

The Ants (Formicidae) and Guests (Myrmecophiles) of Windsor Forest and District.

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Having made an intensive study of the beetles (*Coleoptera**) of Windsor Forest during the last seven years, as might be supposed the inhabitants of ants' nests (beetles and other myrmecophiles) have been strenuously searched for. The result being that not only a number of species have been added to the British list, but the majority of the known British myrmecophilous *Coleoptera* have been taken in the district.

This is what one would expect, as *Acanthomyops* (*Dendrolasius*) *fuliginosus*, Latr., *A.* (*Donisthorpea*) *brunneus*, Latr., and *Formica rufa*, L., all occur; the three ants, with which the greatest number of ants' guests are found in Britain.

Of the ants themselves, 18 out of the 35 known indigenous species occur. Several more (probably very few) species may turn up, including the common and widely distributed *Myrmica laevinodis*, Nyl., which is almost certain to be present; though we have not come across it so far.

The occurrence of the two species, *fuliginosus*, and *brunneus*, chiefly associated with trees is natural in this ancient forest land. It is a fact, however, that they are not found in the same areas; and we believe that if they were, the *brunneus* would be wiped out by the *fuliginosus*.

A certain number of the beetles and parasitica recorded here from ants' nests may be only chance guests, just sheltering, or hibernating, in suitable or convenient habitats. On the other hand they may represent cases where a species is experimenting in a myrmecophilous life. Such cases are called attention to (especially when they have occurred with ants on several occasions, and in different localities) and are not printed in italics. As pointed out in the "Guests of British Ants" (1927), a number of species of *Coleoptera* live with ants, and also in birds' nests. It cannot be the same individuals which are found in ants' nests and birds' nests, as the species are found to be present at the same time in both. It seems probable that at some distant period two sets of their ancestors had branched off into different modes of life; it might be that a bird's nest containing these ancestors was in the tree inhabited by ants, and the beetles found the nest of the latter

*On January 1st, 1930, the *Coleoptera* of Windsor Forest had reached the respectable total of 1339; more than one third of the whole of the British list.

a congenial atmosphere, and then continued the myrmecophilous habit, others remaining birds' nest frequenters.

With the exception of two species taken by Blatch†; all the rest of the species mentioned have been taken by us.

I must thank Mr. Lloyd, the Chief of the Crown Estate Office, for his kindness in rendering us every facility to enable us to carry out our investigations with ants' nests in this productive district; and also Miss Kirk for her assistance in this work, entailing as it does both patience and often considerable strenuous labour.

A short account of the ants of Windsor Forest, together with the myrmecophiles found with them, is now given.

MYRMECINAE.

Myrmecina graminicola, Latr.

This little species, though not rare, is decidedly local in this country; its most northern record being from Staffordshire. It lives in small communities, under stones, in stumps, etc.; individual workers being often found in the nests of other ants. I have kept a colony under observation in my study, which has been in my possession now for twenty years. The males and winged females may be swept off rushes, and other herbage, from August to October, the time of the marriage flight.

A male of this ant was swept off grass near Windsor at 2 p.m. (summer time) on September 11th, 1926.

Formicoxenus nitidulus, Nyl.

This small shining reddish-yellow ant is a myrmecophilous species dwelling in the nests of the "wood ant" *Formica rufa*. Its colonies are not large, and it constructs its nests of the finer materials of which its hosts' nests are constructed. The male is wingless, and very worker-like in appearance. It is very widely distributed, having been taken in Invernessshire and in the Isle of Wight.

We have found it in the nests of *Formica rufa* in Windsor Forest in September and October, 1927; October, 1929; etc.

Monomorium pharaonis, L.

The little "house ant" has been spread by commerce all over the world; it lives in houses, bakers' shops, etc., and even on board ships. It may be looked upon as a British species now, as it has been known to occur in this country for over a hundred years.

Workers were observed running on the tea table in a Restaurant at Windsor on July 24th, 1925.

Myrmica ruginodis, Nyl.

This very common species, the most widely distributed in our islands, and our only ant found in the Shetlands, nests under stones, in rotten stumps, at the edges of woods, etc.; under which circumstances it occurs in Windsor Forest. Marriage flights have been observed there at 5 o'clock (summer time) on September 5th, 1928; and 12.30 p.m. (summer time) on August 21st, 1929.

†The late W. G. Blatch collected Coleoptera in the Windsor district in September 1887.

On July 7th, 1924, a colony was discovered in the stump of a birch tree, and as soon as the ants were disturbed, a number of a small fly put in an appearance, hovering over the ants. Several were captured, and subsequently proved to be *Pseudacteon brevicauda*, Schmitz, a species of Diptera new to the British list. The females of these flies possess a sharp pointed ovipositor with which they lay their eggs between the free segments of the ants' gasters. They are attracted first by the sense of smell, given off by the ants, and subsequently by sight, when near enough to see the ants.

Other myrmecophiles found with this ant at Windsor are the "wood-louse" *Platyarthrus hoffmanseggi*, Brdt., and the Collembolid, *Cyphodeirus albinos*, Nic., both of which occur with all our species of ants; and the beetle, *Drusilla canaliculata*, F., which was taken running in a sandpit with workers of the *Myrmica* on August 27th, 1929. The food of this beetle consists of ants which it kills and devours.

Myrmica sulcinodis, Nyl.

Though widely distributed, this ant is more or less rare. It nests under stones, and timber, in stumps, etc., and is fond of heaths and commons. It is also found on mountains.

On May 25th, 1927, a colony was found in Windsor Forest nesting in a Scot's pine stump.

Myrmica scabrinodis, Nyl.

A very common and widely distributed species occurring in both damp and dry districts. It nests under stones on heaths, and in banks in sandy areas, and also in sphagnum swamps and bogs. It is a thieving ant robbing other ants of their prey and brood: its colonies being often situated near those of other species, individuals entering their nests.

