IRISH BIOGEOGRAPHICAL SOCIETY

Bulletin No. 12

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The Irish Biogeographical Society gratefully acknowledges the generous support of its sponsors in publishing this issue of its Bulletin.

Bulletin of The Irish Biogeographical Society

Number 12

ISSN 0032-1185

Abbreviation: Bull. Ir. biogeog. Soc.

DATE OF PUBLICATION: 15 November, 1989

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BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 12

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EDITORIAL

Happily, the Bulletin continues to thrive. With this issue, the Society completes the publication of the papers accepted for Bulletin No. 11 but which had to be held over for Bulletin No. 12. Bulletin No. 13 is now in preparation and manuscripts which authors wish to have considered for publication in Bulletin No. 14 should be submitted before 1st September 1990. On behalf of the Irish Biogeographical Society, I wish to thank Dr. A. McNally, Assistant Editor, our typist Mrs. M. McNally, our referees, the members of the Editorial SubCommittee and General Committee, and all those who have helped with the production of this Bulletin.

J. P. O'Connor,
Editor.

Bull. Ir. biogeog. Soc. No. 12 (1989)

AMPHIPOD CRUSTACEANS NEW TO BRITAIN AND THE PLYMOUTH AREA.

Mark J. Costello and J. Jonathan Moore

Introduction

Fifteen species of gammaridean amphipods are presently recorded in Irish but not British inshore (< 200m depth) waters. They are Iphimedia nexa Meyers and McGrath 1987, Ampelisca aequicornis Bruzelius 1859, A. eschrichtii Kröyer 1842, A. spinifer Reid 1951, Amphilochus brunneus Della-Valle 1893 (requires confirmation), Aora spinicornis Afonso 1976, Lembos denticarpus Myers and McGrath 1978, Microdeutopus stationis Della-Valle 1893, Hyale grimaldii Chevreux 1900, Ericthonius fasciatus (Stimpson 1853), Listriella mollis Myers and McGrath 1983, Ambasia atlantica (Milne-Edwards 1830), Ichnopus spinicornis Boeck 1861, Stenothoe elachistoides Myers and McGrath 1980, and Syrrhoe affinis Chevreux 1908. Three of these species, I. nexa, A. spinicornis and M. stationis, are here recorded for the first time for British waters. In addition, records of seven species in the Plymouth area of south-west Britain, already recorded elsewhere in British waters, are presented.

Details of the sites and their fauna may be found in the Plymouth Marine Fauna (Marine Biological Association, 1957). Material donated to the British Museum (Natural History) is indicated by BMNH.

Records

A. New to Britain and the Plymouth area

Iphimedia nexa Myers and McGrath, 1978

1. Plymouth Breakwater, Devon (Lat 50° 20'N, Long 4° 9'W), 14 May 1987, 1♀ (BMNH) and 2 juveniles, from amongst red algae on rocks at 9 and 14m depth.

Aora spinicornis Afonso, 1976

1. Torbay, Devon, collected by Rev. T. R. R. Stebbing in 1877, 1♂ labelled as Aora gracilis (Bate) in the Oxford University Museum collection (ref. no. 9939).

2. Fort Bovisand harbour, Devon (Lat 50°, 20'N, Long 4° 9'W), 12 August 1987, 1♂ and 1♀ in the stomach of a pollack, Pollachius pollachius (L.)

3. Fort Bovisand harbour, 21 September 1987, 1♂ and 4♀♀ (BMNH) from harbour wall amongst Laminaria holdfasts and red algae.

4. Further British material, not examined by the authors, occurs in the BMNH (J. Ellis pers. comm.) from (a) Torbay (Stebbing collection), (b) Plymouth (Spence-Bate collection), (c) Kimmeridge Bay, Dorset (grid ref. SY905787, collected 29 March 1977), and (d) Smuggler's Cove, Dorset (grid ref. SY877765, collected 16 April 1977).

Microdeutopus stationis Della-Valle, 1893

1. Mouth of the Yealm estuary, Devon (Lat 50° 18'N, Long 4° 4'W), 17 July 1987, 3♂♂ and 1♀, from a dredged sample. These specimens will be deposited in the National Museum of Wales, Cardiff, with the Field Studies Council Research Centre Collection.

B. New to the Plymouth area only.

Iphimedia spatula Myers and McGrath, 1987

1. Marine Biological Association Museum collection, one specimen collected in tow nets on 1 February 1935 and identified by K. Stephensen as I. eblanae (Bate).

Ampithoe helleri G. Karaman, 1975

1. Mouth of the Yealm estuary, 29 September 1987: 1♂ and 14♀♀ amongst epiphytes on Fucus serratus, 1♂ and 3♀♀ amongst the alga Gigartina, 1♂ amongst epibiota on rock, and 1♂ and 10♀♀ amongst the algae Sargassum muticum, Chorda filum and F. serratus.

