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Original Research Article

Insecticidal Activity of Different Tree Seed Edible Seed Oils and Essential Oils against Brown Planthopper, *Nilaparvata lugens*, (Stal.) (Delphacidae: Homoptera)

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A B S T R A C T

Hexane extracts of five Tree seed olis Neem oil, Annona oil, Pongamia oil, Jatropha oil, Mahua oil and five essential oils Eucalyptus oil, camphor oil, leman gross oil, citronella oil, cedar wood oil were tested for insecticidal activities against the 3rd instar nymphs of brown planthopper *Nilaparvatalugens*, (Stal.) by using 40 days old TN1 rice stems treated by following dipping method with respective Tree seed oil extracts and essential oils in laboratory conditions at Indian Institute of Rice Research, IIRR, Hyderabad, Telangana during 2015-2016. The mortality percent of BPH nymphs at a dose of 1.0% concentration of different seed extracts showed significant insecticidal activity. The mortality percentage was evaluated with different non edible and essential oils of five solvent extracts were *viz*. hexane extracted Tree seed oils neem oil showed significant insecticidal activity 84.00 % followed by pongamia oil 71.25 % jatropha oil 66.00%, Mahua oil 60.40 % , Annona oil 58.25 % compared to control 5.60 % . In essential Eucalypts oil 84.40%, Lemon grass oil 74.40 %, cedar wood oils 67.40 % , citronella oils 64.40% , camphor oils 56.40 % control 3.60 percent.

Keywords

Mortality test, Essential oils, Brown planthopper, TN1 rice plant

Introduction

Rice (*Oryza sativa* L.) (2n=24) belonging to the family Graminae is the staple food crop for one third world's population and occupies almost one fifth of the total land area covered under cereals. It is grown under diverse cultural conditions and over wide geographical range. More than 90% of the world's production was consumed in Asia, which constitutes more than half of the global population. Approximately 11% of the world's arable land is planted annually with rice, production of 748.0 million tons next to it ranks wheat. In India, area under rice is estimated to be 44.9 million ha with a production of 272 million tons. India ranks 1st in area (44.95 million ha) and 2nd in production (272.61 million tonnes), after China (2nd advance estimate, 2015-16, Department of Agriculture, Cooperation and Farmer's Welfare, Ministry of Agriculture, GOI, Rice, being the staple food for more than 70 percent of the population and the source of livelihood for 120-150 million rural households, is the backbone of the Indian agriculture.

Brown planthopper *Nilaparvata lugens* (Stal.) is one of the most menacing insect pests of rice (*Oryza sativa* L.) among various leafhoppers and plant hopper species. The Brown planthopper was a minor pest in most tropical countries of Asia earlier. Brown planthopper *N.lugens* is mainly a pest of irrigated rice but it can also become abundant in rain fed environment and upland rice. At low infestation of this insect, plant height, crop vigour, tiller production reduces, whereas heavy infestation turns plants yellow, which dry up rapidly. Under severe infestation, circular patches of hopper burn are evident in the field. Severely affected plants do not bear any grains. The most commonly practical method of controlling BPH is through application of insecticides. It is imperative to evolve and valuate some useful plant products from *Ocimum* species for management of pest, so that quantity of insecticide used to control the brown planthopper can be reduced. Hence, these useful practices could be utilized as the major components of an effective pest management strategy, against the BPH.

Materials and Methods

Insecticidal activity of Hexane extracted different non edible seed oils and essential oils against third instar nymphs of BPH was conducted at Indian Institute of Rice Research, IIRR, Hyderabad, Telangana in November month, 2015. Bioassays were undertaken using the rice-stem dipping method. Weighed 500mg of extract and dissolved in 1 ml of solvent then added with 10ml of distilled water shook it thoroughly and made up volume to 100ml. Stems were cut from rice plants at tillering stage and washed thoroughly. Stems were cut in to pieces of about 10 cm long just below the node region. Five stem cuttings were dipped in 1.0% extract solution for 30 seconds air dried and then placed in a glass tubes (tube size 20x3cm) taken with 10 ml of water in to test tube. Second and third instar nymphs of BPH collected from culture maintained in glasshouse and released into each test tube using a aspirator then the tube were plugged with non absorbent cotton. Along with extracts, an emulsifier (triton x-100) treatment, solvent and the control (plain water) were also maintained. Experiment designed with seven treatments and five replication. Data on number of nymphs dead was recorded at 1,3,5,7 and 10 days after treatment. Tests were conducted in laboratory where temperature of 26±1 ºC and RH of 60±5% were maintained. Toxicity test done separately for all five Non edible seed oils and five different essential oils.

