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Research Article

Efficacy of various plant Products on different gram varieties against *Callosobruchus maculatus* Fab. (Chrysomelidae: Coleoptera)

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Abstract: Effect of various grain protectants viz. seed & leaves powder and leaves and seeds extract of Caraca asoca (Ashok), Eucalyuptus dives (Eucalyptus), Mesva ferrea (Nageswer), Asparagys racemosus (Satavari), Beta vulgaris (Sugarbect), Leucas linifalia (Halkusha), Terminalia-chebula (Harida), Marina Longifolia (Vish Kandara), mentha-pipertia (Peppermint), Aristolochia bracteata (Ketamer) were used in the present study. The experiments were conducted to evaluate the action of seed and leaves extract in controlling pulse beetle Callosobruchus maculatus.
Keywords: Callosobruchus maculatus, Grain protectants, Gram.

INTRODUCTION

Grain legumes, commonly known as pulses, are important for food and feed, and for sustainable cropping systems in many countries of Asia. Seeds of various pulse species are used as staple human food and their straw is a valued source of animal feed. More than a dozen of pulse crops are grown in various cropping systems throughout the year and their consumption provide nutritional requirements to the consumers, most particularly in the developing world. Pulses provide a substantial amount of protein, carbohydrates, fibers, vitamins, unsaturated fatty acids, macro and micro-nutrients in the daily diet of the people. Some of the essential nutrients like vitamins, metals, such as Calcium (Ca), Magnesium (Mg), Phosphorus (F), Potassium (K) Iron (Fe), Zinc (Zn), Selenium (Se) and Iodine (I) although require in a trace amount but are important to maintain optimum health

India is the major producer of pulses, which are cultivated over an annual average area. The production of Arhar and gram in annual is 662 and 697 kg/ha. In U.P. its production is 991 and 915 kg/ha respectively. Callasobruchus maculatus Fab. are crop pest in India but are destructive to stored pulses. Six species of Bruchids are known in which two namely Callasobruchus maculatus (Fabr.) and Collsobruchus chinensis (Linn) greatly damage stored pulses in rural condition in India. The following work has been planned against Callasobruchus maculatus Fab. so as to develop, economic and feasible management of this noxious pest of gram in storage.

MATERIALS & METHODS

Seed and leaves of plants were collected. They were then thoroughly washed under tap water, followed by distilled water to remove all the dust and dirt particles. There leaves were than dried in shade and further they were ground in a mixer. The extracts of these were prepared by soxhlet extraction method using acetone as solvent 30 grams of leaf powder and 300 ml of solvent were taken for the extraction keeping the ratio of 1:10. After 8 hours of extraction, the extracts were filtered using whattman's filter paper and kept in the refrigerator as stock solution. Further dilution was done with the solvent to get the desired doses for the experiments [1].

The seed protectant in extract and oil forms were thoroughly mixed separately with seeds/grains of susceptible gram variety as per treatment in cylindrical jars of 1 kg capacity by manual shaking. Fifty g of seeds/grains treated with different grain protectant were kept in glass tubes to study the efficacy of protectant on the C. maculatus. Five pairs of 24 hrs old adults of pulse beetle were released in all the three & replications to find out their effect on growth and development of the pest, fecundity, incubation period, hatching per cent, larval period, pupation percent, pupal period, adult emergence and developmental period were recorded.

To assess the losses in different protectant after completion of one generation the weight of damaged seeds was recorded after removing all dusts and insects. The difference between initial and final weights was recorded to find out the loss of weight in seeds percentage of damaged seeds was also recorded by counting damaged and undamaged grains in the 100 seeds of whole samples

of each replication wise. The comparison was made with the untreated (control).The data were computed by recommended statistical model and protocol.

