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EXTENT OF SUPPRESSION OF RICE EAR HEAD BUG, *Leptocoryza acuta*. Th POPULATION BY DIFFERENT NEEM FORMULATION IN FIELD OF PADDY CULTIVAR *Swarna mashuri* (MTU 7029) DURING KHARIF SEASON

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ABSTRACT

Extent of suppression of rice ear head bug (*gundhi bug*), *Leptocoryza acuta* Th. population by six selected neem formulations were carried out in the field of paddy cultivar *Swarna mashuri* (MTU 7029) during four consecutive *kharif* crop seasons of 2005-2008 at Raiganj, Uttar Dinajpur, West Bengal, India. Apart from this there is a plot with no pesticide application considered as control. Experiment was laid out in randomized block design and had three replications for each year. All the treatments were effective significantly to suppress *L. acuta* incidence and accordingly the extent of grain damage. Chaffy grain formation due to *L. acuta* infestation was also minimized in all cases. Numerically least damage with minimum *L. acuta* incidence was noted from the field treated with monocrotophos 36 WSC (1.46 adult + 2.01 nymphs /5 hills and 2.41chaffy grains). This was followed by commercial formulation of nimbecidine (5%), neem oil (2%), neem seed kernel extract (5%), neem leaf extract (5%), neem root extract (5%) and neem bark extract (5%) in descending order. The pesticide untreated plot has registered 4.73 adult +8.62 nymphs' population /5 hills and 33.81% chaffy grains. In consideration of yield increase over control, maximum efficacy was registered when monocrotophos 36 WSC was applied @ 1125ml/ha. This was followed by commercial formulation of nimbecidine, neem oil, neem seed kernel extract, neem leaf extract, neem root extract, neem bark extract in descending order.

Keywords: paddy cultivar, rice ear head bug, neem formulation**,** chaffy grain, extent of loss.

INTRODUCTION

Effective crop protection schedule to improve and sustain rice yields by bio-rational practices is an essential component of modern integrated pest management (IPM) system. About 128 species of insects have been reported to ravage the paddy fields. Out of these only 15 to 20 insect species are economically important (Kalode, 2005). The rice ear head bug (EHB), *Leptocoryza acuta* Th. is one of the major sap sucking pest of paddy (Hashmi *et al*., 1983). Both the nymphs and adults suck the sap from developing grains during milking growth stage and thus make them partial or completely chaffy. Growing panicle is completely shattered and becomes white coloured under severe infestation (Israel *et al.*, 1961). EHB induced loss may range up to 25-35 percent (Banerjee *et al*., 1982). Verma *et al*., (1979) from Uttar Pradesh, India have reported that the extent of loss may extend up to 70 percent. Various control strategies have been adopted to check EHB menace, one common method being the use of newly evolved broad spectrum synthetic insecticide molecules, which is often environmentally unsound and thus result in the accumulation of toxic residues in the harvested produce (Chinniah *et al*., 1998).

In this consideration, the use of bio-pesticides as an eco-friendly and cost effective component in integrated pest management is imperative. Neem, *Azadirachta indica* (A. Juss.), has come under close scientific scrutiny as a source of natural pest control materials imparting no ecological adversity (Schmutterer, 2002). Singh *et al.*, (1999) from the northern parts of Bihar have reported that menace by rice leaf folder can be effectively checked by neem formulations. In addition to this, Durairal *et al*., (1993) have commented that neem formulations can effectively suppress EHB population. Neem formulations were quite safe to paddy field natural enemies (Samiayyan *et al*., 1998). The characteristic garlicky odour of neem materials presumably respells insects and the presence of alkaloids discourages insect feeding. It also inhibits insect reproduction and causes other mating interruption (Schmutterer, 1990). So the use of neem product can confer significant economic advantage and service in agriculture of tropical developing countries, if commendable recommendations can be made and given to the farmers as a suitable alternative protocol (Attri *et al*., 1980). In this contemplation relative efficacy of different neem formulations to suppress rice ear bug population was tested in the paddy field of *Swarna mashuri* (MTU 7029) at Raiganj, Uttar Dinajpur, West Bengal where no such experiment even of preliminary in nature was carried out earlier.

