www.ThePharmaJournal.com

The Pharma Innovation

G Dhivya
Department of Agricultural
Entomology, Pandit Jawaharlal
Nehru college of Agriculture and
Research Institute,
Serumavilangai, Nedungadu,
Karaikal, India

K Kumar
Department of Agricultural
Entomology, Pandit Jawaharlal
Nehru college of Agriculture and
Research Institute,
Serumavilangai, Nedungadu,
Karaikal, India

Bio efficacy of botanicals against the stem borer, *Scirpophaga incertulas* (Walker) in rice

G Dhivya and K Kumar

Abstract
Field trials were conducted during *kharif* 2018 and *rabi* 2018-19 with rice variety ADT 45 to determine the bioefficacy of botanicals and insecticides against the stem borer, *Scirpophaga incertulas*. Results revealed that among all the foliar application, treatment with Rynaxypyr 20 SC @ 150 ml/ha recorded the least percent white ear or dead heart per hill (4.90 to 6.53 and 2.09 to 10.79 per cent/hill) followed by camphor oil @ 1000 ml/ha (4.73 to 6.63 and 2.92 to 11.07 per cent/hill) and superior than the other treatments in field experiment I and II. The effect of these applications was also resulted on the yield attributes, with highest grain yield of 3.43 and 6.64 t/ha was observed in Rynaxypyr 20 SC @ 150 ml/ha treated plot followed by dinotefuran 20 SG @ 200 g/ha (2.50 and 5.82 t/ha) in I and II field experiment.

Keywords: Rice, stem borer, camphor oil, Rynaxypyr 20 SC, dinotefuran 20 SG

Introduction
Rice is the prime source of food for nearly half of the world population. Globally rice, *O. sativa* is cultivated in an area of 160.9 million hectares with a production of 480.1 million tonnes of rice with an average productivity of 4.44 t/ha. (Anon., 2018) [1]. Nearly 300 species of insect pests attack the rice crop at different stages and among them only 23 species cause notable damage (Pasalu and Katti, 2006) [5]. Among them, yellow stem borer *Scirpophaga incertulas* (Walker), attack the crop from the seedling stage to the harvesting stage and thus cause complete loss of affected tillers. Dead hearts are produced when the insect attack at the vegetative stage while white ear heads occur when the stem borer attack at the time of heading. Yield losses due to yellow stem borer, *S. incertulas* are estimated to about 1-19 per cent in early planted and 38-80 per cent in late transplanted rice crop (Singh *et al*., 2015) [6]. Hence, the present study was undertaken.

Materials and Methods
Two field experiment was carried out during kharif 2018 and Rabi 2018-19 at the Eastern farm of Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI), Karaikal to evaluate the effect of botanicals and insecticides over stem borer of rice. The trials were laid out in a Randomized block design having a plot size of 5x4 square meter and spacing of 15 cm x 10 cm with the rice variety, ADT 45. All the treatment were replicated thrice. The efficacy of eight treatments *viz*., camphor oil @ 1000 ml/ha; cedarwood oil @ 1000 ml/ha; eucalyptus oil @ 1000 ml/ha; lemon grass oil @ 1000 ml/ha; neemazal 1.0 EC @ 1000 ml/ha; dinotefuran 20 SG @ 200 g/ha; rynaxypyr 20 SC @ 150 ml/ha were evaluated along with the untreated control against stem borer of rice. The insecticide were applied at 39 and 55 days after transplanting in *kharif* 2018 and 22, 40 and 57 days after transplanting in *rabi* 2018-19. Assessment of dead heart and white ears damage symptom caused by the yellow stem borer, *S. incertulas* was made on ten randomly selected plants per plot. The observations were taken a day before spraying and at 3, 7 and 14 DAS.

The percentage damage was worked out by using the formula.

$$\text{Per cent dead hearts} = \frac{\text{No. of damaged tillers}}{\text{Total no. of tillers}} \times 100$$

$$\text{Per cent white ears} = \frac{\text{No. of damaged productive tillers}}{\text{Total no. of productive tillers}} \times 100$$

Corresponding Author:
G Dhivya
Department of Agricultural
Entomology, Pandit Jawaharlal
Nehru college of Agriculture and
Research Institute,
Serumavilangai, Nedungadu,
Karaikal, India

Data obtained were subjected to analysis of variance (ANOVA) after transformation of data were analyzed with the help of web based software, wasp (WEB AGRI STAT PACKAGE).

