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Bionomics of Tobacco Seed Beetle *Attagenus fasciatus* Thunb. (Coleoptera : Dermestidae).*

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ABSTRACT

Studies were conducted on the bionomics of *Attagenus fasciatus* Thunb. The life-history, brief description of various stages, sex differences and sex ratio are given. The durations of egg, larval, pupal and adult stages are given. There are 18 larval instars. The larva took one year to complete the development. Full grown larva can live without food for 153 days. The studies on food preference indicated that the larva prefers chewing tobacco seeds. The female beetle laid on an average 192 eggs. The duration of life span (egg to adult) for male and female beetles was 376 and 455 days respectively.

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INTRODUCTION

Bidi tobacco is an important cash crop of Kaira, Baroda and Ahmedabad districts of Gujarat. Good Seed is one of the important factors in raising the quality tobacco seedlings. The seeds are to be stored till sold for sowing in the following season. Patel *et al.* (1970) observed that tobacco seed during storage is damaged by various insect pests. Tobacco seed beetle *Attagenus gloriosae* (Thunb.) which is a synonym of *A. fasciatus* (Thunb.) [Mroczkowski (1964)] is one *of the* important pests attacking tobacco seed in storage. The viability of the tobacco seed is affected due to the damage of this beetle. A perusal of literature indi*cates that no information* is available on the bionomics of tobacco seed beetle.

MATERIALS AND METHODS

Initial culture of the tobacco seed beetle larvae was collected from tobacco seeds at Bidi Tobacco Research Station, Anand, during the year 1972-73. The larvae were kept separately in small plastic tubes (5 cm × 2·5 cm) and fed with *bidi* tobacco seeds. These plastic tubes were held at room temperature in a galva*nized trays* (45 *cm* × 35 cm × 15 cm). The pupae were collected as and when formed. The adults emerging from these pupae were used for further studies. For fecundity study, freshly formed pupae were collected from the general culture and sexed. The adults which emerged on the same day from these pupae were paired for mating and oviposition studies. In each petridish a strip of black cotton cloth (2 cm × 3 cm) folded from the middle, was placed for egg laying. *Five per cent* honey solution was provided as a food for the beetles with the help of cotton swab. The swab was placed on a poly-

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thylene paper (2·5 cm×2·5 cm) to prevent absorption of the honey solution by the black cotton cloth. The eggs were counted every day and the beetles were transferred to another petridish for further oviposition. The pre-oviposition, oviposition and post-oviposition periods, longevity of the adults and the incubation period of the eggs were recorded.

To study the number and duration of larval instars and pupal period on *bidi* tobacco seed, the technique used for general culture was followed. Observation on moulting and duration of each instar were recorded as and when exuviae were seen in the container. The total life span of the beetle was worked out.

Food preference of the larvae and the effect of starvation on the larvae were also studied. The sex ratio was worked out from the laboratory reared culture.

OBSERVATIONS

Pre-oviposition and oviposition period

The pre-oviposition period varied from 3 to 38 days with an average of 8·73 days at a varying temp. of 29·16 to 35·00°C. The female beetle laid the eggs on alternate days after mating. The pattern of egg laying was not consistent in this insect species. The eggs were laid in the fold of the cloth strip or in the space left out between the [illegible] and the plastic sheet or [illegible] strip. eggs were laid singly and rarely in clusters. The number of eggs laid by an individual female varied from 46 to 355 with an average of 192.81 eggs. At a varying room temperature of 29·16 to 35·00 °C with an average of 33·27 °C, the oviposition and post-oviposition periods varied from 1 to 28 days and 2 to 25 days with an average of 17·29 and 8·27 days respectively.

Egg:

The eggs of *A. fasciatus* (Thunb.) are white in colour when freshly laid. The colour changes from white to creamy white or yellowish white as the age advances. Distinct eye-spots and the powerful larval jaws could be seen through the transparent egg shell when it is about to hatch. In shape, the egg is barrel like, with a slight swelling in the middle and bluntly rounded at both the ends. (Plate IA). It bears a group of transparent spine like projections of the chorion at one end. The egg measured on an average 0·65 mm in length and 0·36 mm in breadth. The incubation period varied from 7 to 9 days at a temperature of 29·16 to 35·00 °C at R.H. 68 to 82 per cent.

Larvae:

The larvae of *A. fasciatus* start feeding soon after hatching. The number and duration of instars varied considerably in this species. The duration of larval stages of individuals destined to be male and female varied from 204 to 481 and 243 to 492 days with an average

The first instar larva bears a few hairs which are visible as dark bands through the egg-shell before hatching. These hairs are closely pressed to the respective abdominal segments that bear them. The hairs on dorsal surface are spaced in a longitudinal row. These hairs are light brown in colour. Lateral sides of the abdomen are covered with bands of dark brown hairs. The hairs at caudal end are longest and form a sort of tail. The integument of the first instar larva is quite thin, transparent, shining and pale yellow in colour. The head capsule is light brown while the eyes and mandibles are reddish brown and distinct. The average duration of first instar larvae lasted for 10 days (Table 1). The larvae in this instar measured on an average 1·18 mm in length and 0·26 mm in breadth.

