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# STUDIES ON THE ECOLOGY OF ENGLISH HEATHS

## III. ANIMAL COMMUNITIES OF THE FELLING AND BURN SUCCESSIONS AT OXSHOTT HEATH, SURREY

BY O. W. RICHARDS.

(*With twenty-nine Tables and two Figures in the Text.*)

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### INTRODUCTION AND ACKNOWLEDGMENTS

Notes have already been published on the animals occurring on the unfelled and unburnt parts of Oxshott Heath (see this JOURNAL, **12**, 1924, pp. 291-2, 299-301, 304-5). The following account gives the results of a primary survey of the animals of the felled and burnt parts of the Common made in 1922-5. In such a survey identification of specimens is a large part of the work, and I have much pleasure in acknowledging assistance in identification given as follows: Coleoptera, Commander J. J. Walker and Mr J. Collins; Hymenoptera and Diptera, Mr A. H. Hamm; Micro-lepidoptera, Mr E. G. R. Waters; Aphides, Mr F. Laing; Spiders, Dr A. R. Jackson. Dr Jackson, in particular, has named every spider I have captured. Mr W. J. Lucas has also been kind enough to allow me to use some of his notes. Even with all this help, it will be seen that certain groups (e.g. parasitic Hymenoptera) have been more or less neglected.

In the lists given in the paper, the groups of animals are always arranged in the same way; within each group the genera are arranged alphabetically and it is hoped that this may allow those who are interested in some of the groups only to extract the information they require more easily.

This paper cannot pretend to give the same amount of information about the succession of animal communities after felling as has been given in the

case of the plants<sup>1</sup>. Animal ecology, however, has been so much neglected in England that it was thought that any information about the animals would be useful in an area where the plants had been studied and where the vegetational seres identified are easily recognised elsewhere, especially since the plants must in any case be studied first.

Although the succession of the animals has not been studied in detail, yet a certain amount of information on this subject has been obtained. Animal succession is probably of a different nature to plant succession. In the latter, as a general rule, dispersal mechanisms are good enough to allow all the candidates for a bare area to arrive fairly soon, and succession consists in the replacing of one dominant by another as the conditions become suitable for the various dominants. In the case of animals, however, where dominance does not exist, the species in a particular habitat tend to form communities attached to particular plants by a chain of food relations. In each case there are some small animals eating the plant and from that starting point there is a series of carnivores and parasites, the former of gradually increasing size. Such communities, of course, have many species in common and the largest carnivore, which may perhaps be a hawk, will be at the end of a large number of food chains leading to different plant associations.

Animal succession then comes to mean changing the food chain attached to one dominant into another attached to its successor. To show this change accurately, the alterations in a definite quadrat would have to be recorded; but in the case of the animals time was not available for such detailed work. It has, however, been found that when a new dominant arrives, most of the fauna attached arrives within a year or two, and that sometimes the change in the fauna may be very complete and rapid.

In many cases it has been found that the animal community has been slowly changing while the plant community has shown no comparable change. Thus during the colonisation of bare ground by *Calluna*, while *Calluna* spends several years in growing together to form a continuous carpet, the animal fauna is changing not only in its abundance but in its constituent species. The main factor responsible for this change is the gradual arrival of species with imperfect means of dispersal, though habitat changes may sometimes play a part as well. This lag in the occupation of suitable territory is, of course, shown in plants as well, but is probably rarely so marked as it is in animals. In the case of animals it becomes necessary as a consequence to make very careful comparative studies before the real causes of changes in the communities can be detected.

The final arrangement of animals in chains leading to particular plants requires much more knowledge of the food habits than exists at present. The data for Oxshott are very incomplete and most of the foods given for the animals are taken from text books rather than discovered by observations on

<sup>1</sup> See the immediately preceding paper in this issue, pp. 203-243.

the spot. This applies especially to the carnivores, the details of whose food habits are most in need of study.

It seems to be true that, as a general rule, animals are attached to plants by some sort of food relation rather than by the need of similar habitat conditions. No doubt many examples can be given of animals whose distribution is controlled by definite edaphic or physiological requirements, but probably these are usually the species which, though highly characteristic of an association, are not the most common animals in it. The commonest animals in a plant community are often those most common elsewhere. Thus, in this account, all the animals associated with a plant dominant are treated together, though the plant may be growing in what, from the point of view of plant ecology, are several habitats. An animal community may also occur in very small areas owing to the presence of the plant with which it is associated, and areas which botanically speaking are fairly homogeneous and represent a definite plant community may contain several fairly distinct animal communities.

The divisions used here are to a great extent those described and defined in "Studies on the Ecology of English Heaths," Parts I and II (this JOURNAL, **12**, 1924, p. 287 and **14**, 1926, p. 203), dealing with the plant ecology of the district.

#### 1. DRY SERIES

##### A. BARE AREAS.

There are a number of animals that are characteristically found on bare sand. The most typical are the sand wasps, the fly *Anthrax*, and the tiger beetles, which often fly up as one walks across the Common. Normally such species inhabit paths, sandpits, etc., but at Oxshott there has been a great extension of their habitat. Few of the species live entirely on the bare areas, since most have to obtain their food from various plant communities, but many are controlled by the amount of bare sand available for nesting sites. A thick layer of humus usually makes a bare area unacceptable, so that for many species it is only the steeper slopes and the places where the humus has been burnt or blown away that are used. Since this community is merely an association of forms with similar nesting requirements, there is no regular food-cycle amongst its members. The species in Table I occur on dry, bare areas all over Oxshott Common, except in the pinewood which is too shady for most of them. Not enough data are available to determine the rates at which different species colonise new areas. The list of the bees and wasps includes only the most abundant species; it is hoped that this group will be more fully dealt with in a later paper.

Table I. *Animals of bare sand.*

	<i>Species</i>	<i>Food</i>	<i>Nesting place or other habitat</i>
Bee	<i>Andrena argentata</i> Sm.	Pollen and nectar ( <i>Calluna</i> )	Nests in flat, hard sand
"	<i>A. dorsata</i> K.	" ( <i>Rubus</i> , <i>Epilobium</i> )	" " "
"	<i>A. fulva</i> Schr.	Pollen and nectar ( <i>Salix</i> )	" " "
"	<i>A. fuscipes</i> K.	" " ( <i>Calluna</i> )	" " "
"	<i>A. gwynana</i> K.	" " ( <i>Salix</i> )	" " "
"	<i>A. ovatula</i> K. (afzeliella)	" " ( <i>Rubus</i> )	" " "
"	<i>A. sericea</i> Schr.	" "	" " "
Digger wasp	<i>Cerceris arenaria</i> L.	Weevils	Nests in sandy slopes
"	<i>C. labiata</i> F.	"	" " "
"	<i>C. rybyensis</i> L.	Small bees	Nests in sandy cliffs
"	<i>Ceropales maculata</i> F.	A parasite of <i>Psammochares</i>	
Bee	<i>Colletes succinctus</i> L.	Pollen and nectar ( <i>Calluna</i> )	Nests in flat sand especially paths
Digger wasp	<i>Crossocerus wesmaeli</i> Vid.L.	Flies	Nests in cliffs and slopes
"	<i>Diodontus minutus</i> F.	Aphides	Nests in sandy cliffs
"	<i>Evagetes bicolor</i> Lep.	Spiders	Nests in flat sand
Ant	<i>Formica fusca</i> L.	Insects and secretions of aphides	Nests mainly under pine bark
Digger wasp	<i>Gorytes quadrifasciatus</i> F.	Homoptera	Nests in flat sand, or humus
"	<i>G. tumidus</i> Pz.	"	?
Bee	<i>Halictus flavipes</i> F.	Pollen and nectar ( <i>Calluna</i> , <i>Erica</i> , <i>Rubus</i> )	?
"	<i>H. minutus</i> Zett.	Pollen and nectar	Nests in sandy cliffs
"	<i>H. morio</i> F.	" "	" " "
"	<i>H. prasinus</i> Sm.	" " ( <i>Calluna</i> , <i>Erica</i> )	Nests in flat sand
"	<i>H. punctatissimus</i> Sch.	Pollen and nectar ( <i>Ulex</i> , <i>Rubus</i> )	?
"	<i>H. rubicundus</i> Chr.	Pollen and nectar ( <i>Calluna</i> , <i>Rubus</i> )	Nests in flat sand
"	<i>H. villosulus</i> K.	Pollen and nectar (Yellow composites)	" "
Ruby wasp	<i>Hedychridium minutum</i> Lep.	Parasite of digger wasps	
Bee	<i>Megachile circumcincta</i> Lep.	Nectar and pollen ( <i>Rubus</i> )	Nests in flat sand
"	<i>M. maritima</i> K.	" " ( <i>Rubus</i> and <i>Lotus</i> )	" "
Digger wasp	<i>Mellinus arvensis</i> L.	Flies	Nests in flat sand (and cliffs)
"	<i>Methoca ichneumonides</i> Latr.	Parasite of tiger beetles	
"	<i>Miscophus concolor</i> Dahlb.	Small spiders	Nests in flat sand
"	<i>Myrmosa melanocephala</i> F.	Parasite of other aculeates	
Bee	<i>Nomada rufipes</i> F.	Parasite of <i>Andrena fuscipes</i>	
"	<i>N. signata</i> Pz.	Parasite of <i>A. fulva</i>	
Ruby wasp	<i>Notozus panzeri</i> F.	Parasite of <i>Psen</i>	
Digger wasp	<i>Nysson dimidiatus</i> Jur.	Probably parasite of <i>Gorytes tumidus</i>	
"	<i>N. interruptus</i> F.	Probably parasite of <i>G. quadrifasciatus</i>	
"	<i>Oxybelus uniglutinis</i> L.	Flies	Nests in flat sand
"	<i>Priocnemis parvulus</i> Dahlb.	Spiders	Nests in flat sand (also humus)
"	<i>Psammochares chalybeatus</i> Schiodte	"	Nests in flat sand
"	<i>Ps. fuscus</i> L. ( <i>viaticus</i> )	"	Nests in flat sand and slopes
"	<i>Ps. nigerrimus</i> Scop.	"	Nests in flat sand
"	<i>Ps. pectinipes</i> V.deLind.	Parasite of its congeners	
"	<i>Ps. plumbeus</i> F.	Spiders (esp. <i>Trochosa</i> )	Nests in flat sand and slopes
"	<i>Ps. rufipes</i> L.	"	Nests in flat sand
"	<i>Psen shuckardi</i> Wesm.	Homoptera	Nests in flat sand and cliffs

Table I (continued).

	<i>Species</i>	<i>Food</i>	<i>Nesting place or other habitat</i>
Bee	<i>Saropoda bimaculata</i> Pz.	Pollen and nectar ( <i>Erica</i> , <i>Rubus</i> , <i>Epilobium</i> )	Nests in flat sand
"	<i>Sphecodes affinis</i> v.Hag.	Parasite of <i>Halictus</i>	
"	<i>S. gibbus</i> L.	" "	
"	<i>S. divisus</i> K. (similis)	" "	
Digger wasp	<i>Sphex</i> ( <i>Ammophila</i> ) <i>campestris</i> Latr.	Caterpillars (birch)	Nests in flat sand
"	<i>S. (A.) sabulosa</i> L.	" (birch and <i>Calluna</i> )	" "
"	<i>Tachysphex pectinipes</i> L.	Grasshoppers	" "
"	<i>T. unicolor</i> Pz.	"	" "
DIPTERA			
Fly	<i>Anthrax fenestratus</i> Fall.	Parasite of grasshoppers	Adult sits on bare ground
"	<i>Miltogramma punctatum</i> Mg.	Parasite of <i>Colletes</i>	
"	<i>Paragus tibialis</i> Fall.	? Perhaps a parasite	Associates with small aculeates
"	<i>Sciapus loewi</i> Beck.	Larva subterranean and probably carnivorous	Adult often in rabbit holes
"	<i>Sphixapata conica</i> Fall.	Parasite of <i>Mellinus</i> and probably of other digger wasps	
LEPIDOPTERA			
Moth	<i>Salebria fusca</i> Hw.	Larva on <i>Erica</i>	On burnt areas
COLEOPTERA			
Dung beetle	<i>Aphodius tristis</i> Pz.	Larva and adult on dung	? Associated with rabbits
Beetle	<i>Bembidium lampros</i> Hbst.	Carnivorous	Trapped in rabbit holes
"	<i>Byrrhus fasciatus</i> F.	?	
Tiger beetle	<i>Cicendela campestris</i> L.	Carnivorous	
"	<i>C. silvatica</i> L.	"	
Dor beetle	<i>Geotrupes pyrenaeus</i> Charp.	Dung	Associated with rabbits
"	<i>G. typhoeus</i> L.	"	
Beetle	<i>Metabletus <del>farctus</del></i> Gyll.	Carnivorous	
"	<i>Microzoum tibiale</i> F.	?	
HEMIPTERA			
Bug	<i>Zicrona coerulea</i> L.	? Carnivorous	Associated with burnt areas
ORTHOPTERA			
Grasshopper	<i>Tettix bipunctatus</i> L.	Herbs	Flat places, mostly damper parts
ACARINA			
Mite	<i>Erythraeus regalis</i> C.L.K.	? Carnivorous	
ARACHNIDA			
Spider	<i>Aelurillus insignitus</i> Cl.	Carnivorous	
"	<i>Lycosa lugubris</i> Walck.	"	
"	<i>L. monticola</i> C.L.K.	"	
"	<i>L. nigriceps</i> Thor.	"	
"	<i>L. pullata</i> Clerck.	"	
"	<i>L. tarsalis</i> Thor.	"	
"	<i>Tarentula barpipes</i> Sund.	"	
"	<i>Trochosa picta</i> Hahn.	"	Lives in burrows in the sand
OPIOLIONIDA			
Harvestman	<i>Oligolophus tridens</i>	Carnivorous	
"	<i>Mitopus morio</i> F.	"	
MAMMALIA			
Rabbit	<i>Oryctolagus cuniculus</i> L.	Short plants	Mainly burrows in bare areas. Penetrates the pinewood with its dung beetles

## B. CALLUNETUM.

The animal community associated with *Calluna* is a very definite one, and seems to be mainly controlled by the plant rather than by any special edaphic or physiological conditions. Thus the fauna of *Calluna* in woods, in damp places, and in dry, burnt or unburnt areas, is very similar, particularly as regards the most abundant species. *Erica cinerea* and *E. tetralix* seem also to support practically the same set of animals, but probably more accurate observations would show differences. The description of the animal community associated with *Calluna* at Oxshott presents certain difficulties which are met with to some extent in the study of all the communities on the Common. The older, more or less permanent areas of Callunetum have been much interfered with by man and many typical animals are rare or absent. Many of these, however, occur in the now extensive new areas of *Calluna*, and the list in Table II is made by combining the records. Obviously there is a great danger of recording as Callunetum animals those which really only occur in the early stages of colonisation. Probably further study, especially in other districts, would show which species were primarily pioneers. Many species have been found only in the older Calluneta and these may be absent from the newer areas for a number of reasons. First it is very difficult to be certain that the observations have been complete enough; many forms are difficult to find even when common, and many only occur as adults during a short part of the year. There are, however, two factors which are universally important, namely, the effect of the varying powers of dispersal and of different edaphic needs.