Result and Discussion

In the field trial I, prior to imposition of treatments per cent white ear was uniform throughout the experiment and varied between 10.35 to 11.74 per cent per hill. Hence it showed non-significant among the treatments (Table 1). However, variation among the per cent was noticed at three day after spraying. The treatment with rynaxypyr 20 SC @ 150 ml/ha recorded significantly lower white ear per cent (5.60%) which was followed by camphor oil @ 1000 ml/ha (5.61%), but these are on par with each other. However, highest per cent white ear was noticed in untreated control (11.29%). Same trend was followed at 7 DAS. At 14 DAS, there was an increase in the per cent white ear which ranged from 6.53 to 11.93 per cent /hill irrespective of the treatments. It was found that after the first foliar application the per cent white ear was low in the treatment with rynaxypyr 20 SC @ 150 ml/ha followed by camphor oil @ 1000 ml/ha. After the second foliar application, the per cent white ear was in similar trend. Pallavi *et al*. (2018) [4] reported that chlorantraniliprole 0.4 GR @ 10 kg/ha was effective and recorded lowest per cent infestation of rice stem borer, *S. incertulas*.

In the field trial II, before the first foliar application the per cent dead heart ranged from 14.26 to 15.88 per hill. After the application, the per cent dead heart ranged from 4.02 to 14.76, 7.12 to 14.66, and 10.79 to 15.09 per cent per hill at 3, 7 and 14 DAS, respectively. The lowest per cent dead heart / white ear was noticed in the treatment with rynaxypyr 20 SC @ 150 ml/ha which ranged from 4.02 to 10.79 per cent/hill and camphor oil @ 1000 ml/ha which ranged from 4.26 to 11.07 per cent/hill compared to the untreated check (14.76 to 15.09 per cent/hill). Similar trend was observed after the second application. After the third foliar application, the per cent white ear was completely reduced. The lowest per cent white ear was observed in rynaxypyr 20 SC @ 150 ml/ha which ranged from 2.09 to 3.10 followed by camphor oil @ 1000 ml/ha which ranged from 2.92 to 4.41per cent/hill compared to the untreated check (16.45 to 16.75 per cent/hill). Bhatt *et al*. (2016) [2] reported that the camphor oil was highly potent in the larvicidal activity against the bihar hairy caterpillar, *Spilosoma obliqua* Walker at different concentration (2.0 and 2.5 μl) and caused about 6 to 90 per cent larval mortality. Karthikeyan (2018) [3] conducted the field trial and the results revealed that the new insecticide chlorantraniliprole 20 SC @ 150ml/ha was found to be more effective against the rice stem borer, *S. incertulas*

Yield

All the treatments resulted in higher grain yield and proved significantly superior over untreated control (Table 6). The highest yield was recorded with rynaxypyr 20 SC @ 150 ml/ha with the yield of 1.33 and 4.06 t/ha in field experiment I and II while, next best treatments are dinotefuran 20 SG @ 200 g/ha, camphor oil @ 1000 ml/ha, lemongrass oil @ 1000 ml/ha, eucalyptus oil @ 1000 ml/ha, neemazal 1.0 EC @ 1000 ml/ha, cedarwood oil @ 1000 ml/ha and untreated check.

Table 1: Effect of botanicals against the stem borer, *Scirpophaga incertulas* (Walker) during *kharif'* 2018 in rice (Field experiment I)