Second instar:

The colour of the larval integument soon after moulting was light brown gradually changing to dark brown as feeding proceeds. The hairs present on throax and abdomen dry off and become erect soon after emergence. The second instar larvae measured on an average 1·31 mm in length and 0·28 mm in breadth.

Full grown larva:

The full grown larva (Plate IB) is

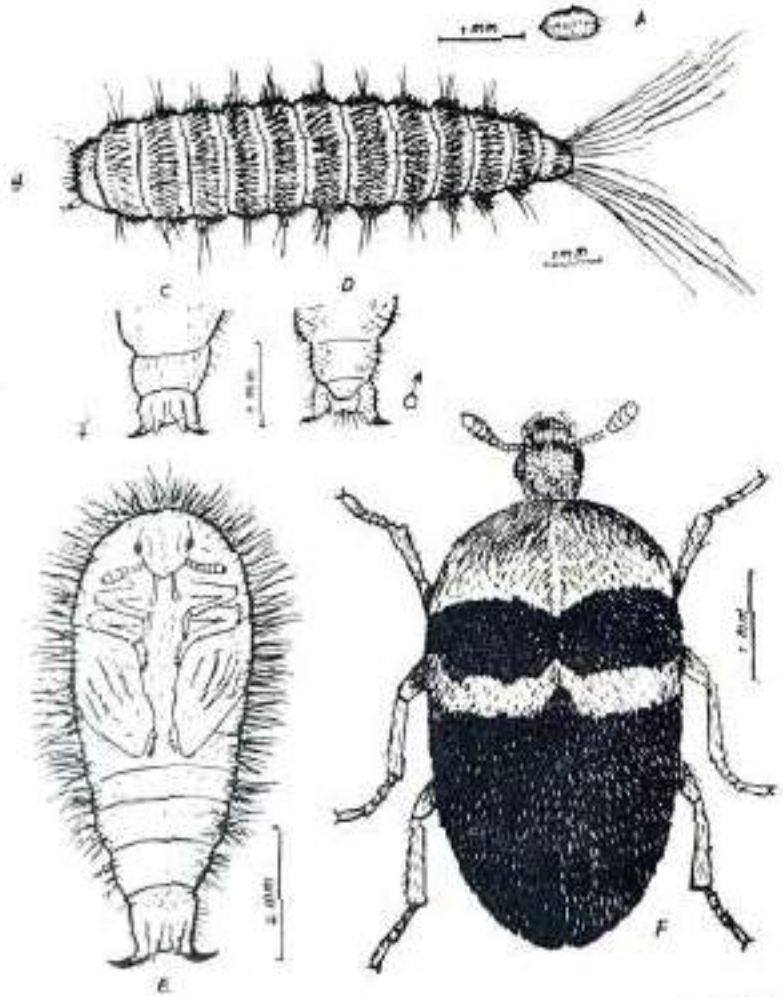

Plate I

A—Egg
B—Full grown larva
C & D—Sex differences
E—Pupa-Ventral View
F—Adult beetle

TABLE 1

Duration of various stages of *A. fasciatus* (Thunb.).

Sex and Number	*Duration of various instars (days)*																	*Total larval period (days)*	*Total No. of moults including last larval skin*	*Pupal period (days)*	*Adult period (days)*	*Duration of lifespan (days)*
	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*	*11th*	*12th*	*13th*	*14th*	*15th*	*16th*	*17th*	*18th*				
Male Range	8-13	7-13	6-16	6-16	7-28	15-36	15-75	10-46	10-56	15-63	7-36	16-93	13-130	17-141	19-62	20-79	21-65	27-27	204 to 481	11-19	5-10	16-57	241-522
22 Average	9·77	10·81	11·31	10·54	15·45	22·77	34·04	30·81	32·63	29·04	23·38	37·95	41·28	41·23	42·68	43·20	37·33	27·00	351·90	15·00	7·95	35·09	395·0
Female Range	8-16	9-17	4-28	6-29	8-31	10-32	8-48	22-64	22-44	10-91	17-128	9-62	21-136	19-109	9-91	10-79	17-79	12-12	243 to 492	12-19	5-9	24-62	297-589
21 Average	10·33	11·09	12·52	12·66	16·48	21·86	29·61	37·62	29·05	26·68	35·38	32·75	46·89	51·35	41·66	40·33	26·33	12·00	392·14	15·6	8·19	43·29	455·39

campodeiform, chestnut brown in colour, however colour variation is common in this instar. The antenna is spike like and is composed of five segments. The mouth parts are of biting type with strong mandibles. The dorsal surface of the head is profusely clothed with hairs but the hairs are sparse on the ventral surface. The thoracic segments are prominent, the prothoracic segment is comparatively bigger in size. The abdomen of the larva comprises nine distinct segments. The first and last abdominal segments are relatively shorter as compared to the rest of the abdominal segments. The thoracic and abdominal tergites are thickly clothed with stout hairs while the thoracic sternites bear a few hairs. The hairs near the anal opening are short and remain free while the rest of the caudal hairs are grouped into two tufts diverging outwards. The full grown larvae measured on an average 9·31 mm in length and 1·79 mm in breadth.