(1) *Dispersal*. A number of *Calluna* insects are unable to fly (usually owing to secondary loss of wings) and these do not occur as a rule in early stages of colonisation. The beetles *Helops striatus* Fourc. and *Carabus catenulatus* Scop. are exceptions. Both are wingless, yet the former is always one of the earliest arrivals on a burnt area. The *Carabus* is well known to walk about a lot in the night and owing to its large size covers the ground quickly. The following wingless insects only occur in the older Callunetum including isolated patches in the felled area which escaped burning and represent slight openings in the old pinewood: the beetles *Othius myrmecophilus* Kies., *Strophosomus coryli* F., *S. lateralis* Pk.; and the Leaf hopper *Ulopa reticulata* F. The last two species are common on most heaths, feeding on *Calluna*. Other forms are probably too small to fly far, except under favourable circumstances, e.g. the beetle *Hypocyrtus longicornis* Pk. and the fly *Limosina* spp. Where trees were growing before the fire a few species escaped by crawling up the trees. Probably this was the case with the woodlouse *Philoscia muscorum* Scop. which occurs under *Calluna* in the older areas and also under bark of burnt chestnut in parts of the Molinietum. In the same way escaped the larvae of a wingless moth, *Luffia ferchaultella* Stph. which fed on the lichens on the trunks.

(2) *Edaphic conditions*. There are many other species which are only found on older Calluneta but for whose distribution no definite reason can be given. These species are given in Table III. The newer areas lack the dense, moist moss carpet that is found in well developed Calluneta and this must have an important effect on many species. Thus the mollusc *Polita radiatula* Alder only occurs in the moss, and beneath it the slugs lay their eggs. When *Betula* grows up its leaves form an equally good cover for slugs' eggs.

In woods near Oxford many of the larger Staphylinid beetles (*Ocypus*, *Quedius*, *Philonthas*) are commonly found hibernating under moss in winter, often in very large numbers. Such beetles only occur at Oxshott on the Calluneta with moss, and this may be the controlling factor. Other insects, e.g. larvae of Syrphid flies and sawflies pupate under moss and might be similarly controlled. The species of spiders have very good powers of dispersal so that anomalies in their distribution ought mainly to be due to edaphic conditions. It will be seen that in the genera *Leptyphantes*, *Centromerus* and *Walchenaera* some species have not been found on the new areas, and these may be controlled by the edaphic conditions.

The beetles of the genus *Bradycellus* have a curious distribution. An isolated specimen of *B. verbasci* Duft. was found in the Molinietum. The Callunetum species are *B. harpalinus* Dj. and *B. similis* Dj. The former is mainly a pioneer which disappears or becomes rare in the later stages, while the latter is not uncommon in any Callunetum but does not colonise quickly. The following are the data for the two species.

In the old heather on the south ridge *B. harpalinus* is rare, while *B. similis* is often common, especially in winter. In the new areas in 1922 and 1923 (i.e. for two years after the fire) only *B. harpalinus* occurred, and it was very abundant under *Calluna*. It also occurred commonly under charred pine bark, where *B. similis* is never found. The isolated relict areas of *Calluna* probably contained *B. similis* in 1922-3, and in early 1924 *B. similis* was the commoner of the two there. On these areas their numbers are now about equal. In like manner *B. similis* appeared under the new *Calluna* in 1924 and seems now to have become the commoner species. Under *Calluna* on the damper areas *B. similis* seemed to arrive earlier. Apparently *B. harpalinus* is the best coloniser (both have well developed wings) while *B. similis* needs the damper conditions which, when the moss carpet is continuous, drive out *B. harpalinus*.

The detailed changes which result from a colonisation by *Betula* have not been recorded. There is certainly a stage when the two communities are present in alternating patches. A few notes have been made on the effect of *Betula* leaves on the *Calluna* fauna. Certain forms, e.g. *Stenus geniculatus* Gr. and *Amphigynus piceus* Marsh, are normal inhabitants of *Calluna* in the early stages of invasion. The latter beetle has not been found at Oxshott, perhaps because it is wingless, but it occurs on other London heaths. The dead leaves



also favour mollusca, allowing them to lay their eggs in a damp situation. Some of the birch-feeding larvae may be found pupating under neighbouring *Calluna* bushes. Probably most of the birds seen on the new *Calluna* areas really nest in the invading birches. A moth, *Acidalia interjectaria* B., also seems to be characteristic of the scrub stage of invasion, especially in hollows.

The general habitat of most of the *Calluna* animals is on the ground beneath the bushes of heather. Nearly all moths hide in the bushes by day and can be beaten out. The exact habitats of the species in this list will therefore not always be given. There is a separate list of the flower visitors to *Calluna*, and to the species of *Erica*. Except when the heather is in flower, the animals are not at all conspicuous; nearly all the small forms, which hide under heather, are not conspicuous even when abundant.

Table II. *Animal community of typical Callunetum (except forms only found on long established areas).*

	<i>Species</i>	<i>Food</i>	<i>Habitat</i>
HYMENOPTERA			
Wasp	<i>Eumenes coarctata</i> L.	Feeds larva on caterpillars	Makes a mud nest on heather
Ant	<i>Formica fusca</i> L.	Insects and secretions of aphides	Nests mainly under pine bark
Digger wasp	<i>Miscophus concolor</i> Dahlb.	Heath spiders ( <i>Stemonyphantes</i> )	Nests in bare sand
Ant	<i>Myrmica ruginodis</i> Nyl.	Insects and secretions of aphides	Nests under <i>Calluna</i> or pine bark. Especially damper parts
,,	<i>M. scabrinodis</i> Nyl.	Insects and secretions of aphides	As above but in dry places
,,	<i>M. sulcinodis</i> Nyl.	Insects and secretions of aphides	Nests under pine bark in dry places
Wasp	<i>Vespa vulgaris</i> L.	Heather insects	Nests in scrub and wood areas
DIPTERA			
Fly	<i>Aphiochaeta pulicaria</i> Fall.	Larva a scavenger	
,,	<i>A. mallochii</i> Wood	Larva "	
,,	<i>Chaetoneurophora curvinnervis</i> Beck	Larva on carrion	The species may be associated with rabbits
,,	<i>Cryptolucilia caesarion</i> Mg.	Larva a scavenger	Adult under heather in winter
,,	<i>Enoplopteryx ciliatocosta</i> Ztt.	Larva carnivorous	Adult under heather in winter
,,	<i>Euaresta conjuncta</i> Lw.	Larva on some undetermined plant	Adult under heather in winter
,,	<i>Gonia ornata</i> Mg.	Parasite of <i>Agrotis</i>	Adult flies in early spring
,,	<i>Machimus atricapillus</i> Fall.	Larva and adult carnivorous	
,,	<i>Oscinis</i> spp.	Larva on grasses	Adult under <i>Calluna</i> in winter
,,	<i>Phaonia signata</i> Mg.	Larva ? scavenger	Adult under <i>Calluna</i> in winter
,,	<i>Scatella stagnalis</i> Fall.	?	
,,	<i>Scatophaga stercoraria</i> L.	Larva ? scavenger	Adult carnivorous mainly in summer
,,	<i>Sciara</i> sp.	" "	Adult under <i>Calluna</i>
,,	<i>Sepsis</i> , at least 2 spp.	" "	" "
Hover fly	<i>Sphaerophoria scripta</i> L.	Larva on aphides	Adult " on flowers
Crane fly	<i>Tipula</i> spp.	Larva subterranean	
Fly	<i>Wagneria lugens</i> Mg.	Parasite of noctuid caterpillars	Adult runs about on bare ground in Sept.

Table II (continued)

	<i>Species</i>	<i>Food</i>	<i>Habitat</i>
LEPIDOPTERA			
Moth	<i>Acidalia straminata</i> Tr.	Larva on herbs	
"	<i>Agrotis pronuba</i> L.	"	Adult hides in <i>Calluna</i>
"	<i>A. tritici</i> L.	"	Adult visits <i>Calluna</i>
"	<i>Amphisbatis incongruella</i> Stt.	Larva on <i>Calluna</i>	Flies in early spring
"	<i>Anarta myrtilli</i> L.	"	Adult visits <i>Calluna</i> flowers
"	<i>Aristotelia ericinella</i> Dup.	"	
"	<i>Coleophora juncicolella</i> Stt.	"	
"	<i>Crambus culmellus</i> L.	Larva on grasses	Perhaps only a pioneer
"	<i>C. geniculeus</i> Hw.	"	" " "
"	<i>Ematurga atomaria</i> L.	Larva on <i>Erica</i> and Leguminosae	
"	<i>Eupithicia nanata</i> Hb.	Larva on <i>Calluna</i> and <i>Erica</i>	
"	<i>Gelechia affinis</i> Dgl.	Larva on mosses	Adult hides in <i>Calluna</i>
"	<i>G. ericetella</i> Hb.	Larva on <i>Calluna</i> and <i>Erica</i>	
"	<i>G. umbrosella</i> Z.	Larva ? on mosses	Adult hides in <i>Calluna</i>
"	<i>Lasiocampa quercus</i> L.	Larva on <i>Calluna</i> and various trees	
"	<i>Phoxopteryx (Ancyliis) unicana</i> Hb.	Larva on <i>Erica</i> and birch	Commoner on damp parts
"	<i>Pleurota bicostella</i> Cl.	Larva on <i>Erica</i>	
"	<i>Plusia gamma</i> L.	Larva on herbs	
"	<i>Plutella maculipennis</i> Curt.	"	
"	<i>Pterophorus monodactylus</i> L.	"	Hibernates in <i>Calluna</i>
"	<i>Salebria fusca</i> Hw.	Larva on <i>Erica</i>	
"	<i>S. palumbella</i> F.	Larva on <i>Calluna</i>	
"	<i>Scythris grandipennis</i> Hw.	Larva on <i>Ulex</i>	
"	<i>S. variella</i> Stph.	Larva on <i>Calluna</i> and <i>Erica</i>	Adult hops about on bare ground
COLEOPTERA			
Beetle	<i>Amara famelica</i> Zimm.	Carnivorous	Perhaps only a pioneer
"	<i>A. familiaris</i> Duft.	"	Especially damper parts
"	<i>Anthicus antherinus</i> L.	Scavenger	
"	<i>Bradycellus harpalinus</i> Dj.	Carnivorous	Newer areas
"	<i>B. similis</i> Dj.	"	Older areas
"	<i>Calathus melanocephalus</i> L.	"	Perhaps more abundant where birch invades
"	<i>Carabus catenulatus</i> Scop.	Carnivorous (worms and snails)	
"	<i>Coccinella 7-punctata</i> L.	Aphides, etc.	
"	<i>C. 11-punctata</i> L.	"	
"	<i>Cryptocephalus fulvus</i> Goetz.	<i>Rumex acetosella</i>	Adult hibernates under <i>Calluna</i>
"	<i>Helops striatus</i> Fourc.	Larva carnivorous under <i>Calluna</i>	Adult in nearly all habitats
"	<i>Metabletus foveola</i> Gyll	Carnivorous	
"	<i>Mycetoporus splendens</i> Marsh	"	Perhaps where birch invades
"	<i>Notiophilus biguttatus</i> F.	"	Especially in wet places
"	<i>Olisthopus rotundatus</i> Ph.	"	Does not arrive for two years
"	<i>Quedius boops</i> Gr.	"	
"	<i>Simplocaria semistriata</i> F.	?	
"	<i>Stenus atratulus</i> Er.	Carnivorous	Damper places
"	<i>S. geniculatus</i> Gr.	"	When <i>Betula</i> invades
"	<i>S. rogeri</i> Kr.	"	Damper places
"	<i>Tachyporus chrysomelinus</i> L.	Carnivorous	
"	<i>T. hypnorum</i> F.	"	
"	<i>Xantholinus linearis</i> Ol.	"	
HEMIPTERA			
Bug	<i>Coranus subapterus</i>	Carnivorous	
"	<i>Cymus melanocephalus</i> Fieb.	?	

Table II (*continued*).

	<i>Species</i>	<i>Food</i>	<i>Habitat</i>
		HEMIPTERA	
Bug	Macrodera micropterum Curt.	?	
"	Nabis ericetorum Schltz.	Carnivorous	
"	Orthotylus ericetorum Fall.	<i>Calluna</i> and <i>Erica</i>	
"	Scolopostethus decoratus Hhn.	?	
"	Trapezonotus arenarius L.	?	
"	Triphleps nigra Wolff.	? Carnivorous	
Leafhopper	Acocephalus albifrons L.	? <i>Calluna</i>	
Psyllid	Rhinocola ericae Curt.	<i>Calluna</i> and <i>Erica</i>	
Mealy wing	Aleyrodid ? sp.	Vegetarian	Very abundant under <i>Calluna</i>
		COLLEMBOLA	
Springtails	Collembola (unidentified)	Very abundant, vegetarian	
		THYSANURA	
	Camptopoda sp.	Vegetarian	
		ORTHOPTERA	
Grasshopper	Gomphocerus maculatus Thunbg.	Herbs	
"	Metrioptera brachyptera L.	"	Mainly damper places
"	Tettix bipunctatus L.	"	
		ARACHNIDA	
Spider	Centromerus concinnus Thor.	Carnivorous	
"	Leptyphantes tenuis Bl.	"	
"	Mangora acalypha Walck.	"	Damper places
"	Pisaura mirabilis Clerch.	"	
"	Stemonyphantes lineatus L.	"	
"	Tarentula barbigera Sund.	"	
"	Walckenaera nudipalpis Westr.	"	Damper places
"	Wideria antica Wid.	"	
"	Xysticus cristatus Clerck.	"	
		OPILIONIDA	
Harvestman	Phalangium opilio L.	Carnivorous	
		ACARINA	
Mite	Erythraeus regalis C.L.K.	Carnivorous	Under <i>Calluna</i> and on bare soil
		CRUSTACEA	
Woodlouse	Porcellio scaber Latr.	Scavenger and carnivorous	Newer areas
		CHILOGNATHA	
Centipedes		Carnivorous	
		DIPLOPODA	
Millipedes		? Scavengers	
		ANNELIDA	
Earthworm		Vegetarian	Damper parts of felled areas
		REPTILIA	
Grass snake	Tropidonotus natrix L.	Carnivorous	Damper parts
		AVES	
Yellow Hammer	Emberiza citrinella citrinella L.	Chiefly plants	
Partridge	Perdix perdix perdix L.	Chiefly plants, insects more in summer	
Stonechat	Saxicola torquata hibernans Hart.	Mainly insects	
		MAMMALIA	
Rabbit	Oryctolagus cuniculus L.	Herbs and Ericaceae	