Statistical analysis

The nymphal mortality was corrected by Abbott's formula. Mortality data converted into percentage mean values then trans-formed into arc sine for one- way ANOVA in toxicity test follow t test and CRD design, obtained data analyzed by using arc sign transformation.

Results and Discussion

Mortality percentage of 3rd instar BPH nymphs evaluated with different hexane extracts of Tree seed oils *viz.*, Neem seed oil, Jatropha seed oil, Pongamia seed oil, Annona seed oil, Mahua seed oil and five essential oils Eucalyptus oil, Lemon grass oil, Citronella oil, Cedarwood oil, Camphor oil presented table 1. In hexane extracts of non edible seed oils Neem oil showed significant insecticidal activity 84.00% followed by Pongamia oil 71.25%, Mahua oil 60.40%, Jatropha oil 66.00%, Annona oil 58.25%, Triton x-100 8.80% and compared to control 5.60% (Fig. 1).

In essential oils Eucalyptus oil 84.40% followed by lemon grass 74.40%,Cedar wood oil 67.40%,Citronella oil 64.40%, Camphor

oil 56.40%,Triton x-100 8.00% and compared with control 3.60%.

In all the oils significantly highest mortality was recorded in eucalyptus oil 84.40% followed by neem oil 84.00% compared with control.

Assessment of toxic effect of non-edible seed oils against BPH *N. lugens* was carried out in the laboratory and the data obtained after particular days after treatment are presented in table 1. It is evident from the table that all seed oils caused significant mortality of the hoppers when compared with control. The mortality of BPH due to seed oils after I DAT varied from 40.00% to 60.00%.The highest of mortality of BPH was observed in the treatment neem oil (60.00%) followed by Pongamia oil (52.00%) which were significantly different from control (0.0%).

The data on mortality of BPH third day after treatment due to seed oils revealed that all treatments were significantly superior over control. The mortality of BPH against various non edible seed oils varied from 42.00% to 72.00%.The highest per cent of mortality of BPH was observed in the treatment neem oil (72.00%) which was significant in efficacy when compared to other oils and control (0.0%). The lowest mortality was recorded in annona oil (42.00%).

Mortality of BPH *N. lugens* fifth day after treatment indicated that all seed oils that all oils were found significantly effective in causing mortality (52.00% to 76.00%) of the nymphs as compared to control (0.0%). Again Neem oil recorded highest of mortality (76.00%) of BPH at 5DAT followed by Pongamia (72.00%) and jatropha (68.00%) oils.

After seven days of treatment, seed oils showed significant mortality of the hoppers as compared to control. The mortality of BPH in seed various oils varied from 62.00% to 98.00% as against controls-Triton x-100 (14.00%) and control(0.0%).The highest per cent of mortality of BPH was observed in the treatment Neem oil (98.00%) which showed significantly high efficacy when compared to other oils.

The data recorded after 10 days after treatment, the mean percent mortality of BPH *N. lugens* due to seed oils varied from 76.00% to 98.00% they showed significant difference in efficacy as compared to control (0.0%).. The highest per cent of mortality of BPH was observed in the treatment neem oil (98.00%) followed by pongamia (90.00%).

Results are closely confirmed with Bhimrao (2005) tested different plant derivatives, against brown planthopper in laboratory condition. Out of different plant derivatives tested, karanj oil @ 2% was the most lethal with 87.50% mortality to the pest along with rendering unsuitability to the host with 48 probe marks and 12mm^2 honeydew excretion in 24 hours duration.

