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EFFECTS OF SORGHUM, MAIZE AND BAJRA DIETS ON EMERGENCE OF RICE MOTH [*CORCYRA CEPHALONICA* (STAINTON)]

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SUMMARY

Twelve diets of grains were prepared in different combination of sorghum, maize and bajra to rear and maintain the rice moth, *Corcyra cephalonica* under laboratory conditions. The study revealed that among all grains and their combination, evaluated, sorghum proved to be significantly better with 86.93 adult emergence upto 80 days after infesting the grains. In case of other than bajra+maize (2+1) and bajra diets 50% moth emergence was achieved within 70 days of infestation in most of diets. The peak emergence of moth was observed during 61-70 days after infesting the grains in case of sorghum, maize, sorghum + maize (2:1), maize + sorghum (2:1). The first and last moth emerged from sorghum, maize, 'Bajra', sorghum + Bajra (2:1) maize + sorghum (2:1) maize +Bajra (2:1), Bajra+ maize (2:1), sorghum + Bajra (2:1), Bajra+ sorghum (2:1), sorghum + maize (1:1), maize + Bajra (1:1) and sorghum + Bajra (1+1) was 30 and 141, 31 and 143, 40 and 150, 32 and 142, 32 and 142, 34 and 144 days after infesting the grains, respectively. The emergence of 50 and 80 per cent of moth from sorghum, maize, sorghum + maize (2:1), maize + sorghum (2:1), maize + Bajra (2:1) was observed up to 70 and 80 days after infesting the grains, while, it was 90 and 110 days after infesting the grains of Bajra, Bajra + maize (2+1). More than 20% moths emerged from sorghum grains alone within 50 days of infestation. Whereas less than 1% moths emerged from bajra diet up to 40 days of infestation as compare to others.

Key words : Bajra, *Corcyra cephalonica*, grains, development, egg, emergence pattern, maize, rearing, sorghum

The rice moth, *Corcyra cephalonica* is a serious pest of stored husked and unhusked rice, other cereals and leguminous grains. Besides, damaging properties rice moth, it serve as an important medium for the successful breeding and rearing of *Ttichogramma* spp.which are used for biological control programme of different destructive borers in many countries of the world (Cadapan, 1998; Mukhukrishnan *et al.*, 1996). For the the commercial production of various natural enemies including coccinellids, lacewings, predaceous heteropterans, and egg parasitoids of the genus Trichogramma the eggs of certain lepidopterans like *Ephestia kuehniella* Zeller, *Corcyra cephalonica* (Stainton) and *Sitotroga cerealella* (Olivier) have been exploited worldwide as alternative hosts in (De Clercq, 2003). Among these, rice moth, *C. cephalonica* has been widely utilized as an efficient alternative host for mass rearing of various biological control agents. The main objective of such mass production in any biological control programme is to have the maximum number of superior individuals at minimum cost. Therefore, worldwide several attempts have been made on modifications of mass rearing system of *C. cephalonica* for the optimization of larval diet, egg dosages and automated system of moth collection. In India, Rice meal moth is being utilized in various biocontrol research, developmental and extension units for mass production of number of natural enemies (Jalali and Singh, 1992). It is very much necessary to select some cost effective adult diets and egg density which can ensure proper development of *C. cephalonica* and production of its significant number of eggs for successful rearing of the egg parasitoid, Trichogramma spp. The rearing host diet is potentially of importance to the nutritional quality of host eggs and the survival of *Trichogramma* and other eggs parasitoids released into the environment as biological control agent. Rearing *C. cephalonica* on a high quality nutrient source resulted in high quality eggs, which ultimately resulted in high quality production of *T. chilonis* reared on such host eggs (Nathan *et al*., 2006). Due to the unavailability of egg masses of different borers throughout the year for mass production of *T. chilonis*, sufficient numbers of *C. cephalonica* eggs are essential. Rearing of these moths is generally done on wheat or chopped rice in the