Table III. *Species found only on older Callunetum.*

1=Older <i>Calluna</i> . 2=Pinewood, <i>Calluna</i> and <i>E. tetralix</i> . 3=Relict <i>Calluna</i> in felled areas.			
Ant	Acanthomyops alienus Först. 1	Insects and secretions of aphides	Nests in sand
„	A. umbratus Nyl. 1	Insects and secretions of aphides	Nests under <i>Calluna</i> and moss
„	Myrmica lobicornis Nyl. 1, 3	Insects and secretions of aphides	Nests under <i>Calluna</i>
LEPIDOPTERA			
Butterfly	Lycaena aegon Schiff. 1	Larva on <i>Erica</i> and <i>Ornithopus</i>	Abundant on older <i>Calluna</i>
DIPTERA			
Fly	Limosina luteilabris Rdi. 1, 2	? Scavenger	Adults under moss
„	Sphaerocera subsaltans F. 1	„	
COLEOPTERA			
Beetle	Amara lunicollis Schiod. 1, 3	Carnivorous	
„	A. trivialis Gyll. 1	„	
„	Astilbus canaliculatus F. 1	Ants	
Ladybird	Chilocorus similis Ross. 1	? Aphides	
Beetle	Hypocyrtus longicornis Pk. 2, 3	? Scavenger	? Too small to fly far
„	Lochmaea suturalis Th. 1, 2	<i>Calluna</i> and <i>Erica</i>	
„	Nebria brevicollis F. 2, 3	Carnivorous	
„	Ocytus cupreus Ross. 1	„	
„	O. olens Müll. 1	„	
„	Othius myrmecophilus Kies. 2 (3?)	?	Wingless
„	Philonthus marginatus F. 1	Carnivorous	
„	P. politus F. 1	„	
„	Quedius molochinus Gr. 3	„	
„	Q. nigriceps Kr. 2	„	
„	Sipalia circellaris Gr. 1, 2	? Carnivorous	
„	Strophosomus coryli F. 1, 2, 3	Vegetarian	Wingless
„	S. lateralis Pk. 1, 2, 3	<i>Calluna</i> and <i>Erica</i>	„
HEMIPTERA			
Leafhopper	Dicraneura variata Hardy 1	Vegetarian	
„	Ulopa reticulata F. 1, 2, 3	<i>Calluna</i>	Wingless
ORTHOPTERA			
Cockroach	Ectobius lapponicus L. 1, 3	? Scavenger	Short-winge
Grasshopper	Stauroderus bicolor Charp. 1, 3	Vegetarian	
ARACHNIDA			
Spider	Agroeca proxima Cambr. 1	Carnivorous	
„	Centromerus bicolor Bl. 1, 3	„	
„	C. silvaticus Bl. 1	„	
„	Cheiracanthium carnifex F. 1, 3	„	
„	Dictynna arundinacea L. 3	„	
„	Leptyphantes ericaeus Bl. 3	„	
„	Linyphia pusilla Sund. 3	„	
„	Micryphantes rurestris C.L.K. 1	„	
„	Nematognus obscurus Bl. 1	„	
„	Robertus lividus Bl. 1	„	
„	Walckenaera acuminata Bl. 1, 3	„	
OPILIONIDA			
Harvestman	Nemastomum lugubre Bl. 2	Carnivorous	
„	Oligolophus agrestis. 2	„	
„	Platybunus corniger Fr. 2	„	
CRUSTACEA			
Woodlouse	Philoscia muscorum Scop. 1, 2	? Scavenger and carnivore	
MOLLUSCA			
Slug	Eggs under moss. 1, 2	Vegetarian and scavenger	
Snail	Polita alliaria Müll. 2	„	„
	P. radiatula Alder. 1	„	„

Table IV. *Insect visitors of Calluna and Erica flowers.*Ca. = *Calluna*. Ci. = *Erica cinerea*. T. = *E. tetralix*. W. = Worker. F. = Female. M. = Male.

HYMENOPTERA			
Bee	<i>Andrena argentata</i> Sm.	F. Ca.	Cf. Table I
"	<i>A. fuscipes</i> K.	F. Ca.	"
Hive Bee	<i>Apis mellifera</i> L.	W. Ca. Ci.	From surrounding houses. Very common
Humble Bee	<i>Bombus agrorum</i> F.	W. Ca. Ci. W. F. T.	The commonest one on T.
"	<i>B. hortorum</i> L.	W. T.	
"	<i>B. jonellus</i> K.	W. Ca. W. M. Ci. W. F. T.	
"	<i>B. lapidarius</i> L.	M. Ca. M. W. F. Ci. W. T.	The commonest one on Ci.
"	<i>B. lucorum</i> L.	M. Ca. M. W. F. Ci. W. T.	Very common on Ci.: the W. bites through the corolla at least of T.
"	<i>B. ruderarius</i> Müll. ( <i>derhamellus</i> K.)	M. W. T.	
"	<i>B. sylvarum</i> L.	F. T.	
"	<i>B. terrestris</i> L.	M. W. Ca. M. Ci. W. T.	Sometimes bites through corolla but not seen to do so here
Bee	<i>Colletes succinctus</i> L.	F. M. Ca.	Cf. Table I. An abundant <i>Calluna</i> bee.
"	<i>Halictus flavipes</i> F.	M. Ca. F. Ci.	Cf. Table I
"	<i>H. minutus</i> Zett.	M. F. Ca.	"
"	<i>H. prasinus</i> Smith	F. Ci.	"
"	<i>H. punctatissimus</i> Sch.	F. Ci.	"
"	<i>H. rubicundus</i> Chr.	M. Ca. T.	"
"	<i>Megachile maritima</i> K.	M. Ci.	"
"	<i>M. willughbiella</i> K.	M. Ci.	Cf. Table XXIX
"	<i>Nomada rufipes</i> F.	M. Ca.	Cf. Table I
"	<i>Prosopis genalis</i> Th.	F. Ci.	Cf. Table XXIX
"	<i>Saropoda bimaculata</i> Pz.	M. F. Ci.	Cf. Table I
Digger wasp	<i>SpheX (Ammophila) sabulosus</i> L.	M. Ca. Ci.	"
DIPTERA			
Fly	<i>Conops quadrifasciatus</i> DeG.	Ca.	? Parasite of Humble Bees
"	<i>Volucella bombylans</i> L.	F. Ca. T.	Commensal of Humble Bees
LEPIDOPTERA			
Moth	<i>Agrotis tritici</i> L.	Ca.	Cf. Table II
"	<i>Anarta myrtilli</i> L.	Ca. Ci.	"
"	<i>Plusia gamma</i> L.	Ca. Ci.	"

C. *EPILOBIUM ANGUSTIFOLIUM*.

A small animal community is associated with this plant wherever it grows at Oxshott; in other places where the plant is more permanent (e.g. cut down woods near Oxford) there are rather more kinds of insects attached to it.

Only one moth feeds on *Epilobium* at Oxshott, *Mompha raschkiella* Z. A single specimen was found in 1923. In 1924 it was common amongst particular patches of the plant, and in 1925 it was common throughout and locally abundant. The adult appears in July. The most important enemy of the willowherb, however, is a beetle, *Haltica oleracea* L. Two specimens were found in July 1924 in the Great Hollow. In the winter of 1924-5 the adults were found hibernating in great abundance in *Polytrichum* and *Molinia*

tufts in the damp areas. In late June 1925 the larvae were a plague on the leaves of *Epilobium*. The larva feeds on the underside and the lower leaves are attacked first. Short or young plants may be killed off, all the leaves being destroyed. On the area invaded by *Calluna*, where *Epilobium* grows to some extent in local clumps in small hollows, almost every clump was infected and at least three-quarters of the plants in each clump.

In the summer of 1924 a few plants in the Molinietum had the upper part of the flowering spike covered with a black aphid (not yet identified). This destroys the upper buds while the lower ones are in flower. Food is solicited from this aphid by the ant *Formica fusca* L. and it is eaten by the ladybirds (larva and adult) *Coccinella 7-punctata* L. and *Adalia bipunctata* L. and probably also by Syrphid larvae. The buds are also destroyed by the gall midge *Perrisia epilobii* F.Loew. which makes the buds swell up and fail to flower. These galls were common on 27. ix. 25. A spider, *Erigone dentipalpis* Wid., has been found to spin its web on *Epilobium*.

Table V. *Insect visitors of Epilobium.*

Bee	<i>Andrena dorsata</i> K.	Male. Cf. Table I
"	<i>Apis mellifera</i> L.	Worker: by far the most important visitor
"	<i>Bombus agrorum</i> F.	Workers
"	<i>B. lapidarius</i> L.	Workers
"	<i>B. lucorum</i> L.	Male and female
"	<i>B. pratorum</i> L.	Males. Only in shrub areas on the S.E. side
"	<i>B. terrestris</i> L.	Male and worker
Digger wasp	<i>Cerceris arenaria</i> L.	Male. Cf. Table I
"	<i>C. labiata</i> F.	" "
Bee "	<i>Cilissa leporina</i> Pz.	Male "
"	<i>Coelioxys rufescens</i> Lep.	Female. Parasite of <i>Megachile</i>
"	<i>Halictus flavipes</i> F.	Male. Cf. Table I
Ruby wasp	<i>Hedychridium minutum</i> Lep.	Cf. Table I
"	<i>Notozus panzeri</i> F.	Male. Cf. Table I
Digger wasp	<i>Psen bicolor</i> F.	
"	<i>P. unicolor</i> V.deL.	Cf. Table XXIX
Bee "	<i>Psithyrus quadricolor</i> Lep.	Parasite of <i>B. pratorum</i> L. and found in the same situation
"	<i>Saropoda bimaculata</i> Pz.	Male and female common
"	<i>Sphecodes divinus (similis)</i> K.	Female. Cf. Table I
DIPTERA		
Fly	<i>Catabomba pyrastris</i> L.	
"	<i>Sicus ferrugineus</i> L.	
COLEOPTERA		
Beetle	<i>Adalia bipunctata</i> L.	
"	<i>Coccinella 11-punctata</i> L.	
HEMIPTERA		
Bug	<i>Plagiognathus arbustorum</i> F.	
"	<i>Triphleps nigra</i> Wolff.	Cf. Table II

## D. DECIDUOUS WOODS.

In the previous paper on Oxshott (this JOURNAL, 1924, p. 304) a few moths were recorded from the mixed deciduous wood on the eastern boundary of the felled area. This community has since been much more fully studied. The most important trees for insects are *Betula* spp., *Quercus*, *Alnus* and *Castanea*. All these have invaded the felled areas to a certain extent, though in this respect *Betula* is much the more important. *Castanea*, even when

common, has very few insects specially attached to it in England. The data are not sufficient to show the details of the colonisation of young birches by animals, so the following plan has been adopted. A special table is given of species found on four-year-old birches (6–12 ft. high) on 22. vi. 25. Fairly extensive records were made on this date, and no difference could be detected between birches growing in different plant habitats. Many of the species in this table are commonly recorded from young birches by other observers, but this may be because animals are easier to see on trees that are not too tall; no doubt, however, some are real pioneers. A second table will be given of species found on Oxshott Common connected with deciduous trees or the undergrowth of the woods they form. Lengthy as this list is, it can only contain a fraction of the species that really occur. In particular the ground fauna has hardly been examined. The insects have been found in the main in two ways. Firstly, they may be found sitting on the palings in the mixed wood. This, especially in the case of moths, gives a sort of random sample of the population of such a wood, though certain genera are never found. Secondly, by beating young birches, oaks, etc., on the felled areas. Many of the species may be found whichever method of search is employed and it is not yet possible to distinguish those that are especially pioneers. The insect visitors of certain plants, such as *Rubus* (Table XIV) or *Teucrium scorodonia* (Table XI), which are specially common in birch scrub, are given separately. Certain animals are definitely associated with older birch woods, mostly species needing tree trunks for some part of their life history. Three lists are given: Trunk feeders, shown in Table VII by a symbol; Table VIII, inhabitants of *Polyporus betulinus* which only grows on the older trees; Table IX, animals living under bark. This last habitat was greatly extended when many birches were killed by fire in 1921. *Castanea* suffered in the same way, and the bark-fauna of the two trees is given in one list.

A few remarks have already been made on the effect of birch leaves on the *Calluna* fauna. In the case of the invasion of *Molinia* the inadequate data available are given in Table X. The most important effect is that wood-mice, almost certainly *Apodemus silvaticus* (none caught), become very abundant. Mollusca become common and lay their eggs, and birch feeding insects pupate under *Molinia* tufts more or less covered with birch leaves.

Table VI. *Insects on young Betula.* 22. vi. 25.

#### HYMENOPTERA

Sawfly	<i>Croesus latipes</i> Vill.	Larva found
Ant	<i>Formica fusca</i> L.	Attending aphides
Digger wasp	<i>Psen shuckardi</i> Wesm.	Hunting for Homoptera
Sawfly	<i>Rhogogastera vividis</i> L.	? Food
"	Two unidentified larvae	Feeding on birch
Parasitic wasps	Braconids and Ichneumonids (e.g. <i>Hemiteles</i> spp.)	Abundant

Table VI (*continued*).

DIPTERA		
Fly	<i>Chelipoda melanocephala</i> F.	Carnivorous. Common on underside of leaves
"	<i>Chilosia pagana</i> Mg.	?
"	<i>Contarina betulina</i> Kieff.	Galls common. Some with a parasite (Hym.)
"	<i>Empis livida</i> L.	Carnivorous. Rare
"	<i>Gymnopternus aerosus</i> Fall.	" "
"	<i>Hilara interstincta</i> Fall.	" "
"	<i>Microchrysa polita</i> L.	?
"	Muscid flies of several kinds	Abundant
"	<i>Phalacrotophora fasciata</i> Fall.	Parasite of <i>Adalia bipunctata</i>
"	<i>Tachydromia minuta</i> Mg.	Carnivorous. Common
"	<i>T. flavipes</i> F. ?	" "
LEPIDOPTERA		
Moth	<i>Cacoecia unifasciana</i> Dup.	Deciduous trees (incl. birch)
"	<i>Coleophora fuscedinella</i> Z.	Larva on birch
"	<i>Drepana lacertinaria</i> L.	Larva found
"	<i>D. falcatoria</i> L.	"
"	<i>Eriocrania</i> spp.	Blotches in leaves very abundant
"	<i>Olethreutes betulaetana</i> Hw.	Rare. Larva on birch
"	<i>Orgyia antiqua</i> L.	Larva common on birch, etc.
"	<i>Phylloporia bistrigella</i> Hw.	Rare. Larva on birch
"	Three or four species of unidentified larvae	
COLEOPTERA		
Beetle	<i>Adalia bipunctata</i> L.	Very abundant. Mostly as larvae. Parasitised by <i>Phalacrotophora</i>
"	<i>Deporaus betulae</i> L.	Common. Birch feeder
"	<i>Luperus rufipes</i> Scop.	Abundant. Birch feeder
"	<i>Malthinus punctatus</i> F.	Carnivorous. Common
"	<i>Orchestes rusci</i> Hbst.	Rare. Birch feeder
"	<i>Phyllobius maculicornis</i> Germ.	Common. Birch feeder
"	<i>Rhamphus flavicornis</i> Clair.	Abundant. Birch feeder
"	<i>Rhynchites harwoodi</i> Joy.	Common. Birch feeder
"	<i>R. nanus</i> Pk.	Abundant. Birch feeder
"	<i>Strophosomus coryli</i> F.	Common. Birch feeder
HEMIPTERA		
Bug	<i>Psallus betuleti</i> Fall.	Common. Birch feeder
Aphides	Unidentified, but very abundant	" "
Leafhopper	<i>Empoasca smaragdula</i> Fall.	Abundant. Birch feeder
"	<i>Oncopsis flavicollis</i> L.	" "
"	<i>O. rufusculus</i> Fieb.	Common. Birch feeder
"	<i>Typhlocyba</i> sp.	Abundant. Birch feeder

Table VII. *Deciduous wood community.*

Most of the Species recorded in Table VI are not repeated here.

