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Influence of Different Seed Colour Varieties of Sesame on the Biology of Rice Moth, *Corcyra cephalonica* (Noctuidae: Lepidoptera)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A laboratory experiment was conducted to study the bionomics of *Corcyra cephalonica* on different coloured sesame genotypes *viz.*, Swetha (white), GT-10 (black), and YLM-17 (brown). According to the results, the duration of egg, larvae, pupae and adult were observed to be significantly longest (6.40, 31.16,14.87 and 10.70 days, respectively) in black seeded genotype GT-10. Whereas, it was shortest (3.64, 24.12, 7.80 and 7.26 days, respectively) in white seeded genotype Swetha. All tested sesame genotypes showed significant impact on the head capsule width, body length and width of different larval instars. Based on biological and morphometric parameters, black seeded genotype (GT-10) was less suitable for the *Corcyra cephalonica* development, while, white seeded genotype (Swetha) was most suitable.

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1. INTRODUCTION

Sesame seeds are very nutritious and therefore confer health benefits. The seeds contain high oil (32.8 – 62.7%) nominally about 52 – 55% [1]. The monounsaturated fatty acids such as oleic and polyunsaturated fatty acids such as linoleic acids are the two most important and predominant fatty acids in sesame seeds [2]. In addition, sesame oil is very resistant to oxidative deterioration due to tocopherols whose bioavailability can be increased by sesamol, which can only be found in sesame seeds making it a very special oil crop [3]. These functional ingredients in sesame protect against hypertension, hypercholesterolemia, cancers, and for managing atherosclerosis, diabetes mellitus, obesity, chronic renal failure, rheumatoid arthritis, Alzheimer's disease as well as dermatological diseases [4]. The area of oilseed in 2020-21 28.79 million ha, production 36.10 million tonnes and productivity 1254 kg/ha [5].

About 81 species of insects belonging to 09 orders invade sesame crop in the field as well as in storage. In storage condition the rice moth, *C. cephalonica* St. and red flour beetle, *Tribolium castaneum* Hbst. cause economic damage [6-8]. The larvae of *C. cephalonica* feed on the seeds by feeding under silken web. When infestation is high, the seeds are converted into powders and sometimes the entire stock of seeds may be converted into a webbed mass. Ultimately, a characteristic bad smell develops and the seeds become rancid and lost their germination capacity which rendered unfit for human consumption [9]. The information on the bionomics of rice moth on different sesame genotypes is meagre and hence the present investigation was conducted with the objective to study the influence of different seed coat colour varieties of sesame on the biology of rice moth.

2. MATERIALS AND METHODS

The studies on influence of different seed colour varieties of sesame on the biology of rice moth was conducted at Entomology Laboratory, Crop Protection Section, ICAR-Indian Institute of Oilseeds Research, Rajendranagr, Hyderabad, Telangana during June 2019 - August 2019, when the laboratory temperature and relative humidity were in the range of 25˚C to 30˚C and 60 to 70 per cent, respectively. Three sesame genotypes with different seed colours were used and five gram seeds of each genotype were placed in nine plastic boxes. Later, ten newly hatched first instar larvae per box were introduced by using camel hairbrush. The open end of the box was closed with a muslin cloth and fastens with a rubber band. The duration of different life stages (egg, larvae, pupae and adult) were recorded. Measurement of the different larval instars head capsule width, body length and width of different life stages (larvae and pupae) were also performed with the ocular micrometre [8].

3. RESULTS AND DISCUSSIONS

3.1 Incubation Period

The egg was pear-shaped with a brownish tinge, gently rounded at one end, and pointy at the pedicel end.

Data presented in Table 1 and depicted in Fig. 1 showed a significant difference in the incubation period among the genotypes. The mean incubation period ranged from 3.64 to 6.40 days. The incubation period was significantly prolonged in black seeded genotype GT-10 (6.40 days) followed by YLM-17 (4.70 days), while it was shortest in white seeded genotype Swetha (3.64 days). These findings are agreement with several workers [10,11] and [8] they also reported that the average incubation period of *C. cephalonica* ranged from 4.66 to 5.80 days on different diets.

