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EFFICACY OF INSECTICIDES AGAINST JAMUN SEED WEEVIL *CURCULIO C- ALBUM* F.

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ABSTRACT

Among seven insecticides evaluated azadirachtin 10000 ppm (1 ml/ l) was found to be the most effective against seed weevil *Curculio c-album* F., followed by deltamethrin 2.8EC (1.0 ml/ l) and malathion 50EC (2.0 ml/l). The least effective was spinosad 45SC (0.3 ml/ l) followed by cyantraniliprole 10.26OD (1.8 ml/ l). Three rounds of sprays (new flush, pre bloom and post bloom) of insecticides gave better protection when compared to single/ two sprays. Maximum healthy fruit yield (49.81 kg/ tree) was obtained with azadirachtin.

Key words: Jamun, *Curculio c-album*, insecticides, sprays, damage grades, healthy fruit yield, BCR, azadirachtin, deltamethrin, malathion, spinosad, cyantranilprole

Jamun, popularly known as "fruit of gods" as it possesses multiple health benefits. The jamun fruits and products are acknowledged for their therapeutic purposes, particularly diabetics. The seed is used in Ayurveda, Unani and Chinese medication for stomach related afflictions. So for 78 insect species from five orders viz., Hemiptera (26 spp.), Coleoptera (8 spp.), Diptera (5 spp.), Lepidoptera (34 spp.), Thysanoptera (6 spp.) are known from jamun (Rajeshkumar et al., 2010) and four mite species (Nayak, 2017) of which seed weevil *Curculio c-album* F., causing significant economic damage to seeds is important (Hiremath et al., 2021). Fletcher (1917) was in a dilemma for placing *C. c-album* as a jamun pest as it was feeding on seeds thinking seed has no economic value. Systemic studies on chemical control of seed weevil of jamun have not been done so far. There is a need for screening of safer and effective pesticides to manage seed weevil without causing the environmental damage. A field experiment was conducted to evaluate the efficacy of seven insecticides against *Curculio c-album* and the results are presented herein.

MATERIALS AND METHODS

The study site was Regional Horticulture Research and Extension Center, GKVK, Bengaluru (13° 05' N, 77° 33'E, 930 masl- Zone-5) of Karnataka. Thirteen jamun varieties/ accessions were used including Mysuru, Chinthamani, Bahadoli, No-58, K-45, No-20, AJG-85, Hoagalagere, Hadonahalli, Kallahalli, Krishnagiri, GKVK-1 and GKVK-2 planted during 2012 and Dhupdal planted during 2019. These were in a compact block at a spacing of 5 x 5 m each and a single tree served as an experimental unit. As the number of trees of single variety were not available for the experiment it was conducted with a three sets using Mysuru (8), Chinthamani (8) and Bahadoli (5) for one round of spray at fruit set (post –bloom); No.-58 (3), K-45 (3), No.-20 (3), AJG-85 (3), Hoagalagere (3), Hadonahalli (3) and Kallahalli (3) for two rounds of spray at flower bud initiation (pre-bloom) and fruit set; Dhupdal (21) for three rounds of spray at new flush, flower bud initiation and fruit set. One or two trees each of these varieties and six plants of Dhupdal were used for no spray (untreated control–UTC) following completely randomized factorial design. The chemicals evaluated include two botanicals (azadirachtin and neem oil), and two pesticides (spinosad and cyantriniliprole), two synthetic pyrethroids (lamda cyhalothrin and deltamethrin) and one OP compound (malathion). Among these, deltamethrin (1 ml/ l) and malathion (2 ml/ l) were standard checks as these were prescribed for jamun (Anonymous, 2017; Singh et al., 2009, respectively). Observations were made on fruit yield/ tree, with observations from seven to 10 pickings, which were weighed and a sample of 100 g was segregated into four damage grades (Pooja, 2019). As the damage by other seed and fruit borer complex was <10% which were not uniform, it was not considered. To know the efficacy of insecticides evaluated in monetary terms, the benefit cost ratio was worked out. Cost of the insecticides used and other data were used for computing cost benefit ratio as per standard procedure.