\* = Species characteristic of older woods

§ = Species lasting into the pinewood

HYMENOPTERA		
Digger wasp	<i>Cerceris arenaria</i> L.	Preys on weevils on oak and birch. Cf. Table I
Sawfly	<i>Croesus septentrionalis</i> L.	Larva on deciduous trees, e.g. birch
Parasitic wasp	<i>Exochilum brevicorne</i> Gr.	Parasite of caterpillars
Sawfly	<i>Fenusa pygmaea</i> Kl.	Larva mines birch leaves (young birches)
Digger wasp	<i>Mellinus arvensis</i> L.	Hunts for flies. Cf. Table I
Sawfly	<i>Monophadnus albipes</i> Gmel.	Larva on birch (young birches)*
"	<i>Paururus noctilio</i> F.	Larva on birch (wood)
Digger wasp	<i>Passaloecus insignis</i> V.deL.	Hunts for aphids on oak and birch
"	<i>Psen unicolor</i> V.deL.	Hunts for Homoptera. Cf. Table
Sawfly	<i>Scolioneura betuleti</i> Klug.	Larva on birch (young birches)
Wasp	<i>Vespa germanica</i> Fab.	Nesting. Carnivorous §
"	<i>V. vulgaris</i> L.	" " §



Table VII (*continued*).

DIPTERA		
Fly	<i>Chrysopilus cristatus</i> F.	Larva carnivorous and subterranean
"	<i>Dioctria atricapilla</i> Mg.	Carnivorous
"	<i>D. hyalipennis</i> F. (flavipes)	"
"	<i>Hylos culiciformis</i> F.	"
"	<i>H. femoratus</i> Mull.	"
"	<i>Mesembrina meridiana</i> L.	Scavenger
"	<i>Medeterus truncorum</i> Mg.	Carnivorous on trunks*§
"	<i>Oedalea holmgreni</i> Ztt.	Carnivorous
"	<i>Pipunculus zonatus</i> Zett.	Parasite of Homoptera
"	<i>Platycnema pulicaria</i> Fall.	?
"	<i>Sciapus platypterus</i> Lw.	? Carnivorous
"	<i>Sphaerophoria scripta</i> L.	Larva on aphides
"	<i>Syrphus torvus</i> O.S.	" " §
"	<i>S. tricinctus</i> Fall.	" " "
"	<i>Volucella pelluceus</i> L.	Commensal of wasps
LEPIDOPTERA		
Moth	<i>Acalla ferrugana</i> Tr.	Larva on birch, abundant in rolled leaves of young birches. Autumn 1925
"	<i>Acidalia aversata</i> L.	Larva on herbs§
"	<i>Acronycta psi</i> L.	Larva on deciduous trees. Pupa under chestnut bark
Butterfly	<i>Adopaea sylvanus</i> Esp.	Larva on grasses. Adult on flowers, e.g. <i>Rubus</i>
Moth	<i>Agrotis pronuba</i> L.	Larva on herbs
"	<i>Aplecta nebulosa</i> Esp.	Larva on deciduous trees
"	<i>Argyresthia brockeella</i>	Larva on alder
"	<i>A. geodartella</i> L.	Larva on alder and birch§
"	<i>A. glaucinella</i> Z.	Larva on oak bark
"	<i>A. retinella</i> Z.	Larva on birch §
"	<i>Boarmia consortaria</i> F.	Larva on oak
"	<i>B. gemmaria</i> Brahm.	Larva on deciduous trees§
"	<i>Borkhausenia lunaris</i> Hw.	Larva on decayed wood
"	<i>Cacoecia lechearia</i> L.	Larva on deciduous trees
"	<i>C. xylostearia</i> L.	" " "
"	<i>Cabera pusaria</i> L.	" " " §
"	<i>Camptogramma bilineata</i> L.	Larva on herbs
"	<i>Capua angustiorana</i> Hw.	Larva on deciduous trees
"	<i>Carcina quercana</i> F.	Larva on oak
"	<i>Chimabache fagella</i> F.	Larva on deciduous trees
Butterfly	<i>Celastrina argiolus</i> L.	Larva on holly and ivy
Moth	<i>Coleophora bicolorella</i> Stt.?	Larva on birch and alder (young birches)
"	<i>C. lutipennella</i> Z.	Larva on oak
"	<i>Crambus pinellus</i> L.	Larva on ? grasses
"	<i>Elachista cygnipennella</i> Hb.	Larva on grasses
"	<i>Endotricha flammealis</i> Schiff.	Larva on dead leaves
"	<i>Epiblema bilunana</i> Hw.	Larva on birch catkins§
"	<i>E. similana</i> Hb.	Larva on birch (young birches)
"	<i>E. solandriana</i> L.	Larva on alder
"	<i>Eriocrania</i> sp. undescribed	Larva on birch (young birches 3-4 years)
"	<i>E. purpurella</i> Hw.	" " "
"	<i>E. salopiella</i> Stt.	" " "
"	<i>E. senipurpurella</i> Stph.	" " "
"	<i>E. unimaculella</i> Zett.	" " "
"	<i>Euchloris pustulata</i> Hufn.	Larva on oak
"	<i>Euchoeca obliterata</i> Hufn.	Larva on alder
"	<i>Eupoecilia nana</i> Hw.	Larva in catkins of birch
"	<i>Fumica casta</i> Pall.	Larva feeds on refuse, pupates on trunks*§
"	<i>Gelechia luculella</i> Hb.	Larva on oak
"	<i>G. proximella</i> Hb.	Larva on birch
"	<i>G. umbrosella</i> Z.	Larva on mosses
"	<i>Geometra papilionaria</i> L.	Larva on deciduous trees
Butterfly	<i>Gonepteryx rhamni</i> L.	Larva on Rhamnus
Moth	<i>Gracilaria alchimiella</i> Sa.	Larva on oak
"	<i>Grapholitha ramella</i> L.	Larva on birch (young birches)
"	<i>G. trimaculana</i> Don.	Larva on elm

Table VII (continued).

LEPIDOPTERA		
Moth	Hedya dealbana Fröl.	Larva on sycamore
"	H. ocellana F.	Larva on deciduous trees
"	Heliozele betulae Stt.	Larva on birch (young birches)
"	Incurvaria muscalella F.	Larva on Rosaceae
"	I. pectinea Hw.	Larva on birch (young birches)
"	Larentia viridaria F.	Larva on galium
"	Lithocolletis faginella Z.	Larva on beech
"	L. messaniella Z.	Larva on oak
"	L. quercifoliella Z.	"
"	L. ulmifoliella Hb.	Larva on birch (young birches)
"	Luffia ferchaultella Steph.	Larva on Lecanora varia, etc., on trunks*§
"	Lyonetia clerkella L.	Larva on deciduous trees
"	Monopis feruginella Hb.	?
"	Notocelia uddmanniana L.	Larva on <i>Rubus</i>
"	Oleuthreutes corticana Hb.	Larva on birch
"	O. lacunana Dup.	Larva on <i>Rubus</i> , etc.
"	Ornix betulae Stt.	Larva on birch (young birches)
"	Pandemis ribeana Hb.	Larva on deciduous trees
"	Paedisca corticana Hb.	Larva on oak
"	Phalera bucephala L.	Larva on birch, etc., defoliating a young birch in VII. 23
"	Salebria betulae Goeze.	Larva on birch (young birches)
"	Scoparia ambigualis Tr.	Larva on moss. Adult hides on trunks*§
"	S. frequentella Stt.	"
"	Swammerdamia heroldella Tr.	Larva on birch. "Adult hides on "trunks
"	Talaeporia tubulosa Retz.	Larva on lichens on trunks*§
"	Tinea parasitella Hb.	Larva in birds' nests
"	T. semifulvella Hw.	"
"	Tischeria complanella Hb.	Larva on oak "
"	Tortrix loeflingiana L.	Larva on deciduous trees (young birches)§
"	T. viridana L.	Larva on oak
"	Xenolechia humeralis Z.	?
COLEOPTERA		
Beetle	Athous haemorrhoidalis F.	Larva on roots§
"	Attelabus curculionides L.	Larva on young oak
"	Byturus tomentosus F.	Larva in flowers of <i>Rubus</i>
"	Coccinella 7-punctata L.	Larva feeds on aphides§
"	C. 10-punctata L.	" " §
"	Cryptocephalus parvulus Müll.	Larva on birch "
"	Ernobius mollis L. (agg.)	?
"	Halyzia 18-guttata L.	Larva on aphides§
"	Hoplia philanthus Füss.	Larva on roots of plants
"	Luperus rufipes Scop.	Birch
"	Phyllobius argentatus L.	Deciduous trees
"	P. pyri L.	" " §
"	Phyllodecta vitellinae L.	Larvae on aspen
"	Rhagonycha fulva Scop.	Predaceous
"	Serica brunnea L.	Larva on roots
"	Strangalia armata Hbst.	Larva on decaying wood
HEMIPTERA		
Bug	Aetorhinus angulatus Fall.	Young birches
"	Anthocoris nemorum L.	Aphides
"	Deraeocoris ruber L.	<i>Rubus</i> and various herbs
"	Orthotylus flavinervis Kb.	Alder
"	Plagiognathus chrysanthemi Wolff.	Various herbs
"	P. arbustorum F.	Various herbs (e.g. <i>Teucrium</i> )
Leafhopper	Aphrophora alni Fall.	Deciduous trees
"	Batracomorphus lanio L.	Oak
Psyllid	Psylla försteri Flor.	Alder
NEUROPTERA		
Lacewing	Chrysopa perla L.	Larva on aphids (young birches)
"	Ch. vulgaris Schneider	" " "

Table VII (*continued*)

ACARINA		
Mite	Eriophyes nalepai Focken	Gall on alder
ARACHNIDA		
Spider	Epeira diadema L.	Web on young birches
AVES		
Cuckoo	Cuculus canorus canorus L.	Insects
Robin	Erithacus rubecula melophilus Hart.	"
Jay	Garrulus glandarius rufitergum Hart.	Mainly a general carnivore*§
Green Wood-pecker	Picus viridis virescens Brehm.	Ants, etc.*§
Stonechat	Saxicola torquatus hibernaus Hart.	Mainly insects
MAMMALIA		
Mouse	Apodemus silvaticus L.	(Probably) mainly herbivorous

Table VIII. *Inhabitants of Polyporus betulinus*

HYMENOPTERA		
A Proctotrupid beetle parasite		
COLEOPTERA		
Beetle	Atheta aequata Er.	? Carnivorous
"	A. cauta (parva) Er.	"
"	A. fungivora Th.	"
"	A. sericea Muls.	"
"	Cis bilammellatus Wood.	Fungus
"	Coninomos nodifer Westw.	"
"	Litargus connexus Geoff. (bifasciatus)	"
"	Octotemnus glabriculus Gyll.	"
"	Proteinus ovalis Steph.	? Carnivorous
COLLEMBOLA		
Springtail	Collembola common	Vegetarian and scavenger

Table IX.

Animals under bark of dead birches (B.), and chestnuts (C.)

DIPTERA		
Fly	Larva of Foreipomyia pallida Winn.	C. (B. ? same species). Scavenger
COLEOPTERA		
Beetle	Atheta aequata Er.	B. Scavenger
"	Cerylon histeroides F.	B. Larva carnivorous
"	Cis vestitus Mel.	B. Fungus eater
"	C. villosulus Marsh.	B. "
"	Ditoma crenata F.	B. Larva carnivorous
"	Dromius quadrinotatus Pz.	C. Carnivorous
"	Helops striatus Fourc.	C. ? Scavenger. Larva, cf. Table II
"	Homalium rivulare Pk.	C. ? Carnivorous
"	Litargus connexus Geoff. (bifasciatus)	C. B. Fungus eater
"	Melasis buprestoides L.	C. Rotten wood of deciduous trees
"	Ocypus morio Gr.	C. Carnivorous
"	Pteryx suturalis Heer.	B. Fungus eater
"	Phyllodrepa vilis Er.	C. Fungus eater? or carnivorous
"	Rhinosimus planirostris F.	C. ?
"	Rhizophagus bipustulatus F.	C. B. Carnivorous on bark beetles
"	Scolytus intricatus Ratz.	C. Wood of deciduous trees
"	Silpha atrata L.	C. ? Carnivorous
"	Silvanus unidentatus Ol.	B. Larva ? carnivorous
"	Thectura cuspidata Er.	B. Feeds on Collembola

Table IX (*continued*).

HEMIPTERA			
Bug	Aneuris laevis F.	C.	?
"	Piezostethus cursitans Fall.	B.	? Carnivorous
"	Xylocoris ater Duf.	C.	"
COLLEMBOLA			
Springtails	Collembola (unnamed) abundant	C. B.	Wood and fungus
THYSANOPTERA			
	Thrips (unnamed bark species)	C.	?
NEUROPTERA			
Snake fly	Rhaphidia sp.	C. B.	Larva carnivorous under bark
ARACHNIDA			
Spider	Epeira umbratica Clk.	C.	Lives under bark, but catches insects from outside
"	Salticus scenicus Clk.	C.	Hibernates under bark, in summer hunts on trunks
"	Zilla atrica C.L.K.	C.	Carnivorous
CRUSTACEA			
Woodlouse	Philoscia muscorum Swp.	C.	Scavenger and ? carnivorous
"	Porcellio scaber Latr.	C. B.	" "
MOLLUSCA			
Slug	Arion subfuscus Drap.	C. B.	Scavenger
"	Limax maximus L.	B.	"
Snails	Polita alliaria Müll.	B.	" ?

