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Bio-efficacy of different insecticides against capsule borer, *Dichocrosis punctiferalis* Guenee infesting castor

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ABSTRACT

An investigation was carried out for two consecutive *Kharif* seasons (2014-15 and 2015-16) with a view to evaluate bio-efficacy of different insecticides against capsule borer, *Dichocrosis punctiferalis* Guenee infesting castor. Considering the capsule damage caused by *D. punctiferalis*, the chlorantraniliprole 18.5 SC, 0.006 per cent (7.07%), flubendiamide 48 SC, 0.015 per cent (7.25%) indoxacarb 15.8 EC, 0.015 per cent (7.29%) and emamectin benzoate 5 SG, 0.0025 per cent (7.36%) were effective in checking the incidence of *D. punctiferalis* in castor which reflected on yield and economics.

Key words: Bio-efficacy, castor, insecticides, capsule borer

Castor (*Ricinus communis* L.) is one of the important and valuable non edible crops in oilseed group and India is one of the world's principal producers of castor. The major castor growing states in India are Gujarat, Andhra Pradesh, Rajasthan, Karnataka, Orissa and Tamil-Nadu. The current castor production in the country is 13.37 lakh tones from 8.85 lakh hectares with a productivity of 1512 kg/ha in 2012-13 (DAC, 2013). In Gujarat, castor is grown in Mehsana, Banaskantha, Sabarkhantha, Gandhinagar, Ahmadabad and Kutch districts. In India, more than 63 species of insect pests have been reported to cause damage to castor crop (Rai, 1976). The major cause for limiting castor production in India is the susceptibility of released varieties/hybrids to a number of foliage feeders of which leaf eating caterpillar, *Spodoptera litura* Fabricius and semilooper, *Achaea janata* Linnaeus cause economic losses. Now-a-days, the capsule borer, *Dichocrosis punctiferalis* is also a serious pest in castor growing areas and causing seed damage in infested capsules and weight loss of damage seeds were 42.3 and 63.0 per cent, respectively in GCH - 4 cultivar (Kapadia, 1996).

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MATERIALS AND METHODS

Field experiment was conducted to evaluate bio-efficacy of different insecticides against capsule borer, *D. punctiferalis* infesting castor at Anand Agricultural University, Anand during two consecutive *kharif* seasons of 2015-16 and 2016-17 in Randomized Block Design with nine treatments and three replications. Castor cultivar GCH 7 was sown with a spacing of 120 cm between two rows and 60 cm within the rows. Gross and net plot area was 6.00 m x 4.80 m and 4.80 m x 2.40 m, respectively. The treatment wise spray was applied on castor crop on appearance of capsule borer and second spray was given at 15 day after first spray. For recording the observations, five plants were

selected randomly from each net plot area. At reproductive phase healthy and infested capsules were counted from three branches of each randomly selected plant prior as well as 5, 10 and 15 days after application of insecticides. Treatment wise castor seed yield recorded and economics were calculated.

RESULTS AND DISCUSSION

The castor capsule damage caused by *D. punctiferalis* was homogeneous in all the treatments before spray as treatment difference was non-significant (Table 1). All the insecticidal treatments were significantly superior over control after 5, 10 and 15 days of first and second spray, pooled over periods of first and second spray as well as pooled over sprays (Table 1).

First Year (2015-16): There was no difference of capsule damage due to *D. punctiferalis* in various treatments before spray and the results was non-significant. The lowest capsule damage caused by *D. punctiferalis* was observed in chlorantraniliprole 20 SC, 0.006 per cent and it was at par with flubendiamide 48 SC, 0.015 per cent, indoxacarb 15.8 EC, 0.015 per cent and emamectin benzoate 5 SG, 0.0025 per cent than rest of insecticides after 5, 10 and 15 days of first and second spray. The treatments *viz.*, spinosad 45 SC, 0.018 per cent, quinalphos 25 EC, 0.05 per cent, chlorphyriphos 50 + cypermethrin 5 EC, 0.055 per cent and novaluron 10 EC, 0.01 per cent remained next effective in controlling the pest till 15 days of first and second spray (Table 1). The highest (23.89 q/ha) seed yield of castor was recorded from the plots treated with chlorantraniliprole 20 SC, 0.006 per cent and it was at par with flubendiamide 48 SC, 0.015 per cent, indoxacarb 15.8 EC, 0.015 per cent and emamectin benzoate 5 SG, 0.0025 per cent (Table 1). Spinosad, quinalphos and chlorphyriphos 50 + cypermethrin 5 EC were produced more or less equal castor seeds. Among the evaluated insecticides, the lowest (15.50 q/ha) castor seed produced from novaluron and it was at par with chlorphyriphos + cypermethrin and quinalphos.

