

SOME DIPTERA AND OTHER INSECTS ASSOCIATED
WITH DECAYING ELMS (*ULMUS PROCERA* SALISBURY)
AT BROMLEY, KENT, WITH SOME ADDITIONAL
OBSERVATIONS ON THESE AND RELATED SPECIES

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During recent years, especially in 1965 and 1967-9, I have made observations on the Diptera visiting some old elm trees at Bromley at the edge of south-east London. These trees are situated in the wedge of farm and woodland which separates Hayes from Bromley Common. Most records relate to a short row of elms at the margin of a field on Oakley Farm, not far from the Rookery, formerly parkland but now used alternately as arable land and pasture for cattle. One tree in this group has supplied most of the species discussed below; it is still living but the decaying heart-wood has been exposed over much of the lower part of the trunk, at least since 1965, and a copious fungus growth has developed on this tree regularly each year. The two adjacent trees have partially decayed trunks often with oozing sap and these have provided some other species of flies. A few observations were also made on a completely dead standing trunk in a hedge separating arable fields on Hook Farm near Fisher's Wood; I knew this tree from 1961 onwards but it has now been cut down.

Many interesting species of flies, which I have in most cases not found elsewhere in the Bromley district in spite of considerable collecting for more than a decade, have occurred on these trees. Some of them are very scarce and their existence in this suburban environment is surprising. Clearly, constant observation of these trees over a long period would have been desirable but I have unfortunately only been able to visit them on three or four occasions in each year mentioned above and less often in other years. In view of the infrequency of my excursions in that area now and the apparently declining productivity of the trees studied, suggested by some recent visits, I decided it would be opportune to publish the records I have obtained as the acquisition of any important additional information now seems unlikely. Nevertheless, the results of this study emphasize how little is really known of the distribution of insects confined to a limited micro-habitat of such sporadic occurrence.

The Diptera associated with these trees may be roughly divided into two broad groups, those species with an interest in the rotten wood itself and those attracted by fungus fruiting bodies growing on

the trunks, although some of the former no doubt develop in the fungal mycelium which pervades the wood. Some of both groups have predatory larvae, while others still are parasites of other animals living in the trees.

THE INSECTS ASSOCIATED WITH THE FUNGUS FRUITING BODIES

Pleurotus cornucopiae (Paulet) Persoon (= *sapidus* Schulz)

The striking colonies of this gill-fungus appear annually on these trees and form a profuse growth of light brown brackets around the lower parts, occasionally spreading further up the trunk. There are usually several generations of fruiting bodies through the summer and early autumn, depending on weather conditions, as there were for example in 1967. *P. cornucopiae* is confined to *Ulmus* species and its seasonal occurrence, soft consistency, rapid growth and size of the gregarious brackets make it very attractive to a wide variety of Diptera, as was found by Buxton (1960) who reared nineteen species of flies from this fungus collected in June and July at Gerrard's Cross, Bucks.

Only one fly, the fungus gnat *Brachypeza radiata* Jenkinson, is apparently confined to the fungus from which Edwards (1924), Hamm and Buxton (*op. cit.*) reared it, and Madwar (1937) gave a full account of the structure and development of the larva. In fresh but mature fruiting bodies of the fungus I have usually found numerous white black-headed larvae of *B. radiata*; smaller numbers if the fungus is dry. Their burrows riddle the flesh and they occur almost to the exclusion of other larvae (except possibly Heleomyzidae), which appear after the *radiata* larvae have vacated and decay has begun. I reared a series of the fly from the Hook Farm tree, these emerging in July, 1966, and also obtained its Ichneumonid parasite *Proclitus edwardsi* Roman in the ratio of two *radiata* to one *edwardsi*. Madwar refers to some collections of larvae which produced no parasites, while in one case 80 per cent. were parasitised. *P. edwardsi* adults are often numerous on the foliage of the affected elms or adjacent trees and it has never been associated with any other host. Edwards (1924) thought that parasitism might account for the scarcity of adult *B. radiata*, but it is of course specific to this rather local fungus. I have often seen adult females visiting the fungus for oviposition and Madwar observed evening swarming, copulation and oviposition by the flies. The medium sized brown gnat is one of the more easily recognized Mycetophilids in the field, possessing characteristic radiating brown streaks on the wing membrane.

