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Effects of soil and foliar application of neem products on densities of rice yellow stem borer, *Scirpophaga incertulas* (Walker) egg masses and their parasitism

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ABSTRACT: **Field experiments were conducted to study the effects of soil and foliar application of certain neem products on the densities of egg masses of the yellow stem borer, *Scirpophaga incertulas* (Walker) (Lepidoptera: Pyralidae), and on the extent of egg parasitism due to *Telenomus dignus* (Gahan) and *Tetrastichus schoenobii* (Ferreira). NPK fertilizers and organophosphate insecticides were included for comparison. The egg mass numbers and their parasitism were assessed at fortnightly interval. The results indicated that the egg masses were more numerous in NPK plots (2.16/m²) than in neem cake plots (1.10/m²), while the parasitism was higher on plants sprayed with neem products + fish oil rosin soap (26.28%) in neem cake plots than on plants with no plant protection in NPK plots (20.92%).**

KEY WORDS: Egg masses, egg parasitism, neem products, rice YSB

INTRODUCTION

Rice crop is affected by several tissue borers, of which the most important and widely distributed one is the yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) (Atwal, 1986; Purohit *et al.*, 1987). The natural enemies of borer species are quite efficient (Hikim, 1998; Gahukar, 1999). About 17 species of parasitoids occur on rice stem borer eggs in Asia (Reissig *et al.*, 1986). Population regulation of YSB at high density has been more due to the action of egg parasitoids than due to weather factors (Nishida and Wongsri, 1994). Ragini (1998) highlighted the potential of YSB natural enemies, especially the egg parasitoids that were more predominant than the larval or pupal parasitoids. Later, Manju (2000) identified these parasitoids as *Telenomus dignus* (Gahan) and *Tetrastichus schoenobii* (Ferreira). This study was undertaken to evaluate the effects of certain neem products against YSB eggs and their parasitism.

MATERIALS AND METHODS

Two field experiments, one during September–December 1999 and the other during November 1999– February 2000, were conducted at Agricultural College and Research Institute, Killikulam in Tamil Nadu. The experiments consisted of four replications in a split plot design. The plots were of 5x4m size and a one metre wide buffer

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surrounded each plot. The variety ADT39 was transplanted at 15x10cm spacing.

The main plots received soil application of neem cake and fertilizers, while foliar sprays were made on the sub-plots. All plots received basal application of organic manures comprising farmyard manure @ 12.5t/ha + daincha (*Sesbania aculeata*) @ 6.25t / ha. The main plot treatments were: M_1 – neem cake @ 15t/ha; M_2 – NPK @ 150: 50: 50 kg/ ha; M_3–neem cake @ 15 t/ha + NPK @ 150: 50: 50 kg/ha; and M_4 - manurial control. The sub-plot treatments were: S_1 – neem products, namely, neem cake extract (10%) or neem oil (3%) in alternate rounds + fish oil rosin soap (FORS) (2.5%); S_2 – monocrotophos or phosphamidon (0.3kg a. i./ha) in alternate rounds; S_3 – no-spray control. The foliar sprays were given thrice, the first at 30 days after treatment (DAT), the second at 45 DAT and the third at 60 DAT. A hand–operated hydraulic sprayer was used to spray the fluids at 500 litres per hectare.

Leaf bits (3cm long) bearing YSB egg masses were collected at weekly interval from a one metre square area in each experimental plot. They were maintained individually in cloth covered glass vials (12 mm diam, 5cm long) under screen house conditions (34.71 ±0.85° C; 79.05 ±0.92% RH) until the parasitoids and/or the host larvae had emerged from them. The vials containing the egg masses were arranged in plastic trays (30 x 24cm) lined with a layer of cotton in such a way that their plug ends touched the cotton that was always kept moist. The egg masses were observed daily for the emergence of borer larvae/parasitoids. The percentage of parasitism was calculated every week based on the emergence of stem borer larvae and/ or adult parasitoids from each egg mass. The data on the number of egg masses and on the percentage of parasitism were transformed before analysis of variance.

RESULTS AND DISCUSSION

The results indicated that the densities of YSB egg masses were significantly ($P<0.05$) different in the experimental plots (Table 1). Moths laid

Table 1. Effect of neem products on YSB egg mass numbers per metre square in ADT 39

Main plot treatment	Pooled mean			
	S_1	S_2	S_3	Mean
Neem cake @ 15t/ha	1.05 (1.23)	0.95(1.20)	1.29(1.33)	1.10(1.25)
NPK @ 150:50:50 kg/ha	2.14(1.60)	2.04(1.57)	2.30(1.66)	2.16(1.61)
Neem cake @ 15t/ha + NPK @ 150:50:50 kg/ha	1.54(1.41)	1.43(1.37)	1.49(1.40)	1.49(1.39)
Manurial control	1.45(1.38)	1.30(1.32)	1.72(1.47)	1.49(1.39)
Mean	1.54(1.67)	1.43 (1.37)	1.70(1.470	

	Pooled mean	
	SEM±	CD (0.05)
Mainplots	0.02	0.05*
Sub-plots	0.02	0.04*
Mainplots x Sub-plots	0.04	0.08^{NS}

Figures in parentheses are square root of x + 0.5 transformed values.

