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"The primary aim of science is to explore the facts of Nature, to ascertain their mutual relations, and to arrange them as far as possible into a consistent and intelligible scheme. This endeavour is the true inspiration of scientific work, as success in it is the appropriate reward. The material effects come later, if at all, and often by a very indirect path."—HORACE LAMB.

"We'll set thee to school to an ant."—*King Lear*, Act II, Scene IV.

THE GUESTS OF BRITISH ANTS

THEIR HABITS AND LIFE-HISTORIES

BY

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With 16 Plates and 55 Text Figures

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College, April 17th, 1910; Woking, March 19th and June 20th, 1920; and many imagos, and also puparia, in two nests of *A. (D.) brunneus*, in Windsor Forest, on September 3rd, 1924.

Aphiochaeta minor Zett., in a nest of *A. (D.) fuliginosus* at Weybridge, September 7th, 1914.

Aphiochaeta conformis Wood, two specimens in a nest of *Myrmica laevinothis* under a stone at Rannoch, on June 14th, 1911.

Trineura aterrima F.—This is a common and widely distributed little Phorid, but I have taken it on several occasions in ants' nests. In 1900 I took it with *F. rufa* at Oxshott, and later in nests of *A. (D.) fuliginosus*—at Wellington College, on May 17th, 1906, and Darenth Wood (♂ and ♀) on June 6th, 1909. Westwood, in 1840, records that, on disturbing nests of *F. fusca* he noticed a small species of *Trineura* hovering over the nests and darting at the ants. Wasmann in quoting this record considers that, from the description of the nest, the ant must have been *F. rufa*, and not *F. fusca*. This was no doubt the case, and it is probable that the fly was *T. aterrima*.

BORBORIDAE.

The same remarks, as to their general habits, apply to this family as to the preceding. Several species of *Limosina* have occurred in ants' nests, where their larvae probably feed in decaying vegetable matter and refuse.

Limosina curtiventris Stnh.—In September, 1906, this little fly bred out, in numbers, from an observation-nest of *A. (D.) fuliginosus* from Wellington College. The nest was kept in a large glass bowl, and consisted of several handfuls of *dbris*, out of the heart of a *fuliginosus* nest, situated in the root of a birch tree, full of ants, their larvae, and also Dipterous larvae. I subsequently found this fly, with the same ant, at Darenth Wood, September 24th, 1909, and Woking, May 5th, and August 14th, 1920, and May 26th, 1923.

Limosina rufilabris Stnh. ?—A specimen of a small *Limosina*, which I took in Scotland, was queried as this species by Collin. I found it in the galleries, in a nest of *F. fusca*, among the ants, under a large heavy stone, at Loch Arber, near Dumfries, on April 30th, 1908. The ants paid no attention to it.

Limosina fungicola Hal., was taken in a nest of *F. rufa* in the Haye Wood, near Knowle, May 30th, 1908, and bred out of a *fuliginosus* observation-nest from Wellington College in June, 1908.

Limosina crassimana Hal., in a nest of *A. (D.) brunneus* at Theale on February 6th, 1923.

PART 4.

MILICHIDAE.

Some species are parasitic in bees' nests, others breed in birds' nests, etc., but certain species in the genera *Milichia* and *Phyllomyza* are undoubtedly myrmecophilous, and are always found with the same species of ant.

In South Nigeria Farquharson found several species of *Milichia* associating with *Crematogaster* species, living on trees. He says the flies alight on the carton of the nest and dodge about among the ants. The *Milichia* larvae cover themselves with excreta, and wander about in the runs of the ants.

Milichia ludens Wahl.—Only four specimens of this little fly (both sexes being represented) have been found in Britain, all of which were taken by me with the ant *A. (D.) fuliginosus*, as follows: Darenth Wood, June 6th, 1909, October 1st, 1910, May 26th, 1911; and Oxshott, June 6th, 1911. It was described by Wahlberg, in 1847, and Raddatz recorded, in 1873, that it lived with the ant *fuliginosus*, and occurred in May and June.

There are three known species, at least, of *Phyllomyza* which are attached to ants' nests in Britain. Their larvae live in the galleries and chambers of their hosts, and are apparently not parasitic in the ants' larvae or pupae.

Phyllomyza formicae Schmitz.—This is the species I have been recording for years, from *Formica rufa* nests, sub *P. formicae* Collin MS. It was originally brought forward as British by Verrall, sub *P. securicornis* Fln., on specimens swept by himself over nests of the wood ant at Braemar, on July 25th, 1873. He pointed out that his specimens had darker legs than Continental types and descriptions, but that he was not well acquainted with the group. It was not taken again until 1901, when I discovered it at Oxshott in *rufa* nests. It also bred out of my large *rufa* observation-nests from Oxshott in 1901, and Weybridge in 1906-7, in some numbers. I noticed that the wings in newly emerged specimens took about five minutes to fully develop. I have also taken it in the field about *rufa* nests at Weybridge and Nethy Bridge. In the latter locality, on May 16th, 1907, I found a number of its larvae in a nest of *F. rufa* var. *rufo-pratensis*. These larvae were at large in the chambers and galleries, in the peaty soil, at the bottom of the nest. Many of these were taken home in a tin with *dbris* from the nest; where they pupated, and the perfect insects emerged in June.