When the fungus begins to decay, darkening in colour but still moist, Drosophilid and *Fannia* (Muscidae) larvae appear. Adults of *Drosophila confusa* Staeger (= *vibrissina* Duda) and *D. phalerata* Meigen visit the fungus in abundance during July and August, and on 29.viii.1967, females of the strikingly marked Drosophilid *Leucophenga maculata* Dufour were numerous around it. Buxton

reared *L. maculata*, formerly considered rare, from this and other fungi and I have observed females visiting a variety of fungi in several localities. The more striking male, with a completely silver thorax, is less often seen but I have taken it by sweeping in Knole Park, Sevenoaks, Kent.

From a portion of detached fruiting body and wood detritus collected on 12.viii.1967 from the base of the tree on Oakley Farm, many *Drosophila confusa* and *D. phalerata* emerged from 17.viii.-9.ix., and several *Fannia* emerged during the same period. These included *F. monilis* Haliday, which was reared from this and *Polyporus squamosus* Fries by Buxton and although it apparently only develops in fungi it is definitely polyphagous since I have also seen females visiting *Hypholoma sublateritium* Fries (Old Windsor Wood, Berks., 10.ix.1967), *Fistulina hepatica* Fries and *Armillaria mellea* (Vahl) Fries (Pond Wood, Chislehurst, 30.ix.1967). Also reared from this sample was *F. canicularis* Linnaeus, which develops in decaying vegetable material of all kinds including decaying fungi (not previously reared from this one) and one female of *F. aequilineata* Ringdahl, which more probably originated from the wood detritus as it is known to develop in decaying elm wood, although there is a record from the fungus *Polyporus dryadeus* Fries (Fonseca, 1968). The latter record may, however, have been due to an error as that fungus grows on decaying trees and *F. aequilineata* was not reared during Buxton's extensive researches into fungus Diptera.

Also reared from that same sample were two males and a female of a *Megaselia* species (Phoridae), these emerging from 20-22.viii.1967. This is a difficult genus of which Buxton reared three species from *P. cornucopiae*. My specimens ran down in the keys provided by Lundbeck (1922) to *M. (Aphiochaeta) fungivora* Wood. This has, however, since proved to be a complex of species, mostly associated with lignicolous fungi and Colyer (1954) established that there were at least four species in this group in Britain. Two of these species were among those obtained from this fungus by Buxton, i.e. *M. imberbis* Schmitz and a second species which Colyer (*op. cit.*) described as new under the name *M. buxtoni*; he knew of no other material of *M. buxtoni* and I am not aware of any more recent records. On comparison of my specimens with the description and figure of the hypopygium provided by Colyer, they proved to be *M. buxtoni*, thus providing the second record of the species; Buxton's specimens were from Gerrard's Cross, Bucks. When describing *buxtoni*, Colyer added another species of the group to the British list, i.e. *M. frameata* Schmitz, the specimens involved being some reared by J. E. Collin, and originally recorded by Wood (1912) under the name *fungivora*, from an unnamed tree fungus. Then Buxton (*op. cit.*) gave an additional record of *M. frameata*, which he reared from *Hypoxylon fragiforme* (Persoon ex Fries) Kickx, also from Gerrard's Cross, Bucks. I am able to add a further locality

for this species since I caught a single male on a colony of *Meripilus giganteus* (Persoon) Fries on a log in the Rookery Wood near to the Oakley Farm elms on 2.ix.1967. I have not found it on *P. cornucopiae* but it would appear to be polyphagous. The paucity of records so far obtained for the species of the *fungivora* group is probably due to their being overlooked as a result of their restricted habitat and extreme similarity to each other and certainly does not reflect their true distribution.

A number of other flies were reared from this material of *P. cornucopiae* in addition to the Drosophilids, *Fannia* and *Megaselia*. These included several specimens of *Scatopse fuscipes* Meigen (Scatopsidae), emerging 9.ix.1967. Buxton obtained this species from *F. hepatica* and *P. squamosus* but not from *P. cornucopiae*. Mr. S. Trifourkis tells me that this species attacks a wide variety of fungi, often infesting samples after their collection for rearing other insects. A few of a small yellowish Cecidomyiid, perhaps the *Lestodiplosis* species which Buxton reared from the fungus, were also obtained.