Similar result was also found by Nathan *et al.* (2007) studied the effects of different neem extract (NSKE) and azadirachtin on mortality, survival and weight of the brown planthopper, *Nilaparvata lugens* (Stal.). He found that almost 100% nymphal mortality was caused by azadirachtin at 0.5 ppm and higher concentrations

Toxic effect of essential oils against BPH, *N. lugens* after particular days of treatment are presented in table 2. One day after treatment of essential oils, mortality of BPH *Nilaparvata lugens (stal.)* are presented in table 2. The mortality caused various essential oils against BPH varied from 42.00% to 68.00% as against 0.0% in controls. The highest per cent mortality of

68.00% was observed in the treatment eucalyptus oil followed by lemon grass (60.00%) (Fig 2).

All essential oils showed significant mortality of BPH compared to control three days after treatment. The mortality of various oils varied from 50.00% to 78.00%.The highest per cent of mortality of the hopper was observed in the treatment eucalyptus oil (78.00%) while lowest mortality was recorded in camphor oil (50.00%).

The data recorded after five days after treatment indicated that all essential oils were significantly superior in causing mortality to *N. lugens* over the control. Mean percent mortality of BPH *N.lugens* varied from 56.00% to 82.00% when compared to control (4.00%). Highest percent mortality was observed in eucalyptus oil (82.00%) while lowest mortality was observed in Camphor oil (56.00%).

Effect of essential oils on mortality of BPH *N. lugens* seventh days after treatment is presented in table 2. All essential oils caused significant mortality of BPH which varied from 62.00% to 98.00% when compared to controls-Triton x-100 (12.00%) and control (6.00%). The highest per cent mortality was found in the treatment eucalyptus oil (98.00%) followed by lemon grass (82.00%).

Table.1 Efficacy of Tree seed oils against brown planthopper, *N. lugens*

		Mean percent mortality of BPH					
S.NO	**Treatment**	**1DAT**	**3DAT**	**5DAT**	**7DAT**	**10DAT**	**Avg**
1	**Neem oil @ 1%**	60.00% *(50.7)	72.00% (58.0)	76.00% (60.1)	98.00% (86.3)	98.00% (86.0)	84.00% (69.1)
2	**Pongamia oil @ 1%**	54.00% (47.0)	58.00% (49.0)	72.00% (58.0)	82.00% (65.0)	90.00% (73.6)	71.25% (58.2)
3	**Jatropha oil @ 1%**	52.00% (46.1)	52.00% (46.1)	68.00% (55.6)	76.00% (62.0)	78.00% (63.4)	66.00% (54.6)
4	**Mahua oil @ 1%**	44.00% (41.5)	50.00% (44.9)	60.00% (50.7)	72.00% (58.9)	80.00% (60.8)	60.40% (51.5)
5	**Annona oil @ 1%**	40.35% (42.3)	42.00% (40.3)	52.00% (46.0)	62.00% (51.9)	76.00% (55.5)	58.25% (46.8)
6	**Triton x-100**	00 (0)	2.00% (3.6)	6.00% (13.1)	14.00% (19.6)	22.00% (27.9)	8.80% (14.2)
7	**Control**	00 (00)	00 (00)	4.00% (7.3)	8.00% (14.1)	16.00% (14.7)	5.60% (10.3)
	SEm	0.82	2.10	2.61	3.01	2.26	3.75
	CD	2.40	6.15	7.58	8.76	6.60	10.91

*Figures in the parentheses are arc sine transformed value. Effect of tree seed oils on mortality of brown planthopper

Table.2 Efficacy of essential oils against brown planthopper *N. lugens* (Stal.)

