Plant Archives Vol. 17 No. 1, 2017 pp. 611-614 ***ISSN 0972-5210***

INFLUENCE OF HOST PLANT NUTRITION ON INSECTICIDES TOXICITY AGAINST RICE BPH, *NILAPARVATA LUGENS* (STAL)

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Abstract

Studies were carried to evaluate the influence of plant nutrients @ 50:30:20kg/ha (50% recommended NPK level), 100:60:40kg/ha (100% recommended NPK level) and 150:90:60kg/ha (150% recommended NPK level) on insecticide toxicity at 24hrs, 48hrs, 72hrs and 96hrs after spray against brown plant hopper, *Nilaparvata lugens* (Stal) in *kharif* 2015 and 2016. Results showed that Fipronil 5%SC recorded the 94.17, 83.33 and 75.83 per cent BPH mortality at 50%NPK, 100%NPK and 150%NPK level, respectively in *kharif* 2015 and; 95.00, 87.50 and 75.83 per cent BPH mortality in *kharif* 2016 followed by Imidacloprid 17.8%SL recorded 91.67, 86.67 and 72.50 per cent mortality in *kharif* 2015; 91.67, 85.00 and 73.33 in *kharif* 2016. Acephate 75% SP recorded 70.83, 66.67 per cent BPH mortality in *kharif* 2015 and; 70.00, 67.50 and 58.33 per cent BPH mortality in *kharif* 2016 at 50% NPK, 100% NPK and 150% NPK level, respectively. Among the tested insecticides Fipronil 5%SC and Imidacloprid 17.8% SL highly influenced by different NPK levels against BPH mortality and Acephate 75% SP have moderately affected. Monocrotophos 36%SL (73.33, 72.50 and 72.50; 72.50, 72.50 and 71.83 per cent mortality in *kharif* 2015 and 2016, respectively) Cypermethrin 25% EC (81.67, 81.67 and 81.12; 82.50, 82.50 and 82.00 per cent mortality in *kharif* 2015 and 2016, respectively) and Rynaxypyr 18.5% SC (23.35, 24.84 and 24.00; 25.00, 25.83 and 24.78 per cent mortality in *kharif* 2015 and 2016, respectively) not showed significant effect in BPH mortality with respect to different NPK levels.

Key words : Host plant nutrition, NPK levels, insecticides and rice brown planthopper.

Introduction

Rice is one of the important cereal crops of the world and forms the staple food for more than 50 per cent of population. Even though, there are many constraints in rice production, insects' pests remain a constant problem in all the rice growing regions (Manikandan Narayanasamy *et al.,* 2014). Rice insect, the brown plant hop-per (*Nilaparvata lugens*) is one of the most serious insect pests of tropical and temperate rice in Asia. The brown planthopper causes direct damage to crops and indirect dam-age by acting as a vector for viral diseases, and susceptible rice varieties often suffer severe yield losses annually from BPH infestations (Sogawa *et al,.* 2003). Nutrition management is one of the most important practices for high production system, but nutrition management may affect response of rice to pests, as well as development pattern of pest populations. The information on uptake of nutrients by the crop due to combined application of major plant nutrients NPK at different doses and rice varieties with differential susceptibility to pest under insecticidal protection is inadequate. Previous studies have demonstrated that host plant affects the susceptibility of insects to pesticides. The use of induced resistance through application of nutrients has been known to have tremendous potential in curtailing the insect pest populations. Previously studies taken up to know the effect of insecticides under different nutrition levels against rice leaf folder and green leaf hopper at field level by Dash (2008). But studies have not explained what will be effect of plant nutrition levels on insecticide toxicity at constant population levels. Hence the study been taken up to know exact toxicity change of insecticides at different NPK levels against rice brown plant hopper.

