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Exploration of potentialities of plant derivatives as insecticidal and phagodeterrant against brown planthopper (*Nilaparvata lugens* S.)

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Abstract
In a greenhouse trial the oil emulsion of neem (*Azadirachta indica* A. Juss.), mahua (*Madhuca longifolia* M. latifolia), Karanj (*Pongamia glabra* L.), Ratanjyoth (*Jatropha curcas*) and linseed (*Linum usitatissimum* L.) and crude extracts of neem, mahua, karanj and linseed were tested at different concentrations for their effects on mortality and feeding behaviour of brown planthopper (BPH), *Nilaparvata lugens*, which is a vector of ragged stunt and grassy stung viruses. Treatments with neem oil and karanj oil @ 2 per cent each and karanj cake extract @ 5 per cent recorded the highest mortality rate of BPH nymphs however, mauha cake extract @ 5 per cent had showed least mortality of BPH nymphs. While, adult BPH feeding rate was very low in plants treated with karanj oil @ 2 per cent and neem oil @ 2 per cent indicating the phagodeterrant action against BPH (*Nilaparvata lugens*).

Keywords: Brown planthopper, plant derivatives, mortality and phagodeterran

Introduction
Bio-pesticides has been given great importance in managing all kinds of pest population. In view of the advantage of biopesticides, there has been wide acceptance of these globally, amounting to around 10 per cent shares of agro chemical market in 2000 AD, with the growth rate of 10-15 per cent per annum. Impact of bio-pesticides in India lead to increase in yield by 108 per cent, pesticide reduction of 67-100 per cent with annual savings of 79,000 $ (Ram Prakash, 2003) [3].

Since the discovery of DDT and BHC (HCH) in the decade of fifty, a long list of synthetic insecticidal molecules have been discovered. These molecules had been used continuosly against different insect pest problems.

The repeatedly, injudiciously and indiscriminately uses of these insecticidal molecules had been done in the past which had created a lot problems viz., pest resurgence, secondary pest out breaks, resistance, environmental pollution etc. To overcome these problem it's the demand of the day to explore the potentialities of plant derivatives in such a way so that these sort of problems would be minimized. Therefore, the present piece of investigation carried out at I.G.K.V., Raipur.

Plant based pesticide for pest management has been identified as a potential alternative to chemical pesticides. Among the plants exhibiting pesticidal action, neem (*Azadirachta indica*) is widely acknowledged for its pest control properties (Schumtterer, 1995). All the concentrations of NG4, neem azal and Rakshak were recorded the highest percentage of feeding deterrency. (Krishnaiah *et al.*, 2001) [4].

The emmission of court ship signals as well as mating behaviour were impaired in BPH *Nilaparvata lugens* females treated with 3 per cent neem oil (Saxena *et al.*, 1993) [5].

In present investigation the bio-efficacy of various plant derivatives were evaluated for their effect of mortality and feeding of BPH *Nilaparvata lugens*.

Materials and methods
The different plant oils of neem, mahua, karanj, Ratanjyot, linseed and cakes of neem, mahua, karanj and linseed were purchased from local market.

The 100 gm cake of each plant derivatives were powdered separately, loosely tied in cotton cloth and soaked in one lit. of water for 12 hr. after 12 hr. each bundle was squeezed to obtain water extract. All the plant derivatives were emulsified in water with 0.1 per cent emulsifier (Ramraju and Babu, 1990) [2]. Design used for the statistical analysis was Completely Randomized Design (CRD).

Mortality rate

Thirty day old potted plants were sprayed with various plant derivatives at different concentrations (Table 1) and allowed to dried for one hr. Then 1st and 2nd instar nymphs per plant were released. Plants were kept confined separately by placing inverted long cylindrical plastic tubes.

Mortality rate was assessed at the interval of 24 hrs, 3 days and 7 days, respectively, after insect release.

Feeding test

The feeding rate of adult BPH on plants sprayed with plant derivatives was assessed through honey dew test as suggested by Pathak and Heinrichis (1982) [6]. Honey dew appeared on filter paper in 24 hours after feeding were measured in mm^2 unit with the help of graph tracing. While, probe mark test was carried out on plants, which was used for feeding test. Plants were taken for staining in test tube containing 1.0 per cent erythrosine dye aqueous solution and kept for 30 min. then probing marks counted visually.

Results and discussion

All the plant derivatives tested were effective in insecticdal and antifeeding action as compared to check.