Second Year (2016-17): Capsule damage due to *D. punctiferalis* before spray was non-significant which indicating (Table 2) uniform capsule damage in the experimental plot. The lower (7.15 to 7.56%) capsule damage due to *D.punctiferalis* was found in the treatment of chlorantraniliprole 20 SC, 0.006 per cent and it was at par with flubendiamide 48 SC, 0.015 per cent, indoxacarb 15.8 EC, 0.015 per cent and emamectin benzoate 5 SG, 0.0025 per cent. Spinosad 45 SC, 0.018 per cent, quinalphos 25 EC, 0.05 per cent, chlorphyriphos 50% + cypermethrin 5% EC, 0.055 per cent and novaluron 10 EC, 0.01 per cent were found equally effective in reducing the capsule damage due to *D. punctiferalis* up to 15 days as well as in pooled over periods of first and second spray (Table 2). The highest (37.54 q/ha) castor seed yield was recorded from the plots treated with chlorantraniliprole and it was at par with flubendiamide, indoxacarb and emamectin benzoate (Table 2). Spinosad, quinalphos and chlorphyriphos 50% + cypermethrin 5% produced statistically equal castor seeds. Among the evaluated insecticides, the lowest (29.17 q/ha) castor seed produced in treatment of and it was at par with chlorphyriphos + cypermethrin and novaluron treatments.

Pooled over sprays and years: The data of pooled over sprays of first year revealed (Table 3) that castor plots treated with chlorantraniliprole 20 SC, 0.006 per cent registered the lowest (7.09%) capsule damage due to *D. punctiferalis* and it was at par with flubendiamide 48 SC, 0.015 per cent, indoxacarb 15.8 EC, 0.015 per cent and emamectin benzoate 5 SG, 0.0025 per cent. More or less similar trend was also observed in second year. Pooled over years indicated that the lowest capsule damage due to *D. punctiferalis* was found in the treatment of chlorantraniliprole 20 SC, 0.006 per cent (7.07%) and it was at par with flubendiamide 48

SC, 0.015 per cent, indoxacarb 15.8 EC, 0.015 per cent and emamectin benzoate 5 SG, 0.0025 per cent. Spinosad 45 SC ,0.018 per cent, quinalphos 25 EC, 0.05 per cent, chlorphyriphos 50 + cypermethrin 5 EC, 0.055 per cent and novaluron 10 EC, 0.01 per cent were statistically at par in reducing the castor capsule damage due to *D. punctiferalis*. Kumar *et al.* (2017) reported that chlorantraniliprole, 0.01 per cent was the best treatment and on par with flubendiamide, 0.02 per cent when sprayed at 15 days interval against *C. punctiferalis* infesting ginger. Patel and Borad (2016) showed that chlorantraniliprole 18.5 SC, 0.006 per cent and indoxacarb 14.5 SC, 0.015 per cent were effectively manage the capsule damage caused by *D. punctiferalis*. The capsule damage was 4.9 to 9.8 per cent in the treatments of flubendiamide and chlorantraniliprole where it was 11.00 to 17.30 per cent in control (Duraimurugan and Lakshminarayana, 2014). Above findings of the earlier researchers are tally with the present investigation.