Sl. No	Treatments	Conc. a.i. ml/g/ha	Per cent white ear/ hill # I Foliar application						Overall mean	Per cent reduction over control
			Pre-treatment count	1 DAT	3 DAT	5 DAT	7 DAT	14 DAT		
1.	Camphor oil	1000 ml	10.91(19.29)	6.75(15.05)ᵃ	5.61(13.70)ᵃ	5.07(13.00)ᵃᵇ	4.73(12.56)ᵃ	6.63(14.87)ᵃ	5.75(13.86)ᵃ	49.56
2.	Cedarwood oil	1000 ml	10.63(19.02)	8.29(16.72)ᶜ	7.05(15.39)ᶜ	6.22(14.45)ᵈ	5.81(13.93)ᶜ	7.53(15.92)ᵃᵇ	6.98(15.54)ᶜ	38.77
3.	Eucalyptus oil	1000 ml	11.70(19.92)	7.49(15.88)ᵇ	6.38(14.63)ᵇ	5.62(13.69)ᵇᶜ	5.25(13.24)ᵇ	6.96(15.27)ᵃᵇ	6.84(15.31)ᵇᶜ	40.00
4.	Lemongrass oil	1000 ml	10.95(19.32)	7.41(15.79)ᵇ	6.30(14.53)ᵇ	5.56(13.64)ᵇᶜ	5.19(13.16)ᵇ	6.80(15.09)ᵃᵇ	6.25(14.47)ᵃᵇ	45.17
5.	Neemazal 1.0 EC	1000 ml	11.74(20.03)	8.39(16.83)ᶜ	7.14(15.50)ᶜ	6.30(14.53)ᵈ	5.88(14.01)ᶜ	8.23(16.66)ᵇ	7.18(15.54)ᶜ	37.01
6.	Dinotefuran 20 SG	200 g	11.22(19.56)	7.60(16.03)ᵇ	6.46(14.73)ᵇ	5.70(13.81)ᶜᵈ	5.30(13.93)ᶜ	7.80(16.21)ᵃᵇ	6.57(14.85)ᵇᶜ	42.36
7.	Rynaxypyr 20 SC	150 ml	10.35(18.76)	6.56(14.84)ᵃ	5.60(13.69)ᵃ	4.94(12.83)ᵃ	5.73(13.85)ᶜ	6.53(14.80)ᵃ	5.87(14.02)ᵃ	48.50
8.	Untreated check	-	10.87(19.24)	10.91(19.29)ᵈ	11.29(19.63)ᵉ	11.36(19.70)ᵉ	11.52(19.84)ᵈ	11.93(20.20)ᶜ	11.40(19.73)ᵈ	-
	CD (P=0.05)	-	NS	0.564**	0.394**	0.739**	0.376**	1.702**	0.812**	-

NS – Non Significant In a column mean followed by a common letter are not significantly different by DMRT (P=0.05)
** - Significant at P = 0.01   Values in Parentheses are Arc sine transformed values
# Mean of 10 plants DAT – Days after treatment
Mean of 3 replications

Table 2: Effect of botanicals against the stem borer, *Scirpophaga incertulas* (Walker) during *kharif'* 2018 in rice (Field experiment I)

Sl. No	Treatments	Conc. a.i.ml/g /ha	Per cent white ear/ hill # II Foliar application						Overall mean	Per cent reduction over control
			Pre-treatment count	1 DAT	3 DAT	5 DAT	7 DAT	14 DAT		
1.	Camphor oil	1000 ml	6.63(14.87)ᵃ	7.22(15.57)ᵃ	6.19(14.36)ᵃ	5.41(13.47)ᵃ	5.01(12.93)ᵃ	5.24(12.86)ᵃ	5.81(13.94)ᵃ	52.99
2.	Cedarwood oil	1000 ml	7.53(15.92)ᵃᵇ	9.79(18.19)ᶜ	7.92(16.40)ᵇ	6.34(14.57)ᵇᶜ	6.28(14.49)ᵇ	6.40(14.65)ᵇ	7.34(15.66)ᵈ	40.61
3.	Eucalyptus oil	1000 ml	6.96(15.27)ᵃᵇ	8.47(16.92)ᵇ	7.37(15.74)ᵇ	6.35(14.59)ᵇᶜ	5.84(13.97)ᵃᵇ	5.92(14.07)ᵇ	6.79(15.09)ᶜᵈ	45.06
4.	Lemongrass oil	1000 ml	6.80(15.09)ᵃᵇ	8.35(16.79)ᵇ	6.45(14.71)ᵃ	6.14(14.34)ᵇ	5.63(13.69)ᵃᵇ	5.11(13.06)ᵃ	6.33(14.57)ᵇᶜ	48.78
5.	Neemazal 1.0 EC	1000 ml	8.23(16.66)ᵇ	8.62(17.07)ᵇ	7.61(16.01)ᵇ	6.83(15.15)ᶜ	6.18(14.39)ᵇ	6.47(14.73)ᵇ	7.14(15.50)ᵈ	42.23
6.	Dinotefuran 20 SG	200 g	7.80(16.21)ᵃᵇ	9.12(17.57)ᵇᶜ	7.76(16.18)ᵇ	6.85(15.17)ᶜ	6.39(14.61)ᵇ	6.54(14.81)ᵇ	7.33(15.71)ᵈ	40.69
7.	Rynaxypyr 20 SC	150 ml	6.53(14.80)ᵃ	7.04(15.38)ᵃ	5.98(14.24)ᵃ	5.28(13.27)ᵃ	4.90(12.87)ᵃ	5.02(12.96)ᵃ	5.64(13.74)ᵃ	54.36
8.	Untreated check	-	11.93(20.20)ᶜ	12.06(20.313)ᶜ	12.26(20.48)ᶜ	12.39(20.61)ᵈ	12.62(20.81)ᶜ	12.51(20.72)ᶜ	12.36(20.58)ᵉ	-
	CD (P=0.05)	-	1.702**	0.919**	0.920**	0.785**	1.202**	0.822**	0.376**	-

