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XXXV. *Some Account of the Kolisurra Silk-Worm of the Deccan, by Captain (now Lieutenant-Colonel) WILLIAM HENRY SYKES, of the Bombay Military Establishment, M.R.A.S., F.R.S., F.G.S., &c. &c.*

(Communicated by the Bombay Branch ROYAL ASIATIC SOCIETY.)

Read the 7th of April 1832.

IN my late researches in that part of the Deccan lying between the sources and junction of the *Bima* and *Mota Mola* rivers, I met with the cocoons* of the silk-worm which is called *Kolisurra* by the Mahrattas. The insect is an object of interest to the manufacturer from the strength of the fibre in the silk it produces.

Dr. ROXBURGH having described the *Tusseht*† and *Arrindi* silk-worms of Bengal in the seventh volume of the *Transactions* of the LINNEAN SOCIETY, I was naturally anxious to ascertain whether the *Tusseht* of Bengal and the *Kolisurra* of the Deccan could be identified, or were to be referred to different species. I am indebted to Colonel KENNEDY for facilitating this inquiry by the obliging transmission to me of the seventh volume of the *Transactions* of the LINNEAN SOCIETY; but unhappily some difficulties are opposed to the determination of the question for the present as I have only met with the insect in its *pupa* and *imago* states. Dr. ROXBURGH describes the caterpillar, which I have not seen, but he does not describe the *pupa*, which I possess. In the description of the moth there are strong points of resemblance between the *Bhugi* and *Kolisurra*, but there are also discrepancies which would induce a belief that they are of different species. On the whole, however, it is of very little moment whether my account adds a new species to the already teeming list of the entomologist, or be considered merely auxiliary to the able notices before the public, since it will at least promulgate the knowledge of the existence, on the

* Vide Plate 22, figure 1.

† “*Bhugi* of Birbhúm,”

western coasts of India, of a valuable insect whose labours can be so readily applied to the useful purposes of life.

The following is a description of the animal, so far as I am acquainted with it, in its different stages. *Eggs*, dirty white, ovate, slightly compressed, firm, marked with two brown parallel rings longitudinally.* Impregnation by the male in the moth state for the mere production of eggs unnecessary; since, in several instances, and I have now one before me, the moth deposits its eggs immediately on issuing from its cocoon, without the possibility of its having met the male; but it is to be inferred that they want the vivifying principle. The eggs are one-tenth of an inch long, and of a proportionate diameter to form a compressed oval; they vary in number from a hundred to two hundred, and the moth is occupied from four to six days in their deposition. One moth produced a hundred and thirty, and another a hundred and ninety-six eggs, besides sixteen found in its abdomen after death.

The first egg deposited is seized by the *tarsi*, which are armed with strong, sharp, incurvated claws. The second egg, on its under surface, has a small spot of reddish-coloured glutinous matter, by which it is attached to the preceding egg; each succeeding egg is provided with similar gluten, and is attached by a suitable motion of the abdomen to those that have preceded it: as the body of eggs accumulates, it is gradually drawn up towards the *sternum* by means of the *tarsi* and claws, the operation being assisted by the pushing of the abdomen and by the hind legs; and on the insect having performed the duties imposed on it by nature, it dies, leaving its body as a shield or covering to its eggs. I witnessed this process, but am not satisfied that it is a usual habit, as another moth deposited her eggs without any such manifestation of economical instinct. Under some circumstances, such as the eggs being deposited on a narrow branch of a tree, this covering must be of very little benefit, since it would necessarily be blown away by the wind, or shaken off by the motion of the branch. If it be an instinct, it is probably intended to screen the eggs from the eyes of depredators, as the body could afford them no other defence. Some days after the eggs are deposited, the depression on their sides becomes greater, and ultimately

* Vide Plate 22, figure 2.

each side sinks into a pit or hollow, the egg assuming the form of a double concave lens.* The circumference is still marked with the two parallel rings. I had hundreds of eggs in different years for months in my possession, but the caterpillars never made their appearance: of the larva, therefore, I cannot speak, not having seen it.†

Pupa.—The *pupa* is an inch long, of an oval form,‡ one end obtuse, the other somewhat acuminate. The posterior extremity (*gastro-theca*) consists of a dark brown (occasionally approaching to a black), smooth, leathery case, divided into nine segments or rings; these rings lessening in size to the acuminate end, and corresponding with the abdominal rings of the future moth; each of these has two apertures or spiracles, which are arranged in two lines on either side: the rings appear capable of shutting into each other, like the tubes of a telescope. The obtuse end, comprising the *cephalo-theca* and *cyto-theca*, &c., is protected by a strong leathery hood in several pieces, on the dorsal side touching the fifth ring, and on the abdominal side joining the first ring; the shape of the hood, therefore, resembles that of the body of a coal-skuttle. Through this covering are discoverable the rudiments of the eyes, the hard shell on the back of the head; and even the wings may be traced, with a little assistance from the imagination. When the *pupa* is pricked with a pin, or is otherwise pained or incommoded, it jerks or twists its abdomen.