On June 29th, 1924, a dealated female was found in a mixed colony of *Acanthomyops (Chthonolasius) umbratus*, Nyl., and *A. (Donistherpea) brunneus*, Latr., (to be referred to later) situated in an ash tree. On September 3rd, 1924, a female was captured on the wing. On October 11th, 1927, a small colony was observed under the same stone as a large colony of *A. (C.) flavus*, F., apparently living in harmony: *Platyarthrus hofmanseggi* was present. On April 10th, 1929, this ant was nesting in sphagnum in a swamp. On June 11th, 1929, a worker was present in a nest of *A. (C.) flavus* in a mole-hill.

Myrmica scabrinodis, Nyl., var. *sabuleti*, Mein.

On June 25th, 1924, a dealated female of this variety was taken in the *umbratus*—*brunneus* nest mentioned above.

Stenammina westwoodi, West.

This is a rare ant, its most northern range with us being the Midlands and Norfolk. It also occurs in the south-east, and south-west of Ireland. Its habits are obscure and it is only comparatively recently that independent colonies have been found in the British Isles. I possess a small colony sent to me from Ireland by Messrs. Philips and Stelfox, in 1921. The original queen is still alive—she must be over nine years old to-day! The winged sexes are sometimes

swept in September and October; and individual workers have been frequently taken in the nests of other ants. A male was taken by evening sweeping in Windsor Forest on September 21st, 1926; and several workers occurred in a colony of *A. (C.) flavus* situated in a rotten stump, covered by a mole-hill, on June 11th, 1929. A single worker was found in a mole's nest, which was full of *A. (D.) brunneus* workers, at the foot of a tree, on August 2nd, 1929.

Leptothorax acervorum, F.

Though these ants sometimes nest under stones, and in the cracks of rocks, etc.; they are mostly found in stumps and under the bark of trees. They also make use of the burrows of other insects in bark, galls, "oak-apples," and the like, in which to found their small colonies. This species is very widely distributed in Britain and Ireland.

In Windsor Forest a small colony was observed nesting under the bark of an oak tree, infested by *A. (D.) brunneus*, on June 26th, 1925; and a few workers were seen in an oak stump on August 14th, 1929. Females were swept up in the evening in a plantation on September 17th, 1926.

Leptothorax nylanderii, Först.

This *Leptothorax* is a much scarcer and more local ant than the preceding. Shropshire is its most northern range in England, and it has not been found in Scotland, nor Ireland. It nests in woods and parks in the bark of trees, and fallen boughs, etc., and will also make use of the borings of other insects. It occurs not infrequently, in company with other ants. It was found in several oak trees infested by *A. (D.) brunneus* in Windsor Forest in 1924. Its nests consist of little cells in and under the bark, and the workers run about freely in company with the *brunneus* in their "runs." One colony had its nest in the rather brittle wood of a rotten beech tree. A colony consisting of a queen, many workers, and larvae, inhabiting a poplar tree infested with *brunneus*, was taken home on April 22nd, 1924, and fixed up in a small plaster observation nest. On May 27th, another queen, and a few workers and larvae were brought home and introduced into this observation nest. A certain amount of fighting took place between the workers of the different colonies, but eventually they settled down, the new larvae being collected with the old, the new queen joining them. This compound colony was kept under observation for several years. On September 17th, 1926, some females were taken by "evening sweeping" in a plantation. A worker was found in a fungus inside a hollow beech tree on June 15th, 1928.

FORMICINAE.

Acanthomyops (Dendrolasius) fuliginosus, Latr.

This is a shining black ant which generally dwells in trees, but it will also build its carton nests in the earth, at the roots of trees and away from them, or even in houses and cellars. Its most northern locality in the British Isles is the Isle of Man, where we discovered it in 1923. It possesses an aromatic smell which is unlike that of any other ant. It may be seen walking in files along regular tracks for long distances, and the nest can often be traced by following up these

tracks. On the other hand it is sometimes very difficult to locate. The nest is constructed of carton which the ants manufacture by chewing up fragments of wood and bark mixed with earth and cemented together with the secretion from the mandibular glands, which are greatly developed in this species. These carton nests, which are often very large, have the appearance of a huge sponge, and consist of a number of irregular cells, separated from each other by thin walls which are rather brittle. These nests were formerly believed, by Huber and other early writers, to be excavated out of wood (and they certainly look like it) which was stained black by the ants' acid. The carton is usually black, but sometimes light brown, or reddish-brown according to the colour of the soil used in its construction. In one case to be mentioned later, it was entirely yellow. In Windsor Forest we have found this ant nesting in an old rabbit burrow in a bank; in oak trees; in the stools of Scots' pine, and larch trees; in a partly hollow hawthorn tree which was cracked, and the carton nest could be seen through the crack high up in the tree; etc. The nest made of yellow carton referred to above was originally situated in the base of a standing larch, but when the tree was cut down some five years ago the ants deserted the stool, and took possession of the trunk of the tree lying on the ground. The trunk was twelve feet long and the ants were using both ends to enter and leave the nest. The yellow carton filled up the whole of the broader end, and was present in strips among the perforated wood reaching to the other end. This tree was cut up in sections for me on September 18th, 1929, and a fine sample was selected for the Oxford Museum.

We have taken a considerable number of Myrmecophiles with this ant in Windsor Forest, as the following list will show. Those species not printed in italics may be only chance guests, and, at any rate, have not been recognised as true myrmecophilous species here-to-fore.

COLEOPTERA.

