Chapter (non-refereed)

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The fauna, including pests, of woodlands and forests

25. INSECTS ON EXOTIC BROADLEAVED TREES OF THE FAGACEAE, NAMELY *QUERCUS BOREALIS* AND SPECIES OF *NOTHOFAGUS*

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Since the early 1970s, and following a number of earlier plantings, it seems that American red oak *(Quercus borealis* syn. *Q. rubra)* has been used more widely in "amenity plantings". This species has been included with other *Quercus* spp in commercial forestry returns giving details of areas planted.

Conservationists regularly quote Southwood (1961) in crediting native oaks as having more insect species associated with them than other British trees. Thus, if red oak was to become widely planted, would the species become an alternative food source for the many insects which depend on the English oaks? Earlier enquiries showed that virtually nothing was known about insects colonizing *Q. borealis* in Britain.

From studies in North America, it was known that some Lepidoptera larvae such as *Operophtera brummata* (winter moth) killed red oaks by repeated defoliation (Embree, 1967). Because this pest species also occurs in Britain, it might similarly jeopardize *Q. borealis* here. Moeller (1967) suggested that the general immunity of *Q. borealis* to insect attack in Germany was due to its planting in mixtures with other *Quercus* spp. However, its defoliation by *Tortrix viridana* (green oak-roller) was observed in a relatively pure stand of 743 hectares. More recently, Zlatanov (1971) published an account of insect pests on 7 species of oak in Bulgaria, including *Q. rubra* (Table 35), although his lists include many pests not known to occur in Britain. Five of Zlatanov's 7 wood-boring pests of *Q. rubra* are "British" species, as are all but one of the leaf-feeding Lepidoptera. However, 16 species of the latter group occur only "rarely" or "to a lesser extent" on *Q. rubra.* Two of the root-feeding pests occur in Britain.

TABLE 35 Insect pests of 3 *Quercus* species in Bulgaria (after Zlatanov 1971).

A. Insect species by orders	*Q. robur*	*Q. cerris*	*Q. rubra*
Coleoptera	45	40	14
Lepidoptera	67	49	29
Hymenoptera	40	15	3
Homoptera	14	8	6
Diptera	2	4	–
B. Insect species by damage type			
Wood borers	41	34	7
Leaf feeders	65	49	28
Gall formers	39	15	3
Pests of current year's growth	13	7	6
Root feeders	8	8	7
Pests of flowers and fruits	3	3	1

With the help of the Forestry Commission, foliage samples were taken in 1972 of *Q. borealis* (P. 1950) and *Q. robur* (P. 1950) growing in Bramfield Forest, Hertfordshire. Diptera, mostly 'casuals' using foliage for temporary shelter, were equally distributed on *Q. robur* and *Q. borealis,* whereas larval Lepidoptera were 3 times more numerous on *Q. borealis* than on *Q. robur.* Otherwise, the differing groups of insects were more numerous on *Q. robur* than on *Q. borealis* (Table 36). Whereas 798 Hymenoptera of the gall-forming Cynipidae were found on *Q. robur,* none were detected on *Q. borealis.* Zlatanov listed 3 species of Cynipidae on *Q. rubra,* all of which occur in Britain, and 2, *Neuroterus numismalis* (silk button spangle gall)

TABLE 36 Numbers and types of insects found on foliage of *Quercus robur* and *Q. borealis* sampled from Bramfield, Herts., between May and October 1972*.

	Q. robur	*Q. borealis*
Lepidoptera (larvae)	98	319
Lepidoptera (adults)	12	8
Coleoptera	99	61
Homoptera (Aphidae)	99	12
Homoptera (Others)	14	9
Heteroptera	9	1
Psocoptera	56	7
Hymenoptera	78	22
Hymenoptera (Cynipidae galls)	798	–
Diptera	84	80
Dermaptera	6	2
Araneae	144	30
Opiliones	8	2

and *N. quercus-baccarum* (common spangle gall), were present on *Q. robur* at Bramfield. Interestingly, the weevil *Curculio pyrrhoceras,* whose larvae are parasites or inquilines in the galls of *N. quercus-baccarum* (Morris, 1976), were only found on *Q. robur* (Table 37). Of the Coleoptera, specimens of *Phyllobius argentatus* were detected with equal frequency on the 2 species of *Quercus,* whereas *Polydrusus cervinus* was commoner on *Q. robur* than *Q. borealis,* a difficult differential distribution to explain, remembering that the adults of both species are general leaf feeders while their larvae consume roots (Table 37). Single specimens of *Coeliodes dryados,* whose larvae are thought to feed in oak buds, were found on both oaks (Morris, 1976). Two species of *Rhynchaenus* (blotch mining weevils), although collected in very small numbers, were restricted to *Q. robur.* More ladybirds, *Adalia 10-punctata,* were found on *Q. borealis.* From these preliminary investigations, it seems that some insects, notably the Cynipidae colonizing *Q. robur,* were not attracted to *Q. borealis.* Following a survey made in Nova Scotia by Brookfield (1972), it was found that the Nearctic species of Cynipidae from *Q. borealis* failed to stimulate gall formation on *Q. robur.* During 1973, more Forestry Commission plantings in East Anglia were examined, in addition to

TABLE 37 Occurrence of selected Coleoptera on foliage of *Quercus robur* and *Q. borealis* sampled at Bramfield, Herts., between May and October 1972*.