Table X. *Animals found in Molinia with dead birch leaves.*  
*Inner circle 26. XII. 25.*

DIPTERA			
Fly	Limosina moesta Villen.	?	Scavenger; abundant
COLEOPTERA			
Beetle	Notiophilus biguttatus F.		Carnivorous
"	Olophrum piceum Gyll.	"	?
"	Othius myrmecophilus Kies.	"	?
CHILognatha			
Centipede	Scolopendra sp.		Carnivorous. Common
CRUSTACEA			
Woodlouse	Philoscia muscorum Scop.		Scavenger and carnivorous. Common
MOLLUSCA			
Slugs	Eggs probably of slugs		Common
MAMMALIA			
Mouse	Apodemus silvaticus L. (probably)		Runs very numerous. Mainly vegetarian

Table XI. *Insect visitors of Teucrium scorodonia.*

M. = Male. F. = Female. W. = Worker

HYMENOPTERA			
Humble Bee	Bombus agrorum F.	W.	Common
"	B. hortorum L.	M.	"
"	B. lapidarius L.	M.	
"	B. lucorum L.	M.	
"	B. rudarius Müll. (derhamellus K.)	W.	
Bee	Saropoda bimaculata Pz.	M. F.	Common
DIPTERA			
Fly	Hylos culiciformis F.		Cf. Table VII

## E. THE GREAT HOLLOW.

In its animals, just as in its plants, this area has a special character. The greater number of the animal communities on the Common are represented in it. It is of interest to note that just as colonisation by oak, birch, and *Castanea* has proceeded further here than elsewhere, so the animals of deciduous woods are better represented. Some, such as *Scoparia* spp., are mainly typical of older woods, and others such as *Endotricha flammealis* Schiff., do not arrive, as a rule, till fairly late in succession. The peculiar character of the hollow, however, is probably most clearly seen in the greater abundance of insect life in general. This it probably owes mainly to its sheltered position, but partly to the fact that it acts as a trap to many of the smaller forms. The damp spots at the bottom of the hollow, besides allowing *Juncus* to grow, support several animals which are characteristic of the wetter areas (see Table XII).

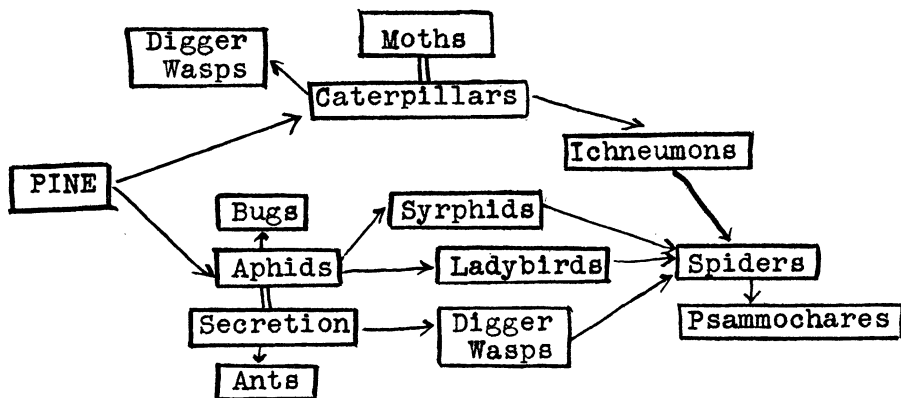


FIG. 1. Food-cycle on young pine.

At the other end of succession there has been a considerable growth of *Pinus* and a number of pine insects have been recorded. The regular pine ant, however, *Formica rufa* L. has not yet arrived. The most important herbivore on the pines is the aphid *Dilachnus pini* L. This is fed on by bugs (*Anthocoris nemorum* L.), ladybirds, and syrphid larvae. Spiders build their webs all over the pines and catch the winged individuals of the aphides, and also the adults of their enemies. The various digger wasps which visit the aphides for their secretions also get caught by the spiders. Finally digger wasps prey on the spiders. Such a community can be found on most of the young pines, even isolated ones in the damp areas, but is best developed in the Great Hollow. A rough diagram of the food relations is given in Fig. 1: the species concerned will be found in Table XIII.

Probably parasites rather than carnivores are the main check on many of the animals. But since the parasites are probably often controlled by carnivores the diagram represents a broad approximation to the truth. Thus, when

a spider is said to eat a moth, it may often eat mainly the parasites of the moth. As far as the total food supply is concerned the result is the same. The moth *Retinia* which feeds on the pine is particularly important because the larvae destroys the growing tip; if the moth were sufficiently abundant it might retard growth enough to modify or at least slow down succession.

When *Pinus* invades a birch scrub successfully a few of the birches generally survive in the pinewood. These continue to support a number of the birch insects; in Table VII such insects, still remaining in the pinewood at Oxshott, are marked with a symbol.

Table XII. *Animals typical of wetter areas which occur in the Great Hollow.*

LEPIDOPTERA		
Moth	<i>Coleophora caespititiella</i> Z.	Larva on <i>Juncus effusus</i>
COLEOPTERA		
Beetle	<i>Crepidodera ferruginea</i> Scop.	Vegetarian
"	<i>Cytillus varius</i> F.	?
HEMIPTERA		
Bug	<i>Nabis rugosus</i> L.	Carnivorous
Leafhopper	<i>Philaenus lineatus</i> L.	Vegetarian
AMPHIBIA		
Toad	<i>Bufo vulgaris</i> aur. L. (?)	Young (perhaps really the Natterjack <i>B. calamita</i> Laur.)

Table XIII. *Animals on young pines in the Great Hollow.*

HYMENOPTERA		
Ant	<i>Acanthomyops niger</i> L.	Secretions of aphides
Digger wasp	<i>Crossocerus wesmaeli</i> V. de Lind.	Secretions of aphides. Cf. Table I
Ant	<i>Formica fusca</i> L.	" " "
Digger wasp	<i>Oxybelus uniglumis</i> L.	" " "
"	<i>Psammochares fuscus</i> L. ( <i>viaticus</i> ) and spp.	Catches spiders for its larvae
"	<i>Psen</i> spp.	Secretions of aphides
"	<i>Sphex sabulosa</i> L.	Caterpillars, e.g. larva of <i>Panolis</i>
Bees	Various bees coming to secretions of aphides caught by spiders	
Parasitic wasps	Numerous ichneumons (unnamed) are similarly caught	
DIPTERA		
Fly	<i>Syrphus vitripennis</i> Mg. and spp.	Larva on aphides
LEPIDOPTERA		
Moth	<i>Gelechia dodecella</i> L.	Larva on <i>Pinus</i>
"	<i>Ocnerostoma piniariella</i> Z.	"
"	<i>Panolis griseovariegata</i> Goeze	"
"	<i>Retinia buoliana</i> Schiff.	"
COLEOPTERA		
Ladybird	<i>Adalia bipunctata</i> L.	Aphides
"	<i>Anatis ocellata</i> L.	"
"	<i>Coccinella 7-punctata</i> L.	"
"	<i>Exochamus quadripustulatus</i> L.	"
Beetle	<i>Myelophilus piniperda</i> L.	Burrows in shoots of <i>Pinus</i>
Bug	<i>Anthocoris nemorum</i> L.	Aphides
Aphid	<i>Dilachnus pini</i> L.	<i>Pinus</i> . (Probably there are other species of aphides)
ARACHNIDA		
Spider	<i>Agelena labyrinthica</i> Cl.	Insects. Very common in summer
"	<i>Linyphia triangularis</i> Cl.	Insects. Autumn

## 2. DAMP SERIES

## A. AQUATIC COMMUNITIES.

The Black Pond is the only large permanent body of water on the Common and has a rich aquatic life, forming a relatively self-contained community, which, however, has scarcely been studied. The dragonflies which breed there range all over the Common, becoming more abundant as the pond is approached, so that there must be a gradient in whatever biotic effects these highly carnivorous insects produce. Most of the dragonflies recorded have been seen by me and are common; others are recorded by Lucas (1900) as common at the right time of the year. A number of other species, only occurring as strays, have not been included. The incompleteness of the records for the Black Pond is obvious in the list, where practically no food for the various carnivores is recorded. The reed swamp on the edge of the pond, also, has not been much investigated; the data for the pond and its margin are given in Tables XIV and XV. The Black Pond is of further importance in being at least the main source of insects for all the temporary pools.

These pools fall into a number of classes depending on their degree of permanence (which is usually correlated with their depth) and their distance from the Black Pond.

The shallower pools were first developed on the bare burnt soil of the Molinietum. When they dried up a dense carpet of *Funaria*, and later *Polytrichum*, was formed. If shallow pools are formed on this carpet they are unfavourable to animal life, and in any case the moss is so absorbent that there is little free water. Such pools, therefore, are a feature of early stages in succession (see Table XVI).

Deeper pools (9 in. to  $2\frac{1}{2}$  ft.) are much more permanent, but they may dry up completely two or three times in the course of the summer. When they dry up they are carpeted by *Juncus supinus*, not by mosses. Such pools occur throughout the Molinietum and they have quite a rich fauna, especially when situated near the Black Pond. A number of insects are able to breed in the deeper pools and not in the shallower pools. The number of kinds and individuals of insects present depends directly on the length of time since the pool was last dried up. At the end of the wet summer of 1924 they had a particularly rich fauna (see Tables XVII and XVIII).

The work of Harnisch (1925) in Germany, Wesenberg-Lund (1921) in Denmark and Johannsen (1921) in Arctic Canada, shows that the community inhabiting such pools is very similar throughout the northern palaearctic region. Wesenberg-Lund has given an interesting account of the enemies of the mosquito larvae and pupae which are one of the main links in the food chain. A very tentative and incomplete food-cycle for the pools is given in the diagram (Fig. 2). The food relations are complicated because, in the case

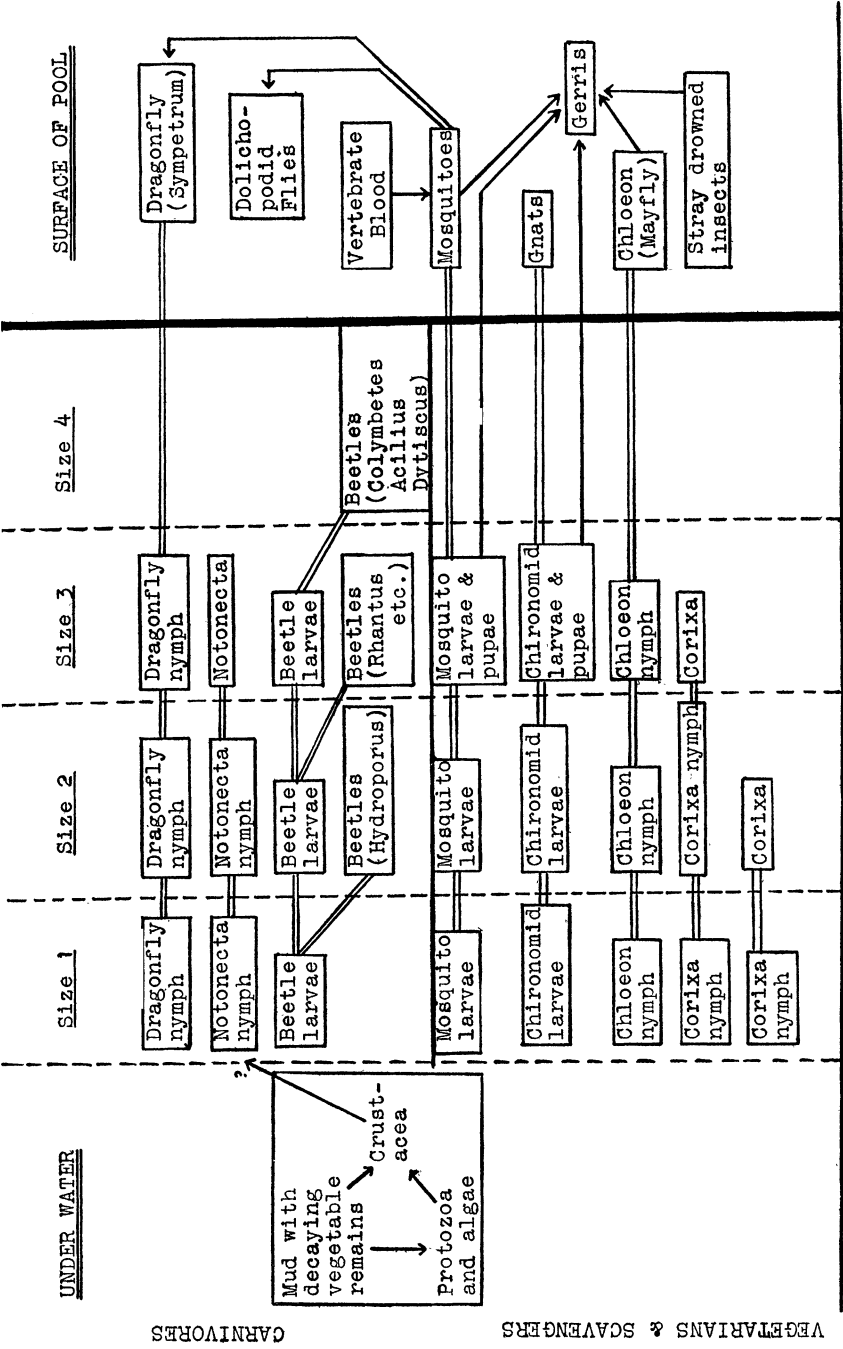


FIG. 2.



of most water beetles and other aquatic insect larvae, it is almost certain that the main factor deciding the food of the carnivore is its size. Many larvae are cannibals and will eat smaller larvae of their own species. A scheme has been adopted which attempts to show the relation of size to the food chain. Among the beetles there are three main sizes, though these are not, of course, sharply marked off, represented by *Hydroporus*, *Agabus* and *Colymbetes-Dytiscus* respectively. The largest type of larva, of course, grows through all the other sizes. In the diagram the thick vertical line represents the surface of the water. The horizontal line divides the aquatic community into carnivores and refuse-eaters. The vertical dotted lines divide the animals into four size-groups, representing either different sizes of the adults, or sizes passed through by growing larvae. The carnivores in any one size-group will eat all the carnivores smaller than themselves, and any refuse-eater up to their own size. Thus a carnivore will eat any other carnivore to the left of it in the diagram and any refuse feeder to the left of it or vertically beneath. Further investigation would probably show that specialisation exists amongst the carnivores in their choice of food and also perhaps that the largest forms would neglect the smallest food animals and only pay attention to those nearer to them in size.

Table XIV. *Animals noticed in the Black Pond.*

		HEMIPTERA			
Bugs	<i>Aretocoris fabricii</i> Fieb.	Scavenger and ? partly carnivorous			
"	<i>A. hieroglyphica</i> Duf.	"	"	"	"
"	<i>A. moesta</i> Fieb.	"	"	"	"
"	<i>Callicorixa praeusta</i> Fieb.	"	"	"	"
"	<i>Corixa geoffroyi</i> Leach	"	"	"	"
		TRICHOPTERA			
Caddis	<i>Phryganea varia</i> F.	Larva carnivorous			
"	<i>Polycentropodidae</i> ? sp.	"	"	"	"
		ODONATA			
Dragonfly	<i>Aeschna cyanea</i> Müll.	Larva carnivorous. Adult carnivorous above pond, etc.			
"	<i>A. grandis</i> L.	"	"	"	"
"	<i>A. juncea</i> L.	"	"	"	"
"	<i>A. mixta</i> L.	"	"	"	"
"	<i>Agrion puella</i> L.	"	"	"	"
"	<i>Anax imperator</i> Leach	"	"	"	"
"	<i>Cordulia aenea</i> L.	"	"	"	"
"	<i>Enallagma cyathigerum</i>	"	"	"	"
	Charp.				
"	<i>Leucorhinia dubia</i> Lind.	"	"	"	"
"	<i>Libellula depressa</i> L.	"	"	"	"
"	<i>L. quadrimaculata</i> L.	"	"	"	"
"	<i>Pyrhosoma nymphyla</i> Sulz.	"	"	"	"
"	<i>P. tenella</i> Vill.	"	"	"	"
"	<i>Sympetrum scoticum</i> Don.	"	"	"	"
		AVES			
Moorhen	<i>Gallinula chloropus chloropus</i> L.	Mainly aquatic plants			
Coot	<i>Fulica atra atra</i> L.				