RESULTS AND DISCUSSION

Results revealed that it was impossible to get healthy fruits (Grade 1) without insecticidal sprays (Table 1). The yield of Grade 2 fruits was only 1.00/ tree and that of Grade 3 fruits was 2.66 kg/ tree, while that of Grade 4 obtained without sprays was fairly high (11.94 kg/ tree). Irrespective of the damage grades and the number of sprays, azadirachtin 10000 ppm (1 ml/ l) led to maximum fruit yield (18.09 kg/ teee) which was significantly superior. The standard checks, deltamethrin 2.8EC (1.0 ml/ l) (15.24 kg) and malathion 50 EC (2.0 ml/ l) (14.37 kg) were the next best. Mean fruit yield per tree with neem oil (5 ml/ l) (11.05 kg) was on par with lambda cyhalothrin 5EC (0.5 ml/ l) (10.69 kg). Similarly, overlooking the number of sprays, the healthy fruit yields were significantly more with azadirachtin (21.21 kg/ tree) followed by deltamethrin (16.11 kg/ tree). Significantly more grade 1 fruits was

Table 1. Efficacy of insecticides against jamun seed weevil *C. c-album* (RHREC, Bengaluru, 2019)

Treatments (ml/ l)	No. of sprays	Yield (kg/ tree)				Total yield (kg/ tree)
		G1	G2	G3	G4	
Neem oil @ 5 ml+ Soap @ 0.5 g	I	1.31	1.96	4.48	17.48	25.24
	II	5.22	5.60	10.58	18.04	39.44
	III	18.15	14.50	20.31	15.03	67.99
	Mean	6.25	5.61	9.40	15.14	
Azadirachtin 10,000 ppm @ 1 ml	I	5.27	7.71	8.36	7.22	28.56
	II	29.77	27.77	23.88	5.90	87.32
	III	49.81	30.75	17.60	3.05	101.21
	Mean	21.21	16.79	13.15	6.60	
Spinosad 45 SC @ 0.3 ml	I	0.59	1.63	2.49	15.73	20.45
	II	1.90	3.55	3.79	17.98	27.22
	III	10.62	6.85	6.59	22.35	46.38
	Mean	3.28	3.31	3.83	17.10	
Cyantraniliprole 10.26 OD @ 1.8 ml	I	2.50	6.07	11.69	9.76	28.06
	II	8.59	10.33	6.16	10.71	35.79
	III	10.63	13.14	11.67	10.96	46.39
	Mean	5.43	7.62	8.22	10.73	
Malathion 50 EC @ 2 ml (ICAR- CISH)	I	2.86	6.18	8.73	16.59	33.20
	II	21.63	13.32	11.43	15.38	61.73
	III	27.61	24.67	14.56	9.49	76.32
	Mean	13.02	11.31	9.44	14.25	
Lambda cyhalothrin 5 EC @ 0.5 ml	I	3.78	3.94	4.70	12.06	24.48
	II	6.63	7.84	9.26	15.94	39.67
	III	13.61	15.07	19.32	16.22	68.37
	Mean	6.00	7.05	9.08	13.54	
Deltamethrin 2.8 EC @ 1 ml (UHSB)	I	4.37	5.61	8.75	10.59	29.32
	II	24.70	18.72	12.29	11.70	67.41
	III	35.36	26.72	18.79	5.30	86.18
	Mean	16.11	13.06	10.40	10.39	
UTC		0.00	1.00	2.66	11.94	15.60
	CD (p=0.05)	SE(m±)				
Treatments	0.77	0.28				
Number of sprays	0.58	0.21				
Treatments X Number of sprays	1.54	0.55				
Grades	0.58	0.21				
Treatments X Grades	1.54	0.55				
Number of sprays X Grades	1.17	0.42				
Treatments X Number of sprays X Grades	3.09	1.11				

Grade 1: Healthy with no visible signs on fruits; Grade 2: ≤10 punctures or scars (feeding/oviposition marks); Grade 3: ≥11 punctures with slight malformation and Grade 4: Unmarketable

obtained with three rounds of spray with azadirachtin (49.81 kg/ tree) followed by deltamethrin (35.36 kg) where the unmarketable fruit (grade 4) yields were significantly lower. One round of spray with the same chemicals gave healthy fruit (grade 1) yields of 5.27 and 4.37 kg/ tree and unmarketable (grade 4) yields of 7.22 and 10.59 kg/ tree, respectively.