Hyale stebbingi Chevreux, 1888

1. Mouth of the Yealm estuary, 29 September 1987, 2♂♂ amongst epiphytes on F. serratus.

Pectenogammarus planicrurus Reid, 1940

1. Fort Bovisand harbour, 12 July 1987, 1♀ in a pollack stomach.

Discussion

All the species are epifaunal. A. spinicornis and M. stationis reach the northern limit of their distribution in Lough Hyne, south-west Ireland (Myers and Costello, 1984; Holmes, 1985). I. nexa is known from northern France, and the south east coasts of Ireland (Myers et al., 1987). I. spatula and H. stebbingi reach their northern limit in the Shetland Islands (Myers et al., 1987; Lincoln, 1979). The range of A. helleri extends from southern Britain to the north of Ireland (Lincoln, 1976, 1979 as A. neglecta, and material in the National Museum of Ireland), and of P. planicrurus from the Mediterranean to the Isle of Man (Lincoln, 1979). P. planicrurus has previously been collected in south-west England from Penance, Cornwall (BMNH, Lincoln, 1979 as "West Channel"). The present records are thus within the known latitudinal range of these species.

A. spinicornis, M. stationis and P. planicrurus are close to the limit of their latitudinal distribution in Plymouth, and thus may not maintain permanent populations in the area. I nexa, I. spatula, A. spinicornis and A. helleri are recently described species, and H. stebbingi has only recently been raised from a variety to full species status (Lincoln, 1979). The recording of these species in the Plymouth area therefore reflects recent taxonomic attention.

Acknowledgements

We would like to thank Mr. J. M. C. Holmes, National Museum of Ireland, for pointing out the presence of A. spinicornis in the Oxford University Museum, and Mr. J. Hull for the loan of the material. Ms. J. Ellis kindly provided information on A. spinicornis and P. planicrurus material in the British Museum (Natural History).

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ASPECTS OF CHAROPHYTE ECOLOGY IN THREE DRAINED TRIBUTARIES OF THE RIVER BOYNE, IRELAND.

Joseph Caffrey and James J. King

Abstract

Three charophyte species, Chara vulgaris L., C. globularis Thuill. and Nitella flexilis (L.) C.A. Ag. were found in surveys of three tributaries of the River Boyne which had been drained and were in various stages of recovery. The species were most commonly associated with Ranunculus penicillatus (Dumort) Bab. var. penicillatus and were found where water velocity varied between 12 and 53 $cm.sec^{-1}$. The pioneering nature of these plants and competition with other macrophytes are discussed in relation to the present distribution of charophytes in these rivers.

Introduction

An extensive literature exists on the distribution and ecology of charophytes, principally from lakes and still-water habitats (Olsen, 1944; Corillion, 1957; Forsberg, 1965; Peryra-Ramos, 1981; John, Champ and Moore, 1982). In contrast, few reports are available on charophytes in river habitats. Allen (1950) and Butcher (1933) regarded running water as an uncommon habitat for charophytes. McCarthy (1977) found Chara sp. during a post-drainage floral survey on one of the rivers examined in the present study. In 1984 three charophyte species were encountered during floral surveys on three tributaries of the River Boyne system.

The River Boyne flows over Carboniferous Limestone and is bordered by rich pastureland for much of its 100km course. The river receives a number of major tributaries (Fig. 1), three of which were investigated during the present survey. These were the Rivers Deel, Stonyford and Trimblestown. Some enrichment from domestic sewage was noted below Athboy on the River Trimblestown and below Raharney on the River Deel. However, no serious sources of agricultural or industrial pollution were evident in these rivers.

The three rivers surveyed were drained between 1971 and 1977. During these operations river bed levels were lowered by as much as 3.5m. All marginal and instream features were removed. These included emergent and submergent plant beds, boulders, gravel beds, deep pools and shallow riffles. All bankside tree and shrub cover was also eliminated. The rivers were reduced to channels of sluggish uniform flow, except in occasional areas where pockets of bedrock interrupted the drainage process.

Methods

The three rivers under investigation were surveyed from their source to their confluence with the River Boyne. The survey was conducted between June and September, 1984.

Water samples for chemical analysis were taken at 15 sites along the three rivers (Fig. 1). The variables measured included pH, total hardness, alkalinity, total phosphate (T.P.), nitrite plus nitrate (NO_2 + NO_3) and calcium (Ca).

Details regarding depth profiles, substrate type and overhead cover were recorded at selected sites. These sites ranged in size from $30m^2$ to approximately $150m^2$ and included sites containing members of the Characeae.

Flow velocity was measured at 2m intervals across, and 5m intervals along the river at the selected sites using an electronic flow meter. All flow rate measurements were recorded at mid-water depth.

At the selected sites detailed floral meppings were compiled. These accurately depict the spatial distribution of the macrophytic complement present.

The nomenclature of Wood and Imahori (1965) and Moore (1986) was adopted for charophytes in the present study.

Charophyte specimens were stored in 4% formalin for subsequent laboratory examination. Confirmation of specimens was given by the British Museum (Natural History).

Results

Chemical and Physical Data

Chemical analysis showed the three rivers to be hard-water systems with a total hardness range of 258-376 $mg.l^{-1}$ $CaCo_3$ (Table 1). The phosphate and nitrate plus nitrite values recorded ranged between 0.016-0.041 $mg.l^{-1}$ and 0.285-1.012 $mg.l^{-1}$ respectively.