3.2 Duration of Different Larval Instar

The data on different larval instar duration and morphometric are shown in Tables 1 to 2 and depicted in Figs. 2 to 6. It was observed that the larvae passed through five instars.

The mean larval duration of first to fifth instar larvae was observed to be shortest on Swetha (4.11, 5.22, 4.66, 4.52 and 4.72 days, respectively).While, it was longest on GT 10 (5.00, 7.14, 5.99, 5.90 and 7.82 days, respectively). Similarly, [8] have also reported that the developmental period of first to fifth instar larvae of *C. cephalonica* fed on different sesamum cultivars ranged from 3.67-5.80, 3.73-5.00, 5.40-6.27, 4.93-5.60, 5.60-6.40 and 7.33-9.33 days, respectively.

The mean head capsule width of first to fifth instar larvae was found to be significantly maximum on Swetha (0.24, 0.27, 0.38, 0.55, 0.73 mm, respectively) and minimum on GT-10 (0.16, 0.19, 0.24, 0.32 and 0.44 mm, respectively). This finding is in conformity with

that of [12] who reported that head capsule width for first to fifth instar was 0.19, 0.22, 0.28, 0.39 and 0.52 mm, respectively.

The mean body length of first to fifth instar larvae was found to be maximum in white seeded genotype Swetha (1.70, 4.00, 6.61, 10.18 and 11.64 mm, respectively) and it was minimum in black seeded GT-10 (1.17, 2.22, 3.69, 4.83 and 6.23 mm, respectively). Similar results were reported by [8] according to them the body length of first to fifth instar *C. cephalonica* larvae were observed to be 1.80, 3.12, 5.60, 7.52 and 10.01 mm, respectively on different sesame cultivars.

The mean body width of first to fifth instar larvae was significantly maximum when larvae developed in white seeded genotype Swetha (0.24, 0.36, 0.75, 1.00 and 1.39 mm, respectively). Whereas minimum body width of first to fifth was noticed in black seeded genotype GT-10 (0.16, 0.28, 0.40, 0.62 and 0.93 mm, respectively). The present investigation is corroborated with the findings of [13] who reported that the mean body width observed to be 0.19, 0.23, 0.31, 0.41 and 0.55 mm, respectively for first to fifth instar.

3.3 Total Larval Period

The total larval period shows a significant difference between the genotypes (Table 1) and was shortest on white seeded genotype *i.e.*, Swetha (24.12 days), which was at par with YLM-17 (26.77 days). However, the highest total larval period was recorded on black seeded genotype *i.e*., GT-10 (31.16 days) (Table 1). Similarly, [8] observed that the total larval period of *C. cephalonica* varied from 26-35 days on three sesamum genotypes.

3.4 Pupal Duration

The effect of different genotypes was significant with respect to the pupal period (Table 1 and Fig. 7). The pupal period on different genotypes was 7.80, 11.39 and 14.87 days on Swetha, YLM-17 and GT-10. Similar work has been done by several workers namely [14,15,13] and [8] as they also reported that pupal period ranged from 7.00 to 16.00 days on different diets.

3.5 Pupal Morphometric

The data presented in Table 3 revealed significant differences in pupal length and width in selected genotypes.

The minimum pupal length and width were observed on GT-10 (7.62 and 1.51 mm, respectively) followed by YLM-17 (7.82 and 1.74 mm, respectively), but significantly lower as compared to Swetha (8.27 and 1.91 mm, respectively). The present findings are close related with the findings of [14,13] and [8] as they reported that the pupa length and breadth varies from 8.00×1.59 mm to 8.56×1.80 mm, when reared on different diets.

3.6 Adult Longevity

The data on adult longevity shows that significant differences were observed among the tested sesame genotypes (Table 1 and Fig. 8). It was significantly prolonged on GT-10 (10.70 days) as compared to other genotypes. This was followed by YLM-17 (9.39 days), whereas shortest adult longevity was noticed on Swetha (7.26 days). Similar, results were reported by [13] and [8] according to them the pupal period of *C.cephalonica* lasted for 6.00 to 14.00 days, respectively on different food diets.

