THE TUMBU-FLY (CORDYLOBIA ANTHROPOPHAGA, GRÜNBERG).

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Before giving a description of the remarkable insect referred to in the foregoing communications from Majors Smith and Blenkinsop, a few words may perhaps be said as to the manner in which infestation by the larva takes place. According to Major Smith's Mendi hammock-boys, the maggot at first leads a free and independent existence on the earthen floor of a hut, and burrows its way beneath the skin of its future host when the latter is asleep. This portion of the fly's life-history has not yet, so far as the present writer is aware, been investigated by a competent observer; and although it is quite possible that the Mendi idea accepted by Major Smith is correct, the story is so curiously similar to the now well-known life-history of the "Floor-Maggot Fly" (Auchmeromyia luteola, Fabr.) as to suggest that the natives, like certain Europeans, have mistaken the one species for the other. We do not yet know whether the Tumbu-fly is oviparous or viviparous, but in either case, since the female is undoubtedly unable to pierce the skin with her ovipositor, the larva in its earliest stage must bore its own way through the integument by aid of its mouth-hooks. If the Mendi belief is not correct, the egg or minute larva must be deposited upon the clothing or skin of its host, where, assuming the fly to be oviparous, the heat of the victim's body would no doubt soon cause the egg to hatch. In the case of Europeans or other human beings wearing clothes, the larva, by crawling along the clothing, might be able to reach spots inaccessible to the parent fly. It is interesting to observe that in Rhodesia, where the fly is very common and the maggot often infests babies,¹ as also in British Central Africa, the belief prevails among white people that the fly enables its progeny to

¹ Cf. G. A. K. Marshall, Transactions of the Entomological Society of London, 1902, p. 540. Writing from Salisbury with reference to the fly on April 19th, 1901, Mr. Marshall said: "It has been a great scourge this year in Salisbury, especially among young babies, the maggots forming a painful boil-like swelling under the skin. One baby had no less than sixty maggots extracted from it, and there have been several cases in which they have had a dozen or more."
obtain access to the human body by depositing its eggs upon flannel or woollen clothing hung out to dry, with the result that, in Central Africa at any rate, it is stated that the wearing of flannel clothing has been found to be impossible. If this is so, the ovipositing fly must be attracted by the odour of the clothing; but, since not only Europeans but also unclothed natives, as well as monkeys, dogs, and other animals, are similarly afflicted, it is obvious that the life-history does not always take the same course. At the same time it must be admitted that the Mendi idea alluded to above is apparently shared by natives in the Congo Free State. This is shown by a recent communication from Dr. A. Yale Massey, late of the Tanganyika Concessions, Limited, who, in forwarding for identification five larvae of Cordylobia anthropophaga, or of a closely allied species belonging to the same genus, from the south-east of the Congo Free State, wrote as follows from Kansanshi, North-western Rhodesia, on April 10th, 1907: “The larvae were extracted from swellings in the groin of a white man, one of our
prospectors, who thought he had buboes. The locality is about 9° 30' S., in the Congo State. The natives say that the trouble arises through sleeping on grass beds."

It is hoped that the following description of the different stages of the Tumbu-fly will enable those who may come in contact with it to recognise the insect.

Larva.—The full-grown larva is a fat, yellowish-white maggot, 12 to 12½ mm. (about half an inch) in length, bluntly pointed at the anterior or cephalic extremity, and truncate behind; its greatest breadth (on the sixth and seventh segments) is 5 mm. The body consists of twelve visible segments, the divisions between which are strongly marked, except between the cephalic and first body-segment (the latter of which bears the anterior or prothoracic stigmata, or respiratory apertures), and between the eleventh and twelfth segments. On the under side of the cephalic segment the tips of the black paired mouth-hooks may be seen protruding, while in a slight depression on the flattened posterior surface of the twelfth segment are situated the paired posterior stigmatic plates. In an adult larva the slit-like apertures in these plates are not very easy to distinguish, but in a maggot in the second, or penultimate stage, it is seen that each plate bears three ridges of tawny-coloured chitin; these ridges run obliquely downwards and outwards, at an angle of 45° from the median vertical line, and, while the median ridge on each plate is nearly straight, the other two ridges are characteristically curved, resembling inverted notes of interrogation, with the concavity directed towards the median ridge. The segments of the body are transversely wrinkled on the dorsal and ventral surfaces (especially on the latter), and puckered on the sides. From the third to the eleventh segment the body is thickly covered with minute recurved spines of brownish chitin (darker in the case of larvae ready to leave the host), usually arranged in transverse series or groups of two or more, which can be seen to form more or less distinct, undulating or irregular, transverse rows. These spines will be described in somewhat greater detail below.