		Mean percent mortality of BPH					
S.NO	**Treatment**	**1DAT**	**3DAT**	**5DAT**	**7DAT**	**10DAT**	**Avg**
1	**ELO@ 0.2%**	68.00% *(55.5)	78.00% (62.1)	82.00% (65.5)	98.00% (86.3)	98.00% (86.3)	84.40% (69.2)
2	**LGO @ 0.2%**	60.00% (50.7)	70.00% (56.7)	72.00% (58.1)	82.00% (65.5)	88.00% (69.9)	74.40%. (60.1)
3	**CWO @ 0.2%**	50.00% (44.9)	60.00% (50.7)	70.00% (56.7)	78.00% (62.1)	80.00% (63.4)	67.40% (55.5)
4	**CTO @ 0.2%**	54.00% (47.2)	58.00% (49.5)	62.00% (50.7)	70.00% (56.7)	78.00% (62.5)	64.40% (53.5)
5	**CAO @ 0.2%**	42.00% (40.3)	50.00% (44.9)	56.00% (46.1)	62.00% (51.9)	72.00% (58.0)	56.4% (48.7)
6	**Triton x-100**	00 (0)	4.0% (5.3)	6.0% (5.3)	12.0% (17.9)	18.0% (24.9)	8.0% (14.2)
7	**Control**	00 (0)	00 (0)	4.0 (3.6)	6.0% (11.0)	8.0% (14.7)	3.6% (8.4)
	SEm ±	0.82	2.10	2.61	3.01	2.26	3.75
	CD	2.40	6.15	7.58	8.76	6.60	10.91

*Figures in the parentheses are arc sine transformed value. Effect of tree seed oils on mortality of brown planthopper

Fig.1 Effect of tree seed oils on mortality of brown planthopper

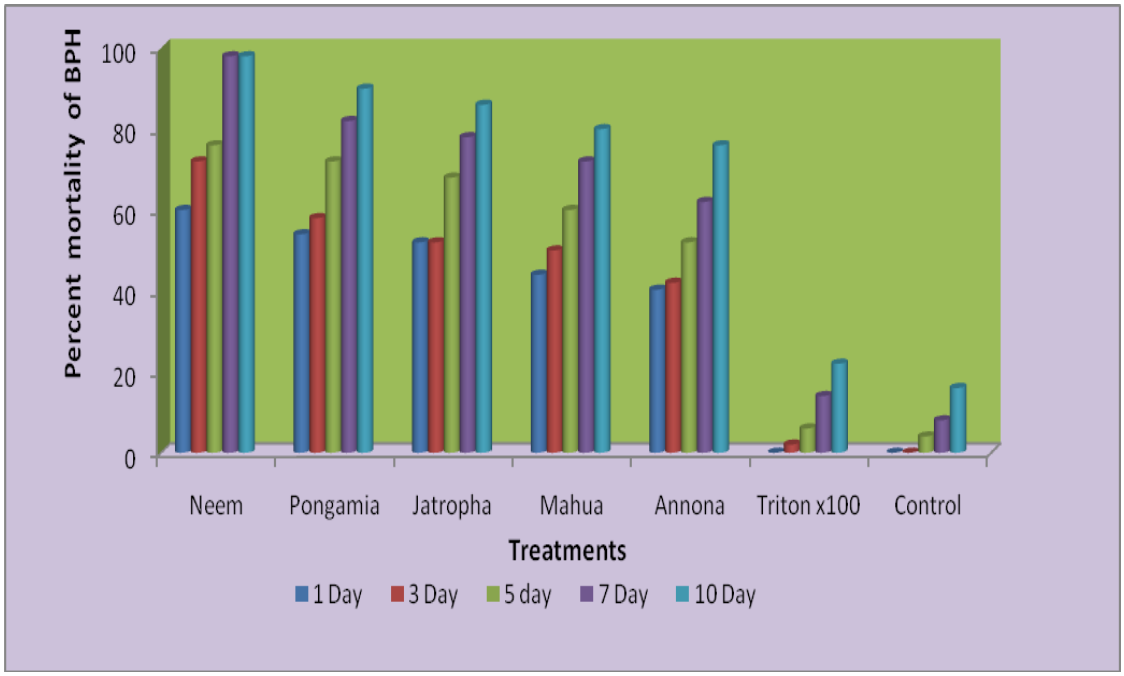
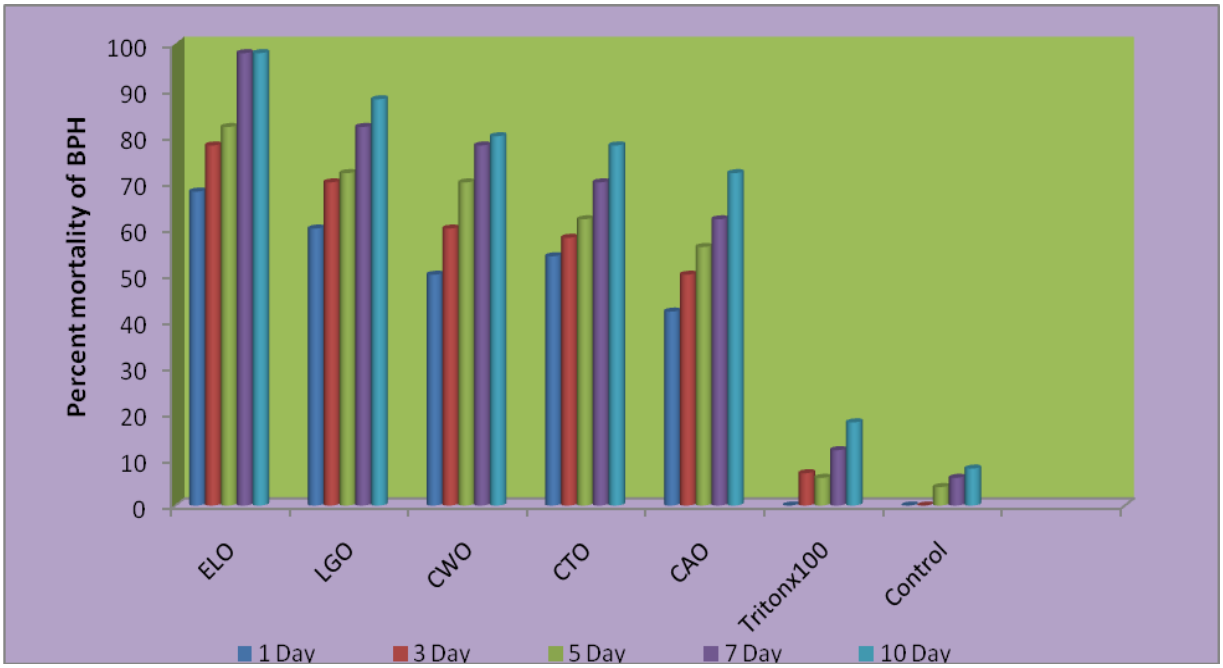