RESULTS AND DISCUSSION

The female laid the minimum number of eggs 9.66 on grain treated with A. bracteata was at par with M. Pipertia (10.33). The maximum fecundity of the pest was recorded S. asoca (57.00%) the grain treated M. Longifolia,T. Chebula, L. Linifolia, B. Vulgaris, A. racemosus, M. ferrea and E. dives being 16.33, 19.66, 22.66, 24.33, 31.33, 39.33 and 41.66 percent respectively. These observations are in agreement with the result of Mahfuj *et al.* , they reported contact and fumigant toxicity of essential oils against Callosobruchus maculates [2].

The A. bractieata seed powder provide the incubation period 11.97 at par with M. Pipertia, M. Longifolia and T. Chebula being 11.89, 11.65 and 11.08 day's respectively. The maximum incubation period S. Asoca 8.03 days the incubation period obtain from the grain treated with L. Linifolia, B. vulgaris, A. racemosus, M. ferred and E. dives having 10.89, 10.45, 10.03, 9.78 and 9.06 day's respectively. All the grain protectants manifested their superiority over control (4.02) in incubation period [3].

The Hatchability percent of the pest was significantly lowest (19.33%) in grain treated with A. bracteata and this treatment was found at par with Hatchability (21.66%) of obtained in grains treated with the M. Pipertia the maximum hatchability percent was found S. asoca (58.99%) at par with E. dives and M. ferrea being 58.00% and 53.66 % hatchability, the treatment A. racemosus, B. vulgaris, L. Linifolia, T. chebula and M. longifolia being 46.00, 35.66, 33.33, 32.33 and 24.00 per cent hatchability respectively. The larval period observed on maximum A. Bracteata (12.75) followed by M. Pipertia and M. Longilolia being 12.54, 11.06 day's respectively (Table 1 & Fig. 1. The minimum larval period day's S. asoca and E. dives 6.33 and 6.73 day's respectively the grain treated with the M. ferrea and A. racemosus being 7.13 and 7.33 day's respectively. The effect of grain protectants were B. vulgaris, L. Linifolia, T. Chebula and M. Longilolia being 9.48, 10.68, 10.76 and 11.06 day's respectively and were significantly superior to control [4-7].

The seed powder of A. bracteata (8.26) followed by M. pipertia, M. Longifolia and T. chebula being 13.66, 17.00 and 17.40 percent respectively. The maximum pupation percent S. asoca (59.02) at par with E. dives and M. ferrea being 37.53, 42.33 and 45.93 percent respectively (Table 1 & Fig. 1). In the present study pupal period of the pest was significantly affected by various grain protectants were compared to untreated grains. The effect of different grain protectants on pupal period ranged from 6.04 to 9.79 day's while in control it was 4.36 the minimum A. bracteta (6.04) and maximum S. asoca (9.79). the treatment E. dives, M. Ferrea, A. racemosus, L. Linifolia, T. chebula, M. Longifolia and M. Pipertia being 9.33, 9.07, 8.87, 8.62, 8.54, 7.64, 7.25, 6.09 and 6.00 day's respectively. It was 4.36 days in control grains.

The minimum adult emergence was found A. bracteata (13.73) at par with M. Pipertia (14.96) percent. The maximum adult emergence S. asoca (51.63) the treatments of E. dives, M, ferrea, A. racemosus, B. vulgaris, L. Unifolia, T. Chebula, and M. Longifolia having 42.14, 34.26, 29.73, 28.76, 26.53, 24.70 and 19.16 percent respectively (Table 1 & Fig. 1). The significantly more f_1 progeny (141.06%) was found in control in comparison to the grain treated with various plant products. The minimum f_1 progeny was A. bracteata (9.06) at par M. Pipertia (10.11) and the maximum f_1 progeny was found in S. asoca (62.16) at par E. dives and M. ferrea being 59.11 and 59.02 % in various plant products, number of adults varied from 45.12 to 19.07 and 141.06 adults in untreated check. The treatment A. racemosus, B. vulgaris, L. Linifolia, T. chebula and M. Longifolia leaves and seed powder was prove to the effective to reducing F_1 population [8-15].