Where charophytes were found in the three rivers, the instream physical characteristics were similar (Fig. 2). At most of the sites where charophytes were recorded no over-hanging tree cover was present. Some recolonisation by alder (Alnus glutinosa (L) Gaertner) had occured along the banks of the River Trimblestown although the shade effect was minimal. The substrate consisted primarily of unstable sand and silt, overlaying a firm gravel bed. In places, this shifting substratum was consolidated into shoals by the resident macrophytic flora. The depth regime in those sites where charophytes were found varied between 27 and 70 cm. The optimum depth for charophyte growth was 40cm. Flow velocity at these sites, measured mid-water and immediately upstream of the plant stand, varied between 12 and 53 $cm.sec^{-1}$.

Vegetation

Three charophyte species were encountered during the survey. Chara globularis Thuill. was recorded from the River Deel and C. vulgaris from the River Stonyford. The specimens found corresponded to C. globularis and C. vulgaris sensu Allen (1950). Nitella flexilis (L.) C.A.Ag., was recorded in the three rivers examined.

No charophytes were observed in the upper reaches of the rivers. First recordings were made at least 15km from each river's source. In these reaches the rivers were broad (6-10m) and the risk of summer drought was negligible.

TABLE 1. Chemical analysis of water samples from the Trimblestown, Stonyford and Deel Rivers, presented as minimum, maximum and mean values.

River	Number of sites	pH	Total hardness ($mg.l^{-1}$ $CaCo_3$)	Alkalinity ($meq.l^{-1}$)	Total P ($mg.l^{-1}$)	NO_2+NO_3 ($mg.l^{-1}$)	Ca^{++} ($mg.l^{-1}$)
R. Trimblestown	3	7.3 -7.7	262-334	5.1-6.6	0.032-0.041	0.787-0.873	74.54-113.02
		7.5	305	6.0	0.037	0.835	92.71
R. Stonyford	7	7.5-7.9	262-376	5.8-6.8	0.024-0.039	0.566-1.012	92.98-128.25
		7.7	303	6.2	0.032	0.871	116.16
R. Deel	5	7.4-7.7	258-376	5.0-6.5	0.016-0.028	0.285-0.657	95.39-133.06
		7.5	332	6.0	0.021	0.513	121.35

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TABLE 2. Percentage frequency with which charophytes grew in close association with vascular plants, other charophyte species or as single species stands. Results are expressed as a percentage of the total number of charophyte recordings in the three rivers.

Associated Taxa	%
Ranunculus penicillatus (Dumort) Bab. var. penicillatus	41.4
Zannichellia palustris L.	14.3
Potamogeton crispus L.	10.0
Unassociated Charophyte stands	10.0
Sparganium erectum L.	8.6
Other charophytes	7.1
Apium nodiflorum L. Lag.	4.3
Potamogeton obtusifolius Mert. and Koch	1.4
Callitriche stagnalis Scop.	1.4
Potamogeton natans L.	1.4

In the middle and lower reaches of the three river systems long, deep and slow-flowing sections alternated with short, shallow glides and riffles. In the deep sections, emergent and floating-leaved vegetation, principally Potamogeton natans L. and Hippuris vulgaris L., dominated the instream flora and cover values of 100% were recorded from many sites. In the riffles and moderately fast-flowing glides, communities of emergent, floating-leaved and submerged plants were found (see Fig. 2).

Charophytes were recorded from moderately fast-flowing stretches and were absent from deep, slow-flowing sections. A total of 70 recordings were made from these river sections, almost 75% of which came from the River Stonyford.

Charophytes were normally associated with other macrophyte species (Table 2). Most common among these were the pollution-sensitive Ranunculus penicillatus var. penicillatus (Caffrey, 1985) and

Zannichellia palustris L., both fine-leaved submerged species adapted to life in fast-flowing water (Haslam, 1978). When growing in association with other macrophytes, in particular Ranunculus and Zannichellia, charophytes frequently grew towards the upstream limit of the associated plant stand. They were less frequently found in the slow-flowing water downstream of these beds (Fig. 2).

The size of the individual charophyte stands varied considerably. Nitella stands were always small ($< 0.25m^2$). Chara stands, on the other hand, varied in extent from $0.5m^2$ to in excess of $2m^2$. Stands of Chara or Nitella found in isolation were always smaller and the plants more diminutive than when in association with other species. When growing together Nitella occupied a position within and towards the upstream portion of the Chara stands. The development of cortical structures on the stem and lower branchlet segments in most species of the genus Chara gives these plants a rigid form. Thus, the plants did not trail with the flow in the manner typical of Nitella and the other submerged macrophytes occupying similar reaches of river. Both species of Chara formed 'domed' stands and offered greater resistance to stream flow than the other associated macrophytes.

Discussion

Of the three charophytes encountered in the present survey, Moore (1979, 1986) regarded C. vulgaris and N. flexilis as being common in a variety of aquatic habitats but considered C. globularis to be rare in running water in Britain and Ireland. However, Corillion (1957) listed N. flexilis and C. globularis among the commonests charophytes in rivers and streams in north west France. Langangen (1974) also reported the latter two taxa from running water in Norway.

