

common round Krusadai Island, I noticed red patches on their bodies. When detached and examined under the microscope, they were found to be clusters of a species of *Cœloplana*. Dr. Devanesan who examined them on the 10th March 1939 is also of the opinion that their organisation and the presence of the two long tentacles with their uniserial branches left no doubt that they were *Cœloplanæ*. As they are uniformly red, they seem to be different from *Cœloplana astericola* Mortensen, which is said to be mottled red and white. Dr. Devanesan and I are continuing our observations on this new species of *Cœloplana* and hope to be able to publish ere long a brief account of its structure and habits.

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<sup>1</sup> Published with the permission of the Director of Fisheries, Madras.

<sup>2</sup> *Curr. Sci.*, 1939, 8, 157.

### A Note on the Biology of *Lucilia sericata* Meigen (*Calliphoridae*, *Diptera*) in Baluchistan

*Lucilia sericata* Meigen (Family Calliphoridae, Order Diptera), the larvæ of which cause cutaneous myiasis in sheep skin is a species of great economic importance. Its attack is particularly severe in Europe, North America, South Africa and Australia. In India it has previously been recorded by Sinton (1921) and Patton (1922), the adults having been bred from cases of human cutaneous myiasis in the North-West Frontier Province. Last year the writer reported the occurrence of this sheep blowfly causing cutaneous myiasis in sheep in Baluchistan (Janjua, 1938). A study of this pest undertaken in the beginning of 1937 has revealed some interesting facts about its biology and these are recorded in this note. The identification of the species has been done by the Imperial Institute of Entomology, London, to whom I am grateful for the help rendered.

Sheep farming is one of the principal occupations of the people of Baluchistan as the area of pasturage is unlimited and the hillsides and valleys of the Province are covered with grass and other succulent plants which afford excellent grazing for sheep. But the presence of *Lucilia sericata* is causing a grave concern to the sheep farmers of Baluchistan. As a result of investigations carried out by the writer for the last three years it has been ascertained that about 20–25 per cent. of the sheep in the Quetta-Pishin, Loralai and Zhob districts of the Province are under the attack of the maggots of this fly.

The sheep attacked by the fly is easily noticed with its head bent down and not feeding normally. It is irritable, uneasy, constantly shaking and when feeding, is frequently seen to stamp one hind leg. The diseased sheep has the habit of looking back over the shoulder and wagging its tail in a characteristic manner. During rest it avoids sun and seeks the nearest shady place. The wool on the affected part shows a dirty greyish-black stain and closer examination reveals a sticky fluid with a peculiarly offensive odour. The maggots of the fly feed in the wool and the adjacent skin, causing the latter to fester and the wool to loosen and become putrid, thus exposing the inflamed flesh with the whitish maggots tunnelling into it. The injuries gradually become transformed into serious ulcers with great loss of tissue. There is a rapid loss of condition and invariably death follows.

The female flies are usually attracted to the sheep after a shower of rain during the rainy season by the odour arising from the fleece. The eggs are then laid in the wool and the maggots on hatching cause lesions in the skin. Any wound, however small, is an added attraction and sheep affected with foot-rot or those with shoulders and loins denuded of wool by rubbing or biting are frequently attacked.

The female deposits her eggs in clusters of from fifteen to twenty-seven and as many as two hundred eggs may be laid at one time. A single female during her life-time may lay about 1,000 eggs. The eggs are mostly laid on

wool which is wet with fæces or urine, the soiled hind quarters of the sheep being especially attractive to the flies. The wounds left on the body of the animal after shearing are also the common places where eggs are laid.

The egg (Fig. 1) is white and somewhat sausage-shaped. It is 1.3 mm. long and 0.39 mm. broad. The incubation period at different times in the seasons varied from 10 hours to 40 hours.

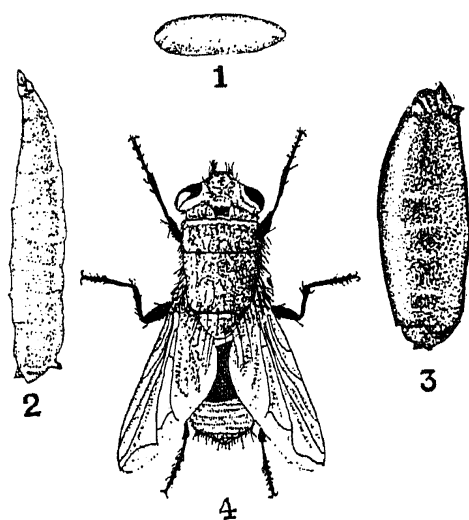


FIG. 1

FIG. 1.—Egg.  $\times 11.5$ .

FIG. 2.—Larva.  $\times 3.5$ .

FIG. 3.—Pupa.  $\times 3.5$ .

FIG. 4.—Adult (female).  $\times 3.5$ .