Apart from those which I succeeded in rearing, several other fungivorous Diptera have been observed visiting the fungus, probably with the intention of ovipositing on it. A few Sphaeroceridae were collected from the caps of *P. cornucopiae*. These included two females, on 29.vii.1967 and 21.x.1967, of *Leptocera parapusio* Dahl, a species which has been reared from fungi on more than one occasion in the past (Richards, 1930). Buxton (1960) only obtained the fly from *Russula ochroleuca*, but it is probably polyphagous. According to Richards, females are apparently much more numerous than males of which he was only able to examine two specimens among seventy-nine examples of the species. *L. parapusio* is the only member of the genus to be regularly found in association with fungi and it has also been recorded from carrion and animal burrows. I subsequently took one male of a second species of the genus, *L. claviventris* Strobl on *P. cornucopiae* on 29.vii.1967; Richards (*op. cit.*) recorded the rearing of this species from ants' nests, narcissus bulbs and rhubarb roots and the capture of adults in animal burrows, but gave no records from fungi. There is, however, a single immature male in the British Museum collection from a "decaying toadstool" at Northaw, Herts., 6.x.1957 (J. C. Deeming) and I have seen one male reared by Mr. S. Trifourkis from *Chondrostereum purpureum* (Persoon ex Fries) Pouz., collected in Epping Forest, 13.ix.1971. These records give confirmation that the fly develops in fungi, but this is evidently only an occasional occurrence unlike the regular association of *L. parapusio*.

Other visitors to the fungus were *Mycetophila ruficollis* Meigen (= *lineola* Meigen of British list) (Mycetophilidae), *Suillia variegata* Loew (Heleomyzidae), *Anisopus cinctus* Meigen (Anisopodidae) and *Alloeostylus diaphanus* Wiedemann (Muscidae). All of these are known to develop in many fungi and *A. cinctus* also utilizes other

types of decaying vegetable material. *A. diaphanus* has carnivorous larvae, but these apparently feed only on fungivorous dipterous larvae. Of these four species only *S. variegata* was among those reared by Buxton from *P. cornucopiae*.

On 5.ix.1965 I took a female of the fly *Plesioclythia* (formerly *Platypeza*) *furcata* Fallén (Platypezidae) from a cap of *P. cornucopiae* on the Oakley Farm tree. This fly has always been reared from *Polyporus squamosus* and has been regarded as host specific, but a number of the polyphagous species discussed here develop in both fungi, which have a similar consistency, growth form and habitat. They do, however, have their own specific fungus gnats, i.e. *B. radiata* in *P. cornucopiae* and *Mycetophila cingulum* Meigen in *P. squamosus* and they do, of course, belong to widely different phylogenetic groupings of fungi. Both fungi occur on Oakley Farm as do their respective Mycetophilidae and *P. furcata* is commonly found there on its normal host. The possibility does exist that *P. cornucopiae* may be used by the Platypezid in seasons when the other plant is scarce. I have, however, sought Platypezid larvae in this fungus without any success as yet and my capture of this specimen may have been an abnormal occurrence.

P. cornucopiae does not deliquesce but dries and toughens in the later stages of decay. Then it becomes attractive to beetles, especially *Mycetophagus quadripustulatus* Linnaeus (Mycetophagidae) of which larvae and adults occur in very large numbers in the autumn and aggregations of hibernating adults can be found under the bark of the trees throughout the winter. Smaller numbers of *Dacne bipustulata* Thunberg (Erotylidae) are usually present also and a variety of Staphylinidae including *Philonthus* species occur. In September, 1961, I found several adults of *Tetratoma fungorum* Fabricius (Tetratomidae) in the fungus on Hook Farm. Paviour-Smith (1964) mentions *P. cornucopiae* (as *P. sapidus*) as rarely utilized by the beetle which is a winter species, normally feeding in *Piptoporus betulinus* on birch.

