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Bio-efficacy of PII 8007 20% SC against fruit borer on pomegranate

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Abstract
The experiment field experiment was conducted at the farm of Pomology Research Centre, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2016-17 and 2017-18 to evaluvate bio-efficacy of chemicals such as PII 8007 20% SC @ 15,20 and 25 g ai/ha Cyantraniliprole10.26% OD, Lambda-cyhalothrin 5% EC and Spinosad 45% EC against fruit borer on pomegranate alongwith untreated control. Results indicated that sprayings of PII 8007 20% SC @ 25 g a.i./ha can significantly reduce the infestation of fruit borer of pomegranate with significant increase in yield. All the insecticidal treatments were significantly superior than untreated control in reducing pomegranate pests i.e. fruit borer population during both the seasons *viz*., Ambia bahar, 2016 and Ambia bahar, 2017.

Keywords: Bioefficacy, Ambia bahar, fruit borer and fruit damage

Introduction
Pomegranate (*Punica granatum* L.) is one of the most adaptable subtropical minor fruit crop, commonly known as *anar, dalim* or *dalimbe* and belongs to one of the smallest families of plant kingdom, Punicaceae. Pomegranate is native to Iran, where it was first cultivated around 2000 BC and spread to the Mediterranean countries (Evereinoff, 1949) [5]. It is extensively cultivated in Spain, Morocco, Egypt, Iran, Afghanistan, Arabia and Baluchistan. Its cultivation spread further to other countries like China, Japan, USA, USSR, Pakistan and India. During 1986, the area under pomegranate cultivation in India was increased due to the introduction of high yielding soft seeded variety "*Ganesh*" in the state of Maharashtra, Karnataka and Gujarat (Bose, 1986) [3].

India, with its diverse soil and climate offers ideal conditions for growing several kinds of fruits. Fruit crops are being grown on an area of about 3.94 million hectares with a total production of 50 million tonnes. In India, the percent availability of fruits per head per day is only 55 g, which is far lower than the recommended level of 85 g per head per day by Indian Council of Medical Research (ICMR).

Pomegranate cultivation is unique in its own way because of its drought In India, it is cultivated on 208.73 thousand ha area with a production of 2442.39 thousand MT and the productivity is 11.70 MT per ha. Maharashtra ranks first in area 136.75 thousand ha with a production of 1578.04 thousand MT and productivity of 11.54 MT per ha (Anonymous, 2017) [1].

In the chemical composition of pomegranate, it represented 52 percent of total fruit weight comprising 73 percent juice and 22 percent seeds. The fresh juice contains 85.40 percent moisture, 10.67 percent total sugars, 1.40 percent pectin as well as the seeds are good source of total lipid 27.20 percent, protein 13.20 percent and crude fiber 35.30 percent. It is also a rich source of riboflavin (Bose *et al.,* 2002) [2]. The roots, rind and seeds are medicinally important especially against diarrhoea. The rind is also used as dyeing material for cloth. A wild type of pomegranate grown in Himachal Pradesh has got great economic importance since its sun dried seeds are used to make condiment called anar-dana (Patyal and Nath, 1993) [8].

The juice of wild pomegranate in Azerbaijan is used in the manufacture of citric acid and sodium citrate for medicinal purpose. The bark of stem and roots contain a number of alkaloids belonging to the pyridine group. It is also employed in the therapeutics in dysentery and diarrhea (Bal, 2008) [4].

In recent years, Anar butterfly/ fruit borer, *D. isocrates* (Fab.) has become a major constraint in the production of appropriate quality fruits of pomegranate for domestic and export markets. Pomegranate fruit borer is the most widespread, polyphagous and destructive pest with a wide range of host plants *viz.,* pomegranate, citrus, guava, litchi, aonla, wood apple, apple, ber, loquat, mulberry, peach, pear, plum, sapota, tamarind, *etc.*

The incidence of sucking insect pests and fruit borer has been reported throughout the year with varying degrees of intensity in Maharashtra and Karnataka (Shevale and Khaire, 1999) [9]. Halleppanvar (1955) [6] reported 100 percent fruit damage to pomegranate under severe endemic conditions in Karnataka. However, average losses of 40 to 90 percent have been reported in India (Wadhi and Batra, 1969) [10]. Pomegranate butterfly, *D. isocrates* is one the most obnoxious pest on pomegranate crop incurring about 65 to 70 percent of yield loss worldwide (Kumar *et al*., 2017) [7].