MATERIALS AND METHODS

Experimental layout

Field experiment was conducted with widely cultivated variety *Swarna mashuri* (MTU 7029) during four consecutive kharif seasons (2005-2008) at Raiganj [26°35´15´´ (N) - 87°48´37´´ (W)], Uttar Dinajpur, West Bengal. The soil of the experimental field was sandy loam with PH value 6.8 and EC value 0.29 mmhs/cm. Field N, P_2O_5 and K_2O was 307,59 and 348 kg/ha, respectively. Experiment was conducted by randomized block design with transplanted 35-day old seedlings at 15x15 cm hill to hill spacing. Except for insecticide application, field management was done in due time following the suggestive direction given in the National protocol with befitting modifications. Treatments include six different neem formulations, each with three replications for each year. Only one plot was treated with synthetic insecticide, monocrotophos 36 WSC @ 1125 ml /ha. No insecticide was applied in control plot. Each plot was 30x30 m by size. Insecticide formulation was applied at three specific times at 25, 50 and 75 days after seedling transplantation (DAT), respectively.

Application of insecticide formulations

Different grades of pesticide formulations were prepared. Neem oil (NOL) formulation was prepared after adding 2 ml of oil into 1 litter of water. The mixture was stirred well, emulsified and stored as working solution (T1). 1 kg green neem leaves were soaked overnight in 5 liter water, grinded and the leaf extract was filtered to prepare neem leaf extract (NLE) formulation (T2). 1 kg neem bark was soaked overnight in 5 liter water, grinded and the extract was filtered to prepare neem leaf extract (NBE) formulation (T3). 1 kg of neem root was soaked overnight in 5 liter water, grinded and the extract was filtered to prepare neem root extract (NRE) formulation (T4). 150 gm of 3 months old neem kernel is finely smashed and subsequently pounded in 1 liter of water to prepare neem seed kernel extract (NSKE) formulation (T5). Desired formulation grade (5%) of commercially available market sample of Nimbecidine was also prepared (T6). Commercial formulation of monocrotophos 36 WSC was applied @ 1125 ml/ha (T7). Except routine field management no pesticide was applied in the control field (T8).

Assessment on ear head bug incidence and the extent of damage

Both the incidence of adult and nymph population of EHB was recorded by hill estimations at three occasions in relation to each phase of pesticide application. In each occasion data was taken 2-day before and 5-day after pesticide application. During each observation 50 hills were randomly selected from each plot and the abundance of both adult and nymph population was noted. From that average incidence of both adult and nymph population was expressed in individuals/5 hills.

Damage by EHB was recorded after recording the percentage of both partially chaffy grains (CHG1) and completely chaffy grains (CHG2) at maturation stage. For these purpose 25 panicles was randomly selected from each plot. Grains from panicles were threshed and from that percentage of CHG1 and CHG2 was calculated.

The data was subject to statistical analysis as per standard procedure. The ^{v}x+0.5 mean of original data was calculated. Efficacy of each application was assessed in consideration of the population suppression against the control. Extent of population suppression percentage was determined is percentage in accordance to the following the formula:

$$\text{Application efficiently} = \frac{(Pc-Pt) \times 100}{Pc}$$

Where

Pc = pest population of control plot
Pt = pest population of treated plot

RESULTS AND DISCUSSIONS

Extent of suppression of rice ear head bug (*gundhi bug*), *Leptocoryza acuta* Th. population by six selected neem formulations and a synthetic pesticide solution were carried out in the field of paddy cultivar *Swarna mashuri* (MTU 7029) during four consecutive *kharif* crop seasons of 2005-2008 at Raiganj, Uttar Dinajpur, West Bengal, India. The results are delineated below:

In consideration of the suppression of gundhi bug population (Table-1). All the neem formulations were found prudent in reducing the number of both adult and nymphal population of EHB in field condition. Significant variation in consideration of EHB population suppression by different pesticide formulation was also noted. Year to year variation of all the formulation was also evicted. Lowest number of EHB was scored for T7 (1.46 adult + 2.01 nymph). This was followed by T6 (1.80 adult + 2.46 nymph), T1 (2.21 adult + 3.03 nymph), T5 (2.37 adult + 3.09 nymph), T2 (2.65 adult + 3.65 nymph), T4 (3.20 adult + 4.34 nymph) and T4 (3.20 adult + 4.34 nymph) in ascending order.