Volvariella bombycina (Persoon) Fries

On 2.ix.1967 a second species of fungus was rather unexpectedly found, growing directly on the heartwood of the Oakley Farm tree. The single fruiting body had a horizontal cap 7" in diameter, with a curved stripe 10" long, arising from a large rough volva protruding from the wood. The surface of the white cap was scale-covered and the gills were pink. This was undoubtedly the rarely found *Volvariella bombycina*. At this date the fungus was fresh and was apparently not very attractive to insects, but one *Drosophila funebris* Fabricius (Drosophilidae) and two *Leiomyza* (Asteiidae) were taken from the cap. A second *D. funebris* was seen to land on the surface of the wood below the fungus, whereupon a spider emerged from a silken tube in the heart-wood and captured it. On 16.ix. the fungus had dried out and no larvae could be found in it, although

D. funebris was again taken on the cap. Both flies have been reared from fungi, the only published record for *Leiomyza*, however, being the rearing of *L. laevigata* Meigen from *P. cornucopiae* by Buxton.

I have taken specimens of the genus *Leiomyza* on several species of fungi in various localities and it seems probable that they are polyphagous. There is, however, still some doubt surrounding the specific identity of my specimens. These flies are tiny shining brown insects with yellow legs. The key furnished by Séguy (1934) is unsatisfactory, separating three species on colour characters only, and the two species recognized in the British List apparently differ significantly only on the colour of the halteres, entirely yellow in *L. scatophagina* Fallén but with black knobs in *L. laevigata* Meigen. Séguy recorded the rearing of the former from stems of the reed (*Phragmites communis* Trin.) infested by *Lipara* species (Chloropidae) but made no comments on the biology of the other species he dealt with. This difference in larval habitat suggests a possible taxonomic difference from the forms developing in fungi. The specimens which I have found in association with fungi vary, however, in the colour of the halteres and the two taken on *V. bombycina* comprised one of each colour. Both forms were also present among the *Leiomyza* captured on *Oudemansiella mucida* Fries at Burnham Beeches, Bucks., 27.viii.1967. Other specimens taken on fungi, i.e. on *Tricholoma sulphureum* (Bullock) Fries at Thursley, Surrey, 28.viii.1967 and on *Hypholoma sublateritium* in Old Windsor Wood, Berks. 10.ix.1967, had black-knobbed halteres. Two series of *Leiomyza*, which I have recently reared, however, shed some light on the problem. Eleven specimens obtained from old dry *P. cornucopiae* growing on an elm root, elsewhere on Oakley Farm, emerging in early xi.1971 from material collected on 11.ix.1971, have dark-knobbed halteres and are also of small build (1.5 mm). A second series of nine specimens, reared from *Armillaria mellea*, collected in Pond Wood, Chislehurst on 7.xi.1971, the flies emerging 10-12.xii.1971, are larger (average length 2 mm) and all but two of them have clear yellow halteres; the other two have the knobs dusky. Comparison of this material has indicated a difference in the wing venation apparently correlated with the colour of the halteres. Those with yellow halteres have the distance between the cross-veins about equal to the last section of the fifth vein, while those with black knobs have this distance from two thirds to three quarters of the last section of the fifth vein in length. The two flies in the *A. mellea* material with darkened knobs are rather exceptional in having the latter condition of the wing, but in agreeing with their congeners in the larger size and they differ from all other material examined in having the legs entirely yellow (the last tarsal segment is usually black in contrast to the rest in this genus). The wing venation character seems to hold good but requires care as the cross-veins tend to be further apart in the females; the specimens with yellow halteres cannot be the species which Séguy described as

L. scatophagina Fallén as his illustration of the wing shows the distance between the cross-veins equal to the last section of the fifth vein. Examination of the genitalia will probably be necessary to sort out the specific limits within this genus.