** - Significant at P = 0.01 in a column mean followed by a common letter are not significantly different by DMRT (P=0.05)
# Mean of 10 plants Values in Parentheses are Arc sine transformed values Mean of 3 replications DAT – Days after treatment

Table 3: Effect of botanicals against the stem borer, *Scirpophaga incertulas* (Walker) during *rabi'* 2018-19 in rice (Field experiment II)

Sl. No	Treatments	Conc. a.i.ml/g /ha	Per cent dead heart/ hill # I Foliar application						Overall mean	Per cent reduction over control
			Pre-treatment count	1 DAT	3 DAT	5 DAT	7 DAT	14 DAT		
1.	Camphor oil	1000 ml	14.95(22.74)[ab]	4.99(12.15)[a]	4.26(11.74)[ab]	6.09(14.25)[ab]	8.16(16.58)[ab]	11.07(19.43)[ab]	6.91(14.83)[ab]	53.31
2.	Cedarwood oil	1000 ml	14.26(22.18)[a]	7.01(15.35)[c]	7.45(15.80)[c]	7.98(16.38)[cd]	9.67(18.11)[b]	13.55(21.58)[cd]	9.13(17.44)[c]	38.31
3.	Eucalyptus oil	1000 ml	15.83(23.43)[b]	6.09(14.25)[bc]	6.11(14.22)[abc]	6.86(15.16)[abc]	7.91(16.32)[ab]	12.64(20.88)[abc]	7.92(16.16)[abc]	46.48
4.	Lemongrass oil	1000 ml	14.71(22.55)[a]	5.84(13.98)[abc]	5.47(13.40)[bc]	7.49(15.86)[bcd]	8.77(17.22)[b]	12.15(20.39)[abc]	7.94(16.17)[abc]	46.35
5.	Neemazal 1.0 EC	1000 ml	15.18(22.93)[ab]	7.19(15.53)[c]	7.46(15.81)[c]	8.94(17.39)[d]	8.67(17.12)[ab]	13.08(21.18)[bcd]	9.06(17.40)[c]	38.78
6.	Dinotefuran 20 SG	200 g	15.88(23.48)[b]	6.73(15.03)[c]	6.59(14.87)[c]	6.91(15.24)[abc]	9.43(17.87)[b]	12.94(21.06)[bcd]	8.52(16.81)[bc]	42.43
7.	Rynaxypyr 20 SC	150 ml	14.52(22.40)[a]	4.68(12.44)[ab]	4.02(11.51)[a]	5.46(13.50)[a]	7.12(15.40)[a]	10.79(19.17)[a]	6.41(14.40)[a]	56.68
8.	Untreated check	-	14.54(22.41)a	14.57(22.57)[d]	14.76(22.56)[d]	14.94(22.72)[e]	14.66(22.50)[c]	15.09(22.84)[d]	14.80(22.63)[d]	-
	CD (P=0.05)	-	0.773**	1.99**	3.21**	1.76**	1.79**	1.882**	1.785**	-

** - Significant at P = 0.01   in a column mean followed by a common letter are not significantly different by DMRT (P=0.05)
# Mean of 10   plants Values in Parentheses are Arc sine transformed values
Mean of 3 replications   DAT – Days after treatment