Microglossa gentilis, Märk.; *Oxyroda vittata*, Märk.; *O. recondita*, Kr. (several 10.v.28; first record with this ant); *O. annularis*, Sahl. (10.v.28, 18.ix.29, 24.ix.29); *Thiasophila inquilina*, Märk.; *Myrmedonia funesta*, Gr.; *M. humeralis*, Gr.; *M. cognata*, Märk.; *M. lugens*, Gr.; *M. laticollis*, Märk.; *Notothecta confusa*, Märk.; *Atheta circellaris*, Gr. (10.v.28, 24.ix.29 also taken with this ant by Allen in Devonshire in 1918); *A. sodalis*, Er. (eight 28.iii.28, several 10.v.28. I have taken this beetle with five species of ants, in various localities, on different occasions). *A. palustris*, Kies., *A. sericea*, Muls., *A. inquinula*, Er., *A. germana*, Shp., *A. celata*, Er., *A. aterrima*, Gr., *A. parva*, Shp., *A. muscorum*, Bris., *Falagria sulcatula*, Gr., *F. obscura*, Gr., and *Placusa pumilio*, Gr., were all taken in the "runs" of this ant and in refuse beneath the larch trunk with the yellow carton, in September and October, 1929. *Quedius maurus*, Sahl. (28.iii.28); *Q. puncticollis*, Th. (six 4.x.27, 11.x.27. Walker has taken this beetle with *fuliginosus* at Cothill, in 1914, on several occasions and he writes "under conditions which led me to suppose that it is a true inmate of the nest of this ant"; Collins has also taken it with this ant in the Oxford district. Walker again found it with this ant at Tubney in 1920); *Q. brevis*, Er., in March, May, and June in 1928 and 1929; *Othius melanocephalus*, Gr. (several

4.x.27) ; *O. myrmecophilus*, Kies. ; *Cephennium thoracium*, Müll., (six 10.v.28. This species has been found in other localities with different kinds of ants). *Trichopteryx thoracica*, Walk. (28.iii.28, 10.v.28) ; *T. montandoni*, All. (1.x.29) ; *Ptilium kunzei*, Heer., *P. rugulosum*, All., *P. n.-sp.*, and *Ptenidium nitidum*, Heer., in the "runs" and refuse from the larch tree nest, September and October, 1929. *Amphotis marginata*, F., *Coninomus constrictus*, Gyll. (14.x.29. Walker has taken this species with the same ant at Tubney, in 1920, and I have done so, at Woking, in 1921).

HYMENOPTERA—*Braconidae*.

Paxylomma fuliginosi, Wilkinson. On September 18th, 1929 we observed several specimens of a large *Paxylomma* in Windsor Forest. Two of these were captured and proved to be a fine new species which Wilkinson has described, in a paper read by that author and myself before the Entomological Society of London, under the above name. The Braconids were hovering over the ants from the colony of *fuliginosus* inhabiting the large felled larch tree described above. On a subsequent visit, on October 1st, another specimen was secured. Cobelli has shown that another species, *P. cremieri*, de Romand, found on the Continent with *fuliginosus*, lays its eggs in the ants' larvae, when they are being carried by their nurses. It is very probable that the same habits are common to *P. fuliginosi*, as it was not until the tree which housed the ants was being cut up that the Braconids put in an appearance. They were probably attracted by the odour given off by the ants when agitated, as well as by the presence of the larvae which they were carrying.

HYMENOPTERA—*Chalcididae*.

Spalangia erythromera, Först.

This shining black Chalcid is only to be found in the nests of *fuliginosus* and I have proved by experiment that it is partly on friendly terms with its hosts, and is parasitic on the larvae of various small flies which live in their nests. We have found it with *fuliginosus* in Windsor Forest, and have bred it from the pupae of *Milichia ludens* and *Neophyllomyza fagicola* taken in the nests of that ant.

HYMENOPTERA—*Proctotrupidae*.

Platygaster sp. ? Several examples of a very small species of this genus were taken with *fuliginosus* on September 3rd, 1929.

Amblyaspis scutellaris, Kief. A specimen was taken in the nest in the cracked hawthorn on June 14th, 1929. Other species of this genus, and varieties of this and other species have been captured with this same ant in other localities.

DIPTERA.

Apiochaeta aequalis, Wood. Several specimens were taken with *fuliginosus* in Windsor Forest on October 11th, 1927. This fly has been found in numbers with the same ant on various occasions and in different localities.

Limosina claviventris, Strob. (= *curtiventris*, Stnh.). Several specimens occurred in a *fuliginosus* nest in Windsor Forest on September 20th, 1927. This fly has been recorded in some numbers from nests of the same ant in other localities.

Milichia ludens, Wahl.

The larvae of this fly, which is only found with *fuliginosus*, and is very rare in Britain, were present in some numbers in a nest of this ant situated in the base of an oak tree on September 3rd, 1929, and also in the nest in the larch tree on September 18th, 1929.

Neophyllozoma fagicola, Hend.

This species was described by Hendel, in 1929, from Austria. We took it (an addition to the British list) in Windsor Forest, in a nest of *fuliginosus* in the stool of a Scots pine on September 9th, 1925, and again in a nest situated in a bank on September 28th, 1926.

Scatopse transversalis, Lw.

Specimens of this fly, the regular associate of *fuliginosus*, were taken in Windsor Forest, in the nest situated in a bank, on October 4th, 1926.

APHIDIDAE.

Stomaphis quercus, L.

On September 4th, 1929, *fuliginosus* was found to be attending a colony of this aphid on an oak tree situated near their nest. This was the first time I had found *quercus* with this ant at Windsor. This species was first taken in Britain many years ago by the late F. Walker at Dulwich, and nothing was known about its connection with ants. It was not found again until September 22nd, 1921, when I discovered specimens on an oak tree at Woking. My attention was called to these insects by the clusters of ants which were attending them. I found it again at Woking on October 7th, 1921, at Wimbledon Common, on July 18th, 1923, at Tubney, on July 16th, 1924, and at Woking on July 29th, 1925, on oak trees, in every case attended by workers of *fuliginosus*. On October 1st and 14th, 1929, the colony at Windsor was still being attended by these ants. On the latter date my attention was specially attracted to several specimens which were coloured differently and were smaller and more slender than the others. When submitted to my friend Mr. F. Laing of the British Museum, he pronounced them to be apterous ♂♂. This sex has very seldom been observed before.

The following other species of myrmecophiles have been found with this ant at Windsor:—the Collembolid *Cyphodeirus albinos*, Nic.; the Acarus *Urodiscella ricasoliana*, Berl. (on the bodies of the ants on September 14th, 1926) and *Laelaps cuneifer*, Mich.; and the "wood-louse" *Platyarthrus hoffmanseggi*, Brdt.

Acanthomyops (Donisthorpea) niger, L.