All three rivers examined were hard-water systems with alkaline pH values (7.3-7.9) and high calcium levels (74.54-133.06 $mg.l^{-1}$). The instream pH values are within the range recorded for all three charophyte taxa from previous studies (Olsen, 1944; Corillion, 1957). While many species of the genus Nitella favour more soft-water systems, N. flexilis is considered to be more cosmopolitan (Krause, 1981). This species has been recorded in waters within the pH range 6.3-7.4 (Imahori, 1954).

Several studies on charophyte ecology in lotic habitats have measured instream flow or referred to its significance for plant colonization. Corillion (1957) recorded flow velocities of 8.3-16.6 cm.sec^{-1} at sites where charophytes grew vigorously. Similar flow rates were reported from the vicinity of charophyte beds by Rook (1984) working on a river of comparable dimensions to those of the River Boyne tributaries. Castella and Amoros (1984) observed charophytes growing in slow-flowing or still backwaters of the Rivers Ain and Upper Rhône in France. They failed to record any charophyte representatives along the more swiftly-flowing main channels. On the other hand both Ackenheil (1944) and Sirjola (1969) recorded flow velocities as high as 70 cm.sec^{-1} from sites in Scandinavia where N. flexilis grew abundantly. The range of flow velocities recorded during the present study (12-53 cm.sec^{-1}) was similar to those of Ackenheil and Sirjola (op. cit).

It is apparent that the charophyte species recorded during this investigation are tolerant of a wide range of flow conditions. The fact that these species all grew vigorously in moderately swiftly flowing water might reflect their adaptability to changing instream conditions and go some way towards explaining their survival in riffle sections of these drained tributary streams.

Charophytes are regarded as early colonizers of suitable new aquatic habitats (Crawford, 1979; Krause, 1981). Such habitats are provided by river drainage. Moore (1979) cited incidents of charophyte colonisation following dredging in two previously disused English canals involving C. vulgaris, C. globularis, N. flexilis and Tolypella glomerata Leonh. McCarthy (1977) recorded dense stands of Chara sp. growing in shallow and deep water situations during a post-drainage floral survey of the River Trimblestown. He had not found Chara in his pre-drainage surveys.

From the above it would appear that charophytes may have been early colonizers of deeper, slow-flowing sites which now carry an abundant phanerogam flora. As these sections of river stabilised and an abundant and diverse phanerogam flora became established it is possible that the

charophyte species were competitively excluded by the more robust and often light-occluding rooted plants (Wood, 1950; Crawford, 1977).

The dominant macrophyte present where charophytes were recorded was R. penicillatus var. penicillatus, a submerged plant whose vegetative growth is favoured by fast flow velocity (Haslam, 1978). This may suggest that the vegetative vigour of the charophytes found in the present survey depends on their ability to tolerate moderately fast-flowing water. Such tolerance may give these charophytes a competitive advantage over other rooted aquatics (Table 2) whose vegetative spread is less favoured by high flow.

The moderate to fast flow velocity combined with instream location and physical form of the charophyte stands may be important factors in the survival of these plants at the sites examined.

Acknowledgements

The authors acknowledge Dr. P. Fitzmaurice and Dr. J. White for their constructive criticisms of the manuscript. We would also like to thank Mrs. J. A. Moore for her comments on charophyte taxonomy and confirmation of specimens.

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FIGURE 1. Map of River Boyne showing the positions of the Rivers Deel, Stonyford and Trimblestown.
Inset shows the Irish location of the River Boyne.