While studying the male logevity of Callasobruchus Maculatus it was found minimum A. bractecta (2.45) at par M. Pipertia and M. Longifolia being 3.09, 3.26 day's respectively. The maximum male longevity found S. Asoca (4.98) at par with E. dives and M. Ferrea being 4.76 and 4.63 day's respectively. Among the different grain protectants male longevity was found in grain treated with A. racemosus, B. Vulgaris, L. Longifolia and T. Chebula having 4.32, 4.04, 3.98 and 3.68 day's respectively. All the grain treatment affected the longevity of male adults significantly to control [16].

The treatment of A. baracteata seed powder the minimum longevity of female (3.06) at par M. Pipertia (3.12) day's respectively the maximum longevity of female treated with S. Asoca (5.43) at par with E. dives, M. Ferrea and A. racemosus being 5.23, 5.08 and 5.01 day's respectively. Among the different grain protectants of female beetles was found in grain treated with B. Vulgaris, L. Unifolia, T. Chebula and M. Longivolia having 4.98, 4.73, 4.12 and 4.03 day's respectively [17].

The minimum damage A. bracteata (4.22%) at par with M. Pipertia (4.35%). The maximum damage S. Asoca (52.68) the observed grain treated with E. dives (32.22) the M. ferrea, A. racemosus, B. vulgaris and L. Linifolia showed significant superior over the control having 22.98, 22.12, 16.33 and 14.04 percent grain damage respectively. The T. chebula and M. Longifolia showed 5.33 and 5.12 percent respectively, all the treatment were significantly superior over the control (92.19) (Table 1 & Fig. 1) [18-22].

Table 1: Effect of different safer plant product on fecundity, incubation period, hatching per cent, larval period, pupation per cent, pupal period, adult emergence, f_1 progeny, longevity (male & female), grain damage (%),weight loss (%) & germination of Callosobruchus maculatus fab.