Recommended use of pesticides at right time certainly helps minimizing the pest damage. But intensive year round production of pomegranate often leads to increased pest build-up that possess necessity for more intensive control. Current control measures of pomegranate pests include prophylactic use of broad spectrum pesticides concerned for health hazards, destruction of natural ecosystem, increasing chances of pest resurgence and development of resistance. As a matter of fact, pesticides are currently considered most economical and dependable tool at farmer's level. However, their use based on data of seasonal incidence of pests, selective mode of action and persistence against target pest, magnitude of adverse effects on prevailing natural enemies of pests and presence of objectionable levels of residues in edible parts in market quality fruits will make them acceptable for good quality of pomegranate fruits.

Material and Methods

To study the Bioefficacy of PII 8007 20% SC against fruit borer on pomegranate. field experiment was conducted at at the farm of Pomology Research Centre, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during 2016-17 and 2017-18.

The total numbers of fruits were counted from selected plants per treatment and calculated healthy and damage fruits per plant. The percent fruits damage by fruit borer (Deudorix isocrates) were recorded per plant in each treatment before spray, 1, 3, 7, 10 and 15 days after I and II spray. Finally percent fruit damage was calculated. The values were then transformed to arc sine transformation for analysis as per randomized block design. The values were then transformed to square root transformation for analysis as per randomized block design.

Results and Discussion

Fruit Borer: *Ambia* Bahar 2016: (Season-I)

The data in respect to bioefficacy of insecticidal treatments against fruit borer on pomegranate up to 15 days after first and second spray are presented in the Table 1 and 2 which suggest that Fruit borer population before spray was very evenly distributed in all the experimental plots, the lowest percent of fruit infestation on pomegranate was observed in PII 8007 20% SC @ 25 g a.i./ha (7.67%), it was followed by Cyantraniliprole 10.26% OD @75 g a.i./ ha (8.98%) and PII 8007 20% SC @ 20 g a.i./ha (9.53%) which were at par with each other. The next treatment showing minimum infestation were Spinosad 45% EC (11.91%), PII 8007 20% SC @ 15 g a.i./ha (13.15%) and Lambda-cyhalothrin 5% EC@15 g a.i. /ha (14.37%) on 15th day after spray. The infestation in untreated control was increased from (9.90 to 26.36%) from before spray to 15th day after spray.

After 2nd spray, significantly minimum percent of fruit infestation on pomegranate was observed in PII 8007 20% SC @ 25 g a.i./ha (8.40%), it was followed by Cyantraniliprole 10.26% OD @ 75g a.i./ ha (10.50%) and PII 8007 20% SC @ 20 g a.i./ha (11.53%) which were at par with each other. The next best treatments in the order of effectiveness were Spinosad 45% EC@ 73 g a.i./ha (%) (14.68%), PII 8007 20% SC @ 15 g a.i./ha (17.12%) and Lambda-cyhalothrin 5% EC @15 g a.i. /ha (18.78%) on 15th day after spray showing significantly less percent infestation than untreated control (42.13%).

Table 1: Bio-efficacy of PII 8007 20% SC against pomegranate fruit borer (Ambia Bahar 2016).

