

worse has just gone. "Yet their sufferings will hardly, if at all, be mentioned or known in England; when, on the other hand, those of the *Endeavour*, because the Voyage is uncommon will very probably be mentioned in every News Paper, and, what is not unlikely, with many Additional hardships we never Experienced; for such are the dispositions of men in general in these Voyages that they are seldom content with the Hardships and Dangers which will naturally occur, but they must add others which hardly ever had existence but in their imaginations by magnifying the most Trifling accidents and circumstances to the greatest Hardships and unsurmountable dangers without the immediate interposition of Providence, as if the whole merit of the Voyage consisted in the Dangers and Hardships they underwent, or that real ones did not happen often enough to give the mind sufficient anxiety. Thus Posterity are taught to look upon these Voyages as hazardous to the highest degree."

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SOME COMMENSAL MIDGES.

By F. W. EDWARDS, M.A., Assistant Keeper, Department of Entomology.

IN many different divisions of the animal kingdom there are to be found examples of symbiosis or commensalism, by which is meant the living together in close association of individuals of two (or more) quite unrelated species. When this association affords obvious advantages to both species concerned and the two are so well adapted to their joint existence that they are seldom found apart and may even be unable to live without each other's assistance, we speak of symbiosis; when the association is less intimate and one at least of the associates derives no special benefit therefrom, the term commensalism is used. Commensalism differs from parasitism in that the weaker member of the partnership does not feed at the expense of the stronger—it is not a sponger—but obtains its own food for itself while depending on its partner for some other benefits, such as shelter or protection from enemies. Perhaps the best-known example of such an association is that of the hermit crab, which carries a particular species of sea-anemone on the back of the whelk-shell in which it lives, while a particular species of worm inhabits the shell with the crab.

Among insects many examples of commensals are known, the most familiar being the various guests found in communities

of ants and termites, and, now that more attention is being devoted to the subject, a number of fresh instances of similar relations are being found to occur between insects of other groups. In this article it is proposed to notice some midges (Chironomid flies) which in the larval stage live in commensal association with other insects.

In 1923 Mr. A. L. Tonnoir described a small midge, the larvæ of which he had found in several widely-separated localities in New Zealand, living on the ventral surface of a larva belonging

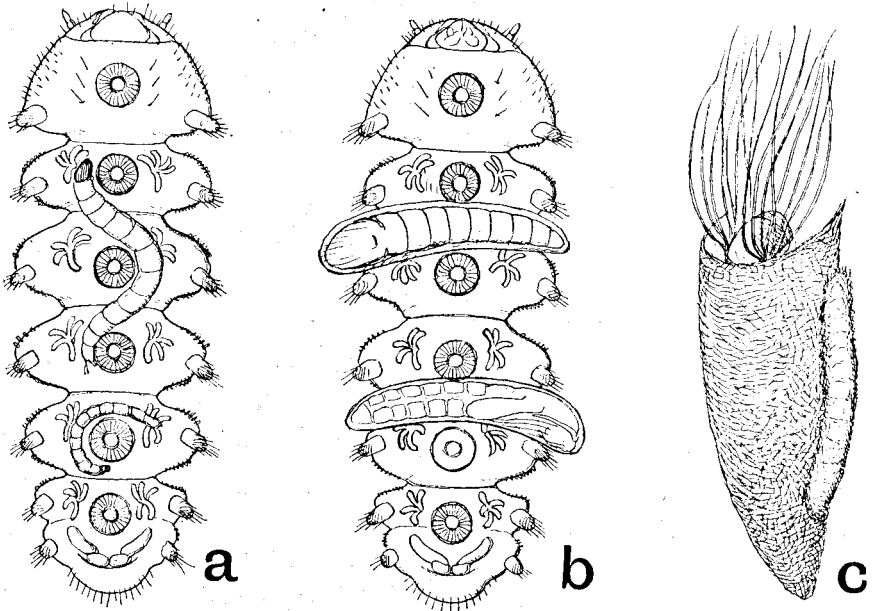


FIG. 1.—*a* and *b*, larva of *Neocurupira hudsoni*, Lamb, with larvæ (*a*) and pupæ (*b*) of *Dactylocladius commensalis*, Tonnoir, on its ventral surface (after Tonnoir); *c*, cocoon of *Simulium ornatum*, Mg., with cocoon of midge (*Eukiefferiella* sp.) beside it.