	Q. robur	*Q. borealis*
Rhagonycha lignosa (Muell.)	6*	30
Malthodes marginatus (Lat.)	5	–
Adalia 10-punctata (L.)	2	10
Stilbus testaceus (Pz.)	5	–
Cortinicara gibbosa (Hbst.)	20	3
Phyllobius argentatus (L.)	6	6
Polydrusus cervinus (L.)	18	1
Strophosomus melanogrammus (Forst.)	3	3
Coeliodes dryados (Gmel.)	1	1
Curculio pyrrhoceras Marsh.	11	–
Rhynchaenus avellanae (Don.)	3	–
Rhynchaenus quercus (L.)	1	–

* total numbers in 12 samples on each of 8 dates

TABLE 38 Relative abundance in June 1978 of selected Coleoptera on exotic species of *Nothofagus* and *Quercus* grown at Thetford Forest.

	Quercus borealis	*Nothofagus obliqua*	*Nothofagus procera*
Dalopius marginatus (L.)	7	4	1
Denticollis linearis (L.)	–	2	–
Cantharis decipiens Baudi	1	1	–
Cantharis nigricans (Muell.)	1	–	–
Rhagonycha lignosa (Muell.)	6	2	5
Dryophilus pusillus (Gyll.)	14	12	31 c
Brachypterus urticae (F.)	1	–	–
Scymnus suturalis Thnb.	–	–	2 c
Exochomus 4-pustulatus (L.)	3 + 1 c	–	–
Aphidecta obliterata (L.)	–	2	3 c
Adalia bipunctata (L.)	1	–	–
Coccinella 7-punctata L.	2	6 + 3	3 + 3
Anatis ocellata (L.)	–	3	4 c
Calvia 14-guttata (L.)	–	–	2
Enicmus transversus (Ol.)	–	–	1
Cortinicara gibbosa (Hbst.)	–	–	1
Rhinosimus planirostris (F.)	1	1	–
Anaspis rufilabris (Gyll.)	1	–	1
Deporaus betulae (L.)	–	1	–
Otiorhynchus rugostriatus (Goez.)	1	2	–
Phyllobius argentatus (L.)	18	37	50
Polydrusus cervinus (L.)	1	–	–
Strophosomus capitatus (De G.)	5	7	17
Strophosomus melanogrammus (Forst.)	5	–	1
Rhynchaenus quercus (L.)	1	–	–

c = spp associated with conifers.

+1 = plus one larva.

mature specimens of *Q. borealis* in the grounds of stately homes in southern England. Despite a wide variety of Coleoptera on decaying timber and associated fungal fruiting bodies, no cynipid galls were discovered.

When studying the fauna of introduced plant species, there is always the possibility of discovering something unusual. Aphids from *Q. borealis* were sent to Dr H.L.G. Stroyan who identified 9 specimens of *Tuberculoides borealis,* a hitherto undetected British species, which had only been described in 1971. Subsequently, Dr Stroyan identified this aphid from *Q. robur* (Stroyan, 1977).

Experience with *Q. borealis* has demonstrated that exotic species of a genus well represented in Britain and Europe may be "unacceptable" to some elements of our native insect fauna. Such a condition would be expected to be even more pronounced among species of *Nothofagus,* an exotic genus of the Fagaceae, with its origins in the remote temperate zones of South America and Australasia. Although *N. procera* and *N. obliqua* were introduced into Britain much earlier (Nimmo, 1971), importation of seed from Chile in 1954 led to a series of widely distributed small trial plots in 1955 and 1956. Further substantial supplies of Chilean seed have recently become available, and these 2 species are now being widely grown by nurserymen. It is thus likely that these fast-growing hardwoods may become common plantation species in the near future. For this reason, during the summer of 1978, insects were sampled on *N. obliqua* and *N. procera* planted in Thetford and Alton Forests between 1953 and 1959. Insects, dislodged from foliage when beaten, were collected on a square canvas tray 1 m^2

TABLE 39 Species of defoliating Lepidoptera larvae found on foliage of *Nothofagus* spp.