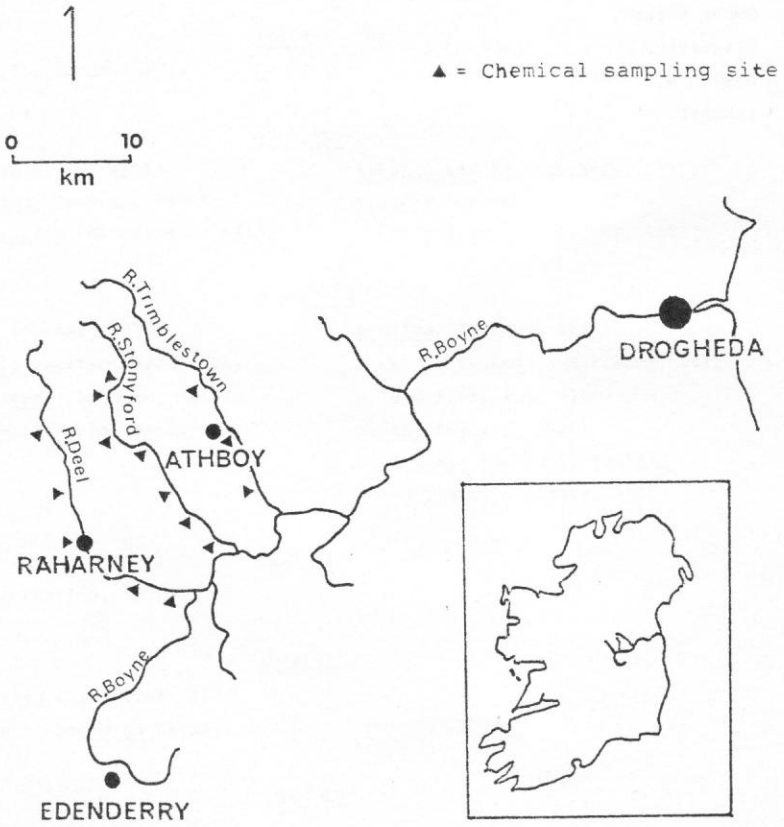
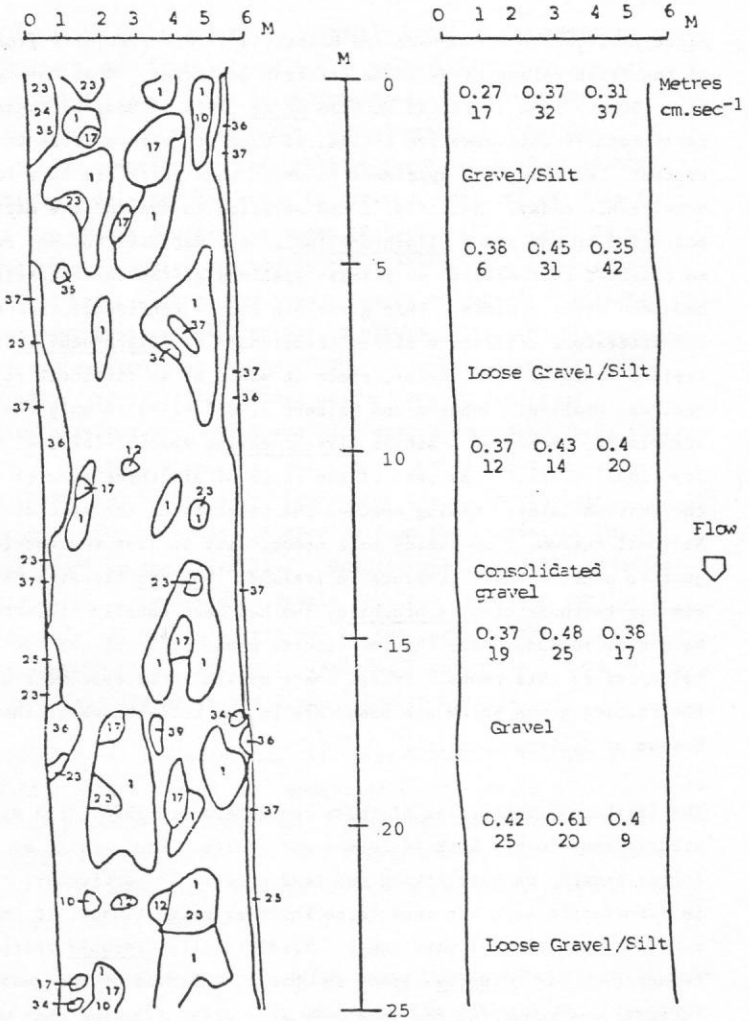


FIGURE 2. Map of section of the Stonyford River showing a typical example of the spatial distribution of Chara vulgaris L. among other macrophytic species.
Also presented are details of depth, flow velocity and substrate type.



1. R. pseudofluitans
17. C. vulgaris
25. R. nasturtium-aq.
36. P. arundinacea
10. P. crispus
23. A. nodiflorum
34. S. erectum
37. G. plicata
12. Z. palustris
24. B. erecta
35. S. emersum
39. A. stolonifera

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SOME IRISH RECORDS OF THE GENERA GLISCHROCHILUS AND SORONIA (COLEOPTERA: NITIDULIDAE).

Martin C. D. Speight

Since publication of Johnson and Halbert's (1902) list, the greater part of the Irish coleopterous fauna has been neglected. What has been published from 1902 to 1980 is listed in Ryan et al (1984). Many of these references carry totally uninformative titles, so that it is impossible to guess their content. Further, the specimens to which they refer are to a large extent untraceable today. Recently, I had occasion to examine the material belonging to the genus Glischrochilus in the National Museum, Dublin, only to discover that nearly every Irish specimen of the three species represented had been wrongly named. This gives one little confidence that a search for literature references citing occurrences of Glischrochilus species in Ireland would be very useful, since it would be so difficult to verify the records involved. Johnson and Halbert (1902) refer to only one, unsubstantiated, record of a single Glischrochilus species (as Ips) from Ireland. Joy (1932) gives "I" as part of the range of all three species known from the British Isles. Having checked the identity of the specimens in the National Museum, I am taking this opportunity to list the species involved just to confirm their presence in Ireland. Soronia occupies habitats similar to those of Glischrochilus and has been equally neglected, so I have also included here the few records known to me of the two Irish species belonging to this genus. Except where marked * the specimens upon which the records given below are based are in the collections of the National Museum of Ireland (Dublin).