Above and to the outer side of each mouth-hook is an antennalike protuberance ("maxilla," of Lowne), which, as in the case of the larva of the Blow-fly (Calliphora erythrocephala, Mg.), exhibits a pair of light brown, ocellus-like spots, or rather papillae, placed one above the other; according to Lowne's interpretation in the case of the Blow-fly, these are sensory in function. In a small larva, 5 mm. in length, from Lagos, the papillae are very clearly
visible; each papilla is surrounded by a ring of pale brownish chitin, and its shape, when viewed from the side, is exactly that of the muzzle of an old-fashioned muzzle-loading cannon.

This small larva also shows on the basal segment of each antenna, or antenna-like protuberance, below and a little to the outer side of the mouth-hook, a prominence bearing a series of about six small, brown-tipped, chitinous spines. These prominences are evidently the same as those referred to by Coquerel and Mondière as "deux appendices analogues (palpes?) plus petits, munis de quelques épines très fines vers leur bord interne," and clearly shown in their figure (Pl. 3, 1b). In the same larva, the spines on the body are most conspicuous, and most strongly developed and chitinised, on the fifth, sixth and seventh segments. The tenth and eleventh segments are also covered with spines, but, since the chitin of which they are composed is not tinged with brown, these segments appear bare. In the adult larva also, the spines on the tenth and eleventh are less conspicuous than those on the preceding segments; on the twelfth segment, which bears the posterior stigmatic plates, the spines are very minute. Fully chitinised spines are dark brown, but this colour is generally confined to the apical half of the spine, or may be absent from the extreme base. In shape each spine is a short cone, with the apex recurved, pointing towards the hinder end of the body. The spines are broad at the base in proportion to their length, and not infrequently, especially on the under side of the body, are bifid at the tip. They are closest together and most strongly developed on the anterior portion of each segment, becoming smaller and showing a tendency to disappear towards the hind margin. They are arranged in irregular transverse rows, which are usually seen to be composed of groups of from two to five spines, placed side by side.

In the adult larva the median area of the ventral surface of segments five (or six) to eleven inclusive is marked with a series of three transverse ridges, which are most prominently developed on the seventh and following segments. On each segment the foremost ridge is the shortest; next in length comes the hindmost, and the middle ridge is the longest of the three, curling round the posterior ridge at each end. Similar but less strongly marked ridges are seen on the dorsal surface.

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In 1897, the late Professor Friedrich Brauer described a Muscid larva in the third stage (7 to 8 mm. long by 3 mm. broad) from the skin of a European at Tanga, German East Africa; and also a smaller larva (3 to 5 mm. long), in the second stage, from the Arabian shore of the Red Sea. Professor Brauer showed that both belonged to the same species, and, from the description given by him of the larger larva, and especially his remarks as to the arrangement of the spines ("on the middle segments, too, they are arranged in peculiar fashion, four or five close together in a row, so that a number of such short rows are to be seen side by side or one behind the other"), there can be little doubt that this East African parasitic Muscid is none other than *Cordylobia anthropophaga*,

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It is possible, however, that a second species of *Cordylobia* occurs in British East Africa, since in the case of a large series of larvae belonging to this genus in the collection of the British Museum, removed from the skin of an Irish terrier at Maungu, East Africa Protectorate, where the parasite is said to be known as the "Maungu worm," the spines are simply scattered singly, instead of being arranged in transverse groups or series, and are also distinctly larger than in the case of Tumbu-fly maggots from Sierra Leone and Lagos, although the larvae themselves are smaller.

