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Effect of insecticides on natural enemies in Bt cotton

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Abstract
Effect of various chemical insecticides on natural enemies in Bt cotton crop was evaluated as a state trial at cotton research station farm, Junagadh Agricultural University, Junagadh, Gujarat during Kharif 2016-17. The chemical insecticides used to spray on Bt cotton crop are Flonicamid 50% WG, Difenthiuron 50% WP, Buprofenzin (IGR) 25% SC, Thiamethoxam 25% WG, Fipronil 5% SC, Neemazal F 5% WSC, Carbosulfan 48% EC, Spiromesifen 22.9% SC, Clothianidin 50% WG, Acetamiprid 20% SP and Dinotefuran 20% SG. The difference in population of all predators (Coccinellids, *Chrysoperla* and spider) was significantly lower in all the insecticidal treatments than control. However, the treatments, Neemazal F 5 WSC (4.9 nos./plant), Buprofenzin 25 SC (4.8 nos./plant) and Acetamiprid 20 SP (4.8 nos./plant) had found somewhat safer for predators and recorded comparatively higher population of predators than rest of the treatments at 7 days after first, second and third spray.

Keywords: cotton, effect, natural enemies, insecticides

Introduction
Cotton (*Gossypium* spp.) popularly known as "king of the white gold", is an important commercial fiber crop grown under diverse agro climatic conditions around the world. Cotton occupies a pre-eminent place among cash crops touching the countries economy at several points. Cotton occupies a place of pride being the prime supplier of raw material (85%) for textile industry, which is one of the leading industries in the country. Cotton industry provides means of livelihood for about 250 million people in the world and about 60 million people through its cultivation, trade and industries in India. Commercially cotton is one of the best vital raw materials and contributes nearly 20 per cent of the entire industrial output of the country (James, 2002) [3]. Cotton crop is infested by several sucking pests' right from germination to harvest. The estimated loss due to sucking pests is up to 21.20% (Dhawan *et al.*, 1988) [1]. Among the sap feeders aphids *Aphis gossypii* (Glover), leaf hoppers *Amrasca biguttula biguttula* (Ishida), thrips *Thrips tabaci* (Linn) and whitefly *Bemisia tabaci* are deadly pests (Udikeri *et al*. 2009) [6].

Cotton growers in India depend heavily on chemical pesticides to combat sucking pests. At least 2-3 sprays are directed against sucking pests. Due to continuous and indiscriminate use of chemical insecticides, there is resistance and hence the efficacy has become less reliable. To overcome this problem discovery of novel substances with different biochemical targets are needed. Novel molecules are effective at low doses and have less exposure in the environment. The three R's-resistance, resurgence and residue are the most potential problems associated with the indiscriminate use of pesticides in cotton agro-ecosystem and have made cotton cultivation non-profitable. Pesticides can prove to be the most effective instruments in crop protection and if correctly used, their effect is fast and complete, which makes them applicable against nearly every pest (Oomen and Bouma 2003) [4]. However, alternate pest control methods and the restricted use of pesticides can minimize the risk of pesticide usage (Soundararajan 2012) [5]. In the present investigation these insecticides have been evaluated for their effectiveness against major sucking pests of cotton and their impact on natural enemies. Biological control is the beneficial action of predators, parasites and pathogens in managing pests and their damage. Bio-control provided by these living organisms, collectively called "natural enemies" is especially important for reducing the numbers of pest insects and mites (Flint *et al*. 1998) [2].

Materials and Methods

The field trial was conducted at Cotton Research Station, Junagadh Agricultural University, Junagadh in during Kharif season of the year 2016-17. Two sample't' test with equal sample size design with having plot size of 6.30 m X 4.80 m and spacing of 1.20 m X 0.45 m. All the recommended agronomical practices were followed during experimentation. The chemical pesticides used as treatments are Flonicamid 50 WG (0.02%) 100g a.i./ha (4 g/10 lit. water), Difenthiuron 50 WP (0.06%) 300 g a.i./ha (12 g/10 lit. water), Buprofezin (IGR) 25 SC (0.05%) 250 g a.i./ha (20 ml /10 lit. water), Thiamethoxam 25 WG (0.005%) 25 g a.i./ha (2 g/10 lit. water), Fipronil 5 SC (0.0175%) 87.5 g a.i./ha (35 ml/10 lit. water), Neemazal F 5 WSC (0.005%) 25 g a.i./ha (10 ml/10 lit. water), Carbosulfan 48 EC (0.048%) 240 g a.i./ha (10 ml/10 lit. water), Spiromesifen 22.9 SC (0.023%) 114.5 g a.i./ha (10 ml/10 lit. water), Clothianidin 50 WG (0.0025%) 12.5 g a.i./ha (0.5 g/10 lit. water), Acetamiprid 20 SP (0.006%) 30 g a.i./ha (3 g/10 lit. water), Dinotefuran 20 SG (0.008%) 40 g a.i./ha (4 g/ 10 lit. water) and control.