On 21.x.1967 a large part of the heart-wood had been cut out, presumably by human agency, where the *Volvariella* had been and in the deep cavity excavated a tight cluster of seven incipient fruiting bodies of *V. bombycina* was present, these having yellowish caps with brown scales, the velum not yet broken. These *V. bombycina* were examined on 11.xi. while in a state of decay but no larvae were found in them. On 10.viii.1969 rotting *V. bombycina* was again seen on the tree and on this occasion one individual of *Drosophila obscura* Fallén and one of each sex of *Megaselia halterata* Wood were captured on it. *D. obscura* was not reared from fungi by Buxton (*op. cit.*) but he quoted a record of it from a fungus in France. *M. halterata* also was not among the Phoridae reared from fungi by Buxton but Colyer (1954) gave details of the known biology of the fly, which has been reared on more than one occasion from cultivated mushrooms, but not apparently from wild fungi. There is some slight doubt as to my identification of the species; the male agrees well with material I have examined in the British Museum (Natural History) collection but the female, which does not differ on external characters and is apparently the same species, has a distinct laterally flattened ovipositor with an apically narrowed tergite projecting over its base. All the females in the Museum collection have the simple ovipositor characteristic of the genus, suggesting that my specimen may be a different species.

A fungus of such sporadic occurrence as *V. bombycina* would be unlikely to have any Diptera specifically associated with it but there is no apparent reason why polyphagous species should not have utilized it more readily. Presumably this is due to some chemical factor possessed or lacked by the fungus.

THE INSECTS ASSOCIATED WITH THE ROTTEN WOOD

The exposed areas where the bark had become detached from the trunk of the tree on Hook Farm exhibited numerous exit holes of the Anobiid beetle *Ptilinus pectinicornis* Linnaeus of which I have also taken adults on the Oakley Farm tree, and these are utilized for nesting by the very slender-bodied, black solitary wasp, *Trypoxylon clavicerum* Lepeletier, which stock their nests with small spiders. Larger cavities in the heart-wood of the Oakley Farm tree are probably the old workings of the smaller stag beetle *Dorcus parallelipedus* Linnaeus, of which I once found a single adult sitting on the tree. These are used regularly by the Crabronid wasp *Ectemnius (Clytochrysus) cavifrons* Thomson and I have seen the females carrying large flies including *Pollenia* species and *Calliphora erythrocephala* Meigen (Calliphoridae) into the holes to provide the food store for their larvae. Fragments of the heart-wood which I

runs, are not often recorded and the only previous Kentish records for *insensilis* are those of Mr. A. A. Allen at Blackheath (Chandler, 1969). Earlier the same morning as my capture of *B. insensilis*, I obtained a female of the more common *B. scutellaris* Desvoidy by sweeping cow parsley near the Rookery; I have already recorded a previous capture of this species in the Bromley district (Chandler, *op. cit.*).

Lonchaea limatula Collin (Lonchaeidae)

The females of this little shining blue-black fly have turned up frequently on the heart-wood of the elm. I have specimens taken there on 5.ix.1965, 8.vii.1967, 2.ix.1967 and 29.vi.1968. On 2.ix.1967 one was observed ovipositing on the wood. The only other specimen I have come across was also a female collected from a beech log at Burnham Beeches, Bucks., 27.viii.1967. Collin (1953), when describing the species, was able to list five localities in Hants, Suffolk, Salop, Gloucs and Inverness and he recorded taking females in plenty around decaying beeches in the New Forest. Many species of the genus develop in rotting wood but Collin did not know of any associations with elm. Beaver (1967) recorded his rearing of four species, not including *L. limatula*, from larvae found under elm bark. *L. limatula* may prefer the heart-wood.

Chyromya sp. (Chyromyiidae)

A female of this tiny yellow fly was taken on the rotten wood on 2.ix.1967 and on this and subsequent occasions they have been observed hovering within the cavity in the heart-wood. Several were taken on the wing in this way on 10.viii.1969; all specimens captured are females but from rotten wood debris collected on 29.vi.1968 two males were reared, emerging 18–19.vii.1968. These are very diminutive, even compared with the females. The flies of this genus have previously been associated with bird's nests, where the larvae are said to feed in the bird excreta. I have not seen a previous record from rotten wood. The specific identity of the species has not yet been established as there is some taxonomic difficulty in the genus at present.

Clusiodes albimana Fallén (Clusiidae)

I have seen this fly several times on the tree and I have got some specimens collected there on 7.vi.1969. It is ubiquitous on decaying wood of all kinds, in which the larvae develop and the early stages are often found in extremely rotten wood.