Cocoon.—Oblong; from one to one and a-quarter of an inch long; has the appearance and almost substance of an exceedingly tough tanned hide; is most firmly attached by a strong cord to a branch of a tree; the cocoon of the male is smaller than that of the female. The animal is said to remain an indefinite time in the *pupa* state, varying from three months to two years. It is converted into the moth while yet in its cocoon, and liberates itself by discharging from its mouth a liquor, which dissolves or loosens that part of the cocoon adjoining to the cord which attaches it to the branch, causing a hole, and admitting of the passage of the moth. The solvent property of this liquid is very remarkable; for that part of the

* Vide Plate 22, figure 3.

† The eggs are said, by Mr. BABER, to hatch in from ten to fifteen days, according to the temperature of the air: the *larvæ* arrive at their full size (two and a-half to three inches) in a month, their prevailing colour being pale or sea-green.

‡ Vide Plate 22, figure 4, *Pupa*.

cocoon against which it is directed, although previously as hard as a piece of wood, becomes soft and pervious as wetted brown-paper. I may observe, however, that on some rare occasions I have found this discharge insufficient to ensure the escape of the moth, which I have been obliged to promote manually; but in all cases a very large opening is left, and the silk threads are entirely severed.

Imago.—In its perfect state the moth is remarkably handsome, if not splendid.* I found its existence limited to a week when confined, those in my possession having died within seven days, and I have no reason to suppose that in a wild state their existence would be prolonged beyond the time necessary for depositing their eggs, which is commonly effected within the week: they did not take any nourishment while they lived. Dr. ROXBURGH's moth of the *Bhugi* had no mouth, nor could I discover, with the assistance of a compound microscope, sutorious organs; but there was decidedly a passage into the stomach (*ventriculus*), which readily admitted of the insertion of a fine needle. By this passage the animal doubtless discharges the fluid which softens the cocoon and facilitates its escape. The absence of the essential organs of the mouth indicates that the moth is only produced to deposit its eggs, and that it does not take food in this state.

Head.—"Roundish, scarcely projecting beyond the anterior margin of the first pair of wings."

Eyes.—"Large, of a dark brown colour," minutely and beautifully reticulated.

Antennæ.—Male. *Bipectinate*, very broad, lanceolate.—Female. *Bipectinate*, very narrow, lanceolate.

Palpi.—Four: the lower ascending, densely covered with hair, the upper pair projecting, incurved, not hairy.

Mouth.—No sutorious organs.

Trunk.—"Oval, completely clothed with fine long orange-brown hair."

Abdomen.—Oblong, ovate, composed of nine parts or rings (Dr. ROXBURGH says seven), including the extreme point. The whole densely covered with fine long orange-brown hair. In the female, the abdomen extends to the margin (or a little beyond) of the posterior wings. In the male, it is considerably shorter.

* Vide Plate 22, figure 5, *Imago*.

Legs.—The first two pair somewhat longer than the posterior legs. The *coxa*, or hip of the first pair, about three-twentieths of an inch long, somewhat compressed, and moving close to the *palpi*, or feelers. The *coxæ* of the posterior legs are consolidated with the trunk and immoveable. The *femur*, or thigh, three-tenths of an inch long, compressed. *Tibia*, or shank, three-tenths of an inch long and round. *Tarsus*, or foot, five-twentieths of an inch long, consisting of five joints; the extreme joints longer than those intermediate. The foot very flexible, even after death, while the rest of the members are very rigid.

The *tarsus* is terminated by two incurved sharp claws, which enable the animal to retain a tenacious hold, supporting itself even on the perpendicular sides of a glass tumbler; it may, however, owe the latter faculty to a viscid exudation from the foot. All the legs are densely covered with straight reddish-brown hair.