Method for recording observations

Insecticidal spraying will be done at the initiation of sucking pests. Population of natural enemies (Predators) will be recorded from five plants in each treatment. Observation will be recorded before spray and at 7 days after each spray.

Results and Discussion

The results presented in Table 1 indicated that mean population of natural enemies *viz.* Coccinellids, Chrysoperla and spider was found non- significant before first spray. However, the difference in population of all predators (Coccinellids, Chrysoperla and spider) was significantly lower in all the insecticidal treatments than control. Among the insecticidal treatments, Thiomethoxam 25 SC @ 25 g a.i./ha (3.4 nos./plant), Difenthiuron 50 WP @ 300 g a.i./ha (3.5 nos./plant), Difenthiuron 20 SG @ 40 g a.i./ha (3.5 nos./plant), Fipronil 5 SC @ 100 g a.i./ha (3.6 nos./plant), Carbosulfan 48 EC @ 240 g a.i./ha (4.0 nos./plant), Spiromesifen 22.9 SC 114.5 g a.i./ha (4.2 nos./plant), Clothianidin 20 SP 12.5 g a.i./ha (4.3 nos./plant), and Flonicamid 50 WG @ 100g a.i./ha (4.6 nos./plant) had reported adverse effect and recorded significantly lowest population of predators than control and at par with each other at 7 days after first spray. However, the treatments, Neemazal F 5 WSC @ 25 g a.i./ha (4.9 nos./plant), Buprofenzin 25 SC @ 250 g a.i./ha (4.8 nos./plant) and Acetamiprid 20 SP @ 30 g a.i./ha (4.8 nos./plant) had found somewhat safer for predators and recorded comparatively higher population of predators than rest of the treatments at 7 days after first spray. More or less same trends were observed at 7 days after second and third spray.

Table 1: Effect of insecticides on major natural enemies in Bt cotton. (2016-17)

S. No	Insecticides	Dose g a.i./ha	Conc.	Population of Coccinellids, Chrysopa & Spider / 5 plants											
				First Spray				Second Spray				Third Spray			
				Before spray		7 DAS		Before spray		7 DAS		Before spray		7 DAS	
				TV*	OV	TV*	OV	TV*	OV	TV*	OV	TV*	OV	TV*	OV
1	Flonicamid 50% WG	100	0.02%	2.55	(6.5)	2.14	(4.6)	2.12	(4.5)	1.82	(3.3)	1.98	(3.9)	1.43	(2.1)
2	Difenthiuron 50% WP	300	0.06%	2.54	(6.5)	1.88	(3.5)	1.96	(3.9)	1.73	(3.0)	1.96	(3.8)	1.34	(1.8)
3	Buprofenzin (IGR) 25% SC	250	0.05%	2.56	(6.6)	2.20	(4.8)	2.14	(4.6)	1.99	(4.0)	2.05	(4.2)	1.48	(2.2)
4	Thiamethoxam 25% WG	25	0.005%	2.58	(6.7)	1.84	(3.4)	2.01	(4.0)	1.65	(2.7)	1.96	(3.9)	1.26	(1.6)
5	Fipronil 5% SC	87.5	0.0175%	2.52	(6.4)	1.89	(3.6)	1.95	(3.8)	1.61	(2.6)	1.91	(3.7)	1.20	(1.4)
6	Neemazal F 5% WSC	25	0.005%	2.54	(6.5)	2.22	(4.9)	2.11	(4.5)	2.03	(4.1)	1.89	(3.6)	1.61	(2.6)
7	Carbosulfan 48% EC	240	0.048%	2.51	(6.3)	2.01	(4.0)	1.96	(3.9)	1.67	(2.8)	1.82	(3.3)	1.26	(1.6)
8	Spiromesifen 22.9% SC	114.5	0.023%	2.57	(6.6)	2.04	(4.2)	1.84	(3.4)	1.71	(2.9)	2.00	(4.0)	1.32	(1.8)
9	Clothianidin 50% WG	12.5	0.0025%	2.58	(6.6)	2.06	(4.3)	1.86	(3.4)	1.69	(2.8)	2.00	(4.0)	1.46	(2.1)
10	Acetamiprid 20% SP	30	0.006%	2.65	(7.0)	2.18	(4.8)	2.10	(4.4)	1.89	(3.6)	1.96	(3.9)	1.51	(2.3)
11	Dinotefuran 20% SG	40	0.008%	2.63	(6.9)	1.88	(3.5)	1.96	(3.8)	1.87	(3.5)	1.84	(3.4)	1.47	(2.2)
12	Control	---		2.61	(6.8)	2.54	(6.5)	2.45	(6.0)	2.57	(6.6)	2.58	(6.7)	2.57	(6.6)
S.Em				0.11		0.10		0.09		0.10		0.08		0.08	
CD at 5%				NS		0.31		0.27		0.29		0.24		0.24	
CV %				7.33		8.74		7.93		9.14		7.05		9.51	

DAS= Days after spray TV=Transformed Value,
*=Square root transformed Value OV= Original Value

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