Materials and Methods

Pot culture studies were conducted during *kharif* 2015 and 2016 in factorial CRD at BPH glass house, College of Agriculture, IGKV, Raipur (C.G.), India. The treatments comprised of 3 nutrient levels, 50:30:20kg/ha

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(50%NPK level), 100:60:40kg/ha (100%NPK level) and 150:90:60kg/ha (150%NPK level); and 6 insecticide treatments, Monocrotophos 36%SL@ 2.5ml/lit (**T$_1$**), Acephate 75%SP@ 1.2g/lit (**T$_2$**), Cypermethrin 25% EC @ 0.3ml/lit (**T$_3$**), Imidacloprid 17.8%SL@ 1.6ml/lit (**T$_4$**), Fipronil 5% SC @ 1.1ml/lit (**T$_5$**), Rynaxypyr 18.5%SC@ 0.3ml/lit (**T$_6$**) and control (**T$_7$**) pot. Rice variety 'Mahamaya' were selected for the experiment. Experiment was replicated thrice.

Rearing of BPH on different plant nutrition levels

Brown plant hoppers initially collected from field were maintained in the air cooled glasshouses at 30 ± 5ºC on forty day old Mahamaya rice plants grown on different fertilizer levels *i.e.,* 50%, 100% and 150%NPK. The pots were placed inside rearing cages of 75x75x75cubic centimeter which consist with of an iron frame with wooden panels and small window on front side and fine wire mesh on top and other sides. To ensure different nutrition levels, rice plants were grown in pots filled with soil collected from LTF site of soil science department. Adult insects were released in pairs for oviposition on rice plants grown on different fertilizer levels. After 2-3 days, the females started egg laying inside the leaf sheath of paddy plant. Later on, when adults emerged they were transferred to another pot with respective fertilizer levels. For transferring the adults, an aspirator is used, which works on the suction of the air principle. Nymphs emerged out within 5 to 6 days from the eggs and allowed to reach fourth instar; they were collected and used for experiment. BPH was reared for 4-5 generations continuously on respective plant nutrition levels *i.e.,* 50%, 100% and 150%NPK. The cages were examined periodically for the presence of predators and other insect species.

Observations to be recorded

Rice variety Mahamaya were gown in plastic pots under different fertilizer levels *i.e.,* 50%, 100% and 150% NPK was treated with recommended doses of respective insecticide. BPH reared on different plant nutrition levels *i.e.*, 50%, 100% and 150%NPK were released and recorded mortality percent at 24hrs, 48hrs, 72hrs and 96hrs. For every observation new BPH were released on to insecticide treated plant and covered with plastic

Table 1 : Influence of host plant nutrition on insecticide toxicity against BPH *Kharif* 2015.

Treatments	Per cent BPH mortality*											
	24hrs			48hrs			72hrs			96hrs		
	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK
T$_1$	93.33 (69.15)	93.33 (69.15)	93.33 (69.15)	83.33^{cA} (56.81)	83.33^{bA} (56.81)	76.67^{cdA} (51.00)	70.00^{cdA} (44.81)	70.00^{eA} (44.81)	66.67^{abA} (41.91)	46.67^{dA} (28.11)	43.33^{cA} (25.82)	43.33^{aA} (25.82)
T$_2$	90.00 (64.82)	90.00 (64.82)	86.67 (60.48)	80.00^{cA} (53.91)	76.67^{bAB} (51.00)	73.33^{dB} (47.33)	66.67^{dA} (42.29)	60.00^{dA} (37.71)	50.00^{cB} (30.15)	46.67^{dA} (28.01)	40.00^{cA} (23.68)	30.00^{abB} (17.52)
T$_3$	96.67 (72.83)	96.67 (72.83)	93.33 (72.77)	90.00^{bA} (64.82)	90.00^{aA} (64.82)	86.67^{aA} (60.48)	76.67^{cA} (50.23)	76.67^{bcA} (50.23)	73.33^{aA} (47.33)	63.33^{cA} (39.39)	63.33^{bA} (39.39)	60.00^{bA} (37.10)
T$_4$	100.00 (77.16)	100.00 (77.16)	96.67 (72.83)	93.33^{abA} (68.49)	90.00^{aA} (64.82)	80.00^{bcB} (53.91)	90.00^{bA} (64.82)	83.33^{aB} (57.58)	63.33^{bC} (39.39)	83.33^{bA} (57.58)	73.33^{aB} (47.33)	50.00^{bC} (30.15)
T$_5$	100.00 (77.16)	100.00 (77.16)	100.00 (77.16)	96.67^{aA} (72.83)	93.33^{aA} (68.49)	83.33^{abB} (56.81)	93.33^{aA} (72.77)	83.33^{abB} (56.81)	66.67^{abC} (41.91)	86.67^{aA} (66.20)	76.67^{aB} (51.39)	53.33^{cC} (32.29)
T$_6$	36.70 (21.71)	40.00 (24.00)	33.33 (19.56)	33.33^{dA} (19.50)	33.33^{cA} (19.50)	30.00^{eA} (17.52)	16.70^{eA} (9.65)	13.33^{eA} (7.67)	13.33^{dA} (7.67)	6.67^{eA} (4.30)	6.67^{dA} (4.30)	6.67^{dA} (3.83)
T$_7$	10.00 (6.24)	10.00 (5.74)	6.67 (4.3)	3.33^{eA} (2.87)	6.67^{dA} (4.3)	3.33^{Fa} (2.87)	3.33^{eA} (2.87)	3.33^{eA} (2.87)	3.33^{dA} (2.87)	3.33^{eA} (2.87)	3.33^{dA} (2.87)	3.33^{dA} (2.87)
Sed±	4.15			3.10			3.39			3.58		
CD (0.05)	NA			6.25			6.84			7.23		
CV (%)	12.99			13.71			15.99			14.90		