Paraclusia tigrina Fallén (Clusiidae)

This is perhaps the most interesting find on the Oakley Farm elm. It is a moderately large long-bodied yellow and brown fly with three conspicuous brown spots on each wing. Allen (1966) recorded taking one specimen at Knole Park, Sevenoaks, Kent, and he could only refer to one previous record, a capture by E. A. Fonseca in Wychwood, Oxon. I have only come across one other

mention of the fly in British literature, i.e. in Thornley (1936), who quotes an occurrence in W. Cornwall originally published by C. W. Dale (1891).

On 29.viii.1967 in rather dull showery weather at about 4.30 p.m. I was standing by the tree when a male *P. tigrina* suddenly appeared and alighted beneath a bracket of *P. cornucopiae*. During the following hour, two further males were taken when they landed on the wood itself. On 16.ix. of the same year a fourth male was also taken on the heart-wood. All Clusiidae whose biology is known develop in rotten wood and, although I have not yet seen a female, it is a reasonable assumption that the fly develops in elm wood. On the same day as the last male of *P. tigrina*, I took a male of *Clusia flava* Meigen on a dead birch trunk just inside the Rookery Wood a few yards from the elm. I have otherwise found *C. flava* always in association with beech trees and this was my first capture of the fly in the Bromley district.

I had not seen *P. tigrina* more recently until 12.ix.1971 when a single male was seen to alight on a beech log at Knole Park during the British Entomological & Natural History Society field meeting held there on that day. It seems extraordinary that such a striking and beautiful insect, which is evidently very scarce in Britain, should be found to occur so close to London and yet not have been taken in the area before Allen's discovery. One of my specimens has been presented to the British Museum (Natural History), where the species was previously unrepresented in the collection.

Aulacigaster leucopeza Meigen (Aulacigastridae)

When I visited the Oakley Farm tree on 7.iv.1969 an adjacent tree had a gelatinous brown resupinate fungus growing on its trunk where the sap was oozing from a wound. On this fungus there were large numbers of this little brown fly which is always attached to decaying trees: two pairs *in copula* were taken. On a subsequent visit on 7.vi.1969 they were again numerous on the suppurations from a wound on another nearby tree, that on which *Brachyopa* (q.v.) was taken, and another short series was taken. Uffen (1962) also took both species on elm trees in Hyde Park, London. The other flies which he took on that occasion, i.e. *Mycetobia pallipes* Meigen (Anisopodidae) and *Phaonia cincta* Zetterstedt (Muscidae), have not turned up on Oakley Farm although both, like *Paraclusia tigrina*, occur in Knole Park, Sevenoaks. I took *M. pallipes* there on a rotten log on 5.vi.1968 and I have since reared this delicate insect from larvae found under bark of a beech stump in Knole Park on 12.ix.1971. *P. cincta* has been taken both at Knole by C. Johnson and at Blackheath by A. A. Allen (information from both collectors *in litt.*), so it might yet be discovered in the Bromley district. The larvae of *A. leucopeza* apparently develop in the sap runs.

collection, which contained seventeen specimens from various Kentish localities, i.e. Bexley, Chattenden, Darenth and Eltham and also provided records from Poole, Dorset, 29.v.1927 and Helford, Cornwall, 17/24.vi.1928, both additions to the sixteen counties listed by Smith (*op. cit.*), although the Cornwall record was published by Thornley (1935). I have personally, however, only taken *histrio* once in Britain, a female on a rotten willow trunk at Runnymede, Surrey, 12.vii.1970.

I can also supply an additional county record for *E. vittipes* Zetterstedt, a beautiful fly with predominantly yellow legs combined with the typical body pattern of the genus. I took a male by sweeping in mixed woodland at White Beech (near Chiddingfold) in W. Sussex, 6.vii.1968. This fly was also taken by A. Brindle & C. H. Wallace-Pugh in vi.1964, during the survey of Blean Woods in E. Kent organized by L. Parmenter, and I captured a female at Dering Wood near Pluckley, also in East Kent during the Kent Field Club meeting held there on 27.vi.1971. I obtained *E. hilaris* at two localities in France in early vi.1971 but have not yet taken that species in Britain.

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