1.5g/L) yielded significantly highest (5778Kg/ha) followed by NSKE and Jimsonweed at 7.5% concentration, which non-significantly yielded as (5034.5) and (4940.5) Kg/ha. However, the plots treated with other plant extracts yielded at par with each other, but significantly better than the check plots (control).

Discussion

In the present experiment showed that the mixture of Buprofezin 15% +Acephate 35% WP (1.5g/L) found the best against the population of white-backed plant hopper on rice crop. It reduced hopper population up to 85.00% and so as the plots treated with the mixture produce highest grain (5778) kg/ha. The results achieved are in agreement with those of (Bhavani and Rao 2005; Ching-Huan Cheng, 1984; Fabellar, Heinrichs, 2003 and Ghosal *et al.,* 2018). The plant extracts of Neem Seed Kernel Extract (NSKE) and Jimsonweed leaves at the rate of 7.5% concentration observed to be effective treatments among botanical extracts against plant hoppers. The previous workers also endorsed the effectiveness of NSKE against plant hoppers in rice, the finding of Sujeetha (2008) showed the confirmation of present results. He mentioned NSKE at 5% against white backed plant hopper was found highly effective in rice. The response of plant hoppers showed trend of shortened life span, extended period of development, minimum growth-index, uneven size and imbalanced weight of adults. Krishnaiah, and Kalode (1990) reported the response of hopper to Need Seed Kernel Water Extract (NSKWE) as Juvenile hormone mimic activity and reduced population when sprayed at 5000 ppm dose on rice. The growth of plant hoppers was also adversely effected as mentioned by (David 1986; Rajasekaran *et al.,* 1987 and Mohan and Gopalan 1990). Transformation from immature life stage to adult emergence was also affected (Ramraju and Sundarababu, 1989) so as biology of hoppers found unsual (Senthil Nathan *et al.,* 2007). The efficacy of other plant leaf extracts such as Euclyptus, Custard apple, Calotropis and Asafoetida at 5 and 7.5% concentrations were also found to be comparatively better against plant hoppers (Prakash *et al*., 2008). Rajappan *et al.* (2000) reported that hopper population declined when NSKE at 5% and jimsonweed leaf extracts were sprayed. (Mariappan *et al.*, 1988) concluded that little mortality in green grass hopper and fewer emergences when pongamia leaf extract was sprayed. Sukumaran *et al.* (1987) observed that pupal deformity in insect pests of rice crop when the leaf extractwas applied. Mahapatra *et al.* (2009) mentioned that Vitex leaf extract at 5% concentration gave superior result in suppression of hoppers and leaf folder population. Abbasi *et al.* (2012) reported that many workers found *Calotropi sprocera* Aiton (Ak) and *Datura alba* (Dhatura) the best botanicals against insect pests of store grains. Alim *et al.* (2017) used root bark of *Calotropis gigantea* for significant control of larvae and adults of *Tribolium castaneum*. Shiva Parsia Aref *et al.* (2016) recommended some essential oils extracted from Eucalyptus floribundi for the management of adults of the *Rhyzopertha dominica* and *Oryzaephilus surinamensis*. Sylvia *et al.* (2017) used leaf extract of C. gigante as deterrent for oviposition and as ovicide against *P. pallicornis*.

Conclusion

The attack of sucking insect in rice fields have increased in last decades, particularly in case of White backed plant hopper *S. Furcifera* across Pakistan. As a control measure, many farmers indiscriminately use insecticides to manage insect attack below than serious economic losses. The continuous use of

insecticides has dire consequences on biological agents, insect resistance and causing food contaminations. The present study tried to find out efficiency of botanical and plant extracts against controlling of *S. Furcifera* in rice field as an effort to minimize insecticide usage and protect biological controlling agents. This research study revealed that botanical and plant extracts have great potential to suppress and manage the population of *S. Furcifera* below economic injury level. Currently, there is need to raise awareness of local growers about significance of botanical and plant extracts as a bio-insecticide against sucking insect such as *S. Furcifera* in rice growing areas.

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