* Mean of three replications; Figures in parentheses are arc sine transformed values.
In a column, means followed by a common small letter(s) between the treatments are not significantly different by CD (P=0.05).
In a rows, means followed by a common large letter(s) between NPK levels within treatment are not significantly different by CD (P=0.05).

covers. Each replication was provided ten final instar BPH.

Results and Discussion

The overall results of the experiment revealed that among the tested insecticides in *kharif* 2015 and 2016 against rice BPH Fipronil, Imidacloprid and Cypermethrin recorded the highest mortality even though difference in toxicity under varied NPK levels. In *kharif* 2015 and 2016 at 24hrs after spray host plant nutrition showed the non significant affect against BPH percent mortality within all the treatments. In *kharif* 2015 and 2016 at 48hrs after spray Fipronil recorded 96.67, 93.33 and 83.33% mortality; and 96.67, 93.33 and 86.67 % mortality at 50% NPK, 100%NPK and 150%NPK level, respectively (table 1) followed by Imidacloprid recorded 96.67, 93.33 and 83.33 in *kharif* 2015 and 90.00, 86.67 and 83.33% mortality in *kharif* 2016 (table 2). At 48hrs the treatments Monocrotophos, Acepahte, Cypermethrin and Rynaxypyr toxicity was less affected by NPK levels. The results are in accordance with Dash and Mukherjee (2009), who conducted field experiment to investigate the interaction effect between nutrient levels and insecticide against *Nilaparvata lugens* and found a high degree of compatibility of nutrient level *i.e,* 60:30:30 kg NPK/ha + $ZnSO_4$ with granular fipronil in minimizing the population of plant hoppers to a lowest level (5.25 no./ hill). At 72hrs after spray (tables 1 and 2) the effect of plant nutrition on insecticide toxicity was more pronounced in treatments Fipronil (93.33, 83.33 and 63.33% mortality in both seasons) and Imidacloprid (90.00, 83.33 and 63.33%; 90.00, 80.00 and 63.33% mortality in *kharif* 2015 and 2016). Similar trend was followed in treatments Monocrotophos, Acepahte, Cypermethrin and Rynaxypyr at 72hrs after spray. At 96hrs after spray significant difference in toxicity levels of Fipronil (86.67, 76.67 and 53.33% in *kharif* 2015; 90.00, 73.33 and 53.33% mortality in *kharif* 2016 at 50%, 100% and 150%NPK levels, respectively) and Imidacloprid (83.33, 73.33 and 50% in *kharif* 2015; 86.67, 73.33 and 53.33% in *kharif* 2016) moderate difference in Acephate (46.67, 40.00 and 30.00%; 43.33, 43.33 and 30.00% mortality at *kharif* 2015 and 2016, respectively) toxicity was observed with

Table 2 : Influence of host plant nutrition on insecticide toxicity against BPH *Kharif* 2016.