Food preference:

Studies carried out on olfactory and gustatory response of larvae to various foods viz., HR 62-7(VFC tobacco) Anand-2 (bidi tobacco), Anand-145 (chewing tobacco) in the form of seeds and powder coriander and wheat flour + yeast indicated that the larvae preferred tobacco seeds (Anand-145) among the materials tested.

Effect of starvation on the larvae:

The studies on the duration of resistance of the larvae to starvation indicated that the first, second and full grown larvae lived on an average 5·35, 5·1 and 153·46 days respectively without food. Thus full grown larvae can live without food for about five months.

Pupa:

The pupa is an exarate type (Plate IE) creamy white in colour and enclosed in a thin membrane. The pupal covering is profusely clothed with yellowish brown silky hairs. The elytra and wings lie across the ventral surface of the body. They enclose the third pair of legs except the tarsal segments which can be seen at the distal end of the elytra. The antennae are arranged in the grooves formed by the first pair of legs. The eyes are prominent and brown. On the dorsal surface of pupa, there are six pairs of brownish transverse bands. The male pupa measured on an average 5·93 mm in length and 2·23 mm in breadth, whereas female pupa measured on an average 6·77 mm in length and 2·47 mm in breadth. The average pupal period for male and female was 7·95 and 8·19 days respectively (Table 1).

Sex differences:

The tobacco seed beetle can be sexed into male and female at pupal stage, as the external genitalia project from the body. Pupae of both the sexes have at their caudal segment a pair of spine like curved structures which are dark brown and diverging out side (Plate I C & D). The external genitalia lie free in between these spine like structures. In female pupae these projec-

tions are long, stout and blunt, and project out at the caudal end. In case of male, they are greatly reduced and rudimentary. These projections, which are the external parts of the genitalia become retracted inside the body when the pupae change into adults. It is thus a temporary exhibition of the character of the sex differences.

Sex ratio:

The sex ratio of *A. fasciatus* (Thunb.) was worked out by collecting and sexing the pupae from the general culture maintained in the laboratory. From 585 pupae observed, 303 were found to be males while 282 of them were females. The male pupae outnumbered female pupae and the ratio of male to female was 1:0·93.

Adult:

The adult is compact and obovate beetle with a ventrally retracted head when at rest (Plate 1). The cuticle is dark brown to black. The head, pronotum and elytra are patterned with a combination of golden and white recumbent to erect hairs. The head capsule is dark brown, oval with typical compound eyes. The antennae are strongly clavate, eleven segmented and light brown in colour. The elytra entirely cover the abdominal tergites. They are clothed with brownish black hairs. A transverse band of golden recumbent hairs is present on the elytra. The hind wings are thin, transparent and well developed. The sternites are deep brown in colour with thick covering of golden recumbent hairs. The legs are brown in colour and clothed with golden hairs. The male beetles measured on an average 4·96 mm in length and 2·44 mm in breadth, whereas, the female beetles measured 5·91 mm in length and 2·72 mm in breadth. The average adult duration for male and female beetles was 35·09 and 43·29 days respectively (Table 1).

Duration of entire life-span:

The entire life-span (from the hatching of the eggs to the death of the adult beetle) varied from 241 to 522 days with an average of 395·0 days for male beetles, whereas for female beetles it varied from 297 to 589 days with an average of 455·39 days (Table 1). The beetles took more than one year to complete one generation.

Nature of damage:

Only larval stage of the tobacco seed beetle (*A. fasciatus* Thunb.) is responsible for the damage. Adults do not cause any damage to the commodity on which they breed. The larva has chewing type of mouth parts with strong mandibles. When feeding on cloth it bites small holes of irregular shape which vary in size, making the cloth unfit for marketing. The larva is also able to digest materials of animal origin. The larvae infesting insect collection, might destroy the entire collection by devouring the carcass of the preserved insect specimens. The larva damages tobacco seeds by feeding on the seeds leaving behind half eaten seeds with broken seed coats.

In case of heavy infestation, the seeds are contaminated with powdery faeces. The damage to the seeds results in loss in weight and reduction in germination.

Natural enemies:

An unidentified predatory mite was found feeding on the eggs and young larvae of tobacco seed beetle. The pupae were devoured by the grubs of cigarette beetle (*Lasioderma serricorne* F.) and of red rust flour beetle ((*Tribolium castaneum* Herbst.) The larvae of *A. fasciatus* (Thunb.) also devour their own pupae.

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