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Biology of *Attagenus fasciatus* Thunberg (Coleoptera: Dermestidae) on four different diets of animal origin

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ABSTRACT: Biology of dermestid beetle, *Attagenus fasciatus* was studied on four different diets of animal origin included dried silkworm pupae and moths of *Bombyx mori*, feathers of white leghorn and on an equal mixture of fur of goat and sheep under laboratory conditions, to know the dietary effect on the developmental process. The mean incubation period was 12-16 days. There were 10-12 larval instars. The life-cycle on four different diets of animal origin varied. On dried silkworm pupae, total larval period ranged from 243 to 298 days and total life-cycle 267-326 days; on dried silk moths, total larval period was 251-307 and total life-cycle 272-330 days; on feathers of white leghorn, total larval period was 264-329 and total life-cycle was 288-355 days, and on an equal mixture of fur of goat and sheep, total larval period was 273-317 and total life-cycle was 297-343 days.

KEY WORDS: Dermestid beetle, dried silkworm pupae, silk moths, feathers and fur

According to Hava (2015) the family Dermestidae includes 66 genera and 1648 species and subspecies. Ecology and classification of dermestid beetles of Palearctic fauna is given by Zhantiev (2009). Dermestid beetles feed on a wide variety of food materials of both animal and vegetable origin (Hinton, 1945). According to review article (Rajendran and Hajira Parveen, 2005) insect pests including dermestid beetles found attacking different types of animal products. *Attagenus fasciatus* Thunberg (Coleoptera: Dermestidae) was reported attacking on different materials such as peanuts, skins, furs, feathers, silk, woolen goods, insects and ground nuts as summarized by Hinton (1945). It has been reported as a pest of house-hold articles in Sweden (Mathlein, 1971). The beetle is widely spread in the tropics and sub-tropics where it is found in stored products and house-hold articles (Halstead, 1974-75), in pharmacies and drug stores in West Germany (Weidner, 1973), on cotton seed meal, cereals and legumes in Humberg (Piltz, 1975), on tobacco seeds in India (Patel and Chari, 1977), in Cargoes from India in U.S.S.R (Belskaya and Popova, 1978), in feed mills and feed stores (Loschiaro and Okumura, 1979), on silkworm cocoons in India (Ansari and Basalingappa, 1985, 1989), on stored groundnuts (Rao *et al.,* 1987), from stored woolen and other keratenaceous materials form India (Veer *et al.,*1991), stored silkworm cocoons in India (Veer *et al.,* 1996), from Italy (Hava and Nardi, 2007), from Qatar (Hava and Pierre, 2008), from UAE (Hava, 2009), found damaging silkworm cocoons in grainages and stores (Shashi Kanta, 2016), from Guatemala (Ochaeta and Hava, 2019), from Nambia (Herman and Hava, 2019) and from Bali Island (Hava and Suprayitno, 2020). Attempts were made to study the biology of *A. fasciatus* by Patel and Chari (1977), Rao *et al.,*

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(1987), Veer *et al.,* (1991) and Ali *et al.,* (2011) on different food materials, temperature and relative humidity. The aim of present study was to know the biology of the beetle *A. fasciatus* on four different diets at room temperature and relative humidity and the dietary effect on the developmental process.

The larvae of different instars of *A. fasciatus* were collected from the mini filature center and grainage at Rayapur, Hubli-Dharwad (India) and reared on dried silkworm pupae of *Bombyx mori* in plastic containers under laboratory conditions. Freshly emerged imagines were collected from the laboratory rearing stock and were allowed to mate. The mated females were separated and kept them singly in the plastic containers (3" x 2") provided with silkworm cocoons as substrate for egg-laying. After oviposition, the eggs laid during first two days were collected and used to study the entire life-cycle on four different diets of animal origin such as dried silkworm pupae and moths of *B. mori*, feathers of white leghorn and an mixture of fur of goat and sheep under laboratory conditions, room temperature 22.6° C – 31.9° C (22.63 ± 1.0) and relative humidity 62.5% -88.5% (79.09 ± 0.60).

The incubation period of egg was 8-13 days and there were 11-12 larval instars. The last instar larvae observed, stopped feeding and remained quiescent for 3-5 (4.2 ± 0.3) days. At the last larval instar, the larval skin found split along the mid dorsal line and the split commenced from the epicranial suture and extended backwards up to the seventh abdominal segment. The newly formed pupae remained within the last larval skin, the exuviae. At the end of pupation, the imagines emerged and remained as quiescent stage in the last larval skin for 5-7 (6.2 ± 0.4) days. The pupal covering was found shriveled up and attached to the tip of the abdomen of imagines. Total incubation period, larval period, pupal period and total life-cycle period varied on four different diets of animal origin (Table 1).