laboratory. It has been reported that *C. cephalonica* have a shorter development time on millet than on sorghum (Russell *et al*., 1980); and a shorter development time on maize than on cocoa (Mbata, 1989). Both male and female reared on mixed diet with a combination of (rice+jowar+maize) had maximum body weight and body length (Bhardwaj *et. al.*, 2017). Arun *et. al.*(2018) also reported that the diet containing (sorghum 1000 g + groundnut 50 g) was outperform other dietary formulations as it resulted in lowest total development period (47.33 days), highest adult emergence (82%). It is very much necessary found out some cost effective food material(s) which can ensure proper development of *C. cephalonica* and production of its significant number of eggs for successful rearing of the egg parasitoid, *Trichogramma* spp. Keeping all these points in view, an experiment was conducted under laboratory condition in the biological control laboratory of the Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, Hisar to evaluate the different diet based on emergence pattern of *Corcyra cephalonica* (Stainton).

MATERIALS AND METHODS

The present studies were carried out in the biological control laboratory of the Department of Entomology, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Latitude 29º to 29-25´ N, longitude 75-25´E, altitude 215 meter above sea level). The studies were conducted from September, 2003 to January, 2004 at 30±1º C and 75±5 per cent relative humidity in a BOD Incubator and relative humidity was maintained by making saturated sodium chloride solution (Winston and Bates, 1960). The fresh (0-24 h) eggs of rice moth of *Corcyra cephalonica* for infesting grains/media were taken from culture being maintained in the biological control laboratory of the Department of Entomology for observation on emergence rate of *C. cephalonica*. The milled grains (3-4 pieces) of sorghum (*Sorghum bicolar* L. Moench), maize (*Zea mays* L.), Bajra (*Pennisetum typhyoides* L.), alone and in different proportions were mixed for feeding. The milled/crushed grains were sterilized in hot air over at 110ºC for two hours. After cooling, the grains, were sprayed and properly mixed with 0.1 per cent formalin, to prevent the growth of mould as well as to increase the grain moisture lost due to heat sterilization. Then it was mixed with 2.5 per cent w/w yeast powder and streptomycin sulphate @ 0.5 g/3 kg of media grains. Then 225 g grains of each treatment was put in glass jars (16 x 10.5 cm) making a layer of rearing media 1.5 inch thick in glass jar which was most suitable for development as rported by Medina & Cadapan, 1982. Then each treatment was infested with 750 fresh eggs (0-24h) of rich moth *C. cephalonica.* Each treatment was replicated four times. The jars were covered with fine muslin cloth, guarded with rubber band. All the jars were set up in trays of the BOD Incubator maintained at 30±1ºC and relative humidity 75±5 per cent maintained with saturated sodium chloride solution. The jars with charged media/ grains placed in the incubator were observed daily for moth emergence after 25 days of placement. The adult emerged were recorded daily and moths were collected in vials and placed in oviposition cages till the last emergence. The total number of adult moth emerged out in each of 48 replication were counted.

The number of adults emerging from different rearing media were recorded and expressed in percentage (Bordoloi,1994).

$$\text{Adult emergence} = \frac{\text{No. of adults emerged}}{\text{Total number of eggs inoculated}} \times 100$$

Statistical analysis

The data were subjected to the analysis of variance. The per cent values were transformed to angular transformation.