The highest (30.72 q/ha) castor seed yield was recorded from the plots treated with chlorantraniliprole (Table 3) and it was at par with flubendamide, indoxacarb and emamectin benzoate. Among the evaluated insecticides the lowest (21.14 q/ha) yield was recorded in the treatment of novaluron and it was at par with chlorpyrifos + cypermethrin, quinalphos and spinosad.

ECONOMICS

The highest (1:18.55) ICBR was noticed in the treatment of indoxacarb 15.8 EC, 0.079 per cent followed by chlorpyrifos 50% + cypermethrin 5% EC, 0.055 per cent, emamectin benzoate 5 SG, 0.0025 per cent, quinalphos 25 EC, 0.05 per cent, chlorantraniliprole 20 SC, 0.006 per cent and flubendiamide 48 SC, 0.015 per cent. The treatment of chlorpyrifos 50% + cypermethrin 5% EC and quinalphos 25 EC gave higher ICBR but mediocre in efficacy against capsule borer.

CONCLUSION

Considering the capsule damage caused by *D. punctiferalis,* the chlorantraniliprole 18.5 SC, 0.006 per cent, flubendiamide 48 SC, 0.015 per cent, indoxacarb 15.8 EC, 0.079 per cent and emamectin benzoate 5 SG, 0.0025 per cent were effective in checking the incidence of *D. punctiferalis* in castor which also reflected on yield and economics.

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Table 1 Capsule damage caused by *D. punctiferalis* in different insecticides and its effect on yield in 2015-16

Sr. No.	Treatment	Capsule damage (%) days after spray									Yield (q/ha)
		Before spray	First spray			Pooled over periods	Second spray			Pooled over periods	
			5	10	15		5	10	15		
T_1	Chlorantraniliprole 18.5 SC 0.006 %	15.30 (6.96)	15.33c (6.99)	15.39c (7.04)	15.42c (7.07)	15.38c (7.03)	15.46c (7.11)	15.51c (7.15)	15.53c (7.17)	15.50c (7.14)	23.89e
T_2	Spinosad 45 SC 0.018%	15.86 (7.47)	17.97b (9.52)	18.31b (9.87)	18.60b (10.17)	18.29b (9.85)	18.83b (10.42)	19.02b (10.62)	19.30b (10.92)	19.05b (10.65)	18.58bc
T_3	Novaluron 10 EC 0.01 %	16.92 (8.47)	18.04b (9.59)	18.38b (9.94)	18.76b (10.34)	18.39b (9.95)	18.99b (10.59)	19.11b (10.72)	19.39b (11.02)	19.16b (10.77)	15.50b
T_4	Chlorpyrifos 50% + cypermethrin 5% EC 0.055%	14.73 (6.47)	18.03b (9.58)	18.37b (9.93)	18.67b (10.25)	18.35b (9.91)	18.92b (10.51)	19.09b (10.70)	19.37b (11.00)	19.13b (10.74)	17.23bc
T_5	flubendiamide 48 SC 0.015%	15.69 (7.31)	15.36bc (7.02)	15.50c (7.14)	15.58c (7.21)	15.48c (7.12)	15.62c (7.25)	15.68c (7.30)	15.78c (7.40)	15.69c (7.31)	22.99e
T_6	Indoxacarb 15.8 EC 0.015%	15.86 (7.47)	15.40bc (7.05)	15.56c (7.20)	15.60c (7.23)	15.52c (7.16)	15.73c (7.35)	15.77c (7.39)	15.86c (7.47)	15.79c (7.40)	22.28e
T_7	Emamectin benzoate 5 SG 0.0025%	15.82 (7.43)	15.43bc (7.08)	15.54c (7.18)	15.68c (7.30)	15.55c (7.19)	15.76c (7.38)	15.83c (7.44)	15.88c (7.49)	15.82c (7.43)	22.22d
T_8	Quinalphos 25 EC 0.05%	15.85 (7.46)	17.99b (9.54)	18.33b (9.89)	18.65b (10.23)	18.32b (9.88)	18.89b (10.48)	19.08b (10.69)	19.35b (10.98)	19.11b (10.72)	18.89cd
T_9	Control	14.70 (6.44)	21.08a (12.94)	21.38a (13.29)	21.84a (13.84)	21.43a (13.35)	22.04a (14.08)	22.15a (14.22)	22.40a (14.52)	22.20a (14.28)	12.10a
S. Em ±	Treatment (T)	0.99	0.79	0.78	0.77	0.43	0.76	0.77	0.77	0.43	1.13
	Period (P)	-	-	-	-	0.25	-	-	-	0.25	-
	T X P	-	-	-	-	0.75	-	-	-	0.74	-
	C.V. %	10.96	7.95	7.74	7.56	7.45	7.42	7.49	7.35	7.13	10.16