3.7 Adult Morphometrics

The data given in Table 3 revealed that significant differences were observed for wing expansion and length of both male and female moths among selected genotypes.

3.8 Male Moth

The minimum male body length and wing expansion was observed in black seeded genotype GT-10 (7.24 and 12.64 mm, respectively), but was at par with YLM-17 (7.78 and 11.74 mm, respectively). However, it was maximum in white seeded genotype Swetha (8.86 and 14.81mm, respectively).

3.9 Female Moth

Minimum female body length and wingspan was recorded on GT-10 (7.75 and 15.71 mm, respectively) which was followed by YLM-17 (10.14 and 16.45 mm, respectively), but significantly lower as compared to Swetha (11.26 and 17.04 mm, respectively). Similarly, [8] have reported that the female moth of *C. cephalonica* measured 12.24 mm in length and 16.38 mm in breadth, when developed on different sesame genotypes.

Table 1. Duration of life cycle of *C. cephalonica* reared on different sesame genotypes

Sesame genotypes (seed colour)	Egg period (days) #	Larval period (days) #					Total larval period	Pupal period (days) #	Adult longevity (days) #	Total developmental period
		1st instar	2nd instar	3rd instar	4th instar	5th instar				
Swetha (white)	3.64 (2.15)	4.11 (2.26)	5.22 (2.49)	4.66 (2.38)	4.52 (2.35)	4.72 (2.39)	24.12 (5.01)	7.80 (2.96)	7.26 (2.87)	35.94 (6.08)
GT-10 (black)	6.40 (2.72)	5.00 (2.45)	7.14 (2.85)	5.99 (2.64)	5.90 (2.63)	7.82 (2.97)	31.16 (5.67)	14.87 (3.96)	10.70 (3.42)	52.47 (7.31)
YLM-17 (brown)	4.70 (2.39)	4.31 (2.30)	6.08 (2.66)	5.38 (2.53)	5.10 (2.47)	6.10 (2.66)	26.77 (5.27)	11.39 (3.52)	9.39 (3.22)	43.20 (6.65)
S.Em	0.053	0.005	0.011	0.011	0.010	0.043	0.020	0.037	0.014	0.031
C.D (5%)	0.164	0.016	0.034	0.034	0.030	0.133	0.061	0.113	0.044	0.096

 # Figures in the parentheses are square root transformed values. All the values are mean of five replications

Table 2. Morphometric parameters of *C. cephalonica* larvae on different sesame genotypes

Sesame genotypes (seed colour)	Different larval instars head capsule with, body length and width (mm) #														
	1st instar			2nd instar			3rd instar			4th instar			5th instar		
	Body Length (BL) (mm)	Body width (BW) (mm)	Head capsule width (HCW) (mm)	BL (mm)	BW (mm)	HCW (mm)	BL (mm)	BW (mm)	HCW (mm)	BL (mm)	BW (mm)	HCW (mm)	BL (mm)	BW (mm)	HCW (mm)
Swetha (white)	1.7 (1.64)	0.24 (1.12)	0.24 (1.11)	4.00 (2.24)	0.36 (1.17)	0.27 (1.13)	6.61 (2.76)	0.75 (1.32)	0.38 (1.17)	10.18 (3.34)	1 (1.41)	0.55 (1.25)	11.64 (3.56)	1.39 (1.55)	0.73 (1.32)
GT-10 (black)	1.17 (2.45)	0.16 (1.08)	0.16 (1.09)	2.22 (1.80)	0.28 (1.13)	0.19 (1.09)	3.69 (2.17)	0.4 (1.18)	0.24 (1.11)	4.83 (2.41)	0.62 (2.61)	0.32 (1.15)	6.23 (2.69)	0.93 (1.39)	0.44 (1.20)
YLM-17 (brown)	1.64 (2.45)	0.19 (1.09)	0.18 (1.09)	(3.69) (2.10)	0.3 (1.14)	0.2 (1.09)	5.72 (2.59)	0.56 (1.25)	0.34 (1.16)	8.11 (3.02)	0.88 (1.37)	0.44 (1.20)	8.92 (3.15)	0.87 (1.36)	0.61 (1.27)
S.Em(±)	0.006	0.008	0.008	0.008	0.008	0.008	0.005	0.011	0.009	0.004	0.009	0.013	0.024	0.047	0.006
C.D (5%)	0.018	0.024	0.024	0.025	0.026	0.024	0.016	0.034	0.028	0.012	0.028	0.04	0.075	0.143	0.018