Efficacy of each formulation was determined in terms of their capacity to suppress the incidence of both adult and nymphal population of EHB in comparison to ‘control’ plots. Highest EHB adult suppression efficacy was recorded in T7 (69.13%). This was followed by T6 (61.93%), T1 (52.23%), T5 (49.89%), T2 (42.90%), T4 (32.30%) and T3 (28.23%) in ascending order. Similarly highest EHB nymph suppression efficacy was recorded in T7 (76.71%). This was followed by T6 (71.44%), T1 (64.86%), T5 (66.15%), T2 (58.53%), T4 (49.67%) and T3 (46.48%) in ascending order.

In all the cases, a single formulation was relatively more effective to the nymphal population than the adult. This may due to the reasons that the nymphs take food more voraciously than the adult. So the chances of pesticide contact were increased. Further due to the immature body, the function of pesticide formulation was more effective. For this extent of population suppression was comparatively higher for the nymphal population than the adult.

In consideration of the suppression of chaffy grain formation (Figure-1), sucking of the milky fluid from the growing grain results in chaffy grains (CHG). Application of the pesticide formulation suppressed the pest population and consequently the incidence of CHG was reduced. CHG were of two types partially (CHG1) and fully (CHG2) chaffy. From the average value of three consecutive years, it is evicted that lowest incidence (%) of CHG was counted for T7 (2.36 CHG1 + 2.05 CHG2). This was followed by T6 (3.07 CHG1 + 4.27 CHG2), T1 (5.44 CHG1 + 4.92 CHG2), T5 (7.57 CHG1 + 5.74 CHG2), T2 (10.61 CHG1 + 8.82 CHG2), T3 (18.33 CHG1 + 9.77 CHG2) and T4 (14.24 CHG1 + 7.52 CHG2) in ascending order. The control plot has registered 32.62 CHG1 and 11.21 CHG2. But for all the treatments incidence of CHG1 was higher than CHG2 in all the years. No paddy growth dependent change of efficacy of pesticide formulation was noted. For all the treatments separately maximum and minimum infestation was noted in 2008 and 2007 respectively. Climatic conditions in 2008 favoured the higher level of damage. Partial chaffy grain is formed due to limited grain sucking by EHB. While repeated attack or an attack for a long time causes fully chaffy grain formation. Under pesticidal stress the chances of multiple attack and the attack for a long duration is considerably reduced. Single attack though occurred but the frequency was low. All this resulted in the low incidence of chaffy grains.

Table-1. Impact of different neem formulation on the incidence of rice ear head bug and yield generation of the paddy cultivar S*warna mashuri* (MTU 7029).

Treatment	Insecticide formulation	Incidence of ear head bug population (individuals/5 hills)										Yield(q/ha)				Application Efficacy (%) (in respect of yield increase over control)
		Adult				Decrease of incidence over control (%)	Nymph				Decrease of incidence over control (%)					
		2007	2008	2009	Mean		2007	2008	2009	Mean		2007	2008	2009	Mean	
T1	Neem oil (2%)	1.93 (1.56)	1.85 (1.53)	2.86 (1.83)	2.21 (1.65)	53.23	3.35 (1.96)	3.08 (1.89)	2.84 (1.83)	3.09 (1.90)	66.15	34.06	32.96	30.57	32.53	32.31
T2	NLE (5%)	2.32 (1.68)	2.13 (1.62)	3.65 (2.04)	2.65 (1.77)	42.90	3.56 (2.02)	3.51 (2.00)	3.65 (2.04)	3.58 (2.02)	58.53	29.76	31.41	27.81	29.66	20.63
T3	NRE (5%)	2.79 (1.81)	2.85 (1.83)	4.55 (2.25)	3.39 (1.97)	28.23	4.60 (2.26)	4.70 (2.28)	4.55 (2.25)	4.62 (2.26)	46.48	27.11	28.87	24.74	26.91	14.15
T4	NBE (5%)	2.49 (1.73)	2.77 (1.81)	4.35 (2.20)	3.20 (1.92)	32.30	4.10 (2.14)	4.57 (2.25)	4.35 (2.20)	4.34 (2.20)	49.67	29.82	28.12	27.13	28.36	15.33
T5	NSKE (5%)	2.11 (1.62)	2.02 (1.59)	2.97 (1.86)	2.37 (1.69)	49.89	3.18 (1.92)	3.05 (1.88)	2.86 (1.83)	3.03 (1.88)	64.86	31.91	33.78	29.92	31.87	29.62
T6	Nimbecidine (5%)	1.48 (1.41)	1.57 (1.44)	2.34 (1.69)	1.80 (1.52)	61.93	2.45 (1.72)	2.59 (1.76)	2.34 (1.69)	2.46 (1.72)	71.44	34.56	34.87	32.09	33.84	37.64
T7	Monocrotophos 36 WSC (1125 ml/ha)	1.21 (1.31)	1.33 (1.35)	1.85 (1.53)	1.46 (1.40)	69.13	1.99 (1.58)	2.19 (1.64)	1.85 (1.53)	2.01 (1.58)	76.71	35.67	36.11	33.37	35.05	42.56
T8	Control	4.72 (2.29)	4.85 (2.31)	4.61 (2.26)	4.73 (1.52)	-	8.95 (3.07)	9.11 (3.10)	7.81 (2.88)	8.62 (3.02)	-	25.57	24509	25.10	23.59	-
CD(P=0.05)		0.12	0.19	0.21	0.27	-	0.15	0.18	0.14	0.21	-	1.34	1.53	1.74	1.26	-