Treatments	Per cent BPH mortality*											
	24hrs			48hrs			72hrs			96hrs		
	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK	50% NPK	100% NPK	150% NPK
T1	96.67 (72.83)	86.67 (61.92)	86.67 (60.48)	80.00^{cA} (53.91)	76.67^{cAB} (50.23)	70.00^{aB} (44.81)	70.00^{cA} (44.81)	73.33^{bA} (47.33)	66.67^{bA} (41.91)	43.33^{cA} (25.82)	46.67^{bA} (28.11)	43.33^{bA} (25.82)
T2	90.00 (64.82)	93.33 (68.49)	80.00 (53.91)	80.00^{cA} (53.91)	76.67^{cA} (51.00)	73.33^{aA} (47.33)	66.67^{cA} (42.29)	56.67^{cAB} (34.81)	50.00^{cB} (30.15)	43.33^{cA} (25.72)	43.33^{bAB} (25.97)	30.00^{cB} (17.52)
T3	96.67 (72.83)	96.67 (72.83)	93.33 (72.77)	90.00^{bA} (64.82)	86.67^{bA} (60.48)	83.33^{abA} (57.58)	80.00^{bA} (53.91)	83.33^{aA} (56.81)	83.33^{aA} (57.58)	63.33^{bA} (39.39)	66.67^{aA} (42.29)	60.00^{aA} (37.10)
T4	100.00 (77.16)	100.00 (77.16)	93.33 (73.43)	90.00^{bA} (64.82)	86.67^{bAB} (61.92)	83.33^{bcB} (56.81)	90.00^{aA} (64.82)	80.00^{abB} (53.91)	63.33^{bC} (39.39)	86.67^{aA} (66.20)	73.33^{aB} (47.33)	53.33^{aC} (32.29)
T5	100.00 (77.16)	100.00 (77.16)	96.67 (77.11)	96.67^{aA} (72.83)	93.33^{aA} (72.77)	86.67^{cB} (61.14)	93.33^{aA} (72.77)	83.33^{aB} (56.81)	66.67^{bC} (41.91)	90.00^{bA} (69.10)	73.33^{aB} (47.71)	53.33^{aC} (32.29)
T6	40.00 (23.68)	36.67 (21.71)	33.33 (19.56)	36.67^{dA} (21.64)	33.33^{dA} (19.50)	30.00^{dA} (17.52)	16.67^{dA} (9.65)	23.33^{dA} (13.51)	13.33^{dA} (7.67)	6.67^{dA} (4.30)	10.00^{cA} (5.74)	6.67^{dA} (4.30)
T7	10.00 (6.24)	10.00 (5.74)	10.00 (6.24)	6.67^{eA} (4.30)	13.33^{eA} (7.67)	3.33^{eA} (2.87)	13.33^{dA} (7.67)	10.00^{dA} (6.24)	3.33^{dA} (2.87)	6.67^{dA} (4.30)	6.67^{cA} (4.30)	3.33^{dA} (2.87)
Sed±	4.30			3.88			4.28			4.06		
CD (0.05)	NA			7.83			8.64			8.19		
CV (%)	16.75			11.57			13.47			12.68		

* Mean of three replications; Figures in parentheses are arc sine transformed values.
In a column, means followed by a common small letter(s) between the treatments are not significantly different by CD (P=0.05).
In a rows, means followed by a common large letter(s) between NPK levels within treatment are not significantly different by CD (P=0.05).

respect to varied NPK levels. Similar results are published by Dash, 2008 in rice leaf folder, *Cnaphalocrocis medinalis* and revealed that the effectiveness of triazophos was more pronounced in nutrient level 60:30:30 kg NPK/ha in minimizing the leaf folder incidence (9.32% leaf infestation) at peak activity of pest than any other treatment combinations. Similar reports are given by Dash *et al.* (2008) against gall midge, *Orseolia oryzae* under field condition which revealed greater compatibility of nutrient dose 60:30:30 kg NPK/ha + $ZnSO_4$ with granular fipronil in arresting the silver shoot (SS) incidence to a appreciable level (3.01% SS) at peak activity of the pest than other treatment combinations. From the entire investigation insecticides with systemic toxicity like Fipronil and Imidacloprid was highly affected due to different NPK levels compared to contact and stomach action insecticides like Cypermethrin and Rynaxypyr. The semi systemic insecticide like Monocrotophos and residual systemic insecticide like Acephate toxicity was moderately affected.

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