	Nothofagus obliqua	*Nothofagus precera*	*Nothofagus hybrida*
Carcina quercana (F.)	+	–	–
Pandemis corylana (F.)	+	–	–
Pandemis heparana (D. & S)	+	–	–
Epirrata autumnata (Bork.)	–	–	+
Operophtera brumata (L.)	–	+++	+
Ennomos erosaria (D. & S.)	–	+	–
Crocallis elinguaria (L.)	+	–	–
Apocheima hispidaria (D. & S.)	+	–	–
Apocheima pilosaria (D. & S.)	+	+	–
Biston betularia (L.)	+	–	–
Biston startaria (Hufn.)	+	–	–
Agriopis aurantiaria (Hub.)	+	+	–
Agriopis marginaria (Fab.)	+	+	–
Errannis defoliaria (Clerck)	+	++	–
Ectropis bistortata (Goeze)	+	–	–
**Phalera bucephala* (L.)	–	+	–
Orgyia antiqua (L.)	+	–	–
Euproctis similis (Fues.)	+	–	–
Lymantria monacha (L.)	+	–	–
Eilema deplana (Esper)	+	–	–
Orthosia cruda (D. & S.)	–	+	–
Orthosia gothica (L.)	+	+	–
Orthosia stabilis (D. & S.)	+	+	–
Brachionycha sphinx (Hufn.)	+	+	–
Acronicta psi (L.)	+	–	–
Colocasia coryli (L.)	+	+	–

+/++/+++ species recorded from 1, 2 or 3 localities.

* Recorded 1975/76. All others 1978, combined records of R.C. Welch, J.N. Greatorex-Davies and R.M. Brown.

before being counted and identified. However, because numbers of samples were not standardised, the abundance of Coleoptera should only be considered in relative terms (Table 38). Although only 60% of the more numerous species are listed, they illustrate the difficulties of interpretation. The presence of the second most abundant species, *Dryophilus pusillus* (Anobiidae), was more a reflection of site than of the attractiveness of *Nothofagus* spp. This species was most probably associated with *Larix* beneath which *Nothofagus* had been planted. Two other specimens were collected at a second site at Thetford and none were found at Alton. Four of the 7 species of Coccinellidae found on *Nothofagus* spp are similarly associated with conifers. More *Phyllobius argentatus* were found on *N. procera* than on *N. obliqua* at one site, but, at other locations, both species of *Nothofagus* were colonized to the same extent. Most Coleoptera species were poorly represented, the few individuals trapped probably being "accidentals", such as *Brachypterus urticae* which feeds on nettles.

At present, the scant available evidence suggests that very few of the Coleoptera recorded on *Nothofagus* spp are potential pests, but this is not so when considering the Lepidoptera. It is likely that the 26 species so far identified are leaf-feeders to a greater or lesser extent (Table 39). Some of these larvae have been recorded from as many as 12 alternate hosts (Table 40). Interestingly, all but 2 have been observed feeding on native *Quercus* spp, 9 on native *Fagus* and one on *Castanea*, a naturalized alien, all 3 tree genera, like *Nothofagus*, being part of the Fagaceae. In interpreting the results of surveys, note should be taken of the

TABLE 40 Alternate host plants of 26 species of Lepidoptera larvae known to defoliate *Nothofagus* spp.*

Alternate Hosts	Nos. of spp. feeding on:— Family	Genus
FAGACEAE	24	
Quercus		24
Fagus		9
Castanea		1
BETULACEAE	24	
Betula		21
Corylus		9
Carpinus		7
Alnus		7
ROSACEAE	22	
Crataegus		18
Prunus		17
Malus		9
Rosa		6
Pyrus		4
Sorbus		1
Rubus		1
SALICACEAE	17	
Salix		17
Populus		6
TILIACEAE	11	
Tilia		
ULMACEAE	10	
Ulmus		
CAPRIFOLIACEAE	5	
Viburnum		2
Lonicera		3
OLEACEAE	3	
Fraxinus		2
Ligustrum		1
TAXACEAE	2	
Taxus		
PINACEA	2	
Pinus		2
Picea		1
Larix		1
ACERACEAE	1	
Acer		
PLATANACEAE	1	
Platanus		
HIPPOCASTANACEAE	1	
Aesculus		
"Non-tree" families	9	

* of Table 40

occurrence of members of the Rosaceae which are often alternate hosts of polyphagous Lepidoptera.

When planting exotic species of trees, foresters should be aware of potential insect pests, conservationists should know how many insect species they are likely to support, whilst the ecologists may wish to understand the factors determining which insects successfully colonize trees and which do not. Plans have been made with R.M. Brown of the Forestry Commission to sample *Nothofagus* more extensively.

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