This ant is very abundant and widely distributed in the British Isles, nesting in the earth, under stones, in tree stumps, and even in towns, under the pavements, and in houses, etc. It is not, however, very abundant in Windsor Forest and very few myrmecophiles have been found in company with it. One very large colony was found under the bark of a large beech tree on August 26th, 1925, many males, as also egg masses, and cocoons of the ants being present. An example

of *Atheta sodalis*, Er., was captured in this nest, as also *Atheta analis*, Er.

In another colony under the bark of a beech tree an individual of *Euryusa optabilis*, Heer. (the usual guest of *A. (D.) brunneus*) was taken on July 30th, 1926.

We have also found it nesting in Scots pine stumps, in sphagnum, and under boards; in the last two cases *Cyphodeirus albinos* and *Platyarthrus hoffmanseggi* being present.

A marriage flight was noticed on July 24th, 1925, extending over a large area.

Acanthomyops (Donisthorpea) alienus, Först.

This species is not nearly so widely distributed nor so common as *niger*, and it lives a more subterranean life. The only example we have met with so far in Windsor Forest was a single male taken sheltering under the bark of a felled beech on August 14th, 1929.

Acanthomyops (Donisthorpea) brunneus, Latr.

This very local species has only occurred in Oxfordshire and Berkshire in this country, and Windsor Forest is its headquarters. Here we have worked out its life-history, and many happy hours have been spent investigating its nests. It is a regular dweller in trees and we have found it nesting in oak, elm, ash, beech, poplar, willow, chestnut, hawthorn and maple. On August 8th, 1928, however, a colony was inspected inhabiting the timbers of the roof of "Ranger's Lodge." The beams were riddled by the ants, which had been present in considerable numbers. The nests are situated inside the trees, and may be in the roots, the centre of the tree, or in one of the main branches, and quite high up. The marriage flights take place in June and July, and the winged sexes are found present in numbers in the nests in those months, and, preparatory to a flight, running on the outer surface of the tree. After this flight, the young females enter holes or crevices in trees, boughs, etc., and found a new colony. Solitary young queens are found in such situations; and young colonies, consisting of a few small workers, with their galleries extending only a short distance into the wood. As the colony grows the galleries extend, until the greater part of the branch, or inside of the tree, is riddled with them. Some of the borings are as fine as lacework, and others much coarser, with much larger passages. In course of time vast quantities of frass accumulates, caused by the ants continually excavating chambers, galleries, and passages in the hard wood. The ants themselves run on the surface of the tree in tracks, under and in the crevices of the bark, and are not conspicuous; disappearing when disturbed.

A considerable portion of the food of this ant consists of the excreta of large grey plant lice (mentioned later) which they rear. I have also seen them carrying Psocids, and other small insects; and in captivity they will devour dead flies, honey, etc.

In observation nests without a queen the workers lay parthenogenetic eggs which produce very small workers.

Very many insects have been taken with *brunneus* at Windsor, but as before only the true, or known, myrmecophiles are printed in italics.

COLEOPTERA.

Aleochara sanguinea, L. in company with *brunneus* on June 7th, 1924. (I have taken this species in birds' nests in Richmond Park). *Microglossa gentilis*, Märk., has occurred with this ant on July 9th and 24th, 1925, and June 30th, 1926. (It is found usually with *fuliginosus* and also in birds' nest). *M. pulla*, Gyll. July 31st, 1925 (also usually with *fuliginosus* and in birds' nests). *Oxyopoda recondita*, Kr., often abundant with *brunneus* at Windsor. *Ilyobates propinguus*, Aubé, June 19th, 1924—"the behaviour of this individual in the presence of the *brunneus* workers was exactly that of an ants' nest beetle." (It has been taken with *rufa* in France and Germany, and the late H. Dollman found it with *flavus* and *Myrmica* sp. at Ditchling). *Myrmedonia limbata*, Pk. June 6th, 1924. *Drusilla canaliculata*, F. June 29th, 1924. *Callicerus rigidicornis*, Er., in a mole's nest, at the foot of a "*brunneus*" tree, full of the ants August 2nd, 1929. (This beetle has been taken with *fuliginosus* at Chobham by the late E. Saunders, and Wellington College, Joy; twice at Woking with *rufa* by the late G. C. Champion; and we have taken it with *niger* in the New Forest). *Atheta nitidula*, Th., sometimes not uncommonly (generally recorded with *fuliginosus*). *A. vicina*, Steph., some seven specimens were taken with *brunneus* on October 12th, 1926. (Harwood took 20 specimens with *rufa* in the Limpsfield Woods, Kent; Walker found it with *fuliginosus* at Tubney, and I captured it with the same ant at Oxshott). *A. analis*, Er. August 5th, 1925, etc. *A. sodalis*, Er. June 19th and 25th, September 3rd, 1924. *Euryusa optabilis*, Heer, frequently. *E. sinuata*, Er., generally present and often in numbers. *Tachyusida gracilis*, Er., nine specimens of this beetle were taken by me in a nest of *brunneus* in an old oak in October, 1926, the only time it has ever occurred in Britain. *Quedius ventralis*, Ahr., March 28th, 1928 (recorded with *fuliginosus* by Rouget in France; Crotch took it with the same ant at Weston and Champion at Woking). *Q. aetolicus*, Kr. (*subapicalis*, Joy) October 16th, 1926 (usually found in birds' nests, fungi, etc.). *Q. scitus*, Gr., June 29th, 1924, August 31st, 1926, four September 16th, 1927, February 15th, 1928 (Crotch recorded it with *fuliginosus* at Cambridge). *Xantholinus glaber*, Nord., June 29th, 1924. (Often found in birds' nests. Rouget took it with *fuliginosus* in France, and Wasmann regards it as the regular guest of that ant; Schmitz found it with *brunneus* in Holland. In England Fowler records it often in company with ants, and Crotch with *fuliginosus* at Cambridge). *Leptacinus formicetorum*, Märk., one specimen October 16th, 1926 (this is the regular guest of *F. rufa*). *Othius myrmecophilus*, Kies., August 26th, 1925, August 31st, 1926. *Medon propinquus*, Bris., several May 5th, 1924. *Leptinus testaceus*, Müll., one November 26th, 1924. (This little blind beetle is parasitic on field mice and also occurs in the nests of *Bombi*; it has been recorded with *fuliginosus* by Rye at Mickleham, Champion at Tilgate Forest and Guestling by Collett). *Calyptomeres dubius*, Marsh., December 11th, 1924 in the wood-frass from the centre of the nest. *Stenichnus godarti*, Latr., August 31st, 1926, several February 15th, 1928. *S. exilis*, Er., May 4th, 1924. *Euconus claviger*, Müll., nine specimens in October, 1926; its only record for Britain. *Euthia schaumii*, Kies., June 25th, 1925. *E. formicetorum*, Reitt., August 12th,