S. No.	Treatment	Common name	Dosage ml/kg	fecundity (leg/female)	Incubation (period)	Hatching (%)	Larval period	Pupation (egg/female)	Pupal (period)	Adult emergence	f_1 progeny	Longevity		Grain damage (per cent)	Weight loss (per cent)	Germination (per cent)
												Male	Female			
1.	Mesva ferrea	Nageswer	Seed kernal 15g	39.33 (38.82)	9.78	53.66 (19.91)	11.06 (19.37)	52.65 (46.49)	7.25	34.26 (35.79)	59.02 (18.20)	4.63	5.08	22.98 (23.50)	36.09 (37.41)	68.76
2.	Leucas Linifolia	Halkusha	seed 15g	22.66 (28.39)	10.89	33.33 (35.24)	9.48 (17.85)	37.53 (37.76)	8.62	7.53 (15.89)	25.03 (50.18)	3.98	4.73	14.06 (21.97)	15.13 (22.87)	81.05
3.	Saraca asoca	Ashok	seed 15g	57.00 (48.67)	8.03	58.99 (46.66)	12.78 (20.88)	59.02 (50.18)	6.04	51.63 (145392)	62.16 (30.02)	4.98	5.43	52.68 (46.49)	39.73 (39.06)	61.67
4.	Mentha Pipertia	Peppermint	Leaves 15g	10.33 (18.72)	11.89	21.66 (27.69)	6.73 (15.00)	13.66 (21.64)	9.37	14.96 (22.71)	10.11 (52.00)	3.09	3.12	4.35 (11.97)	4.09 (11.54)	84.68
5.	Eucalyptus dives	Eucalyptus	Leaves 15g	41.66 (40.16)	9.06	58.00 (49.60)	12.54 (20.70)	58.03 (49.60)	6.09	42.14 (40.45)	59.11 (18.53)	4.76	5.23	32.22 (34.57)	36.12 (36.93)	64.15
6.	Terminalia chebula	Harida	Seed 15g	19.66 (26.28)	11.08	32.33 (34.63)	7.33 (15.68)	17.40 (24.65)	8.87	4.70 (12.52)	25.00 (50.24)	3.68	4.12	5.33 (13.31)	5.12 (13.05)	80.20
7.	Aristolochia braceata	Ketamer	Seed 15g	9.66 (18.05)	11.97	19.33 (26.06)	6.33 (14.54)	8.26 (16.64)	9.79	12.73 (20.88)	9.06 (17.46)	2.45	3.06	4.12 (11.68)	3.98 (11.39)	87.38
8.	Beta Vulgaris	Sugarbeet	Leaves 15g	24.33 (29.52)	10.45	35.66 (36.63)	10.68 (19.00)	42.33 (40.57)	8.54	28.76 (32.39)	32.06 (34.45)	4.04	4.98	16.33 (23.81)	22.25 (28.11)	80.34
9.	Marina Laongi Folid	Vish Kandra	Seed 15g	16.33 (23.81)	11.65	24.00 (29.03)	7.13 (15.45)	17.00 (24.35)	9.07	19.46 (05.91)	19.07 (25.84)	3.26	4.02	5.12 (13.05)	4.36 (11.97)	82.32
10.	Asparagus racemosus	Satavari	Seed 15g	31.33 (24.02)	10.03	46.00 (42.71)	10.76 (19.09)	45.93 (42.65)	7.64	9.73 (18.15)	95.12 (42.19)	4.32	5.01	22.12 (18.04)	24.20 (29.97)	79.33
11.	Control			92.07 (74.32)	4.02	91.05 (72.59)	14.33 (22.22)	96.37	4.36	86.53 (68.42)	141.06 (92.35)	5.68	6.78	22.19 (18.68)	52.68 (46.49)	88.66
	S.E. ± (d)			1.1179		1.4613	0.449	1.8922	0.733	0.5240		0.086	0.043	0.6010	0.8830	2.037
	C.D. (5%)			2.3327		3.0493	1.334	3.9486	2.179	1.0936		0.258	0.129	1.2546	1.8424	6.051