Figures in parentheses are retransformed values; those outside are arcsine transformed value

Table 2 Capsule damage caused by D. punctiferalis in different insecticides and its effect on yield in 2016-17

Sr. No.	Treatment	Capsule damage (%) days after spray								Yield (q/ha)
		Before spray	First spray			Pooled over periods	Second spray			Pooled over periods	
			5	10	15		5	10	15		
T_1	Chlorantraniliprole 18.5 SC 0.006 %	15.23	15.24a (6.91)	15.28a (6.95)	15.45a (7.10)	15.32a (6.98)	15.49a (7.13)	15.50a (7.14)	15.54a (7.18)	15.51a (7.15)	37.54c
T_2	Spinosad 45 SC 0.018%	14.92	18.74c b (10.32)	18.87c b (10.46)	19.36c b (10.99)	18.98b (10.58)	19.35c b (10.98)	19.31c b (10.93)	19.64b (11.30)	19.43b (11.07)	29.55b
T_3	Novaluron 10 EC 0.01 %	15.70	18.83c b (10.42)	18.96c b (10.56)	19.60c b (11.25)	19.12b (10.73)	19.72d c (11.39)	19.66d c (11.32)	20.11c b (11.82)	19.83b (11.51)	26.78b
T_4	Chlorpyrifos 50% + cypermethrin 5% EC 0.055%	14.95	18.80c b (10.39)	18.96c b (7.16)	19.44c b (11.08)	19.06b (10.66)	19.51a (11.15)	19.42d c (11.05)	19.92c b (11.61)	19.62b (11.27)	28.51b
T_5	flubendiamide 48 SC 0.015%	15.20	15.45b a (7.10)	15.52c b (7.17)	15.64c b (7.27)	15.53a (7.17)	15.71a (7.33)	15.79a (7.40)	15.86a (7.47)	15.79a (7.40)	35.75c
T_6	Indoxacarb 15.8 EC 0.015%	13.86	15.48b a (7.12)	15.53b a (7.23)	15.61a (7.24)	15.53a (7.17)	15.70a (7.32)	15.79a (7.40)	15.88a (7.49)	15.79a (7.40)	35.43c
T_7	Emamectin benzoate 5 SG 0.0025%	15.27	15.52b a (7.16)	15.60b a (10.49)	15.76b a (7.38)	15.62a (7.25)	15.89b a (7.50)	15.95b a (7.55)	16.04a (7.63)	15.96a (7.56)	35.20c
T_8	Quinalphos 25 EC 0.05%	16.40	18.75c b (10.33)	18.90c b (14.12)	19.40c b (11.03)	19.00b (10.60)	19.46d c (11.10)	19.63d c (11.29)	19.86c b (11.54)	19.65b (11.31)	29.17b
T_9	Control	16.43	21.85c (13.85)	22.07c (19.78)	22.78c (14.99)	22.22c (14.30)	22.97d (15.23)	23.25d (15.58)	23.50c (15.90)	23.23c (15.56)	19.95a
S. Em ±	Treatment (T)	0.98	1.00	1.02	1.04	0.51	1.06	1.09	1.07	0.53	1.80
	Period (P)	-	-	-	-	0.34	-	-	-	0.35	-
	T X P	-	-	-	-	1.02	-	-	-	1.07	-
	C.V. %	11.12	9.82	9.99	10.01	9.94	10.10	10.32	10.02	7.13	10.10

Figures in parentheses are retransformed values; those outside are arcsine transformed value