1924; *Batrisodes venustus*, Reich., not uncommon. *B. delaportei*, Aubé., abundant, first British capture June 14th, 1924. *B. adnexus*, Hampe, very rare June 6th, 1924 first British capture, one June 30th, 1926. *Euplectus punctatus*, Muls., July 9th, 1926; *E. afer*, Reit. var. *infirmus*, Raff. June 25th, 1925 first British record, June 29th, 1925, and in numbers July 9th, 1926, always in company with *brunneus*. *E. sanguineus*, Den., June 26th, 1925. *E. piceus*, Mots., February 15th, 1928 (Märkel records it with *A. (D.) emarginatus* in Germany. Fowler gives *F. rufa* Parkhurst Forest, and Collins took it with *Leptothorax acervorum* at Wytham Park. André notes seven species of *Euplectus* with ants). *Trichopteryx montandoni*, All., on various occasions, and sometimes abundant. *Ptenidium kraatzi* August 12th, 1924, September 16th, 1924, July 17th, 1925 in some numbers. *P. turgidum*, Th., scarce October 12th, 1925, May 5th, 1925, July 9th, 1926. *Symbiotes latus*, Redt. In the tracks of the ants, June 29th, 1925, June 30th, 1926 (Wasmann gives *brunneus*, Redtenbacher 1858 says "this species lives with ants; the late E. W. Janson recorded it, in 1859, "moving about amongst the ants" in a strong colony of *A. (C.) umbratus* inhabiting an old tree. *Dendrophilus punctatus*, Hbst; July 9th and 17th 1925. *Plegaderus dissectus*, Er. September 3rd, 1924, June 25th, 1925, February 15th, 1928, and September 6th, 1928, occasionally abundant mixed with the ants and in their frass (it is, however, more usually found under beech and other bark away from ants). *Abraeus globosus*, Hoff; very frequently with *brunneus*, and sometimes common (Perris described the larva from a *fuliginosus* nest, Wasmann gives *brunneus*, *fuliginosus* and *rufa*, Rouget *fuliginosus*, and André mentions *F. rufibarbis* also. Fowler records it from Mickleham with *fuliginosus*, and Crotch with the same ant at Weston, and remarks "I have no doubt this species is a truly myrmecophilous insect." Walker also took it with *fuliginosus* at Tubney. Although often found in rotten wood and under bark away from ants, there can be no doubt this beetle shows a great liking for the company of ants). *A. granulum*, Er., literally in hundreds in the frass of an ash tree in company with *brunneus*, February 15th and 22nd, 1928. (Märkel recorded it with *F. rufibarbis* in Germany. Crotch with *fuliginosus* at Cambridge). *Corticaria serrata*, Pk., June 8th, 1926 (Fowler records it with *rufa* at Weybridge and *fuliginosus* at Horsell). *C. elongata*, Gyll., September 3rd, 1924. *Cryptophagus pilosus*, Gyll., December 11th, 1924. *C. umbratus*, Er., January 15th, 1925 (this [and the proceeding] species is generally found in haystack refuse, etc. I have taken it deep down in the bed of a badger at Windsor). *Ptinus subpilosus*, Strm., April 22nd, 1924, August 12th, 1924, August 17th, 1925 (it has been found with *fuliginosus* in other localities: I regard this beetle as a regular myrmecophile). *Cryptocephalus pusillus* F., larva in larval case 29.vii.29 (Weise showed that it was probable that all the species of *Cryptocephalus* change to pupae in ant's nests. I reared a specimen of *C. fulvus*, Goez., from a larva taken in a *fuliginosus* nest at Wellington College in April 1910). *Scryptia fuscula*, Müll., in wood of ash trees bored by, and full of, workers of *brunneus* June 30th, 1926, July 9th, 1926, July 4th, 1927, several specimens on each occasion (Fowler remarks, ". . . the larva and the perfect insect appear to be, at all events to a certain extent myrmecophilous") *Dryophthorus corticalis*, Pk., in the utmost pro-

fusion and only in "*brunneus*" trees; first record for Britain July 9th, 1925. Its larvae and pupae are often present in the galleries side by side with the ant's brood. *Stereocorynes truncorum*, Germ. This species has occurred very frequently in oak trees inhabited by *brunneus* and sometimes in abundance in their galleries, but never in trees uninhabited by the ants.

HYMENOPTERA.

Chalcididae.

Pteromalus deplanatus, Nees., Sept. 16th, 1926, July 29th and October 23rd, 1919, etc., sometimes in abundance (It is probable that the insect is only hibernating in the nests; Mr. Waterston told me this is the same species one finds in houses, behind pictures, etc.).

Proctotrupidae.

The following species of *Proctotrupidae* have been taken in *brunneus* nests at Windsor. It is impossible to say if they have any real connection with the ants. In certain genera a number of species in each have been found with ants, and it is possible they are parasitic on the ants, or some of the guests; but in the present state of our knowledge, a bare list must suffice:—*Trichacis didas*, Walk. (abundant); *Aphanogmus tenuicornis*, Th. (twice); *Aclista scotica*, Keif.; *Belyta nigriceps*, Cam. (three times, once in numbers); *Conostigmus lucidus*, Kief. (twice); *C. alutaceus*, Th.; *C. leptothorax*, Keif. (twice); *C. innotatus*, Kief.; *C. dubiosus*, Kief. (twice); *C. sp.?* near *wasmanni*, Kief. (several times, both sexes); *Ceraphron scoticus*, Kief.; *C. terminalis*, Först., ♂ (July 29th, 1929, 1st record for Britain), *Ceraphron sp.?* ♀; *Synacra brachialis*, Nees.; *Acropiesta rufiventris*, Kief., and *A. striolata*, Th.