After 24 hrs, 3 days and 7 days of treatment Karanj oil @ 2 per cent was most lethal with 87.50 per cent mortality followed by neem oil @ 2 per cent (72.50%) and Karanj cake extract @ 5 per cent (70%) Table-1. While, least insecticidal action was observed in treatment mahua cake extract @ 5 per cent with 35 per cent mortality (Table-1).

Plant derivatives as an insecticide, it is essential that it should have some toxic substances or active ingredients which would bring from the insect activity, as Karanj and neem known to have its insecticidal property. These are in agreement with report of Mordue and Blackwell (1993) [7] who found the mortality of BPH might be due to inhibition of feeding behaviour by Azadirachtin, resulting from blockage of input receptors for phagostimulants by stimulation of deterrant receptor cell or both. Similarly, Jena and Dani (1994) [8] tested five neem products for persistant toxicity, the results obtained on persistant toxicity showed that green mark, neem oil, margocide-CK and margocide-OK could kill insect upto 8.0, 76.7, 73.3 and 56.7 per cent, respectively, within 24 hours of treatment at 1 per cent concentration.

Adult feeding rate of BPH was very low on plants treated with Karanj oil @ 2 per cent with 12 mm^2 honey dew excretion and highest 48 probe marks in 24 hrs duration by five BPH females. While, least phagodeterrant action was observed in linseed cake extract treatment with least probe marks 16.75 and highest area of honey dew excretion 184.25 mm^2 (Table-2). The experimental findings are in agreement with report of Ramraju and Babu (1990) [2] who found that BPH feeding rate was very low in plants treated with neem cake extract @ 5 per cent (343.33 mm^2) i.e. 13.5% decrease over control treatments, among oils Karanj oil at 1 per cent indicated reduction in honey dew excretion by BPH over control treatment. Similarly Aldhous (1992) [2] observed that feeding of insects on neem oil treated plants was reduced because in Azadirachtin molecules hydroxyfuran fragment is present which causes antifeedent action. Karanj contains Karanjin and bitter sponins due to which they might have indicated feeding deterrant against BPH. Less food intake by BPH was noted on neem seed oil treated plants as reported by Anonymous (1981) [10].

Among different plant derivatives tested against, *Nilaparvata lugens* in laboratory condition, Karanj oil @ 2 per cent was the sole product which showed most lethal and stronger phagodeterrent action against BPH.

Table 1: Relative bio-efficacy of different plant derivatives against BPH *Nilaparvata lugens* (Stal.)

Sr. No.	Treatment	Mean mortality per cent of BPH nymphs		
		After 24 hrs	**After 3 days**	**After 7 days**
1	Neem oil @2%	40(39.23)	60(50.76)	72.50(58.37)
2	Mahua oil @2%	30(33.20)	42.50(40.68)	62.50(52.23)
3	Karanj oil@2%	47.50(43.56)	70(56.78)	87.50(69.29)
4	Ratanjyoth oil@2%	20(26.56)	27.50(31.62)	42.50(40.68)
5	Linseed oil @2%	22.50(28.31)	42.50(40.68)	55(47.86)
6	Neem cake extract @5%	20(26.56)	35(36.27)	52.50(46.43)
7	Mahua cake extract @5%	10(18.43)	25(30)	35(36.27)
8	Karanj cake extract @5%	47.50(43.56)	65(53.72)	70(56.78)
9	Linseed cake extract @5%	17.50(24.72)	35(36.27)	47.50(43.56)
10	Control plot (plain water spray)	0	0	0
	SEm±	5.20	2.76	3.11
	CD (5%)	15.04	7.97	9

* Mean of four replications; figures in parentheses are Arcsine transformed values.

Table 2: Honeydew and probing marks of BPH (*Nilaparvata lugens*) on TN1 treated plants after 24 hrs.

Sr. No.	Treatments	Honeydew in 24 hrs. (mm^2/5f)	Average Probing marks per seedling
1	Neem oil @2%	35.50	42.00
2	Mahua oil @2%	70.00	17.50
3	Karanj oil@2%	12.00	48.00
4	Ratanjyot oil@2%	42.50	30.00
5	Linseed oil @2%	47.50	25.75
6	Neem cake extract @5%	118.25	22.50
7	Mahua cake extract @5%	131.25	21.25
8	Karanj cake extract @5%	111.00	23.75
9	Linseed cake extract @5%	184.25	16.75
10	Control plot (plain water spray)	322.00	11.75
	SEm±	4.68	3.61
	CD (5%)	13.54	10.44

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