The Irish representatives of these two genera are associated with arboricolous fungi, both as larvae and adults. They are to be found among fungal growths on both living and dead trees. In particular, they occur in association with sap runs (also known as slime fluxes, in American) caused by or infested with fungi. Traditionally, Soronia species are said to occur on oak (Quercus) trees in which the larvae of the goat moth (Cossus) are tunneling the wood. It goes without saying that with the progressive disappearance of the goat moth from western Europe and the

relentless removal of overmature and dead trees by mankind, beetles with the habitat preferences of these little nitidulids have become scarcer. In Ireland old trees of all sorts are now scarce and the goat moth is now extremely localised, so it is of particular interest to note that both Soronia species and Glischrochilus quadriguttatus are evidently associated with Fraxinus in Ireland. At all stages of its life history Fraxinus has an extremely poor associated fauna, few species showing a preference for it and those preferring other trees rarely also using Fraxinus when it is available. That the three nitidulids alluded to above are inhabiting Fraxinus sap runs etc. may well be the key to their survival in Ireland, since ash is today the most generally distributed large deciduous tree in the island and the only large tree found with any frequency in hedgerows. Many saproxylics one might expect to find in Ireland, particularly species associated with old oaks, are today lacking from the fauna. If they were present in the past they appear to have vanished along with the oak forests. Had they been able to make use of ash perhaps they would be found in Ireland today.

One of the Glischrochilus species recorded from Ireland, G. quadripunctatus (L.), is associated with conifers of the genus Pinus, and not with deciduous trees. The saproxylic fauna of conifers is lacking almost in its entirety from Ireland so the presence of this beetle is of some interest. There is but one record, and that is very recent, so the species may have arrived here only subsequent to the establishment of extensive commercial conifer plantations, rather than representing a survival of the indigenous Pinus sylvestris fauna. The available data do not seem adequate to argue this issue one way or the other.

GLISCHROCHILUS

The Irish species of this genus may be distinguished using the key in Freude et al. (1967), which has been used here. By way of contrast the key to Glischrochilus species in Joy (1932) is misleading.

Glischrochilus hortensis (Fourcroy, 1785)
Kerry: 17 July 1930, Cruagh, Killarney, E. F. Bullock.
Kildare: 5 May 1935, Sallins, A. W. Stelfox.
Kilkenny: 24 April 1925, Kilkenny, R. A. Phillips.

Glischrochilus quadriguttatus (Fabricius, 1777)
Dublin: May 1928, Glendhu, at sap, H. Heasler.
Kerry: June 1908, Cahirnane, Killarney, E. F. Bullock; August 1915, Killarney, E. F. Bullock; * 10 May 1988, V9585 (MT3), Muckross, under loose bark on fungus-infested sap run on large, living Fraxinus, M. C. D. Speight.

Glischrochilus quadripunctatus (L., 1758)
Kildare: 30 August 1980, S6898 Athy, beside R. Barrow, D. Murphy.

SORONIA

Males of S. punctatissima can be easily distinguished by their distally expanded and sharply bent front tibiae, but the two species are otherwise by no means easy to identify in all cases. The determinations carried out here are based on the use of Freude et al. (1967).

Soronia grisea (L., 1758)
Antrim: September 1935, L. Neagh, E. O'Mahony.
Carlow: 5 August 1929, Kilcarry Br., A. W. Stelfox.
Dublin: 17 April 1982, O0935 Phoenix Pk., beaten, Crataegus/Fraxinus, J. O'Connor; December 1924, St. Anne's, Clontarf, E. O'Mahony.
Galway: * 24 May 1974, L7735, beaten from Fraxinus, mixed woods, M. C. D. Speight.
Kerry: July 1919, Killarney, E. F. Bullock; 27 April 1931, Deerpark, Killarney, E. F. Bullock.
Offaly: * 24 May 1983, N0230 Mongan Bog, in pitfall trap on raised bog, J. Good.

Soronia punctatissima (Illiger, 1794)
Cavan: 5 August 1929, Kilcarry Br., A. W. Stelfox.
Kerry: July 1935, male, Muckross, Killarney, E. F. Bullock; * 20 May 1988, male, V9585 Muckross, Killarney, under loose bark over fungus-infested sap-run on large, living Fraxinus, deciduous woods, M. C. D. Speight.

Acknowledgements

I am indebted to Dr. Jim O'Connor for the opportunity to examine material from the collections in his care.

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Bull. Ir. biogeog. Soc. No. 12 (1989)

NOTES ON THE DISTRIBUTION OF CALLIOSTOMA ZIZYPHINUM (L.) (MOLLUSCA) ON THE SHORES AND SHALLOW WATERS OF THE IRISH COAST.

E. F. M. O'Loughlin.

Introduction.