S_1, monocrotophos/ phosphamidon @ 0.3 kg ai/ha;

S_2, Neem cake extract 10%/Neem oil 3% + Fish oil rosin soap 2.5%;

S_3, No-spray control.

Significant at 5% level, NS = Non-significant

significantly more egg masses on the plants in NPK plots (2.16/m²) than on the plants in all other plots. Egg masses were significantly lower on the plants in neem cake treated plots (1.10/m²). This indicated that the plants in neem cake treated plots were less attractive for the YSB moths than the plants in NPK plots. Egg masses occurred at moderate densities in the manurial control plots and in the neem cake + NPK plots (1.49/m²). Foliar application of the neem products + FORS (1.43/m²) was significantly superior to the insecticides (1.54/m²) in lowering the egg mass numbers compared to that in the unsprayed plots (1.70/m²). The interaction showed that basal application of neem cake followed by spraying with monocrotophos or phosphamidon or neem products significantly reduced the borer egg numbers (0.95–1.05/m²).

The data on extent of parasitism also revealed that egg parasitism was significantly ($P<0.05$) variable on plants in the experimental plots (Table 2). Parasitism was significantly low on plants in NPK plots (18.30%). It was higher in both neem cake plots and neem cake + NPK plots (25.79–27.52%) than in the manurial control plots (23.79%). The foliar sprays also significantly influenced parasitism, lowest in the control plots (20.92%), moderate in insecticide sprayed plots (24.34%), and highest in neem products + FORS plots (26.28%). The interaction between soil application and foliar spray had no significance although maximum parasitism was observed in the neem cake plots protected with neem products + FORS spray (30.21%).

YSB moths laid significantly more egg masses in NPK plots than in other plots in this study. Nitrogen-rich greenish foliage following N application usually attracts the moths to oviposit since nitrogen causes the rice leaves to exude oryzanone, a stem borer attractant (Seko and Kato, 1950). Phosphorus also tends to increase the

Table 2. Effect of neem products on the egg parasitism in ADT 39

Main plot treatment	Pooled mean parasitism (%)			
	S_1	S_2	S_3	Mean
Neem cake @ 15t/ha	29.10(32.55)	30.21(33.23)	23.25(28.53)	27.52(31.44)
NPK @ 150:50:50 kg/ha	18.68(25.40)	20.07(26.50)	16.15(23.58)	18.30(25.16)
Neem cake @ 15t/ha + NPK @ 1 50:50:50 kg/ha	26.39(30.80)	28.75(32.34)	22.22(27.88)	25.79(30.34)
Manurial control	23.21(28.57)	26.11(30.54)	22.04(27.77)	23.79(28.96)
Mean	24.34(29.33)	26.28(30.65)	20.92(26.94)	

	Pooled mean	
	SEM±	CD (0.05)
Mainplots	0.80	0.81*
Sub-plots	0.48	0.99*
Mainplots x Sub-plots	0.96	0.97NS

Figures in parenthesis are angular transformed values.

S_1, monocrotophos/phosphamidon 0.3 kg a. i. /ha

S_2, Name cake extract 10%/Neem oil 3% + fish oil rosin soap 2.5%; S_3, No spray control.

* Significant at 5% level, NS= Non-significant

abundance of stem borers but to a lesser degree than nitrogen (Ferreira, 1983). On the other hand, potassium suppresses yellow stem borer. However, the egg laying was significantly less when neem cake was added to soil, indicating that neem cake is responsible for the reduction in oviposition. It is probable that as the neem cake decomposes, the odour emanating from the plots may have a repellent effect on the moths. Oviposition was also much less after foliar application of neem products + FORS. The interactive effects of soil application of neem cake followed by foliar spray with either OP compounds or neem products also show that neem products applied to soil or foliage could reduce egg mass numbers on rice plants. *Telenomus dignus* and *Tetrastichus schoenobii* were the two parasitoids recovered from the egg masses collected from the experimental plots. Neem products did not appear to have much effect on parasitism as more eggs were parasitized in the plots where neem cake was applied to the soil and/or when neem products were sprayed on the foliage than in insecticide sprayed plots. Srinivasa *et al.* (1996) reported that botanical insecticides were relatively safer to the parasitoids *Trichogramma australicum* (Girault), *Bracon hebetor* Say and *Trichogramma israeli* at lower concentrations. It may be concluded that application of neem products both in soil and on foliage can reduce densities of rice yellow stem borer egg masses without reducing the extent of egg parasitism that was not influenced by host egg density.

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