Sr. No.	Treatments	Dose		% Fruit damage due to fruit borer					
		g a.i /ha	Formulation ml/ha	1st spray					
				Before Spray	1 DAA	3 DAA	7 DAA	10 DAA	15 DAA
T_1	PII 8007 20% SC	15	75	8.19	8.79	8.95	9.35	10.13	13.15
				16.63	17.24	17.40	17.80	18.56	21.26
T_2	PII 8007 20% SC	20	100	7.64	7.69	7.75	8.19	8.69	9.53
				16.04	16.10	16.17	16.63	17.15	17.98
T_3	PII 8007 20% SC	25	125	6.91	6.98	7.05	7.15	7.25	7.67
				15.24	15.32	15.39	15.51	15.62	16.08
T_4	Cyantraniliprole10.26% OD	75	750	7.43	7.50	7.58	7.72	7.92	8.98
				15.82	15.89	15.98	16.13	16.35	17.43
T_5	Lambda- cyhalothrin 5% EC	15	300	8.22	8.93	9.19	10.29	11.26	14.37
				16.66	17.38	17.65	18.71	19.61	22.27
T_6	Spinosad 45% EC	73	160	8.01	8.65	8.88	9.18	9.98	11.91
				16.44	17.10	17.34	17.64	18.42	20.19
T_7	Untreated control	-	-	9.90	10.27	13.60	17.94	22.27	26.36
				18.34	18.69	21.64	25.06	28.16	30.89
S.Em.±				0.76	0.59	0.61	0.63	0.69	0.77
C.D. at 5%				NS	1.81	1.87	1.94	2.14	2.38

Figures in bold are Arc sine transformed values; * DAA = days after application; * NS- Non significant

Table 2: Bio-efficacy of PII 8007 20% SC against pomegranate fruit borer, (*Ambia* bahar 2016)

Sr. No.	Treatments	Dose		% Fruit damage due to fruit borer				
		ga.i/ha	Formulation ml/ha	2nd spray				
				1 DAA	3 DAA	7 DAA	10 DAA	15 DAA
T_1	PII 8007 20% SC	15	75	13.84	14.04	14.45	14.68	17.12
				21.84	22.01	22.34	22.53	24.44
T_2	PII 8007 20% SC	20	100	9.59	9.67	10.10	10.56	11.53
				18.04	18.11	18.53	18.97	19.85
T_3	PII 8007 20% SC	25	125	7.72	7.80	7.91	8.00	8.40
				16.14	16.22	16.34	16.43	16.85
T_4	Cyantraniliprole 10.26% OD	75	750	9.07	9.16	9.29	9.47	10.50
				17.52	17.62	17.75	17.92	18.91
T_5	Lambda- cyhalothrin 5% EC	15	300	15.10	15.35	16.46	17.12	18.78
				22.87	23.06	23.94	24.44	25.68
T_6	Spinosad 45% EC	73	160	12.55	12.83	13.08	13.79	14.68
				20.75	20.99	21.20	21.80	22.53
T_7	Untreated control	-	-	28.93	31.08	34.23	37.75	42.13
				32.54	33.88	35.81	37.91	40.47
S.Em.±				0.79	0.85	0.84	0.90	1.00
C.D. at 5%				2.43	2.61	2.60	2.76	3.07

Figures in bold are Arc sine transformed values; * DAA = days after application; *NS- Non significant.

***Ambia* bahar 2017: (Season-II)**

The data in respect to bio efficacy of insecticidal treatments against fruit borer on pomegranate up to 15 days after first and second spray are presented in the Table 3 and 4. Uniform distribution of fruit borer infestation was observed in the experiment in all treatment plots suggesting the need to impose the treatments.

After 1st spray, significantly minimum fruit infestation was observed in PII 8007 20% SC @ 25 g a.i./ha (6.72%), Cyantraniliprole 10.26% OD @75g a.i./ ha(7.82%) and PII 8007 20% SC @ 20 g a.i./ha (8.53%) and these treatments were at par with each other. The next promising treatment was Spinosad 45% EC @ 73 g a.i./ha (10.36%), PII 8007 20% SC @ 15 g a.i./ha (12.59%) and Lambda-cyhalothrin 5% EC@15 g a.i. /ha (14.28%) on 15th day after spray and the infestation in control plot rose from 9.03% to 21.94%, over a period 15 of days after application of the treatment.