DIPTERA.

Apiochaeta aequalis, Wood, many imagos and puparia in two *brunneus* nests September 3rd 1924 (I have found it in numbers on various occasions with *fuliginosus*, in other localities). *Atrichopogon lucorum*, Mg. It is perhaps uncertain if the fly has any real connection with this ant; never the less its larvae were found in numbers in the cells of the ant in wood in the centre of the tree among the ants (and their brood) of a very populous colony in January, 1925. Many male and female imagos emerged in April.

HEMIPTERA.

Pilophorus perplexus, D. & S. On June 25th, 1924 young larvae of this bug were observed running about on the trunks and dodging in and out of the cracks in the bark, among the ants, of oak trees inhabited by *brunneus*. Later in July perfect insects were obtained by beating the branches of these trees. This insect is frequently to be found on *brunneus* trees.

APHIDIDAE

Stomaphis quercus, L.—On October 1st, 1925 specimens of this Aphid were observed to be attended by workers of *brunneus*. As we have seen this species is usually attended by *fuliginosus*. *Stomaphis longirostris*, F.—This species was new to Britain when I first discovered

it in Windsor Forest in 1924. On April 24th a number of very young green *Stomaphis* were found under the bark of an oak tree in the "runs" of *brunneus*, and a cluster of large egg-like cases, from which young plant lice hatched later. The ants were carrying some of the aphids about, and when disturbed they hurried off with them into safety. These insects were continually met with under the bark of various trees inhabited by *brunneus*, and on June 6th, I found many very fat, large examples, grey in colour and swollen with young. My friend Mr. Laing identified these as the above species. These plant-lice generally have the end of their very long proboscis buried in the wood of the tree, and however large they may be the ants drag and jerk at them unmercifully to make them leave go, so as to carry them into safety when danger threatens.

DIPLOPODA.

Proterojulus fuscus, Am. Stein, often occurs in great profusion among the ants in the frass and in the wood of trees inhabited by *brunneus*.

PSEUDOSCORPIONINA.

Chelifer wideri, C.L.K. occurs in the same situations and under the same condition, often in numbers, as the last mentioned creature.

ARANEINA.

Tetrilus arietinus, Thor.—The egg-sacs, young and adults of this myrmecophilous spider are frequently met with in *brunneus* nests. The egg-sacs are fastened to the walls of the galleries and passages of the nest.

Harpactes hombergi, Scp. This spider preys on ants and I have frequently met with it in, and in the neighbourhood of, *brunneus* nests.

Microneta viaria, Bl.—October 16th, 1926. (I have taken this spider with other species of ants on many occasions and in different localities).

ACARINA.

Antennophorus, sp?

On June 25th, 1925, many of the ants in a *brunneus* colony were found to have a mite of this genus fastened on their chins. Some of these mites were sent to Father Wasmann who considered them to belong to an undescribed species. These interesting creatures are partly true guests being fed by the ants, and partly ecto-parasites being always attached to the ants bodies. Sometimes two, or more, will be found resting on a single ant. There are four other British species of *Antennophorus*, each being found with a different species of ant.

Laelaps (Cosmolaelaps) cuneifer, Mich.

On July 20th, 1926, examples of this species were found in the *brunneus* nest mentioned above. This mite is found with a number of species of ants; it is a scavenger in their nests, feeding on the dead bodies of ants, etc.

DIPLOPODA.

The millepede *Proterojulus fuscus*, Am. Stein, sometimes occurs in great numbers in *brunneus* nests in Windsor Forest.

Both the Collembolid *Cyphodeirus albinos* and the Isopod *Platyarthrus hoffmanseggi* are found with this ant.

Acanthomyops (Chthonolasius) flavus, F.

The little yellow turf ant is very widely distributed, it chiefly nests in fields, under stones, etc., and raises the well known earth-mounds which resemble mole-hills covered with grass. On August 12th, 1926, males were present in some numbers, and also the Collembolid *C. albinos* and the aphid *Forda formicaria*, C. Heyd, in a colony situated under a large flat stone. The Collembolid also occurred and the millipede *Polyxenus lagurus*, L., in a large colony nesting in the centre of an old hawthorn tree. Most of the workers in this nest were very small and pale in colour. On August 14th, 1930, winged females were swept off grass in the evening.

Acanthomyops (Chthonolasius) umbratus, Nyl.

This is a larger, more brightly coloured, ant than *flavus* and its workers are more uniform in size. It is widely distributed in Britain, but always uncommon, with usually isolated colonies. It nests in the earth, and also in trees and stumps, and under stones, etc., and often its colonies are very large. I have demonstrated that it constructs carton, though in a much less degree than *fuliginosus*. The newly fertilized females found their colonies in nests of *A. (D.) niger*.

I have found *umbratus* nesting at the foot of, but also in, various trees in Windsor Forest. I know of a very large colony in a large oak tree, the ants entirely occupying the wood mould with which the lower half of the tree is filled. In this nest the curious round yellow mite *Sphaerolaelaps holothyroides*, Leon., was found to be in abundance on June 13th, 1928. Another strong colony was found in the stub of a felled poplar on October 26th, 1927. The mite *Antennophorus uhlmanni*, Hall., occurred in some abundance in this nest, as many as 3 or 4 specimens being found on many single workers. *Uropolyaspis humeratus* also occurred on the femora of various workers, its usual situation. A round red mite (unidentified) was found on the gasters and tarsi of some of the workers, and one example was observed fastened to the foreleg of an *Antennophorus*! Another small mite (also unidentified) was crawling free about the nest, and *Cyphodeirus albinos*, Nic., was present in numbers. On August 4th, 1926, in a strong colony nesting in the root of an oak tree, workers of *A. (D.) niger* were found to be present, thus proving that an *umbratus* female had originally founded her colony in a *niger* nest, and most of the original *niger* workers had died off. Many males of *umbratus* occurred in this colony.