Table 4: Effect of botanicals against the stem borer, *Scirpophaga incertulas* (Walker) during *rabi'* 2018-19 in rice (Field experiment II)

Sl. No	Treatments	Conc. a.i. ml/g /ha	Per cent white ear/ hill # II Foliar application						Overall mean	Per cent reduction over control
			Pre-treatment count	1 DAT	3 DAT	5 DAT	7 DAT	14 DAT		
1.	Camphor oil	1000 ml	11.07(19.43)[ab]	5.79(13.87)[b]	5.24(13.21)[b]	5.49(13.50)[b]	6.07(14.18)[ab]	6.76(15.05)[ab]	5.87(13.96)[b]	62.77
2.	Cedarwood oil	1000 ml	13.55(21.58)[cd]	7.16(15.51)[c]	7.16(15.46)[c]	7.49(15.85)[b]	7.94(16.32)[b]	8.63(17.07)[ab]	7.67(16.04)[d]	51.36
3.	Eucalyptus oil	1000 ml	12.64(20.88)[abc]	6.44(14.66)[bc]	6.12(14.31)[bc]	6.39(14.63)[b]	7.03(15.31)[b]	7.49(15.86)[ab]	6.69(19.13)[c]	57.57
4.	Lemongrass oil	1000 ml	12.15(20.39)[abc]	6.17(14.37)[bc]	6.04(14.13)[bc]	6.27(14.45)[b]	6.79(15.08)[b]	7.15(15.47)[ab]	6.48(14.70)[bc]	58.90
5.	Neemazal 1.0 EC	1000 ml	13.08(21.18)[bcd]	6.90(15.22)[bc]	6.37(14.57)[bc]	6.61(14.88)[b]	7.91(16.32)[b]	8.40(16.79)[b]	7.23(15.55)[cd]	54.15
6.	Dinotefuran 20 SG	200 g	12.94(21.06)[bcd]	6.69(14.96)[bc]	6.41(14.64)[bc]	6.74(15.02)[b]	7.44(15.78)[b]	7.98(16.38)[ab]	7.05(15.35)[cd]	55.29
7.	Rynaxypyr 20 SC	150 ml	10.79(19.17)[a]	3.94(11.43)a	3.14(10.12)[a]	4.33(11.83)[a]	4.16(11.69)[a]	6.13(14.33)[a]	4.34(11.88)[a]	72.47
8.	Untreated check	-	15.09(22.84)[d]	15.17(22.90)[d]	15.44(23.10)[d]	15.87(23.44)[c]	16.12(23.63)[c]	16.29(23.79)[c]	15.77(23.37)[e]	-
	CD (P=0.05)	-	1.882**	1.59**	1.833**	2.509**	2.840**	2.117**	0.909**	-

** - Significant at P = 0.01 In a column mean followed by a common letter are not significantly different by DMRT (P=0.05)
# Mean of 10 plants Values in Parentheses are Arc sine transformed values
Mean of 3 replications DAT – Days after treatment

Table 5: Effect of botanicals against the stem borer, *Scirpophaga incertulas* (Walker) during *rabi'* 2018-19 in rice (Field experiment II)