Phyllomyza lasiae Collin MS.—Unfortunately none of the males of this fly sent to Father Schmitz, by the British Museum and myself, was in good enough condition to be described. It was first taken by me on April 26th, 1901, at Oxshott, in a nest of *A. (D.) fuliginosus* situated in the roots of a beech tree. I noticed that

these little flies flew out of a small hole, in the lower part of the tree, by which the ants gained access to their nest. Later in 1906-7 I found it with the same ant (its normal and proper host) at Wellington College, and it bred freely in my observation-nest from that locality. On May 6th, 1911, a number of puparia was collected from a *fuliginosus* nest at the last-named locality and introduced into my observation-nest; imagos emerged on May 14th and 28th. It has occurred continuously from 1915 in the Woking *fuliginosus* nest, and many examples have been reared from puparia obtained from that source.

Phyllomyza donisthorpei Schmitz was first taken by me in a nest of *A. (D.) fuliginosus* situated in the sand-hills at Birkdale on June 22nd, 1905, and I have subsequently found it with the same ant at Wellington College, Darenth Wood, and Oxshott. Its habits are similar to those of the two above-mentioned species.

Phyll. equitans *Neophyllomyza fagicola* Hendel.—This little fly occurs with *A. (D.) fuliginosus*, with which ant I have taken it at Woking, Wimbledon Common, and Windsor Forest.

It was described by Hendel, in 1924, from Austria, and the above is the first record of this species having been found in Britain. *Neophyllomyza* is a subgenus of *Phyllomyza*, and its species are very like those of the latter in appearance and habits. They only possess, however, two pairs of bristles on the thorax, instead of four pairs, as in *Phyllomyza*.

PART 5.

CHIRONOMIDAE.

This family comprises the well-known blood-sucking Gnats and Midges, and one would not expect to find myrmecophilous species among them. Nevertheless certain species of *Ceratopogon* are truly myrmecophilous, and we have already seen that some gnats are fed by ants in widely separated regions of the globe. It may be of interest to mention that in the subfamily *Ceratopogoninae*, species not only attack the mammalia, and especially man, but also other insects, and their larvae. De Peyerimhoff points out that the blood of certain caterpillars, in Cuba, was sucked by these insects; as also that of gnats, and other Diptera, and large Oil-Beetles, elsewhere. Jacobson has recorded similar facts with Dragon-flies, and Lepidoptera, in Sumatra.

Ceratopogon myrmecophilus Egger.—This fly was first taken in Britain by me in a nest of *F. rufa* at Oxshott on May 6th, 1898, and I have since taken it, and at times in numbers, at Weybridge, Darenth Wood, New Forest, and Abbots Wood, Eastbourne, with the same ant. The female is decidedly rare, and I have only twice taken it in the field—one at Oxshott in the *débris* of a *rufa* nest on

the date mentioned above, and a second at Weybridge under a stone on a *rufa* nest on August 27th, 1918. I bred a few females (but many more males) in my *rufa* observation-nest from Weybridge in 1906, and a single female hatched out of a nest of *F. exsecta* on May 18th, 1910, brought up from Parkhurst Forest, I. of W. The males have the habit of hovering in the air over *rufa* hillocks—I have even seen them doing this over observation-nests in the laboratory—and this they probably do when searching for the female. I have captured them in every month from May to October. Hamm found males at Bournemouth in August, 1914, hovering over *rufa* nests. Schiner recorded, in 1863, that *C. myrmecophilus*, in Austria, hovers over and creeps into, and about, ants' nests.

Ceratopogon braueri Wasm.—Butterfield bred specimens of a *Ceratopogon* from puparia taken on the underside of a stone over a nest of *F. fusca* at Grassington, Yorks, on May 5th, 1918. One of these, which he kindly gave to me, was identified by Collin as *C. braueri*. This species was described by Wasmann, in 1893, who had taken larvae, puparia, and imagos in nests of *F. fusca* at Vorarlberg. The larvae live in the galleries of the nests, and the ants pay no attention to them.

Trichopogon lucorum Mg.—In January, 1925, a number of the curious larvae of this little fly was found in cells, inhabited by *A. (D.) brunneus* and its brood, in wood taken from the centre of a large felled oak in Windsor Forest. Many male, and female, imagos emerged in April.

BIBIONIDAE.

Two species of *Scatopse* are regular myrmecophiles.

Scatopse transversalis Lw.—This little fly can generally be found in company with any colony of *A. (D.) fuliginosus*, running about among the ants in their tracks, and on the tree which they may be inhabiting. Its larvae, and puparia, are also to be found in the *débris* of the nests. I first took it with that ant on the sandhills at Birkdale on June 22nd, 1905, and have since observed it with the same species at Wellington College, Darenth Wood, Oxshott, Woking, Tubney, Wimbledon Common, and Windsor Forest. The imago is present from May till October. In May and June, 1906, it bred out of my Wellington College observation-nest; and puparia collected in the Woking nest, in October, hatched in about a week. It also occurs, though much more sparingly, with *F. rufa*, with which ant I have taken it at Knowle, Camberley, and Windsor Forest. Hamm records it as being fairly common at Cothill, with the black ant—*fuliginosus*.

This is probably the species recorded by Wasmann from Dutch Limburg, when he wrote that certain *Scatopse* species are so commonly and regularly to be found in nests of *fuliginosus* that they may well be considered myrmecophiles.