After 2nd spray, the least percent fruit infestation was observed in PII 8007 20% SC @ 25 g a.i./ha (7.39%), Cyantraniliprole10.26% OD @75g a.i./ ha (9.16%) and PII 8007 20% SC @ 20 g a.i./ha (10.52%) and all these treatment were found at par with each other. Among the treated plots maximum infestation was observed in Lambda-cyhalothrin 5% EC @15 g a.i. /ha (20.70%) but it was significantly less than untreated control (40.43%).

Table 3: Bio-efficacy of PII 8007 20% SC against pomegranate fruit borer (*Ambia* bahar 2017*)*.

Sr. No.	Treatments	Dose		% Fruits damage due to fruit borer					
		ga.i/ha	Formulation ml/ha	1st spray					
				Before Spray	1 DAA	3 DAA	7 DAA	10 DAA	15 DAA
T_1	PII 8007 20% SC	15	75	7.46	8.05	8.23	8.65	9.46	12.59
				15.85	16.48	16.67	17.10	17.91	20.79
T_2	PII 8007 20% SC	20	100	7.39	6.81	6.88	7.13	7.65	8.53
				15.78	15.12	15.21	15.48	16.05	16.98
T_3	PII 8007 20% SC	25	125	5.90	5.99	6.07	6.18	6.29	6.72
				14.05	14.17	14.27	14.39	14.52	15.02
T_4	Cyantraniliprole10.26% OD	75	750	6.21	6.29	6.38	6.53	6.74	7.82
				14.43	14.52	14.63	14.81	15.05	16.24
T_5	Lambda- cyhalothrin 5% EC	15	300	8.05	8.73	8.97	10.10	11.07	14.28
				16.48	17.19	17.43	18.53	19.43	22.21
T_6	Spinosad 45% EC	73	160	7.02	7.70	7.94	8.25	9.09	10.36
				15.37	16.11	16.37	16.69	17.55	18.78
T_7	Untreated control	-	-	9.03	9.43	12.32	14.55	17.98	21.94
				17.49	17.88	20.55	22.42	25.09	27.93
S.Em.±				0.78	0.59	0.78	0.69	0.66	0.73
C.D. at 5%				NS	1.82	2.40	2.14	2.03	2.25

Figures in bold are Arc sine transformed values; * DAA = days after application; * NS- Non significant

Table 4: Bio-efficacy of PII 8007 20% SC against pomegranate fruit borer (*Ambia* bahar 2017).

Sr. No.	Treatments	Dose		% Fruit damage due to fruit borer				
		ga.i/ha	Formulation ml/ha	2nd spray				
				1 DAA	3 DAA	7 DAA	10 DAA	15 DAA
T_1	PII 8007 20% SC	15	75	13.27	13.97	14.40	14.65	17.47
				21.36	21.95	22.30	22.50	24.71
T_2	PII 8007 20% SC	20	100	8.60	8.68	9.10	9.58	10.52
				17.05	17.13	17.56	18.03	18.92
T_3	PII 8007 20% SC	25	125	6.77	6.84	6.93	7.03	7.39
				15.09	15.16	15.27	15.38	15.77
T_4	Cyantraniliprole 10.26% OD	75	750	7.91	7.98	8.10	8.29	9.16
				16.33	16.41	16.54	16.74	17.61
T_5	Lambda- cyhalothrin 5% EC	15	300	15.00	15.39	16.45	17.12	20.70
				22.79	23.10	23.93	24.44	27.06
T_6	Spinosad 45% EC	73	160	11.01	11.63	11.86	12.59	15.62
				19.38	19.94	20.14	20.79	23.28
T_7	Untreated control	-	-	26.16	29.18	32.76	36.02	40.43
				30.76	32.70	34.92	36.88	39.48
S.Em.±				0.74	0.80	0.93	1.24	1.01
C.D. at 5%				2.27	2.46	2.88	3.81	3.12

Figures in bold are Arc sine transformed values; * DAA = days after application; * NS- Non significant

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