Fig.2 Effect of Essential oils on mortality of brown planthopper



Mean percent mortality of BPH ten days after treatment in various essential oil treatments is presented in table 2. All essential oils caused significant mortality of BPH as compared to control. The mortality of BPH in various essential oils varied from (72.00%to 98.00%). The highest percent mortality of BPH was observed in the treatment eucalyptus oil (98.00%) while lowest percent mortality was observed in camphor oil (72.00%).

The results are closely confirmed with the finding of the Duangdean *et al.,* 1995 found that the insecticidal efficacy of aromatic plant- sweet flag (*Acorus calamus*L.) rhizome crude extract (ECE) at 150 mg/ml caused death of nymphs and adults 95.85 per cent and 98.98 via contact poison, respectively. Suresh *et al.* (1996) reported the essential oil of *Santolina chamaecyparissus* reduced the survival of *Nilaparvata lugens* after 72 hours.

Jena and Dani (1994) tested five Neem products for persistent toxicity, the results obtained on the persistent toxicity showed that green mark, Neem oil, margocide CK and margocide OK could kill insect up to 80, 76.70, 73.30 and 56.70 per cent, respectively within 24 hrs of treatment at 1.0 per cent concentration.

Conclusion

The results showed that in hexane extracts of different tree seed oils Neem oil elucidated significantly highest percentage of nymphal mortality 84.00% compared to control 5.60%, in different Essential oil eucalyptus oil showed significant highest mortality percentage 84.40% compared to control 3.75%.

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