The maggot on hatching bores into the skin by means of sharply pointed mouth parts. They are found in squirming masses in the affected skin. During feeding they emit a slimy fluid which is chiefly responsible for the soiled appearance and rotting of wool in the infested patches of skin.

The full grown maggot (Fig. 2) is glistening white and 14 mm. to 16 mm. long and about 3 mm. broad. The mandibular hooks of the mouth parts at the anterior end are curved inwards and strongly chitinized. The anterior spiracles are provided with rings of spines which assist in locomotion. The body is cylindrical, slightly flattened dorso-ventrally, broad in the posterior region and is gradually narrowed towards the anterior end of the head. Besides the conical head there are eleven apparent segments—three thoracic and eight

abdominal. In the intersegmental regions there are girdles of spines assisting the maggot in creeping through the skin. The larval period during the season varies from 5 to 11 days. When fully fed the maggot crawls away from the body of the sheep and drops to the ground where it burrows into the earth and remains as such before turning into a pupa. They are usually found within a depth of  $\frac{1}{4}$  inch in the soil in an earthen chamber formed by caking of the soil. The prepupal period varies from 3 to 16 days during summer but this period is prolonged during the winter as hibernation takes place in this stage. The prepupæ are found at depths from 6 to 12 inches in winter and migrate to the surface during March next to turn into pupæ. The duration of the hibernating prepupæ ranged from 137 to 162 days.

In other sheep-rearing countries the mode of hibernation of *Lucilia sericata* varies. In South Africa the fly passes the winter in all stages except as egg and breeds continuously throughout the year (Smit, 1929). In New South Wales it is present at all seasons of the year (Gurney and Woodhill, 1926); in the United States it overwinters in the larval and pupal stage (Bishopp, 1916) while in New Zealand it strikes the sheep throughout the winter (Miller, 1921).

During pupation the body of the prepupa contracts as a whole, the anterior segments are entirely withdrawn and the anterior spiracles although occupying the same position as in the larva, lie at the anterior end of the body. The pupa (Fig. 3) is of a rich dark brown colour and is 8 mm. to 9 mm. long and 3.35 mm. broad. The duration of the pupal period during summer varied from 15 to 21 days and 28 to 33 days in spring.

When about to emerge, the fly, by means of a pulsating bladder-like organ on the front of its head, makes a circular slit at the anterior end of the pupal case and this cap-like portion is usually split into two halves by two lateral slits running forwards horizontally and meeting at the anterior end.

The adult fly (Fig. 4) on emerging is very soft and makes its way to some sunny spot where it spreads its wings and raises them up and down to facilitate drying. After a few hours the body and wings dry and the colours of the body become evident. For the description of the adult fly reference may be made to Patton and Evans (1929).

Mating takes place within five or six days after emergence and oviposition occurs within a day or so after copulation. The longevity of the flies under laboratory conditions ranged from 25 to 55 days. There are four generations of the fly each year; the first generation beginning from the end of March to the middle of May; second from the beginning of June to the middle of July; third from the beginning of August to the end of September while the maggots of the fourth generation overwinter in October and flies emerge out of them in March next.

The duration of the various stages in the life-history is summed up as follows: Egg, 0.30-0.40 days; Larva, 5-11 days; Prepupa, 3-16 days during summer and 137-162 days in winter; Pupa, 15-21 days during summer and 28-33 days in spring and Adult fly, 25-55 days.

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## Surface Structure of Polished Iridescent Shells

ELECTRON diffraction pictures were taken from the polished surfaces of the following iridescent shells:—

(1) *Lamelliderns marginalis*, (2) *Turbo*, (3) *Haliotis*, (4) *Nautilus pompilius*, and (5) *Margaritefera vulgaris*.

30 k.v. Electrons were used. The grinding and polishing were done with wet emery powder. The pictures show one or two diffuse rings, corresponding to a liquid or amorphous state. Thus it appears that here the process of polishing has converted the laminar body structure of the iridescent shells into an amorphous one.

In this connection it is worth recording that these shells in the polished state have been examined optically by Sir C. V. Raman<sup>1,2,3</sup> and by X-rays by Rama Swamy<sup>4,5</sup>; they find that in many cases the crystals of aragonite are arranged with considerable regularity so as to build up a laminated structure of nacre. The pieces of shells which are optically examined were about 0.1 mm. thick, and even here a body structure is observed. Thus the present work again shows that the electrons are even more suited for the examination of the surface structure than light.

This work was carried out in the Physics Department of the Indian Institute of Science, and my thanks are due to Sir C. V. Raman, for his kindness in placing the facilities of his department at my disposal.

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<sup>1,2,3</sup> Raman, C. V., *Proc. Ind. Acad. Sci.*, 1935, 1A, 567, 574 and 559.

<sup>4,5</sup> Rama Swamy, S., *ibid.*, 1935, 1, 871 and 1935, 2, 345.