RESULTS AND DISCUSSIONS

The emergence and per cent emergence pattern of rice moth, *C. cephalonica* on different grains are presented in Table 1 and 2, respectively. The peak emergence of moth was observed during 61-70 days after infesting the grains in case of sorghum, maize, sorghum + maize (2:1), maize + sorghum (2:1), sorghum+ bajra (2:1), sorghum+maize (1:1) and sorghum+bajra (1:1). While peak emergence during (71-80) days after infesting the grains of 'Bajra', maize + Bajra (2:1) and maize + Bajra (1:1) were recorded, whereas, on Bajra+ sorghum (2:1) and bajra+maize (2:1) the peak emergence was during 91-100 days after infesting. The first and last moth emerged from sorghum, maize, 'Bajra', sorghum + Bajra(2:1) maize + sorghum (2:1) maize +Bajra (2:1), Bajra+ maize (2:1), sorghum + Bajra (2:1), Bajra+ sorghum (2:1), sorghum + maize (1:1), maize + Bajra (1:1) and sorghum + Bajra (1+1) was 30 and 141, 31 and 143, 40 and 150, 32 and 142, 32 and 142, 34 and 144 days after infesting the grains, respectively (Table 1), The emergence of 50 and 80 per cent of moth from sorghum, maize, sorghum + maize (2:1), maize + sorghum (2:1), maize + Bajra (2:1) was observed up

TABLE 1
Emergence pattern of *Corcyra cephalonica* moth on different grains.

Days after infesting	Average No. of moth emerged on different grains at different intervals												
	Sorghum	Maize	Bajra	Sorghum+ maize (2 : 1)	Maize+ sogrhum (2 : 1)	Maize+ Bajra (2 : 1)	Bajra+ maize (2 : 1)	Sorghum+ Bajra (2 : 1)	Bajra+ Sorghum (2 : 1)	Sorghum+ Maize (1 : 1)	Maize+ Bajra (1 : 1)	Sorghum+ Bajra (1 : 1)	Total
30-40	30.75	12.50	1.50	22.50	7.75	4.50	1.25	6.50	2.25	11.00	5.75	4.50	110.64
41-50	110.75	30.75	20.25	71.75	37.25	14.25	3.25	25.25	26.50	75.50	29.00	25.00	466.44
51-60	150.50	121.75	31.75	146.00	135.75	35.00	23.25	107.25	44.00	156.50	38.50	86.00	1076.16
61-70	156.25	165.00	33.00	175.00	170.00	135.00	41.50	140.00	58.76	163.25	117.50	142.75	1497.96
71-80	122.25	103.50	44.00	110.50	125.75	147.00	48.50	97.75	53.50	71.25	117.50	70.75	1112.16
81-90	27.50	39.25	41.25	40.75	30.25	69.00	46.75	57.00	57.75	83.25	34.00	51.00	579.72
91-100	21.50	32.50	40.50	23.00	17.50	13.50	52.25	36.50	62.25	27.75	31.00	48.00	406.20
101-110	18.00	11.75	29.00	26.00	17.75	6.50	43.50	20.00	26.00	15.25	9.50	22.75	246.00
111-120	6.50	7.00	27.25	13.25	6.00	8.00	33.25	13.50	18.25	7.75	11.75	13.25	165.72
121-130	7.50	2.75	10.25	4.50	4.50	5.50	17.25	5.00	9.75	4.00	6.75	6.00	83.64
131-140	3.50	2.75	9.75	3.00	2.75	2.25	10.00	2.00	3.75	4.00	3.50	3.25	50.4
141-150	1.25	1.50	2.25	1.50	1.25	1.50	2.00	1.25	1.75	2.25	2.25	1.25	199.92
Total	656.16	531.00	292.68	637.68	556.44	441.96	322.68	511.92	364.50	618.72	406.92	474.48	-

TABLE 2
Percent emergence pattern of *Corcyra cephalonica* moth on different grains.