*Puparium.*—Of the usual barrel-shaped Muscid type. Average dimensions: length 10.4 mm., greatest breadth 4.5 mm. Though at first of a ferruginous or light chestnut tint, the puparium gradually darkens until it becomes "seal brown" or practically black.

*Perfect Insect.*—A thick-set, compactly built fly, of an average length of about 9.4 mm.; specimens as small as 6.4 or as large as 10.4 mm. in length are occasionally met with. Head, body and legs, straw yellow; dorsum of thorax and of abdomen with blackish markings; wings with a slight brownish tinge. The eyes meet together for a short distance in the median line above in the case of the male, but are separated by a broad front in the female (see figure). On the dorsum of the thorax the dark markings, which are a pair of longitudinal stripes not reaching the hind margin, are covered with a greyish bloom and, consequently, not very conspicuous; this bloom is also present on the abdomen, but here the markings are much more distinct, especially in the female, in which the third segment, as also the fourth segment with the exception of the hind margin, is entirely black or blackish. In the female the second segment is marked with a blackish quadrate median blotch, and has a similarly coloured hind border, broadening towards the sides, while the first segment has a narrow dark hind margin. In the male these markings are not so extensive; the dark hind margin to the second segment is interrupted on each side of the median blotch, which is triangular in shape, and there is a yellow area of considerable size on the proximal half of the third segment, on either side of a blackish median quadrangular blotch; the fourth segment is similarly but less conspicuously marked.

Care is necessary in order not to confuse *C. anthropophaga*, Grünb., with *Auchmeromyia luteola*, Fabr. (the "Floor-Maggot Fly"), which is found in the same parts of Africa and presents a deceptive resemblance to the Tumbu-fly in coloration, since it also has a pale yellow head and body, with dark markings on the thorax, and the distal half of the abdomen blackish. Without going too
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depth into details, however; it may be said that the two species may be distinguished by the fact that in *A. luteola* the eyes are wide apart in both sexes, the body is narrower and more elongate, the hypopygium of the male is in the form of a conspicuous forwardly directed hook, for which the ventral half of the penultimate segment of the abdomen serves as a sheath; and lastly, by the fact that the second abdominal segment in the female is twice the length of the same segment in the male. The "floor-maggot" itself is devoid of the characteristic spines described above in the case of the Tumbu-fly larva, and the posterior surface of its last segment, instead of being vertical, as in the latter, slopes backwards at an angle of 45°, and has around its hind margin a series of fleshy spines; the stigmatic plates on this segment, too, are extremely small and wide apart (2 mm. apart in an adult larva), while in the Tumbu-fly maggot they are much larger and close together (at the nearest point separated by less than the diameter of a single stigmatic plate).

Within the last few years *C. anthropophaga* has been wrongly identified as *Bengalia depressa*, Walk., under which name it has frequently been referred to in reports on "Economic Zoology" and other literature. The true *B. depressa* however, is a very different insect, the life-history of which is unknown, and there is no evidence whatever to show that its larva is a subcutaneous parasite.

1 A brief description of *A. luteola* by the writer will be found in the *British Medical Journal*, January 30th, 1904, p. 246; on the previous page Captain P. S. Lelean, R.A.M.C., gave a figure of the female fly. The author also figured the perfect insect and its larva in Allbutt and Rolleston's "System of Medicine," vol. ii., part ii. (1907), p. 184.

2 For the original description and figures of the "floor-maggot," see Drs. J. E. Dutton, J. L. Todd, and O. Christy, "Reports of the Trypanosomiasis Expedition to the Congo, 1903-1904," of the Liverpool School of Tropical Medicine and Medical Parasitology (London: Williams and Norgate, 1904), pp. 49-54, pl. iii., and figures of larva in text.

3 For the explanation of the manner in which the confusion with *B. depressa* has arisen, as also for an historical account of the Tumbu-fly, see Austen, *Proceedings of the Entomological Society of London* for the year 1907, pp. xliii.-xlvii.