The common topshell Calliostoma zizyphinum (L.) is widely distributed on Irish and British coasts (Seaward, 1982), but despite the abundance of this species, surprisingly little is known concerning its biology and ecology. Nichols (1900) lists eight species of the genus Calliostoma occurring in Ireland, of which C. zizyphinum is by far the most common. During the course of a study on geographical variation in the shell shape of C. zizyphinum (O'Loughlin, 1988), many locations around the Irish coast were investigated and the distribution of this topshell was recorded. The distribution of colour morphs of C. zizyphinum around Strangford Lough has attracted some interest (Seed, 1979; Roberts and Kell, 1987). C. zizyphinum also shows considerable variation in shell morphology (O'Loughlin and Aldrich, 1987a, 1987b). The distribution of this topshell and the environmental conditions in which it is found are outlined for each site investigated below. Many collections were made with the assistance of the Dublin University Sub-Aqua Club (DUSAC), the Irish Sub-Aqua Club (ISAC) and the following individuals (with initials): Dr. J. C. Aldrich (JCA); Dr. J. G. Wilson (JGW); Dr. J. M. Rochford (JMR); Dr. J. A. Dorman (JAD); Dr. Frank Jeal (FJ); Paul Somerfield (PS); Barbara Rafferty (BR); Angela Larkin (AL); Ian Lawler (IL); Martyn Linnie (ML); Roma O'Loughlin (ROL).

Collection sites

Dalkey Sound, Co. Dublin (O2826)

(1) 6.ix.1984. Sublittoral, 9-12m (JGW and JMR). 73 variegated shells.

(2) 22.viii.1985. Sublittoral, 12-15m (ISAC). 17 variegated and 2 white shells.

Common. Shells were found mostly on the top or sides of rocks and boulders No shells are present on the shore of Dalkey Island or down to a depth of 5m. The two white shells were collected at 15m. White shells have previously been recorded at Dalkey Island, see Walpole (1853) and Nichols (1900).

Killoughter, Co. Wicklow (T3599)

(1) 10.vii.1985. Sublittoral, 10-12m (DUSAC). 14 variegated shells. Rare. Shells were collected on a single rocky outcrop in an area surrounded by sand and shingle. Five shells were collected in shallow water inshore (6m) of the above collection site during a diving expedition in 1987.

Slade, Co. Wexford (X7598)

(1) 13.vii.1986. Sublittoral, 7-10m (DUSAC). 39 variegated shells. Common. The intertidal shores of Hook Head are far too exposed to maintain a population of C. zizyphinum because of the lack of algal cover. The shells were darkly coloured with purple pigment and were common in the red algal layer, rare in shallow water.

Hook Head, Co. Wexford (X7397)

(1) 14.vii.1986. Sublittoral, 10-11m (DUSAC). 10 variegated shells. Rarer than at Slade, shells were distributed similarly to those at Slade at the above depths but were absent in shallow water and on the shore.

Courtmacsharry Bay, Co. Cork (W5343)

(1) 1.vii.1984. Littoral, (JAD). 2 variegated shells (washed ashore on a sandy beach).

Lough Hyne Marine Nature Reserve, Co. Cork (W1028)

(1). 12.iii.1986. Littoral tidal rapids, (with PS). 41 variegated shells. Permission No. 3/1986.
Common, in wide crevices and under rocks. Sloane et al. (1961) noted that in the rapids C. zizyphinum appeared to prefer stations at which there is a current of medium speed. This topshell appears to be absent in the lough itself and at the edge of the lower end of the Rapids.

Bantry Bay, (Coolieragh), Co. Cork (V9152)

(1) 10.iv.1984. Littoral. 1 variegated shell.
This shell was found under small rocks in the shelter of a large boulder, and despite a prolonged search no more specimens were found.

Knightstown, Valentia Island, Co. Kerry (V4277)

(1) 28.vii.1985. Littoral (with ROL). 2 variegated shells.
Despite the presence of a sheltered shore C. zizyphinum is rare on the shore and in shallow waters south of Knightstown. Previously recorded here by Beaumont (1900).

Lough Kay, Doulus Bay, Co. Kerry (V4380)

(1) 27.vii.1985. Littoral, (with ROL). 4 variegated shells.

As at Knightstown, C. zizyphinum is rare on the shore and shallow waters of this sheltered inlet of Doulus Bay.

Scanlan's Island, Muckinish Bay, Co. Clare (M2622)

(1) 24.vii.1986. Littoral tidal rapids, (IL). 48 variegated shells.

Common, in the lower half of the rapids under rocks and algae, but rare in the muddier conditions outside the rapids.

Corranroo Bay Tidal Rapids, Aughinish Bay, Co. Galway.(M3312)

(1) 30.xi.1983. Littoral tidal rapids (top), (with FJ).37 variegated shells.

(2) 3.v.1984. Littoral tidal rapids (bottom), (with JAD). 166 variegated shells.

No shells were collected in between these two locations which are 90m apart. Shells were most plentiful at the lower end of the rapids (equivalent to normal LWST), and in both cases shells were collected under rocks and algae, and in pools. C. zizyphinum is absent in the very muddy surrounding conditions and appears to be confined to the tidal rapids.

Aughinish Bay, Co. Galway (M3212)

(1) 27.i.1986. Littoral tidal rapids. 52 variegated shells.

Common, in the lower end of the rapids under rocks and algae, and in pools beside the rapids. No shells were found on the shore between this rapids and the Corranroo Bay rapids.

Costelloe, Co. Galway (L9729)

(1) 28.i.1986. Littoral. 4 variegated shells.