***** Figure in parentheses is angular values

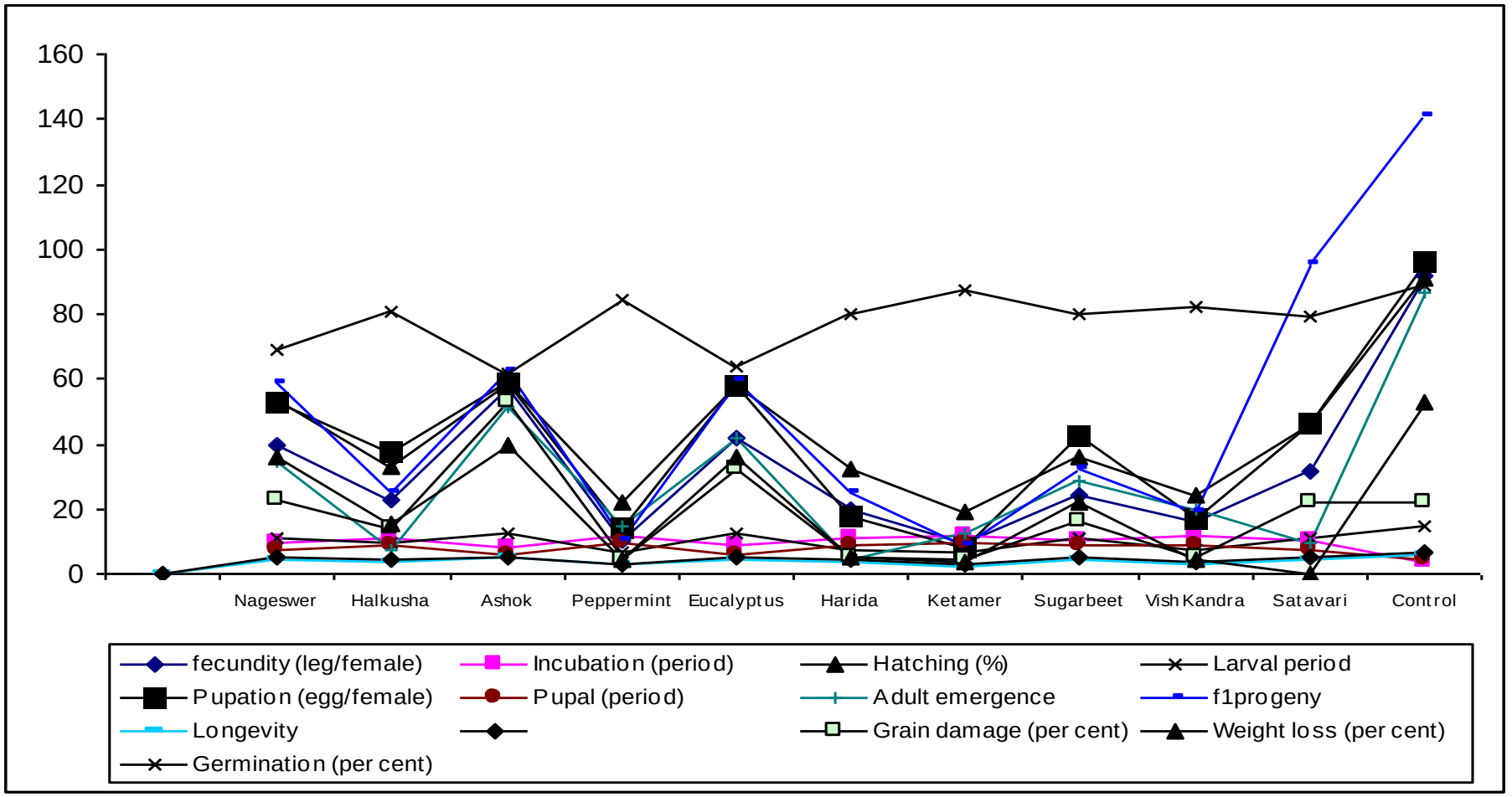

Fig -1 Effect of different safer plant product on fecundity, incubation period, hatching per cent, larval period, pupation percent, pupal period, adult emergence, f_1 progeny, longevity (male & female), grain damage (%),weight loss (%) & germination of Callosobruchus maculatus fab.

The minimum loss in weight of A. bracteatu (3.98%) at par with M. Pipertia and M. Longifolia 4.09 and 4.36 per cent respectively. The maximum loss in weight S. Asoca (39.73%) at par with E. dives and M. ferrea 36.12 and 36.09 per cent respectively the grain treated with A. racemosus, B. Vulgaris, L. Linifolia and T. chebula being 36.09, 24.20, 22.25 and 15.13 per cent respectively all the grain protectants showed their superiority in terms of loss in weight over untreated [23-24].

There was no adverse effects of grain treated on the germination of gram varieties, the maximum germination was recorded in grain treated with A. bracteata seed powder (87.38%) fallowed by M. Pipertia, M. Longifolia, T. Chebula, L. Linifolia and B. vulgaris having 84.68, 82.32, 82.20, 81.05 and 80.34 per cent respectively. The minimum S. Asoca (61.67 per cent) fallowed by E. dives, M. Ferrea and A. racemosus being 64.15, 68.76, 79.33 per cent respectively. While it was 88.66 per cent in untreated check conclusively grain protectants did not render any side ill effect towards their germination under various treatments. However slight variation in germination was rated negligible. The efficacy of different oils against pulse beetle C. chiensis in green gram Vigna radiate and their effect of germination also reported [25-26].

The protection of gram the stored grain pest is one of the most important challenging problems. Even if one third of these posses are saved, we can feed 10-11 million people of our country, all the year round with these saving.

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