to the Dipterous family Blepharoceridæ. The larvæ of this latter family always live on rocks in rapid streams, attaching themselves by means of a row of six suckers, between and around which the tiny midge larvæ make themselves at home, evidently with the object of finding shelter from the current (Fig. 1, *a*). According to Mr. Tonnoir, the whole of the larval and pupal stages of the midge are spent in this position, though he did not ascertain how the young larva reaches its protector. When the midge larva is full-grown, it comes to lie transversely between two suckers, and secretes a mass of jelly, in which it changes to a pupa. The gelatinous coating fixes the pupa firmly to the Blepharocerid larva, and shortly after its formation the pupa

turns within its sheath so that it faces upwards, that is, towards the ventral surface of the large larva (as shown in the upper of the two midge pupæ in Fig. 2, *b*). In this position the pupa remains until the adult midge is ready to emerge. A remarkable fact about this association is that the midge is strictly confined to one species of host (*Neocurupira hudsoni*), although other species of Blepharoceridæ occur in the same localities. Mr. Tonnoir considers that this selection is due to the comparatively large size of the larva of *Neocurupira hudsoni*, which therefore offers a more efficient shelter; but he also finds that *Neocurupira hudsoni* is slower in its development than the other Blepharoceridæ, a fact of no little importance to the midge, which must of necessity attain to the adult stage before its host larva changes to a pupa.

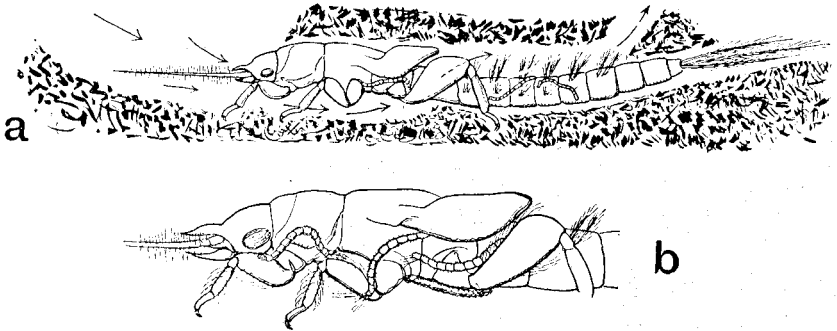


FIG. 2.—Nymph of *Ephemera vulgata*, L., with larvæ and (on enlarged figure *b*) a cocoon of the midge *Camptocladius ephemere*, Kieff (after Šulc and Zavřel).

In 1924, that is, during the year following the publication of Mr. Tonnoir's discovery, Mr. K. Šulc and Prof. Zavřel issued an account of another remarkable commensal midge larva, found by them in Czechoslovakia, living on the nymphs of the large may-fly (*Ephemera vulgata*). This nymph has the unusual habit (for a may-fly) of forming a burrow in the mud at the bottom of a stream, remaining more or less stationary, and, by the vibration of its appendages, causing a current to pass through the burrow (Fig. 2, *a*). Organic particles and minute animals are drawn in with the current, and the larger organisms form the food of the may-fly nymph, being caught in a sort of filter composed of erect hairs on the nymph's antennæ and front legs. Smaller particles pass through this filter and provide food for the midge larvæ (Fig. 2, *b*) which live in the burrow and may very probably perform a useful service for the nymph by keeping its gills clean. The authors do not state whether the midge

larvæ are ever eaten by the may-fly, but presumably they are sufficiently active to escape its jaws; they pupate in a loose cocoon attached to the body of the nymph. The association of these two species of insects is evidently very definite, because the same midge has since been found living with the same may-fly in Yorkshire, a student of Leeds University having independently discovered the connexion between them. Any possible doubt as to the identity of the midge has been removed by the comparison of material sent to the British Museum by Prof. J. Zavřel of Brno and Mr. E. Percival of Leeds. The adult midge has also been met with in Cheshire by Mr. H. Britten in a locality where may-flies (*Ephemera danica*) were abundant.