 # Figures in the parentheses are square root transformed values. All the values are mean of five replications

Table 3. Morphometric parameters of *C. cephalonica* pupa and adult on different sesame genotypes

Sesame genotypes (seed colour)	Pupa#		Adult#			
	Length (mm)	Breadth (mm)	Male		Female	
			Length (mm)	Breadth (mm)	Length (mm)	Breadth (mm)
SWETHA	8.27	1.91	8.86	14.81	11.26	17.04
(white)	(3.05)	(1.71)	(3.14)	(3.98)	(3.50)	(4.25)
GT-10	7.62	1.51	7.24	12.64	7.75	15.71
(black)	(2.94)	(1.58)	(2.87)	(3.70)	(2.93)	(4.09)
YLM-17	7.82	1.74	7.78	11.74	10.14	16.45
(brown)	(2.97)	(1.66)	(2.96)	(3.57)	(3.34)	(4.18)
S.Em (±)	0.005	0.008	0.005	0.003	0.116	0.004
C.D (5%)	0.017	0.023	0.015	0.010	0.358	0.011

 # Figures in the parentheses are square root transformed values. All the values are mean of five replications

3.10 Total Developmental Period

The total developmental period was shortest on Swetha (35.94 days), which was at par with YLM-17 (43.20 days). Whereas, it was significantly delayed on GT-10 (52.47 days) (Table 1). The genotype GT-10 recorded longest development period in all the instars of *Corcyra cephalonica*. Prolongation in the developmental time indicates a compensatory action, where larvae subjected to a poorer nutritional source tend to compensate for food stress by lengthening the immature stage [16]. The lengthening of the larval period would allow the larvae to reach the ideal (or minimum) weight for pupation, a stage with nutritional/energy expenditure for the insect [17].

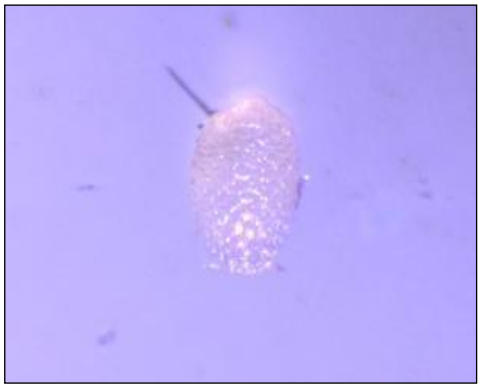

Fig. 1. Egg of *C. cephlonica*

Fig. 2. First instar larvae of *C. cephalonica*

Fig. 3. Second instar larvae of *C. cephalonica*

Fig. 4. Third instar larvae of *C. cephalonica*

Fig. 5. Fourth instar larvae of *C. cephalonica*

Fig. 6. Fifth instar larvae of *C. cephalonica*

Fig. 7. Pupae of *C. cephalonica*

Fig. 8. Adult of *C. cephalonica*

Life stages of *C. cephalonica* on sesame genotypes

4. CONCLUSION

Based on the above finding, it was concluded that the white seed coat genotype (Swetha) favoured rapid development of the insect and was considered a highly susceptible genotype. On the other hand, the black seed genotype (GT-10) was considered less susceptible. However, the brown seeded genotype (YLM-17) was considered moderately susceptible to pest damage.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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