



Figure 2. Enlarged view of the same showing surface striations and pores (arrow head) (bar = 10  $\mu$ m).

trichoid sensilla in general<sup>8</sup>. Although some sensilla trichodea are reported to be short, their other structural features were much different from those of the cuticular projections observed in the present case. The morphological feature of the basal portion of the cuticular structure suggests that it may have connection with inner epidermis and hypodermis. The surface also indicates the presence of a number of pores. The porous nature, the size and the shape of the projection links it more towards sensilla basiconica. However, sensilla basiconica are reported to occur in smaller number and their arrangements are also not like the cuticular structure observed on the abdominal sur-

face of *Blepharia* in the present case. As far as the arrangement and low-magnification image is concerned, the structure is very similar to the cuticular spines described in other species. However, the presence of pores and striations, as revealed from magnified image, establishes a major difference of the projection from spines. One of the possibilities is that the cuticular projection functions as a sensilla. In that case the nonflexible base, striations on the surface and porous nature of the structure suggest that its function is more likely to be, as a chemoreceptor, rather than a mechanoreceptor<sup>8</sup>. The other possibility is that the cuticular projections with more or

less pointed tip may be used to penetrate deep into the host tissue to derive nutrients which may be transported through the porous surface. However, a third possibility of using this specialized structure by the parasite, simultaneously as a chemosensilla and as a mechanical device for penetrating the host tissue for the purpose of deriving nourishment, also appear to be logical. In any case, it is certain that the specialized cuticular structure is an important parasitic adaptation for the maggot of the fly, *Blepharia zebina*.

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## Green algae (*Oedogonium* sp.) and *Lemna* sp.: The new alternate hosts for *Spodoptera litura* Fabricius

In India, tobacco caterpillar *S. litura* Fab. appears every year as a severe pest in rabi crops, viz. gram, wheat, linseed, sunflower, etc., particularly at certain locations of Jabalpur, MP<sup>1</sup>. The pest is particularly serious in haveli fields. 'Haveli' system of cultivation is a predominant

practice in heavy soils of Jabalpur district. Under this system, rain water is impounded in bunded fields during kharif season and direct sowing of rabi crops is done with no tillage after letting out impounded water about 10-12 days before sowing of the rabi crops. On the impounded

water, algae and *Lemna* sp. grow naturally.

The second-third instar caterpillars, which are already present in the field at the time of sowing of rabi crops, start devouring the germinating seeds. At times, its severity necessitates resowing. Hence,



Table 1. Survival and development of *Spodoptera litura* Fab. on the alternate source of food

Host	Period (days)				Longevity (days)		Oviposition period (days)	Fecundity	Sex ratio (M : F)
	Egg	Larval	Prepupal	Pupal	Male	Female			
Gram	3.37	19.99	2.50	8.40	5.30	8.37	4.27	~ 879	1 : 1.14
Algae ( <i>Oedogonium</i> sp.)	4.22	24.25	2.97	8.22	4.55	7.82	4.72	636	1 : 1.22
<i>Lemna</i> sp.	4.02	20.65	2.30	8.17	4.27	8.45	4.15	718	1 : 1.85
Algae + <i>Lemna</i> sp. (1 : 1)	3.75	24.37	2.45	8.22	5.40	8.27	4.35	685	1 : 1.85
S. Em. $\pm$	0.14	0.25	0.12	0.15	0.17	0.15	0.12	22.38	
CD at 5%	0.42	0.72	0.37	N.S.	0.51	0.45	0.34	64.19	

an experiment was conducted in the laboratory of the Department of Entomology, JNKVV, Jabalpur in search of an alternate source of food, which enables the pest to develop into second-third instar caterpillars before the main crop appears in the field.

The freshly emerged larvae of *S. litura* were obtained from the laboratory culture. Soil was collected from the endemic area of the pest (Kathonda village of Jabalpur district). The tin tray (76 × 38 × 10 cm) filled with soil served as treatment. There were six treatments, viz., normal soil of endemic area containing organic matter, sterilized soil without organic matter, soil covered with green algae (*Oedogonium* sp.), soil covered with *Lemna* sp., soil covered with the mixture of algae and *Lemna* sp. (1 : 1), and soil incorporated with germinating seeds of gram @ 4 g/tray. Six freshly emerged larvae of *S. litura* were placed on the soil surface and then the trays were covered with muslin cloth and tied up with string. Each treatment had ten replications. The larvae were observed every alternate day for pupation. The pupae were transferred to the petri dishes along with moist blotting paper and kept under glass chimney till the adults emerged. The sex of the moths was identified and they were paired under glass chimney. Cotton swabs soaked in 20% glucose solution were provided daily for adult feeding. The castor shoots, the cut ends of which were dipped in water, were provided for egg laying. The duration of each developmental stage, adult longevity, female fecundity, oviposition

period and sex ratio of the pest reared on different media were recorded. The data so obtained were statistically analysed and presented in Table 1.

The study revealed that the pest could not survive on the sterilized soil or on the normal soil of endemic area containing organic matter. However, the pest could complete its life-cycle on green algae (*Oedogonium* sp.), *Lemna* sp. and their mixture. The egg and larval period were significantly prolonged and the female fecundity and adult longevity were significantly reduced due to feeding on algae and *Lemna* sp. as compared to the pest reared on germinating seeds of gram (Table 1).

There is no report in the literature that *S. litura* feeds on green algae or *Lemna* sp. However, it appears that these alternate hosts might be playing an important role in the development of *S. litura* to third-fourth instar before the arrival of the main crop. After the harvest of rabi crops, neither does the pest persist in the soil as larva or pupa nor do the moths breed actively in the vicinity<sup>2,3</sup>. Hence, it is likely that the moths migrate to distant places<sup>2,4-8</sup>. As the pest infestation is not serious in the kharif season, it must be migrating back in the rabi season and the main remigration period is September<sup>2</sup>. However, as there is no crop at that time in the field, the female moths should be laying their eggs on the surface of the moist soil in the haveli fields, since the pest has no specific liking for the site of oviposition<sup>2,9</sup>. The larvae, after emergence, probably feed on algae or

*Lemna* sp. till these are available. As soon as the fields become dry, these flora dry up but by that time the crop is sown and the seeds start germinating. The caterpillars which by now had grown to 3-4 instar, start attacking germinating seeds.

Thus the present study reveals that if the green algae and *Lemna* sp. can be removed from the water before it is allowed to settle on the fields along with the receding water, the young caterpillars of *S. litura* can be starved to death and the pest intensity could be controlled.

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