Sl. No	Treatments	Conc. a.i.ml/g /ha	Per cent white ear/ hill # III Foliar application						Overall mean	Per cent reduction over control
			Pre-treatment count	1 DAT	3 DAT	5 DAT	7 DAT	14 DAT		
1.	Camphor oil	1000 ml	6.76(15.05)[ab]	2.58(9.05)[ab]	2.92(9.71)[ab]	3.46(10.52)[ab]	3.93(9.66)[a]	4.41(12.01)[ab]	3.46(9.59)[a]	79.04
2.	Cedarwood oil	1000 ml	8.63(17.07)[ab]	6.16(14.36)[c]	6.37(14.58)[d]	6.54(14.78)[c]	7.47(15.83)[c]	7.91(16.30)[c]	6.89(15.17)[c]	58.86
3.	Eucalyptus oil	1000 ml	7.49(15.86)[ab]	4.27(11.85)[bc]	4.07(11.62)[bc]	4.37(11.98)[bc]	4.99(12.80)[abc]	6.09(14.11)[bc]	4.75(12.47)[b]	71.22
4.	Lemongrass oil	1000 ml	7.15(15.47)[ab]	4.58(12.30)[c]	4.63(12.39)[cd]	4.82(12.62)[bc]	5.10(12.86)[abc]	5.63(13.68)[bc]	4.95(12.77)[b]	70.01
5.	Neemazal 1.0 EC	1000 ml	8.40(16.79)[b]	5.16(13.09)[c]	5.10(13.02)[cd]	5.49(13.42)[bc]	5.88(13.98)[c]	7.54(15.92)[c]	5.83(13.88)[bc]	64.46
6.	Dinotefuran 20 SG	200 g	7.98(16.38)[ab]	5.16(13.02)[c]	4.98(12.86)[cd]	5.09(12.99)[bc]	5.67(13.71)[bc]	6.78(14.98)[bc]	5.53(13.51)[b]	66.50
7.	Rynaxypyr 20 SC	150 ml	6.13(14.33)[a]	2.16(8.25)[a]	2.09(8.27)[a]	2.36(8.73)[a]	3.12(9.94)[ab]	3.10(9.88)[a]	2.56(9.01)[a]	84.44
8.	Untreated check	-	16.29(23.79)[c]	16.23(23.75)[d]	16.45(23.86)[e]	16.51(23.97)[d]	16.62(24.00)[d]	16.75(24.14)[d]	16.51(23.94)[d]	-
	CD (P=0.05)	-	2.117**	3.139**	2.230**	3.118**	3.809**	3.230**	1.612**	-

** - Significant at P = 0.01 In a column mean followed by a common letter are not significantly different by DMRT (P=0.05)
# Mean of 10 plants Values in Parentheses are Arc sine transformed values
Mean of 3 replications DAT – Days after treatment

Table 6: Yield of rice, *O. sativa* in different treatments

Sl. No.	Treatments	Conc. ml/g per ha	Grain yield (t/ha)	
			Field experiment I	Field experiment II
1.	Camphor oil	1000	2.28[bc]	5.68[bc]
2.	Cedarwood oil	1000	1.70[de]	5.13[d]
3.	Eucalyptus oil	1000	1.91[d]	5.30[cd]
4.	Lemongrass oil	1000	1.96[cd]	5.18[d]
5.	Neemazal 1.0 EC	1000	1.86[d]	4.63[e]
6.	Dinotefuran 20 SG	200	2.50[b]	5.82[b]
7.	Rynaxypyr 20 SC	150	3.43[a]	6.64[a]
8.	Untreated check	-	1.33[e]	4.06[f]
	CD (P=0.05)	-	0.370**	0.384**

**-Significant at P = 0.01 In a column mean followed by a common letters are not significantly different by DMRT (P=0.05)

Conclusion

Management of stem borer with botanicals and insecticide is practical and easily approach to farming community. Among the various botanicals camphor oil @ 1000 ml/ha and in insecticides rynaxypyr 20 SC @ 150 ml/ha were proved to be best and these could be included in IPM strategies to cater the needs of farming community in karaikal region.

References

1. Anonymous. GOI, Agricultural Statistics at a Glance. Directorate of Economics and Statistics. Government of India. Krishi Bhavan. New Delhi, India 2018.
2. Bhatt P, Thodsare N and Srivatsava RP. Insect growth regulatory activities from oils of camphor and clove against Spilosoma obliqua. J Appl. Nat. Sci 2016;8(3):1434-1437.
3. Karthikeyan K. Efficacy of new insecticide molecule against major pests of rice. Journal of Rice Research, 2018;10(2):60-65.
4. Pallavi D, Sharanabasappa, Girijesh GK. Evaluation of newer insecticide molecules against rice stem borer *Scirpophaga incertulas* on paddy. International Journal of Chemical Studies 2018;6(2):2551-2554.
5. Pasalu IC, Katti G. Advances in ecofriendly approaches in rice IPM. Journal of Rice Research 2006;1(1):83-90.
6. Singh P, Singh R, Dhaka SS, Kumar H, Kumari N. Bioefficacy of insecticides and bio-pesticides against yellow stem borer, *Scirpophaga incertulus* (Walk.) and their effect on spiders in rice crop. South Asian Journal of Food Technology and Environment 2015;1(2):179-183.