Days after infesting	Average No. of moth emerged on different grains at different intervals											
	Sorghum	Maize	Bajra	Sorghum+ maize (2 : 1)	Maize+ sogrhum (2 : 1)	Maize+ Bajra (2 : 1)	Bajra+ maize (2 : 1)	Sorghum+ Bajra (2 : 1)	Bajra+ Sorghum (2 : 1)	Sorghum+ Maize (1 : 1)	Maize+ Bajra (1 : 1)	Sorghum+ Bajra (1 : 1)
30-40	4.68	2.35	0.51	3.52	1.3	1.31	0.38	1.26	0.61	1.77	1.41	0.94
41-50	21.56	8.14	7.43	14.77	8.08	7.64	1.39	6.20	7.88	13.5	8.53	6.21
51-60	44.49	31.00	18.27	37.67	32.47	32.45	8.59	27.14	19.82	38.80	17.99	24.34
61-70	68.30	62.14	29.54	65.11	63.02	62.19	21.45	54.49	36.07	65.19	46.86	54.42
71-80	86.93	81.63	44.58	82.43	85.6	80.96	36.48	73.58	50.75	76.71	75.73	69.33
81-90	91.12	89.03	59.35	88.8	91.0	87.89	50.96	84.71	66.59	90.17	84.09	80.08
91-100	94.41	95.15	73.18	92.43	94.20	91.80	67.15	91.84	83.67	94.66	91.70	90.20
101-110	97.13	97.36	83.09	96.51	97.39	96.21	80.63	95.75	90.80	97.09	94.04	94.99
111-120	98.13	98.68	92.39	98.58	98.47	98.47	90.93	98.38	95.87	98.38	96.92	97.78
121-130	99.2	99.19	95.90	99.29	99.28	99.23	96.28	99.36	98.49	99.02	98.58	99.05
131-140	99.8	99.70	99.23	99.76	99.77	99.74	99.38	99.75	99.50	99.67	99.44	99.73
141-150	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

to 70 and 80 days after infesting the grains, while it was 90 and 110 days. While it was 90 and 110 days after infesting the grains of Bajra, Bajra + maize (2+1). More than 20% moths emerged from sorghum grains alone within 50 days of infestation. Whereas less than 1% moths emerged from bajra only up to 40 days of infestation as compare to others. In case of bajra+maize (2+1) 50 % moth emergence was achieved late *i.e.* 71-80 days of infestation and in case of bajra 50% emergence was too late *i.e.* 81-90 days after infestation. In case of other than these two diets 50% moth emergence was achieved within 70 days of infestation in most of diets. On Bajra+ sorghum (2:1), it took 80 and 100 days and on maize + Bajra (1:1), 80 and 90 days after infesting the grains for 50 and 80 per cent moth emergence, respectively.

The present findings are supported by Ram *et al.* (2003) where they reported the peak emergence up to 62 days after infesting the grains and for 50, 75 and 90 per cent emergence it took 64 and 81 and 91 days after infesting the grains, respectively. Murthi and Rao (1945) reported the first emergence of moth after 39 days of infesting the sorghum grains. Rao (1954) reported the earliest moth to be appear after 43 days and last moth 76 days after infesting the sorghum grains.

CONCLUSION

The diet prepared from sorghum proved better out of the twelve diets of grains in different combination of sorghum, maize and bajra for rice moth, *Corcyra cephalonica* under laboratory conditions. Sorghum proved to be significantly better with 86.93 adult emergence upto 80 days after infesting the grains. In case of sorghum, maize, sorghum + maize (2:1) and maize + sorghum (2:1) the peak emergence of moth was observed during 61-70 days after infesting the grains. The maximum emergence (50 and 80 %) of moth were from sorghum, maize, sorghum + maize (2:1), maize + sorghum (2:1), maize + Bajra (2:1) was observed up to 70 and 80 days after infesting the grains, while, it was 90 and 110 days after infesting the grains of Bajra, Bajra + maize (2+1). Within 50 days of infestation with sorghum alone more than 20% moths emerged. Whereas less than 1% moths emerged from bajra diet up to 40 days of infestation as compare to others. The first and last moth emerged from sorghum, maize, 'Bajra', sorghum + Bajra (2:1) maize + sorghum (2:1) maize +Bajra (2:1), Bajra+ maize (2:1), sorghum + Bajra (2:1), Bajra+ sorghum (2:1), sorghum + maize (1:1), maize + Bajra (1:1) and sorghum + Bajra (1+1) was 30 and 141, 31 and 143, 40 and 150, 32 and 142, 32 and 142, 34 and 144 days after infesting the grains, respectively.

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