Perhaps the most interesting discovery made in connection with this ant at Windsor was the finding of a joint colony of *umbratus* and *brunneus* (referred to above under *brunneus*) in an ash tree on June 25th, 1924. Workers of both species were placed in a small tube together and were found to be quite friendly. It was evident that an *umbratus* queen had founded her colony in a *brunneus* nest. This, as far as I am aware, had never been observed before.

This tree was felled a year later when the *brunneus* workers were

found to be in smaller numbers, but the *umbratus* were in greater numbers in cells with their larvae in the soft wood and frass at the base of the tree.

On August 1st. 1930,* at about 10 a.m. (summer time) *umbratus* females both winged and deälated, were observed in the town of Windsor, and later further afield, crawling about hunting for *niger* nests, etc., in which to found their colonies. This showed that a marriage flight had taken place in the afternoon and evening of the day before.

Acanthomyops (Chthonolasius) mixtus, Nyl.

This species, which is slightly more widely distributed, though somewhat rarer than *umbratus*, is intermediate between *flavus* and *umbratus*. Its habits are similar to those of the latter species. I have demonstrated that the females found their colonies in nests of *A. (D.) alienus*.

On April 10th, 1928, a young deälated female *mixtus* was taken in a sandpit in Windsor Forest. In my book on *British Ants* (2nd Edtn. p. 279) I record finding a number of young freshly very active deälated females (together with males and winged females) in a *mixtus* nest situated in a juniper root at Box Hill in September, 1913, and I suggested that such young females may have already been fertilized in the nest, and as the females of this species do not lay till the following year, and as only one queen occurs in a nest, these young queens may leave the nests in the spring, which would account for the isolated females found on roads, etc., at that time of the year.

Formica rufa, L.

This species is known as the "Horse Ant," "Wood Ant," etc., and it constructs the well known hillocks of pine needles in fir woods, and also of other materials according to its surroundings. It is widely distributed in England, but its range is peculiar in Scotland, and it is scarce in Ireland. Its range at Windsor is considerably less than it was formerly. When the late W. G. Blatch collected Coleoptera in *rufa* nests at Windsor in September, 1887, he found their hillocks in the Great Park; now one has to go much further afield in the Forest to find *rufa* nests. A winged female was taken in a sand pit on May 28th, 1930.

We have taken a number of myrmecophiles with this ant in this locality:—

COLEOPTERA.

Oxypoda formiceticola, Märk., *O. haemorrhoea*, Sahl., *Thiasophila angulata*, Er., *Dinarda märkeli*, Kies., *Notothecta flavipes*, Gr., *N. anceps*, Er., *Atheta analis*, Gr., *Atheta sodalis*, Er. (on several occasions), *Quedius brevis*, Er., *Xantholinus atratus*, Gr., *Leptacinus formicetorum*, Märk., *Othius myrmecophilus*, Kies., *Phloeocharis subtillissima*, Mann. (on several occasions), *Pteryx suturalis*, Heer. (in numbers on several occasions), *Trichopteryx montandoni*, All., *Ptilium myrmecophilum*, All. (Blatch IX. 87), *Cephenium thoracicum*, Müll. (on several occasions, I have also taken it with this ant at Weybridge, etc.), *Dendrophilus*

* On the same day males and winged females of *brunneus* were swept off grass, and winged and deälated females were observed crawling about in Windsor Forest.

pygmaeus, L., (Blatch IX. 87), *Myrmetes piceus*, Pk., *Monotoma conicicollis*, Aub., *M. formicetorum*, Th. (this species was abundant in a *rufa* nest on September 17th, 1926, but has not turned up again since then).

HYMENOPTERA—*Proctotrupidæ*.

Tropidopria fuliginosa, Wasm.

DIPTERA.

Scatopse transversalis, Lw.

COCCIDAE.

Newsteadia floccosa, Westw.

COLLEMBOLA.

Cyphodeirus albinos, Nic.

DIPLOPODA.

Proterojulus fuscus, Am. Stein, in considerable numbers, several of the extremely rare male on two occasions.

Polyxenus lagurus, L., often abundant.

ARANEINA.

Thyreosthenius biovatus, Camb.—always present.

Formica sanguinea, Latr.

The blood-red "Robber ant" is the only slave-making species in this country. Its distribution is scattered stretching from Dorset to Worcester, and reappearing in Westmoreland, and in the Highlands of Scotland where I discovered it in several localities.

It nests in the ground and also in stumps, and it covers its nests in the summer with a low layer of vegetable débris.

This is not the place to deal with the slave-making habits of *F. sanguinea*, but a full account of this interesting instinct will be found in *British Ants* (2nd Edtn., p. 323).

It occurs in several areas in Windsor Forest chiefly occupying the stumps of the Scots pine, but we have found it nesting in banks on several occasions.

On May 31st, 1927, Miss Kirk captured a fine male of the spider *Linyphia furtiva*, Camb., which was running in company with and very closely resembling, the workers from a colony of *sanguinea* situated in a large Scots' pine stump. The little ant *Leptothorax acervorum*, F., was living in this nest, and the millepede *Polyxenus lagurus*, L., occurred in the débris of the nest.

On May 27th, 1929, the day after a heavy thunderstorm which had extinguished a forest fire in this area, a number of *sanguinea* workers was observed in a sand pit. They were toiling up the steep side of the pit, carrying their fellows, their slaves, and their prey. Two examples of the beetle *Dinarda dentata*, Gr. (the regular guest of this ant) were captured, when climbing up the side of the pit in company with the sanguineas. A newly constructed *sanguinea* nest was found situated in the ground at the top of the sand pit. It was evident that the ants had moved their nest to this spot, either on account of the fire, or the thunderstorm. This nest was dug up on

the 29th, but the only insect found other than ants, their slaves, and brood, were one example of *Atemeles emarginatus*, F. (rather a surprise as it is the regular guest of *Formica fusca*, L., and *Myrmica* species), and one example of *Atheta linearis*, Grav.

Formica fusca, L.

This species is widely distributed in the British Isles and is a common species; but it is not abundant in Windsor Forest, where we have found it nesting under bark, in stumps, and in banks, etc. It is a cowardly ant, and is the species upon which *F. sanguinea* most frequently makes slave raids.