Thus, for managing *C. c-album* three rounds of sprays are must, and azadirachtin 10000 ppm (1 ml/ l), deltamethrin 2.8 EC (1 ml/ l) and malathion 50 EC (2 ml/ l) were found highly effective. In a similar study against litchi fruit borer *Conopomorpha litchiella* Bradley two rounds of spray with spinosad were found superior (Pandey, 2015). The cost economics presented in Table 2 reveal that with the 13 varieties used, mean total yield (Grade 1, 2 and 3) in untreated control was 15.61 kg/ tree with net return of Rs 233.36/ tree. With malathion spray followed by deltamethrin and azadirachtin it was more and the least with spinosad followed by lamda cyhalothrin. The benefit cost ratios with one spray ranged from 11.21 (spinosad) to 74.26 (azadirachtin); with two sprays fruit yield was maximum with azadirachtin (87.32 kg/ tree), and benefit cost ratios ranged from 8.09 (spinosad) to 152.04 (azadirachtin). With three rounds of azadirachtin spray (101.21 kg/ tree) yielded highest total jamun fruits followed by delatmetrhin and malathion and was the least (46.38 kg/ tree) with spinosad followed by cyantraniliprole, and benefit cost ratios ranged from 7.37 (spinosad) to 130.41 (azadirachtin). Pandey (2015) observed that lambda cyhalothrin gave maximum yield in litchi against litchi fruit borer *C. litchiella.*

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Table 2. Benefit cost ratio of insecticides used against jamun seed weevil *C. c-album* (RHREC, Bengaluru, 2019)

Treatment (dose/l)	0 Spray		I Spray					II Spray					III Spray				
	Yield (Kg/ tree)	NR (Rs./ tree)	Yield (Kg/ tree)	Cost (Rs./ tree)	GR (Rs./ tree)	NR (Rs./ tree)	BCR	Yield (Kg/ tree)	C (Rs./ tree)	GR (Rs./ tree)	NR (Rs./ tree)	BCR	Yield (Kg/ tree)	C (Rs./ tree)	GR (Rs./ tree)	NR (Rs./ tree)	BCR
Neem oil @ 5 ml+ Soap @ 0.5 g	12.61	148.5	25.24	24.4	551.0	526.5	21.52:1	39.44	48.9	1611.0	1562.1	31.92:1	67.99	86.9	4280.5	4193.6	48.26:1
Azadirachtin 10,000 ppm @ 1 ml	13.91	228.0	28.56	22.8	1716.0	1693.2	74.26:1	87.32	45.4	6948.0	6902.6	152.04:1	101.21	68.0	8936.0	8868.0	130.41:1
Spinosad 45 SC @ 0.3 ml	16.00	242.5	20.45	40.5	346.5	306.0	7.55:1	27.22	80.8	734.5	653.7	8.09:1	46.38	121.2	2076.5	1955.3	16.14:1
cyantriniliprole 10.26 OD @ 1.8 ml	15.83	263.0	28.06	118.1	1441.5	1323.4	11.21:1	35.79	236.0	2200.0	1964.0	8.32:1	46.39	353.9	2960.5	2606.6	7.37:1
Malathion 50 EC @ 2 ml	19.65	258.0	33.20	21.6	1340.5	1318.9	61.06:1	61.73	43.0	4066.5	4023.5	93.57:1	76.32	64.4	5956.0	5891.6	91.48:1
Lambda cyhalothrin 5 EC @ 0.5 ml	14.35	287.0	24.48	18.0	1007.0	989.0	54.85:1	39.67	35.9	1910.0	1874.1	52.26:1	68.37	53.7	3834.0	3780.3	70.41:1
Deltamethrin 2.8 EC @ 1 ml	16.92	206.5	29.32	20.4	1435.5	1415.1	69.37:1	67.41	40.6	4956.5	4915.9	121.08:1	86.18	60.8	7147.5	7086.7	116.56:1

NR: Net Returns; GR: Gross Returns; BCR: Benefit Cost Ratio

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