(-): not applicable, figure in the parenthesis is the square root transformed values

In consideration of yield generation and application efficacy (Table-1), maximum yield was obtained from T7 plot (35.05q/ha). This was followed by T6 (33.84q/ha), T1 (32.53q/ha), T5 (31.87/ha), T2 (29.66 t/ha), T4 (28.36 q/ha) and T3 (26.91q/ha) in descending order. The lowest yield of 23.59 q/ha was obtained from pesticide untreated field. In consideration of yield increase over control, maximum efficacy was registered for T7 (42.56%). This was followed by T6 (37.64%), T1 (32.31%), T5 (29.62%), T2 (20.63%), T4 (15.33%) and T3 (14.15%) in descending order. In consideration of the incidence of both adult and nymph of EHB, a yield generation equation has been postulated.

Yield (t/ha) = 36.122 - 0.617 (nymph) - 0.184 (adult), r^2 = 89.66

So, increase of nymph and adult EHB causes 0.617 and 0.184 unit yield reduction, respectively. This implies that in consideration of yield loss WH is more important. Losses incurred due to WH at early growth stage are partially compensated by the generation new panicle bearing tillers during the subsequent growth period.

Relative superiority of neem formulations was assessed on different crops. Present findings are in agreement with those of Dreyer (1987) who have reported that the pests of egg plant could be controlled effectively by neem seed aqueous extract (NSKE) and neem oil (NOL) formulation. Present observation also matches with that of Shahid *et al.*, (1992) who have concluded that the incidence of jassid and brinjal fruit borer could be profitably suppressed by different neem formulations. Ponnusamy (2003) from Tamil Nadu have reported a quantum jump of yield generation by 11.79% when the paddy field was treated with neem formulations. Kaul *et al*., (1999) and Singh *et al.* (1999) have also noted the positive impact of neem products on paddy yield production. Present observation is also supported by Ahmad *et al*., (1993) who have noted the negative impact of neem formulations on brinjal fruit

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borer incidence. Commercial neem derivatives have been found effective against rice leaf folder (Sing *et al*., 1999), maize stem borer (Bhatnagar *et al*., 1997, Akbar *et al*., 1999), thrips (Kumar *et al*., 1999) and white backed plant hopper, (Raguraman *et al*., 1996). Anti-feedant activity of commercial formulation of neem (Nimbokil) against neonate larvae *of* maize stem borer was also documented by Ganguli *et al*., (1998) and Bhanukiran *et al*., (2000). Furthermore, pest suppression efficacy of neem oil and neem seed kernel extract on different crop were stated by Akbar *et al*., (1999), Kumar *et al*., (1999) and Bhanukiran *et al*., (2000). Incidence of cucumber beetles and vegetable leaf miner can be managed successfully by neem formulation as reported by Larew *et al.*, (1984). The findings of the present observations are also compatible with the observations of Natarajan *et al*., (1990) who have reported that neem formulations effectively suppressed white fly incidence in cotton field.

Figure-1. Extent of chaffy grain formation under different insecticidal treatments.

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