Males were taken in a sandpit on July 29th, 1930, and by evening sweeping on August 13th.

On May 19th, 1927, a female of the Myrmecophilous fly *Microdon eggeri*, Mik., was captured in Windsor Forest, which was depositing eggs in a Scots pine stump inhabited by this ant.

INTRODUCED SPECIES.

MYRMICINAE.

Monomorium pharaonis, L.

This species has already been dealt with (see p. 2).

DOLICHODERINAE.

Iridomyrmex humilis, Mayr.

This is the well-known "Argentine Ant," which is rapidly becoming cosmopolitan. Its natural habitat is the Argentine and Brazil, whence it has been transported by commerce, etc., to New Orleans (extending to the Gulf of Mexico, over five thousand square miles); California, Louisiana, Cape Colony and Basutoland. It now occurs in the Canary Islands and Madeira, and has been observed in Portugal, Guernsey, the centre of France, Belgium, Hamburg, and I discovered it at Palermo in Sicily in 1926.

In Britain it has been recorded from, Exeter, Plymouth, Devon; Eastbourne, Sussex; Enfield, Middlesex; Tring, Herts; Manchester, Lancashire; Broadbottom, Cheshire; Edinburgh and Belfast.

On August 17th, 1927, this species was observed running about on the dinner table at my house at Putney on the evening of my Entomological Club supper. I naturally concluded that they had been brought up from Windsor with the flowers and grapes, which had been so kindly given to me. Consequently on August 30th a visit was paid to the Royal gardens, and the Argentine ant was found to be present in profusion in all hot-houses. I was informed that it had occurred there for many years. Though a nuisance in many ways, at Windsor at any rate it does not hurt the flowers, fruit, cucumbers, etc., etc., which are all exceptionally fine; and it has at least killed off all other ants and insect pests.

ADDENDA.

To page 3. *Myrmica lobicornis*, Nyl.

This ant, though by no means common, is widely distributed in Britain. Its colonies are usually small, and it nests under stones, in banks, etc., and is fond of sandy districts. A dealated female was taken in a sand pit in Windsor Forest on May 6th, 1930.

To page 4. *A. (D.) fuliginosus*, Latr.

On May 28th, 1930, a dealated female was found in a sand pit in Windsor Forest. The insect no doubt was hunting for an *umbratus* nest in which to found her colony, but the date is rather early for a female which had presumably only recently been winged.

On May 14th, 1930, a Chrysopid larva with its body covered with the remains of its prey was taken with *fuliginosus* in Windsor Forest. In my book "*Guests of British Ants*," I record taking the same larva with this ant at Oxshott, but unfortunately I stated it was a *Hemerobius* species. In that genus the larvae do not possess the habit of covering their bodies with the remains of their prey.

Two specimens of the Coleopteron *Cephenium thoracicum*, Müll., were taken with this ant on May 14th, 1930.

A *Xenotoma* species occurred with *fuliginosus* on October 11th, 1927. Mr. Nixon (to whom I am indebted for the name of the genus of this Proctotrupid and other species mentioned later) tells me that it is not in the British Museum collection, and may be new.

Exallonyx ligatus, Ners., was found with *fuliginosus* on June 14th, 1929.

To page 8. *Acanthomyops (Donisthorpea) brunneus*, Latr.

The beetles *Euplectus nitidus*, Fair., and *Microglossa gentilus*, Märk., were taken in nests of this ant on June 11th, 1930.

Rhyncolus truncorum, Germ., this rather rare weevil occurred in some numbers in a *brunneus* nest on July 15th, 1930, and subsequent dates. The beetles were in the cells with the ants and their brood; some even resting on the ants' larvae. I find that on every occasion when I have taken this beetle in Windsor Forest it has always been in company with this ant—such dates are July 31st, 1925, October 14th, 1925, July 14th, 1926, June 27th, 1927, and subsequent dates, in some numbers in a nest in an ash tree; February 16th, 1920. Sir Guy Marshall tells me that the species of an exotic genus allied to *Rhyncolus* always live with ants.

Teredus nitidus, F., is parasitic on wood boring beetles and has never, as far as I am aware, been recorded with ants before; nevertheless as it occurred in such numbers in the workings of, and with, this ant in Windsor Forest this year, the fact must be put on record. The other beetles which had, or were inhabiting the oak tree in which this nest occurred were *Anitya rubens*, *Dorcatoma chrysomelina*, Stn., *Rhyncolus truncorum*, Germ., *Atomaria pulchra*, Er., *Euryusa sinuata*, Er., and *Batrisodes delaportei*, Aubé.

The Dipteron *Apiochaeta brevicostalis*, Wood, occurred in the galleries of the above mentioned nest.

The Proctotrupid *Conostigmus lucidus*, Kieff., was found in a *brunneus* nest on November 16th, 1927, February 1st and 15th, 1928. I have recorded this species with *brunneus* before and it is evidently associated with it.

Caliceras reitteri, Kieff. A ♀ of this little Proctotrupid, which is new to Britain, which Mr. Nixon tells me is a very distinct but rare species was taken in a *brunneus* nest on June 8th, 1929.

A small Cynipid *Alloxysta ullricki*, Giraud, which Mr. Ferriere has kindly named for me, was taken with *brunneus* on July 8th, 1930. This belongs to a section which does not make galls but is parasitic on *Aphidae*. Hence no doubt its presence in a *brunneus* nest.

The small moth *Borkhausenia pseudopretella*, Steph.? was observed in some numbers in a tree inhabited by *brunneus*. The tree was apparently solid, but when cut down it was found to be hollow in the lower portion. The moths were with the ants in this hollow, and as it seemed entirely shut in, and must have been living on the débris, etc., of the nest for some time, possibly for years.

This brings these short notes on the ants and myrmecophiles of Windsor Forest to a close.

Of course space has not permitted much description of the habits of these interesting insects and their association together, but anyone who wishes to go more fully into the subject will find it dealt with in all its details in my *British Ants*, 2nd edition, 1927, and *Guests of British Ants*, 1927.

NOTES