In both the instances noticed above the habits of the midge larva appear to be definitely fixed, and the larva has never been found except in association with its host. There are, however, some cases of what may be termed facultative commensalism, in which the midge larva, though frequently found in association with another insect, can also live independently. Two examples of this have come to my notice, in both of which the midge larva inhabits the cocoons of "black-flies" (*Simulium*). When studying the biology of British *Simulium* in 1916-20 I frequently found that the cocoons of *S. ornatum*—a species which is very common on water plants in small rivers with a moderate current—included a tiny, active, midge larva; very often the pupa of this midge (a small *Eukiefferiella*) was found in a slight cocoon lying close beside the cocoon of the *Simulium* (Fig. 1, c). I was unable to investigate the exact nature of this association, but further light has now been thrown upon the matter by Mr. H. J. Falkner, of Torquay, who has found midge larvæ in the cocoons of *Simulium latipes* and *S. aureum*. Regarding these larvæ Mr. Falkner writes (February 27 and March 7, 1929):

"Did I tell you of the strange little midge whose larval and pupal stages seem to be passed entirely in the pupal sheath of the Simuliidæ? It behaves just like the worm at the end of the whelk shell inhabited by the hermit crab. That is, it does not leave the sheath, but stretches forward to feed—and apparently lives the whole time and pupates in the same sheath, as there accumulates quite a lot of detritus with the cast larval skins in the very bottom of the sheath. I found them difficult to rear, as the midge larval stage is passed during the *Simulium* pupal stage, then on the exodus of the *Simulium* fly the midge pupates; this means that, when I collected the *Simulium* pupæ to rear, the larval midges died, and it was only by collecting empty *Simulium* pupal sheaths with midge pupæ inside that I managed

to get out five or six as flies. . . . I have an idea that it is the same minute larva that is found on water-cress growing in swift streams, and the one that normally pupates in the shelter of the junction of stem and leaf, and that my case is one of facultative or adaptive commensalism brought about by the total absence of shelter except in the cocoons—which were all taken from stones at or near the edge of fast streams.”

Mr. Falkner's suggestion as to the identity of the midge larvæ is probably well founded. Specimens submitted by him proved on examination to belong to the species described by Goetghebuer as *Cricotopus dispar*, the larvæ of which I have found in abundance (in the absence of *Simulium*) on submerged leaves of such plants as water-cress and *Sium*. Nevertheless, the occurrence of these larvæ in *Simulium* cocoons seems to be more than accidental. A point worth noting is that all four of the midge larvæ referred to in the above notes belong to the same group of the family Chironomidæ. To this group belong also certain peculiar larvæ which have become definitely parasitic on may-fly nymphs, thus completing the transition from independent life to parasitism, the intermediate stages being exemplified by the larvæ described above. It may confidently be anticipated that further study of this group of midges will reveal the existence of other species with equally interesting habits.

BARKER'S BUSHBUCK.

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BUSHBUCKS are the typical members of a subfamily of antelopes known as the *Tragelaphinæ*; the group also includes the elands, kudus, bongos, the Indian nilgai, and four-horned antelope. These antelopes are large or medium in size and, with the exception of the elands and bongos, horns are found only in the male sex; the horns are spirally twisted, keeled anteriorly, and without the well-marked transverse ridges met with in the nearly allied groups. In most of these antelopes the body is marked with vertical white stripes, or white spots, and there is frequently a white chevron on the forehead.

All the bushbucks are included in the single genus *Tragelaphus*; it is probable, however, that the nyala (*T. angasi*) and the mountain bushbuck (*T. buxtoni*) will have to be considered as representing distinct genera. The true bushbucks, or