Table XV. *Animals in the reed swamp at the edge of the Black Pond.*

		DIPTERA
Fly	Leptis scolopacea L.	Larva subterranean, carnivorous. Adult carnivorous
		LEPIDOPTERA
Moth	Crambus pascuellus L.	Larva on grasses
"	C. pratellus L.	"
"	C. tristellus F.	"
		COLEOPTERA
Beetle	Acupalpus meridianus L.	Carnivorous
"	Coccidula rufa Abst.	"
"	C. scutellata Hbst.	"
"	Cyphon padi L.	Larva aquatic ? carnivorous
"	Plectroscelis concinna Marsh.	Cruciferae
		AVES
Snipe	Capella gallinago gallinago L.	Subaquatic insects, worms, etc.

Table XVI. *Shallow temporary pools.*

		COLEOPTERA
Beetle	Agabus bipustulatus L.	Carnivorous
"	Helophorus affinis Marsh.	? Vegetarian. This species may even occur in foot-marks
"	Hydroporus melanarius Stm.	Carnivorous
"	H. planus F.	"
"	H. pubescens Gyll.	Carnivorous. This species may aestivate in the dried mud

Table XVII. *Deeper temporary pools with Juncus supinus.*

		DIPTERA
Mosquito	Aedes annulipes Mg.	Larva vegetarian and scavenger
Gnats	Chironomids. None identified	
Fly	Caenia albula Mg.	? Adult on the surface
"	Campsicnemus scambus Fall.	Carnivorous, on the surface
"	Dolichopus vitripennis Mg.	" "
"	Hydrophorus bipunctatus Lehm.	" "
"	Octhera mantis DeG.	" "
		COLEOPTERA
Beetle	Acilus sulcatus L.	Carnivorous, on the surface
"	Agabus chalconotus Pz.	Carnivorous (especially where there is much dead grass)
"	A. bipustulatus L.	Carnivorous. Very common
"	Anacaena limbata F.	? Vegetarian
"	Berosus luridus L.	"
"	Colymbetes fuscus L.	Carnivorous. Common
"	Dytiscus marginalis L.	"
"	Gyrinus natator Scop.	Carnivorous, on the surface
"	Helochares punctatus Shp.	? Vegetarian
"	Helophorus affinis Marsh	"
"	Hydroporus discretus Fair.	? Carnivorous
"	H. erythrocephalus L.	"
"	H. gyllenhali Schiödt	" Common
"	H. neglectus Schaum.	"
"	H. planus F.	"
"	H. pubescens Gyll.	" Common
"	Ibybius aenescens Th.	Carnivorous
"	Rhantus bistriatus Berg.	"
"	R. pulverosus Steph.	"

Table XVII (*continued*)

HEMIPTERA			
Bug	<i>Arctocoris fabricii</i> Fieb.	? Scavenger and partly carnivorous.	Common
"	<i>A. fallenii</i> Fieb.	" "	"
"	<i>A. hieroglyphica</i> Duf.	" "	Common
"	<i>A. limitata</i> Fieb.	" "	"
"	<i>A. moesta</i> Fieb.	" "	Common
"	<i>A. sahlbergi</i> Fieb.	" "	"
"	<i>A. semistriata</i> Fieb.	" "	"
"	<i>A. striata</i> L.	" "	"
"	<i>Callicorixa praeusta</i> Fieb.	" "	"
"	<i>Corixa geoffroyi</i> Leach	" "	Common
"	<i>Hygrotrechus</i> (Gerris) <i>paludum</i> F.	Carnivorous, on the surface	
"	<i>Limnotrechus</i> (G.) <i>gibbifer</i> Schum.	" "	
"	<i>L. lacustris</i> L.	" "	Common
"	<i>L. odontogaster</i> Zett.	" "	
"	<i>Notonecta furcata</i> F.	Carnivorous	
"	<i>N. glauca</i> L.	" Common	
"	<i>N. halophila</i> Edw. ( <i>viridis</i> Delc.)	"	
"	<i>N. maculata</i> F.	" Common	
EPHEMEROPTERA			
Mayfly	<i>Chloeon dipterum</i> L.	Larva vegetarian	
ODONATA			
Dragonfly	<i>Sympetrum</i> sp.	Larva carnivorous	
ARACHNIDA			
Spider	<i>Tetragnatha</i> sp.	Carnivorous, on rushes at edge	
AMPHIBIA			
Frog	<i>Rana temporaria</i> L.	Carnivorous (not breeding here?)	

Table XVIII. *In Juncus supinus of dried pools.*

LEPIDOPTERA		
Moth	<i>Coleophora glaucicolella</i> Wood	Larva on <i>Juncus</i>
"	<i>Glyphipteryx thrasonella</i> Scop.	" Abundant
COLEOPTERA		
Beetle	<i>Aculpalsis dorsalis</i> F.	Carnivorous
"	<i>Bembidium lampros</i> Hbst.	"
"	<i>Pterostichus diligens</i> Stm.	"
"	<i>P. nigrita</i> F.	"
HEMIPTERA		
Bug	<i>Acanthia saltatoria</i> L.	Carnivorous
"	<i>Limnotrechus gibbifer</i> Schum.	(Aestivating)
CRUSTACEA		
Woodlouse	<i>Porcellio scaber</i> Latr.	Scavenger and carnivorous
ARACHNIDA		
Spider	<i>Erigone atra</i> Bl.	Carnivorous

Another set of animals lives in the drains that were dug across the Common after felling. In the drains which are choked with dead leaves of *Molinia* the only insect that has been noted is the beetle *Agabus chalconotus* St. Many of the drains however are more like small streams and have a proper aquatic vegetation, consisting of *Glyceria fluitans*, *Polygonum polygonifolius* and much *Spirogyra*. Similar ditches on other London heaths have been found to have a nearly identical fauna (Table XIX). The edge of these drains has also a very characteristic set of animals, some of which are found nowhere else on the Common (Table XX). A number of flies with aquatic or semi-aquatic

larvae probably breed in these ditches. The adults are either flower-haunting bee-flies (*Eristalis*) or blood-suckers (Tabanids) and are found all over the Common. The species that have been recorded are given in Table XXI.

Table XIX. *Insects in the ditches.*

DIPTERA			
Fly	<i>Gymnopternus nanus</i> Mcq.	Carnivorous	22
"	<i>Hydrellia griseola</i> Fall.	Larva on grasses	11
"	<i>Limosina humida</i> Hal.	"	24
"	<i>Parhydra aquila</i> Fall.	"	2
"	<i>P. coarctata</i> Fall.	"	2
"	<i>P. quadripunctata</i> Mg.	"	8
COLEOPTERA			
Beetle	<i>Agabus bipustulatus</i> L.	Carnivorous	
"	<i>A. sturmii</i> Gyll.	"	Common
"	<i>Anacaena globulus</i> Pk.	? Vegetarian	
"	<i>A. limbata</i> F.	"	
"	<i>Helophorus affinis</i> Marsh.	"	
"	<i>Hydrobius fuscipes</i> L.	"	
HEMIPTERA			
Bug	<i>Aretocoris fabricii</i> Fieb.	Scavenger and ? partly carnivorous	
"	<i>A. sahlbergi</i> Fieb.	"	
"	<i>Velia currens</i> F.	Carnivorous, on the surface	"
ODONATA			
Dragonfly	<i>Aeschna juncea</i> L. la.	Carnivorous	
"	<i>Agrionid</i> la.	"	
TRICHOPTERA			
Caddis	<i>Polycentropodidae</i> la.	Carnivorous	

Table XX. *In vegetation at the edges of ditches.*

COLEOPTERA			
Beetle	<i>Agononum oblongum</i> F.	Carnivorous	
"	<i>Bembidium lampros</i> Hbst.	"	
"	<i>Lathrobium brunnipes</i> F.	"	
"	<i>L. terminatum</i> Gr.	"	Common
"	<i>Olophrum piceum</i> Gyll.	"	
"	<i>Pterostichus minor</i> Gyll.	"	Common
"	<i>P. strenuus</i> Pz.	"	
"	<i>Stenus ossium</i> Steph.	"	
"	<i>S. rogeri</i> Kr.	"	
COLLE			
Springtails	<i>Collembola</i> common	Vegetarian and scavengers	
CRUSTACEA			
Woodlouse	<i>Porcellio scaber</i> Latr.	Scavenger and partly carnivorous	
ARACHNIDA			
Spider	<i>Centromerus prudens</i> Cambr.	Carnivorous	
"	<i>Walckeraera nudipalpis</i> Westr.	"	

Table XXI. *Diptera with aquatic or subaquatic larvae.*

Fly	<i>Chrysops coecutiens</i> L.	Larva carnivorous.	Bloodsucker
"	<i>Eristalis arbustorum</i> L.	Larva scavenger.	On flowers
"	<i>E. intricarius</i> L.	"	"
"	<i>E. pertinax</i> Scop.	"	"
"	<i>E. tenax</i> L.	"	"
"	<i>Haematopota pluvialis</i> L.	Larva carnivorous.	Adult a bloodsucker
"	<i>Helophilus hybridus</i> Lw.	Larva scavenger.	Adult on flowers
"	<i>Sericomyia borealis</i> Fall.	"	"
"	<i>Tabanus bromius</i> L.	Larva carnivorous.	Adult a bloodsucker
"	<i>T. sudeticus</i> Z.	"	"
"	<i>Therioptectes distinguendus</i> Verr.	"	"
"	<i>T. tropicus</i> Mg. var. <i>bisignatus</i> Jaenn.	"	"

## B. SPHAGNETUM.

Although this has not been much investigated, it is certainly poorly represented at Oxshott. Nearly all the *Sphagnum* was shaded by heavy woods before felling and so was unsuitable, and since the felling animals have been slow in arriving. The only insects that have been noted are the beetle *Cyclonotum orbiculare* F. and the bug *Microvelia reticulata* Burm. No doubt there is a large microfauna.

## C. SUCCESSION ON BARE, WET AREAS.

In the earlier stages of succession there is no distinction in habitat between bare, wet areas and the margins of pools. Gradually, however, mosses form a carpet, which, when dense, becomes the habitat of a different set of animals. The animals characteristic of the early stages of succession still hang on at pool margins, in dried up pools and at damp spots on the paths. In the late summer of 1922 bare, wet areas were very extensive and the animals were those of a pond margin (e.g. *Loricera*, *Bembidium* spp.). In the winter of 1922-3 the ground was much flooded and the *Anchomenus*, *Loricera*, *Notiophilus biguttatus* F. and *Acanthia* were found hibernating under pine bark above the water level. In the summer of 1923 the bare areas were much smaller owing to the spread of *Funaria hygrometrica*; many of the pioneers, however, will tolerate the moss when it is short. The growth of moss is not regular, and does not begin quickly on areas often flooded, so that some bare areas existed in 1925.

In any spot where succession was watched *Bembidium lampros* Hbst. and *Pterostichus diligens* Stm. came in with the mosses and soon became abundant. The latter beetle hibernates in *Polytrichum* and not under pine bark. In 1924 the animals characteristic of bare, damp areas were much scarcer and various new animals appeared. Probably the community eventually changes into one of the normal damp ground series, but this has not yet happened in the places that have been watched. *Polytrichum* at any rate can remain as a local dominant for some years. These facts are summarised in Table XXII. The four stages shown are (1) the bare ground stage, (2) young *Funaria*, (3) *Funaria*, *Ceratodon* and *Polytrichum*, (4) *Polytrichum*. *Ceratodon* may be the main moss where the ground is a little drier, and here the digger wasps *Priocnemis parvulus* Dahlb. (commonly), *Psammochares fuscus* L. (*viaticus*) and *Gorytes quadrifasciatus* F. are found nesting.

The arrival of *Carabus*, the large apterous predaceous beetle, is probably partly correlated with the first abundance of molluscs and earthworms on which it commonly feeds. All these forms are mainly found under bark of pine, etc., in the damp areas, but come out at night. In the following table the correlation between the arrivals is shown:

		1923	1924	1925
<i>Molluscs</i>	<i>Limax maximus</i> L.	A few	A few	Common
	<i>Arion ater</i> L.	"	Common	"
	<i>A. subfuscus</i> Drap.	"	"	"
	<i>Polita alliaria</i> Müll.	"	"	A few
<i>Earthworms</i>		—	A few	Common
<i>Beetle</i>	<i>Carabus catenulatus</i> Sepp.	—	One	"

Table XXII. Succession on bare, wet areas.

1 = Summer 1922. 2 = Summer 1923. 3 = Summer 1924. 4 = Summer 1925

COLEOPTERA					
Beetle	<i>Amara lunicollis</i> Schiödt	Carnivorous	—	2	—
"	<i>Anchomenus 6-punctatus</i> L.	"	1	2	3
"	<i>Bembidium biguttatus</i> F.	"	—	2	—
"	<i>B. bruxellense</i> Wesm.	"	1	—	—
"	<i>B. lampros</i> Hbst.	"	1	2	3
"	<i>B. riparium</i> Ol.	"	1	—	—
"	<i>Carabus catenulatus</i> Scop.	"	—	—	4
"	<i>Cytillus varius</i> F.	?	1	2	—
"	<i>Haltica oleracea</i> L.	Larva on <i>Epilobium</i>	—	—	3
"	<i>Loricera pilicornis</i> F.	Carnivorous	1	—	—
"	<i>Megasternum boletophagum</i> Marsh	Scavenger	—	—	4
"	<i>Notiophilus biguttatus</i> F.	Carnivorous	1	2	3
"	<i>N. palustris</i> Duft.	"	1	—	—
"	<i>Pterostichus angustatus</i> Duft.	"	—	—	3
"	<i>P. diligens</i> Stm.	"	—	2	3
"	<i>P. nigrita</i> F.	"	—	2	—
"	<i>Stenus longitarsis</i> Th.	"	1	—	—
"	<i>S. rogeri</i> Kr.	"	1	—	—
"	<i>Tachyporus chrysomelinus</i> L.	" ?	1	?	3
"	<i>T. hypnorum</i> F.	" ?	1	?	3
HEMIPTERA					
Bug	<i>Acanthia saltatoria</i> L.	Carnivorous ?	1	2	—
"	<i>Nabis rugosus</i> L.	"	—	—	3
"	<i>Trapezonotus arenarius</i> L.	?	1	?	—
COLLEMBOLA					
Springtails	<i>Collembola</i> abundant	Vegetarian	?	?	?
ORTHOPTERA					
Grasshopper	<i>Tettix bipunctatus</i> L.	Vegetarian	1	2	—
CRUSTACEA					
Woodlouse	<i>Porcellio scaber</i> Latr.	Scavenger and ? car- nivorous	—	—	—
ARACHNIDA					
Spider	<i>Erigone atra</i> Bl.	Carnivorous	—	2	—
"	<i>Lycosa amentata</i> Cl.	"	1	—	—
"	<i>Oedothorax fuscus</i> Bl.	"	—	2	—
"	<i>Pirata piraticus</i> Cl.	"	1	—	—
"	<i>Tarentula barpipes</i> Sund.	"	1	—	—
"	<i>Trochosa ruficollis</i> DeG.	"	1	—	—
"	Young of <i>Lycosa</i> , <i>Tibellus</i> , <i>Pirata</i>	"	1	—	—
"	Young of <i>Xysticus</i> sp.	"	1	?	?
ANNELIDA					
Earthworms		Vegetarian	—	—	—
MOLLUSCA					
Slug	<i>Limax maximus</i> L.	Scavenger	—	—	—
Snail	<i>Polita alliaria</i> Müll.	? Carnivorous	—	—	—

## D. MOLINIETUM.

Before the fire in 1921 there was an extensive growth of *Molinia* and, since much of it was not destroyed, the animal community connected with it was fully developed when the Common was first visited in 1922; there are thus no observations on the actual changes resulting from the growth of *Molinia* on a given area. The fauna is not unlike that of an ordinary meadow, though there are a number of peculiar forms. Some of the bugs, e.g.