Wings.—*Alæ* horizontal, expanded with faint whitish stripes in the direction of the nervures. Superior, or first pair, of cream, or orange-brown, darker on the exterior margins than on the abdominal edges; anterior margins slightly convex, and, from the point of insertion to the tip, bounded with a bluish-grey belt, which extends across the thorax; posterior edges slightly concave, ornamented with a broad border, the outer edge of which is greyish, faint green, or yellowish fuscous colour, the centre whitish, and the inner edge of a deep carmine; inner or abdominal edge of the wing straight. In the centre of each wing there is a remarkable eye, the pupil of which resembles transparent mica, surrounded by an iris of the colour of the posterior border of the wings, with an additional narrow circle of black; but the outward segment of the iris has the various colours mingled into a brownish-yellow, excepting the black of the outer ring, which is more prominent than on the inner side. The posterior, or second pair of wings, resemble the first, in colour and ornament, in every respect; the posterior margins, however, are convex. The wings and body are densely covered with straight fine hair, the colour of which varies from cream and dun in the female, to almost rufous or light maron in the male.

The advantage in cultivating the *Kolisurra* is in its feeding indiscriminately on the *sagwan* (teak-tree),* the *bor*,† the *ásana*,‡ and the mulberry, *tút*.§

* *Tectona grandis*. † *Zizyphus jujube*. ‡ *Terminalia alata glabra*. § *Morus Indica*.

The cocoon in the drawing is on the branch of a teak-tree. I have not been able to ascertain that any use is made of the silk of the *Kolisurra* on Western India, although the knowledge of the existence of the insect is universal, from there being an adage in *Mahratta*, that a man who voluntarily involves himself in almost inextricable difficulties is like the *Kolisurra* shut up in its cell. The extensive use, also, by matchlock men of the cocoon cut into thongs, as ligatures for binding the matchlock barrel to the stock, could not fail to diffuse the knowledge of the insect: the thongs are more durable than those of leather.

Wherever Dr. ROXBURGH's description of the *Bhugi* applied to the *Kolisurra*, I have used his language marked by inverted commas.

With respect to the strength of the fibre of the silk, I have to remark, that a single filament or thread supported a weight of one hundred and ninety-eight grains; and in repeated trials, I was cautious to guard against using a double filament, I have no reason to doubt, therefore, the results fairly indicating its strength.

The male moth differs from the female, in the following particulars:—The body is less by one-third; the legs shorter; the *antennæ* oval, or broad lanceolate, instead of narrow lanceolate; the ground-colour of the wings two or three shades darker, and their expansion less; those of the female measuring seven inches across, and of the male five and a-half inches. A male in my possession lived six days without food, and during his confinement deposited daily a quantity of a brownish-white fluid, which had a disagreeable odour.

(Signed) W. H. SYKES.

NOTE.

London, May 21, 1832.

SINCE the above was written, now some years ago, I have reared many of the insects from the *pupa* state, and can bear unhesitating testimony that the females invariably deposited their eggs without the possibility of their having communicated with males: but the eggs were never productive; in fact, they had not been fecundated.

With respect to the *Kolisurra* not being the *Arrindi* silk-worm of Dr. ROXBURGH, which an European entomologist has pronounced it to be, no further evidence is necessary than that of Mr. ATKINSON, who states that the cocoons of the latter are remarkably

soft and white, and the filament so exceedingly delicate as to render it impossible to wind off the silk. On turning to F. CRAMER (*Papillons exotiques des trois parties du Monde: l'Asie, l'Afrique, et l'Amerique, Pl. A, 148*), there is a figure a good deal resembling the female *Kolisurra*, denominated the *Phalæna (Bombyx) Paphia*: references are made also in CRAMER to SEBA, tom. iv. tab. 23, fig. 5, 6; to DRURY, tom. ii. tab. 5, fig. 1, under *Phal. Myletta*: but the authors were ignorant of the habits of the insect.

It is of very little moment, however, whether or not the *Kolisurra* be known to naturalists, the object of this paper being to diffuse a knowledge of new facts connected with its economy, and applicability to the uses of man.

The following is a description of the *Bombyx Paphia*, by a distinguished entomologist; the specific characters of the old writers being defective.

W. H. SYKES, Lieut.-Colonel.

Bombyx Paphia.—LINN.

B. alis patentibus falcatis concoloribus flavis: strigis rufis ocelloque fenestrato. Fab.
Habitat in Asia in India Orientali.

Alæ omnes flavæ, anticæ falcatæ strigis duabus violaceo-rubris anteriore undata. Ocellus (antice) annulo exteriori nigro, secundo roseo, tertio albido, quarto flavo-cænososo quinto aurantio, maculâq: fenestrata, lineâ fusca obliquâ par medium disci currente, postice paullo differt, annulo exteriori nigerrimo, 2do. aurantio, 3tio. cænososo, 4toq. flavo. It may here be remarked, that the fuscous line on the anterior wings divides the "Macula fenestrata" nearly equally running in an oblique direction. In the posterior wings the fuscous line is drawn over the anterior margin of the disk, and runs obliquely.

F. W. HOPE.