The life-cycle parameters on dried silkworm pupae were as follows, observed total larval period was ranged between 243-298 days, with a mean of 272.17 ± 5.16 days pupal period was 13-15 (13.59 ± 0.23) days and total duration to complete life-cycle was 267-326 (295 ± 5.47) days. Further on dried silk moths, total larval period was 251-307 (282.09 ± 6.0) days, pupal period was 12-15 (13.09 ± 0.32) days and total life-cycle was 272-330 (305.09 ± 6.04) days. On feathers of white leghorn, total larval period was 264-329 (294.30 ± 6.44) days, pupal period was 12-15 (14.10 ± 0.32) days and total life-cycle was 288-355 (311.20 ± 6.47) days. Similar observations on another diet (equal mixture of fur of goat and sheep) revealed that total larval period was 273-317 (290.90 ± 4.64) days, pupal period was 12-15 (14.30 ± 0.30) days and total life-cycle was 297-343 (315.80 ± 4.52) days.

The larval period was of 243-298 (272.17 ± 5.16) days, was less when the larvae fed with dried silkworm pupae followed by 251-307 (282.09 ± 6.0) days on dried silk moths. The larval period on feathers and fur was almost same (264-329 (294.30 ± 6.44) and 273-317 (290.90 ± 4.64) respectively. The pupal period was 12-15 days on all the four diets, not much difference was found.

Table 1. Developmental periods (days) of *Attagenus fasciatus* on different diets of animal origin

Diet	Incubation	Larval	Pupal	Total
Dried silkworm pupae	8-13 (10.50 ± 0.46)	243-298 (272.17 ± 5.16)	13-15 (13.59 ± 0.23)	267-326 (295.08 ± 5.47)
Dried silk moths	8-13 (10.07 ± 0.45)	251-307 (282.09 ± 6.0)	12-15 (13.09 ± 0.34)	272-330 (305.09 ± 6.04)
Feathers of white leghorn	8-13 (10.86 ± 0.46)	264-329 (294.30 ± 6.44)	12-15 (14.10 ± 0.32)	288-355 (311.20 ± 6.47)
Mixture of fur of goat and sheep (1:1)	8-13 (10.64 ± 0.39)	273-317 (290.90 ± 4.64)	12-15 (14.30 ± 0.30)	297-343 (315.80 ± 4.52)

Table 2. Comparison of present results of Biology of *Attagenus fasciatus* with earlier reports

Authors, diet, temperature and humidity	Incubation period (days)	Larval period (days)	Larval instars	Pupal period (days)	Total (days)
Patel and Chari (1977) Tobacco Seeds Room temperature and humidity	7-9	204-492	10-18	5-10	——-
Rao et al., (1987) Groundnuts (25 ± 1)° C and 75 ± 10% RH	7	399	——	17	——-
Ali et al., (2011) Dried child milk 30° C and 40% RH	5-9 (6.6 ± 0.3)	657-1000 (889.8 + 83.1)	9-19	8-17 (12.6 + 0.7)	——-
30° C and 60% RH	5-10 (7.4 + 0.5)	535-610 (583.8 + 13.3)	16	7-12 (10.5 + 0.5)	——-
30° C and 80% RH	7-13 (8.5 + 0.5)	254-374 (341.0 + 22.5)	9-13	8-9 (8.3 + 0.3)	——-
35° C and 40% RH	3-5 (4.0 + 0.3)	321-432 (356.8 + 19.8)	12-17	6-9 7.6 + 1.1)	——-
35° C and 60% RH	3-6 (4.5 + 0.4)	226-295 (255.2 + 12.1)	5-15	7-9 (8.0 + 0.7)	——-
35° C and 80%	4-6 (5.1 + 0.3)	101-150 (122.4 + 9.53)	6-9	8-10 (8.5 + 0.7)	——-
Present study: 22.6° C – 31.9° C (22.63 ± 1.0) and 62.5% -88.5% (79.09 ± 0.60)					
Dried silkworm pupae	8-13 (10.50 ± 0.46)	243-298 (272.17 ± 5.16)	11-12	13-15 (13.59 ± 0.23)	267-326 (295.08 ± 5.47)
Dried silk moths	8-13 (10.07 ± 0.45)	251-307 (282.09 ± 6.0)	11-12	12-15 (13.09 ± 0.34)	272-330 (305.09 ± 6.04)
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Mixture of fur of goat and sheep (1:1)	8-13 (10.64 ± 0.39)	273-317 (290.90 ± 4.64)	11-12	12-15 (14.30 ± 0.30)	297-343 (315.80 ± 4.52)

It is well established fact that the temperature and relative humidity influences the developmental process of insects. Patel and Chari (1977), Rao *et al*. (1987), Veer *et al*. (1991) and Ali *et al*. (2011) reported the biology of *A. fasciatus* by on different food materials, temperature and relative humidity. The present study showed significant variations with that of the earlier studies (Table 2).

The incubation period was 8-13 days and larval instars were 11-12 on all the four diets, differ significantly when compared with that of earlier studies. According to Esperk *et al*. (2007) intraspecific variability in the number of larval instars is a widespread phenomenon across insect taxa; documented for more than 100 species in which various factors affecting the number of instars like temperature, photoperiod, food quality, humidity, injuries, inheritance and sex. The variations were because of the effect of temperature, relative humidity and food materials fed to the larvae of *A. fasciatus*.

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