*Stenodema* and *Trigonotylus* and leafhoppers, e.g. *Tettigonia*, show typical adaptations to grass conditions in their colouring, and, in the case of the bugs, in their elongate shape. Grasshoppers are excessively abundant, and have increased in numbers since 1922. The grass-moths (*Crambus*) were exceedingly abundant in 1922 and to a less extent in 1923. Since then they have been relatively scarce. The same is true of the common rush feeding moth, *Bactra lanceolana* Hb. Perhaps they increased originally as a result of the hot summer in 1921; at any rate no other cause can be suggested. The animals recorded are given in Table XXIII.

The effect of invasion by *Betula* has been discussed in a previous section (p. 257). *Molinia* can grow for a long time in areas which have been invaded by pine. Such *Molinia*, growing in pinewoods, still has associated with it most of the small insects, etc., which normally live under the tufts, e.g. beetles, bugs, spiders and woodlice. The moths and grasshoppers disappear. Many of the fungus beetles of the pinewood hide in the tufts in winter; several weevils, probably attracted from neighbouring leguminous crops, hibernate in *Molinia* growing under the shade of pine. Many of the insects found in the *Calluna* growing in the same situation also occur.

Table XXIII. *Animals of the Molinietum.*

DIPTERA		
Fly	<i>Borborus geniculatus</i> Meq.	Hibernates in tufts. ? Scavenger
"	<i>Loxocera albiseta</i> Schrk.	?
"	<i>Sépedon sphegeus</i> F.	Common in autumn
"	<i>Sepsis</i> spp.	Hibernate in tufts. Larva a scavenger
LEPIDOPTERA		
Butterfly	<i>Adopaea sylvanus</i> Esp.	Larva on grasses
"	<i>A. thaumas</i> Hufn.	"
"	<i>Coenomympha pamphilus</i> L.	"
Moth	<i>Crambus hamellus</i> Thnbg.	Larva on grasses. Not common but characteristic
"	<i>C. pascuellus</i> L.	Larva on grasses. Abundant
"	<i>C. tristellus</i> L.	"
Butterfly	<i>Epinephele ianira</i> L.	"
Moth	<i>Euxanthis hamana</i> L.	"
Butterfly	<i>Heodes phloeas</i> L.	Larva on <i>Rumex</i> spp.
Moth	<i>Nomophila noctuella</i> Schiff.	Larva on herbs
Butterfly	<i>Pararge megaera</i> L.	Larva on grasses
Moth	<i>Plusia gamma</i> L.	Larva on herbs
"	<i>Plutella maculipennis</i> Curt.	"
COLEOPTERA		
Beetle	<i>Bradycellus verbasci</i> Duft.	Carnivorous
"	<i>Haltica oleracea</i> L.	Larva on <i>Epilobium</i> . Adult hibernates in tufts
"	<i>Hoplia philanthus</i> Füss.	Larva on plant roots
"	<i>Pterostichus strenuus</i> Pz.	Carnivorous. Adult in tufts in winter
"	<i>Sitones lineatus</i> L.	Leguminosae. Adult in tufts in winter
"	<i>Stenus flavipes</i> Steph.	Carnivorous. Adult in tufts in winter.
		A characteristic species
"	<i>S. rogeri</i> Kr.	Carnivorous
"	<i>Tachyporus chrysomelinus</i> L.	Carnivorous ? Adult in tufts in winter
"	<i>T. hypnorum</i> F.	" " "

Table XXIII (*continued*).

HEMIPTERA		
Bug	<i>Nabis major</i> Costa.	Carnivorous
"	<i>N. rugosus</i> L.	"
"	<i>Stenodema calcaratum</i> Fall.	On grasses
"	<i>S. holsatum</i> F.	"
"	<i>Trigonotylus ruficornis</i> Geoff.	"
Leafhopper	<i>Philaenus lineatus</i> L.	"
"	<i>Tettigonia viridis</i> Liv.	"
COLLEMBOLA		
Springtails	<i>Collembola</i> . None identified	Vegetarian and scavengers
ORTHOPTERA		
Grasshopper	<i>Chorthippus elegans</i> Charp.	Herbs
"	<i>C. parallelus</i> Zett.	Herbs. A short winged form not be coming common before 1924
"	<i>Gomphocerus maculatus</i> Thnbg.	Herbs. Abundant. With green forms
"	<i>Metrioptera brachypterus</i> L.	" Abundant
"	<i>Omocestus viridulus</i> L.	"
"	<i>Stauroderus bicolor</i> Charp.	" Commonly with green forms
ARACHNIDA		
Spider	<i>Agelena labyrinthica</i> Cl.	Mainly on bare areas, but catches grass insects, e.g. <i>Philaenus</i>
"	<i>Drassodes troglodytes</i> C.L.K.	Carnivorous
"	<i>Linyphia clathrata</i> Spnd.	"
"	<i>Lycosa amentata</i> Cl.	"
"	<i>Pisaura mirabilis</i> Cl.	"
"	<i>Segestria senoculata</i> L.	"
"	<i>Stemonyphantes lineatus</i> L.	"
"	<i>Tibellus oblongus</i> Walek.	"
"	<i>Xysticus erraticus</i> Bl.	"
CRUSTACEA		
Woodlouse	<i>Porcellio scaber</i> Latr.	Scavenger and partly carnivorous
AVES		
Skylark	<i>Alauda arvensis arvensis</i> L.	Mainly seeds
Kestrel	<i>Falco tinnunculus tinnunculus</i> L.	Mainly mice, partly young birds
Partridge	<i>Perdix perdix perdix</i> (L.)	Mainly plants. Partly insects in summer
Pheasant	<i>Phasianus colchicus</i> L.	" " "
Stonechat	<i>Saxicola torquata hibernans</i> Hart.	Mainly insects
MAMMALIA		
Hare	<i>Lepus europaeus occidentalis</i> de Winton	Vegetarian

## E. JUNCETUM.

The *Juncus* fauna has not been fully worked out, but probably the number of species is rather low. In individuals, however, the actual rush-feeders are often exceedingly abundant. *Coleophora caespititiella* Zell. must destroy at least half the seeds produced. Some of these rush-feeders also occur on *J. squarrosus*, growing on drier areas, but the fauna given in Table XXV is that connected with *J. effusus*. A few insects are included which visit flowers growing commonly in the Juncetum.

Table XXIV. *Animal community in the Juncetum.*

HYMENOPTERA		
Bee	<i>Bombus lucorum</i> L.	Female: On <i>Lotus uliginosus</i> and <i>Cirsium</i>
"	<i>Megachile maritima</i> K.	Male. Common on <i>Lotus</i> [ <i>palustre</i> ]
"	<i>M. willughbiella</i> K.	" "
"	<i>Psen unicolor</i> V. de Lind.	Female hunting " leafhoppers amongst
"	<i>Psammochares? piliventris</i> Mor. ( <i>cardui</i> )	Female on <i>Lotus</i> [ <i>Juncus</i> ]
Wasp	<i>Vespa germanica</i> Fab.	Worker (probably fly-hunting) in <i>Juncus</i>
"	<i>V. vulgaris</i> L.	" " "
"	<i>V. rufa</i> L.	" " "



Table XXIV (*continued*).

DIPTERA		
Fly	<i>Dolichopus pennatus</i> Mg.	Predaceous
"	<i>Gymnopternus nanus</i> Mcq.	"
"	<i>Tachydromia flavipes</i> F.?	"
"	<i>Psectrosciara coxendix</i> Verr.	Adults, sometimes very common on heads of <i>Juncus</i> . Larva ? scavenger
LEPIDOPTERA		
Butterfly	<i>Adopaea silvanus</i> Esp.	On flowers of <i>Lotus</i>
Moth	<i>Bactra lanceolana</i> Hb.	Larva on <i>Juncus</i> . Abundant 1922-3
"	<i>Coleophora caespitiella</i> Zell.	" " Abundant
"	<i>C. glaucicolella</i> Wood	" " "
"	<i>Gliphipteryx thrasonella</i> Scop.	" " Common 1924-5
COLEOPTERA		
Beetle	<i>Crepidodera transversa</i> Marsh	Vegetarian. Abundant in 1924
"	<i>Cyphon variabilis</i> Thnbg.	Larva carnivorous
"	<i>Pterostichus stremus</i> Pz.	Carnivorous
"	<i>Rhagonycha fulva</i> Scop.	Carnivorous (sometimes on flowers of <i>Lotus</i> )
"	<i>Xantholinus linearis</i> Ol.	? Carnivorous
HEMIPTERA		
Bug	<i>Anthocoris nemorum</i> L.	Carnivorous
"	<i>Trigonotylus ruficornis</i> Geoff.	Vegetarian
Leafhopper	<i>Athysanus sordidus</i> Zett.	"
"	<i>Conomelus limbatus</i> Fab.	" Abundant
"	<i>Limotettix antennata</i> Boh.	"
ARACHNIDA		
Spider	<i>Chromolithus festivus</i> C.L.K.	Carnivorous. Web on heads of <i>Juncus</i>
"	<i>Dictynna luteus</i> F.	" " "
"	<i>Pisaura mirabilis</i> Cl.	Carnivorous

## F. SPECIAL PLANTS.

Certain plants characteristic of wet areas always have certain animals, either vegetarians or flower visitors, associated with them. These animals certainly seek the plant rather than any special conditions and so are given separately rather than in the community in which the plant grows. Thus the flowers of *Potentilla erecta* are always visited abundantly by the fly *Hercostomus nigripennis* Fall; and the bees *Prosopis brevicornis* Nyl. and *P. genalis* Thoms., occasionally by workers of *Bombus agrorum* Fab.

*Rumex acetosella* is the food of the beetles *Cryptocephalus fulvus* Goeze, *Apion rubens* Steph. and *Rhinoncus castor* F. These are found with the plant wherever it occurs.

Ragwort (*Senecio jacobaea*) and other species of *Senecio* are fed on by the beetle *Longitarsus jacobaeae* Wat., and the flowers of this and other Yellow Composites are visited by the fly *Sicus ferrugineus* L. and bees of the genus *Halictus*.

The species connected with *Salix* (broad-leaved species), with *Ulex europaeus* and with *Rubus* are so numerous that they are given in Tables XXV, XXVI, and XXVII. The flowers of the first two plants are important as being the main source of food for the spring bees, and of various other hibernated insects.

Table XXV. *Animals connected with Salix spp.*

M. = Male. F. = Female. W. = Worker

HYMENOPTERA			
Wasp	Ancistrocerus callosus Thoms.	On flowers	F.
Bee	Andrena albicans Müll.	"	M. F.
"	A. bimaculata K.	"	M.
"	A. clarkella K.	"	M. F.
"	A. dorsata K.	"	M. F.
"	A. fulva Schrk.	"	F.
"	A. gwynana K.	"	M.
"	A. parvula K.	"	F.
Hive bee	Apis mellifera L.	"	W.
Humble bee	Bombus agrorum F.	"	F.
"	B. jonellus K.	"	F.
"	B. lapidarius L.	"	F.
"	B. lucorum L.	"	F.
"	B. pratorum L.	"	F.
"	B. terrestris L.	"	F.
Bee	Halictus minutus Zett.	"	F.
"	H. punctatissimus Sch.	"	F.
Digger wasp	Psammochares fuscus L. (viaticus)	"	F.
DIPTERA			
Fly	Chilosia vulpina Mg.	"	M.
"	Chortophila muscaria Mg.	"	M. F.
"	Eristalis intricarius L.	"	M.
"	Orthoneura geniculata Mg.	"	M.
"	Platychirus albimanus F.	"	M. F.
"	Rhabdophaga saliciperda Duf.	Galls on the stems with two Chalcid parasites	
"	Scatophaga stercoraria L.	On the flowers	M.
"	Syrphus lasiophthalmus Zett.	"	M. F.
LEPIDOPTERA			
Moth	Cerura furcula L.	Larva on leaves	
Butterfly	Vanessa io L.	On the flowers	
COLEOPTERA			
Beetle	Adalia bipunctata L.	On the flowers	
"	Crepidodera aurata Marsh	Feeds on the leaves	
"	Melanophthalma gibbosa Hbst.	On the flowers	
"	Meligethes ovatus Stm.	"	
HEMIPTERA			
Bug	Anthocoris nemoralis F.	On the flowers	
"	A. nemorum L.	"	
Psyllid	Psylla salicicola Först.	Feeds on the leaves	

Table XXVI. *Animals associated with Ulex.*

M. = Male. F. = Female. W. = Worker

HYMENOPTERA			
Sawfly	Abia loniceræ L.	On the flowers	F.
Bee	Andrena bimaculata K.	"	M.
"	A. dorsata K.	"	M.
"	A. gwynana K.	"	M.
Hive bee	Apis mellifera L.	"	W. abundant
Humble bee	Bombus agrorum Fab.	"	F. common
"	B. ruderarius Müll. (derhamellus)	"	F.
Bee	Halictus flavipes F.	"	F.
"	H. punctatissimus Sch.	"	F.
DIPTERA			
Fly	Eristalis pertinax Scop.	"	M. F.
"	Euaresta conjuncta Lw.	Adult hibernates in <i>Ulex</i>	
"	Platychirus albimanus F.	On the flowers	M. F.
"	P. scutatus Mg.	"	M.

Table XXVI (*continued*):

DIPTERA		
Fly	<i>Scatophaga stercoraria</i> L.	On the flowers M.
"	<i>Syrphus auricollis</i> Ztt.	"
"	<i>S. cinctellus</i> Zett.	"
"	<i>S. lasiophthalmus</i> Ztt.	"
"	<i>S. punctulatus</i> Verr.	"
"	<i>S. torvus</i> O.S.	"
"	<i>Tephritis vespertina</i> Lw.	Adult hibernates in gorse
LEPIDOPTERA		
Moth	<i>Laspeyresia ulicetana</i> Hw.	Larva on gorse
"	<i>Scythris grandipennis</i> Hw.	"
COLEOPTERA		
Beetle	<i>Adalia bipunctata</i> L.	On the flowers
"	<i>Apion ulicis</i> Först.	Larva on the seeds
"	<i>Micrambe vini</i> Pz.	Larva on the flowers
"	<i>Sitones regensteinensis</i> Hbst.	Larva on <i>Ulex</i>
"	<i>S. tibialis</i> Hbst.	"
HEMIPTERA		
Bug	<i>Asciodema obsoletum</i> Fieb.	On <i>Ulex</i>
"	<i>Dictyonota strichnocera</i> Fieb.	"
ARACHNIDA		
Spider	<i>Epeira cornuta</i> Cl.	Webs of the young abundant on <i>Ulex</i> in the spring

Table XXVII. *Insect visitors of flowers of Rubus fruticosus (agg.)*.

M. = Male. F. = Female. W. = Worker

HYMENOPTERA		
Bee	<i>Apis mellifera</i> L.	W. abundant
"	<i>Bombus agrorum</i> Fab.	F. W. common
"	<i>B. hortorum</i> L.	M. W.
"	<i>B. lucorum</i> L.	M. F. W. common
"	<i>B. pratorum</i> L.	M. common. W. only where a scrub has developed
"	<i>B. ruderarius</i> Müll. ( <i>derhamellus</i> )	M. F.
"	<i>B. terrestris</i> L.	M. F. W.
Digger wasp	<i>Cerceris labiata</i> F.	M. Cf. Table I
"	<i>C. rybyensis</i> L.	M. "
Bee	<i>Chelostoma campanularum</i> K.	M.
"	<i>Coelioxys elongata</i> Lep.	M. F. Parasite of <i>Megachile</i>
Digger wasp	<i>Gorytes quadrifasciatus</i> F.	M.
Bee	<i>Halictus flavipes</i> F.	F. Cf. Table I
"	<i>H. nitidiusculus</i> K.	F.
Ruby wasp	<i>Hedychridium minutum</i> Lep.	Cf. Table I
Bee	<i>Megachile circumcincta</i> Lep.	F.
"	<i>M. maritima</i> K.	M. Cf. Table I
"	<i>M. versicolor</i> Smith	M.
"	<i>M. willughbiella</i> K.	F. Cf. Table XXIX
Digger wasp	<i>Nysson interruptus</i> F.	M. Cf. Table I
Wasp	<i>Odynerus pictus</i> Curt.	F.
Bee	<i>Osmia leucomelaena</i> K.	F.
Digger wasp	<i>Oxybelus uniglumis</i> L.	M. F. Cf. Table I
Bee	<i>Prosopis brevicornis</i> Nyl.	M. F.
"	<i>P. communis</i> Nyl.	M. F.
"	<i>P. confusa</i> Nyl.	M. F. common
"	<i>P. genalis</i> Thoms.	M. F. Cf. Table XXIX
Digger wasp	<i>Psen shuckardi</i> Wesm.	M. Cf. Table I
Bee	<i>Psithyrus barbutellus</i> K.	M. parasite of <i>Bombus hortorum</i>
"	<i>Ps. distinctus</i> Perez.	M. parasite of <i>B. lucorum</i>
"	<i>Ps. quadricolor</i> Lep.	M. common parasite of <i>B. pratorum</i>
"	<i>Saropoda bimaculata</i> Pz.	M. F. common. Cf. Table I
Digger wasp	<i>Sphex campestris</i> Latr.	" "
"	<i>S. sabulosa</i> L.	M. common. F. Cf. Table I
"	<i>Tachysphex unicolor</i> Pz.	M. Cf. Table I

Table XXVII (*continued*).

DIPTERA		
Fly	<i>Chilosia scutellata</i> Fall.	Larva ? fungi
"	<i>Empis aestiva</i> Lw.	Carnivorous
"	<i>Eristalis arbustorum</i> L.	Cf. Table XXII
"	<i>E. intricarius</i> L.	"
"	<i>Fabriciella ferox</i> Pz.	Larva parasite of large caterpillars
"	<i>Sicus ferrugineus</i> L.	
"	<i>Volucella pellucens</i> L.	Commensal of wasps
"	<i>V. plumata</i> L.	Commensal of <i>Bombus</i>
LEPIDOPTERA		
Butterfly	<i>Adopaea sylvanus</i> Esp.	Cf. Table VII
"	<i>Epinephele janira</i> L.	
COLEOPTERA		
Beetle	<i>Byturus tomentosus</i> F.	Cf. Table VII
"	<i>Rhagonycha fulva</i> Scop.	
"	<i>Strangalia armata</i> Hbst.	Cf. Table VII
HEMIPTERA		
Bug	<i>Anthocoris nemorum</i> L.	
"	<i>Plagiognathus arbustorum</i> F.	Cf. Table VII

## G. PINE STUMPS AND FUNGI.

The pine stumps and the fungi connected with them form a relatively clear-cut habitat, occurring in every part of the area. Fungi are by no means all equally attractive to insects, and, though this has not been worked out in detail, it is mainly the species connected with the stumps that have a large fauna. The community is probably nearly the same as that which is associated with fungi in the pinewood. The animals at the base of the food chain are larvae of small flies and Collembola. The staphylinid beetles feed on these but there are no details of their feeding habits.

The pine stumps are the home of another set of animals which gradually destroy the stumps. There is probably a good deal of difference between the early stages of colonisation of fresh pine stumps and of those which have been burnt. This has not been much studied at Oxshott, but in a general way the effect of burning is to cut out the early stages of the succession. A number of animals, often highly specialised to life under bark, only occur under fresh stumps, or those not badly burnt. The beetle *Melanophila acuminata* DeG. which is peculiar to burnt pine stumps and usually arrives while the fire is still smoking, has not been seen at Oxshott, though recorded from other heaths in southern England.

The normal course of succession probably begins with arrival of Scolytid beetles (e.g. *Hylastes*). With them come their special enemies, such as the beetles belonging to the genus *Rhizophagus*, which feed on the Scolytids. In the solid wood *Asemum* and *Crioccephalus* make their burrows. The holes formed allow fungi to enter and their mycelia soon become abundant under the bark and in the wood. With them come abundant Collembola and their enemies the staphylinid beetles, small carabids; probably the flat, bark-haunting bugs also feed on them. Quite soon queen ants arrive and make their nests under the bark, and later the workers begin to excavate their

galleries in every direction. These activities soon loosen the bark and a kind of humus collects beneath it. As soon as ants have become abundant the woodpeckers attack the stumps and are perhaps one of the most important agencies in their destruction. When the bark has become really loose the specialised bark animals disappear and their place is taken by an assemblage of forms that need a dark, damp habitat. Such are woodlice, molluscs, earthworms and the carabid beetles which prey on them. Probably at Oxshott a stump may disappear in about eight years but the length of time would vary very considerably with local conditions. Under the shelter of a pine wood the stumps might persist almost indefinitely, while in damp, exposed situations the decay is rapid.

The stumps are often an important addition to the habitat in which they are situated because they may be used by whatever animals occur as hibernation quarters (beetles, wasps, flies), nesting sites (digger wasps, ants, spiders) or as shelter by day in dry areas (molluscs, beetles). The existence of stumps probably allows various animals to maintain themselves in such a habitat as a Callunetum, animals which would normally have to wait for more mesophytic conditions to be established.

Sclerodermae have a little fauna of their own. They grow mainly in the birch-scrub stages and often contain the beetles *Atheta xanthoptera* Steph., *Cryptophagus lycoperdi* Hbst. and *C. punctipennis* Bris. Perhaps the first named feeds on the larvae of the Cryptophagi.

Table XXVIII. *Animals associated with fungi.*

DIPTERA		
Fly	Chilosia longula Ztt.	Larva in <i>Boletus bovinus</i>
"	Forcipomyia spp.	Can be bred abundantly from fungi
"	Leria cineraria Lw.	Larva on fungus ( <i>Sparassis crespa</i> )
"	Limosina antennata Duda	" ? ( <i>Sparassis crespa</i> )
"	L. luteilabris Rdi.?	" " "
"	L. parapusio Dahl.	" " "
"	Mycetophilids common	Larva on fungus
COLEOPTERA		
Beetle	Aleochara brunneipennis Kr.	Carnivorous ( <i>Lactarius turpis</i> )
"	Atheta xanthoptera Steph.	" "
"	Autalia impressa Ol.	( <i>L. turpis</i> )
"	Boletobius pygmaeus F.	Carnivorous
"	B. trinotatus Er.	" ( <i>L. turpis</i> )
"	Gyrophæna gentilis Er.	" "
"	Philonthus marginatus F.	" ( <i>L. turpis</i> )
"	Ph. proximus Kr.	" "
"	Ph. varians Pk.	" "
"	Proteinus brachypterus F.	" "
"	P. ovalis Steph.	" ( <i>L. turpis</i> )
"	Quedius cinctus Pk.	" "
"	Tachinus laticollis Gr.	" "
ANNELIDA		
Earthworm		Vegetarian ( <i>Polyporus schweinitzi</i> )
MOLLUSCA		
Slug	Arion ater L.	Vegetarian eating <i>Boletus bovinus</i>

Table XXIX. *Animals associated with pine stumps.*

HYMENOPTERA		
Ant	<i>Acanthomyops niger</i> L.	Nesting
"	<i>Formica fusca</i> L.	"
"	<i>Leptothorax acervorum</i> F.	" (early stages)
Bee	<i>Megachile willughbiella</i> K.	Probably nests in the very rotten wood
Ant	<i>Myrmica</i> spp.	Nesting
Bee	<i>Prosopis genalis</i> Thoms.	Probably nests in the very rotten wood
Digger wasp	<i>Psen unicolor</i> V. de Lind.	" " "
Wasp	<i>Vespa germanica</i> F.	Females hibernating
"	<i>V. vulgaris</i> L.	"
DIPTERA		
Fly	<i>Exechia spinigera</i> Winn.?	Larva on fungi
"	<i>Mycetophilus ocellus</i> Walk.	Larva on fungi (adults sometimes hide under bark)
"	<i>Phaonia</i> spp. and other muscids	Hibernating
"	<i>Tachypeza nubila</i> Mg.	Larva carnivorous in rotten wood. Adult on small flies
LEPIDOPTERA		
Moth	<i>Oecophora sulphurella</i> F.	Larva on rotten wood. Pupa under bark
COLEOPTERA		
Beetle	<i>Adalia bipunctata</i> L.	Hibernating
"	<i>Agathidium laevigatum</i> Er.	Fungus
"	<i>Anisotoma humeralis</i> Kug.	"
"	<i>Ascum striatum</i> L.	Larva in solid wood
"	<i>Atheta aequata</i> Er.	Carnivorous
"	<i>A. linearis</i> Gr.	" early stages of stumps
"	<i>Baptolinus alternans</i> Gr.	"
"	<i>Bradycellus harpalinus</i> Dj.	Sheltering
"	<i>Cerylon histeroideus</i> F.	Larva carnivorous
"	<i>Coccidula</i> spp.	Hibernating
"	<i>Conosoma pubescens</i> Gr.	Carnivorous (later stages)
"	<i>Crioceraphus ferus</i> Kr.	Larva in solid wood (early)
"	<i>Ditoma crenata</i> F.	Larva under bark, carnivorous (early)
"	<i>Dromius angustus</i> Brulle	Carnivorous (early)
"	<i>Elatér balteatus</i> L.	Larva on rotten wood
"	<i>Helops striatus</i> Fourc.	Probably mainly sheltering
"	<i>Homalium rivulare</i> Pk.	Carnivorous. Mainly in fungi
"	<i>Hylastes ater</i> Pk.	Larva in wood and bark (early stages)
"	<i>H. cunicularius</i> Pk.	" " "
"	<i>H. palliatus</i> Gyll.	" " "
"	<i>Leistus spinibarbis</i> F.	Carnivorous (later stages)
"	<i>Leptusa fumida</i> Er.	" (early stages)
"	<i>Melanotus rufipes</i> Hbst.	Larva on wood (early stages)
"	<i>Mycetoporus lucidus</i> Er.	Carnivorous (fungi)
"	<i>Nebria brevicollis</i> F.	" (later stages)
"	<i>Ocypus morio</i> Gr.	"
"	<i>Pentarthrum huttoni</i> Woll.	Larva on wood
"	<i>Phloeonomus punctipennis</i> Th.	Carnivorous (early stages)
"	<i>Phloeopora reptans</i> Gr.	" "
"	<i>Phyllodrepa vilis</i> Heer.	" "
"	<i>Pissodes notatus</i> F.	Larva on wood
"	<i>Pterostichus angustatus</i> Duft.	Carnivorous. Burnt stumps
"	<i>P. vulgaris</i> L.	"
"	<i>Quedius maurus</i> Sahlb. (fageti)	"
"	<i>Rhizophagus bipustulatus</i> F.	" (early stages)
"	<i>R. ferrugineus</i> Pk.	" "
"	<i>Scaphisoma agaricinum</i> L.	Fungi
"	<i>Silpha atrata</i> L.	Carnivorous? (later stages)
"	<i>Sphindus dubius</i> Gyll.	Fungi (early stages)
"	<i>Thanasimus formicarius</i> L.	Carnivorous, esp. on dead trees
"	<i>Xantholinus linearis</i> Ol.	"
HEMIPTERA		
Bug	<i>Piezostethus cursitans</i> Fall.	" (early stages)

Table XXIX (*continued*).

NEUROPTERA		
Snakefly	Rhaphidia maculicollis Steph.	Larva carnivorous (early stages)
COLLEMBOLA		
Springtails	Collembola abundant	Vegetarian
	Campodea sp.	"
ARACHNIDA		
Spider	Agelena labyrinthica Cl.	Hibernating and making webs on the stumps when there are no bushes
"	Prothesima petiverii Scop.	Hiding egg cocoons
"	Trochosa ruricola DeG.	" and hibernating
"	Salticus scenicus Cl.	Hunts on the stumps (catches <i>Oecophora</i> )
CRUSTACEA		
Woodlouse	Porcellio dilatatus Brandt	Scavenger and partly predaceous (later stages)
"	P. scaber Latr.	Scavenger and partly predaceous (later stages)
CHIOGNATHA		
Centipedes	Lithobius spp. and others	Carnivorous. Common in later stages
MOLLUSCA		
Slug	Arion ater L.	Vegetarian. Common in later stages
"	A. subfuscus Drap.	" " "
"	Limax maximus L.	" " "
ANNELIDA		
Earthworms		Vegetarian. Common in later stages
AVES		
Great Spotted Woodpecker	Dryobates major anglicus Hart.	Feeds on ants and other insects
Green Woodpecker	Picus viridis virescens Brehm.	" " "
MAMMALIA		
Rabbit	Oryctolagus cuniculus L.	Use the stumps as special depositories for dung

## CONCLUSION

The animals found on the felled and burnt areas at Oxshott Common in the years 1922-5 have been recorded and some of their effects on one another, and of their relations to plant succession, have been described. It would be premature to make any generalisations about heath-animals.

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