At time of collecting there was a lack of algal cover due to harvesting by locals. This may explain the scarcity of this topshell in this sheltered shore.

Rossroe, Killary Harbour, Co. Galway (L7765)

(1) 1.vi.1986. Sublittoral, 5-10m (DUSAC). 59 variegated shells.

Shells were common at the above depths but absent in shallower water and on the nearby shore. No shells were found in deeper water.

Rosmoney Bay, Clew Bay, Co. Mayo (L9387)

(1) 5.vii.1985. Littoral, (with ROL). 70 variegated shells.

Common, on rocks and algae at the extreme lower shore. No shells were found either due east of this site as conditions got muddier, or due west on a shore covered in small stones lacking algal cover.

Castleaffy Strand, Clew Bay, Co. Mayo. (L9488)

(1) 12.viii.1989. Littoral. 47 variegated shells.

(2) 2.ix.1984. Littoral. 15 variegated shells.

(3) 9.iv.1985. Littoral, (with ROL). 89 variegated shells.

Very common in the channel leading into Castleleaffy Strand, occasionally in densities of over 20 large shells/m^2. Like Rosmoney Bay, this site is quite muddy and shells were mostly confined to algae rather than the generally mud covered rocks. No shells were found inside or outside the channel.

Gubbaun Pt., Clew Bay, Co. Mayo (L8194)

(1) 1.iii.1986. Littoral. 4 variegated shells.

Rare on this exposed northern end of Clew Bay and despite an extensive search at low water only four specimens were found which were under rocks.

Keel Strand, Achill Island, Co. Mayo (F6304)

(1) 2.viii.1984. Littoral. 4 variegated shells (empty).

Rare. Live specimens appear to be absent on the shore in this area implying that the above four shells were most likely washed ashore.

Moyteoge Head, Achill Island, Co. Mayo (F5603)

(1) 10.viii.1986. Sublittoral, 24m (AL). 14 variegated shells.

Common, but were completely absent on the inshore cliffs and in less than 10m depth.

Downpatrick Head, Co. Mayo.(G1243)

(1) 1.vi.1985. Sublittoral, 15m (DUSAC). 11 variegated shells.

Common on vertical bare rocks, but were absent on the nearby shore.

Aughris Head, Co. Sligo (G5137)

(1) 6.ii.1985. Littoral tidal rapids. 78 variegated shells.

Common. Topshells were collected inside the rapids and were most common under rocks nearer the outflow of the rapids. Only one shell was collected outside this area (50m due east) implying that this topshell is rare in the general littoral area of Aughris Head.

Moross Peninsula, Mulroy Bay, Co. Donegal (C1839)

(1) 20.vii.1984. Sublittoral, 0-2m (PS). 14 variegated shells.

(2) 31.v.1985. Littoral. 29 variegated shells (empty).

Shells were difficult to find on the shore and shallow water. All 29 shore shells were dead specimens whose shells were in perfect condition. Nowhere else in this study were there so many empty shells found at the same time. The cause of this is not known.

Kearney Point, Ards Peninsula, Co. Down (J6551)
(1) 19.vii.1985. Littoral, (with JCA). 19 variegated shells.
(2) 13.x.1985. Littoral. 21 variegated shells.
Common. Shells were collected under rocks and stones which were in turn sheltered by large boulders common at this site.

Barr Hall, Strangford Lough, Co. Down (J6148)
(1) 4.vii.1984. Littoral, (with JCA). 5 variegated and 5 white shells.
Despite being recorded as common by Seed (1979), topshells were difficult to locate on the above date. Those collected were all found on fronds of Laminaria digitata (Hudson) which covered low water areas between small islands.

Granagh Bay, Strangford Lough, Co. Down (J6148)
(1) 10.iii.1986. Littoral (JCA and IL). 93 variegated and 36 white shells.
Common. Topshells of both types were found on and under rocks and algae.

Big Rock, Strangford Lough, Co. Down (J6050)
(1) 31.iii.1987. Sublittoral, 5-8m (with ML). 30 variegated and 97 white shells.
Common. Most shells were collected on kelp (L. digitata), and on rocks and stones in the deeper water (8m).

Ballyhenry Point, Strangford Lough, Co. Down (J5852)
Several collections (1.i.1984 to 31.iii.1987), of 350+ variegated and 46 white shells.
Very common. 119 variegated shells were collected at the same time as the above 46 white shells and these figures give the correct proportion of colour shells at this site. Topshells were distributed on rocks and algae all over the lower shore.

The Dorn, Strangford Lough, Co. Down (J5956)
(1) 20.vii.1985. Littoral tidal rapids. 42 white shells.
Seed (1979) and Roberts and Kell (1987) record no variegated shells at this site, and no variegated shells were found during the above collection. However, one variegated shell was collected by a party of students making a general collection in The Dorn area in October, 1984 though I cannot confirm if this topshell is from the rapids. This does suggest that the variegated shell may not be totally excluded from this site.

Audley's Rocks, Strangford Lough, Co. Down (J5950)
(1) 14.x.1986. Sublittoral, 10m (with ML). 29 white and 6 variegated shells.
Rare. Two 45 minute dives were necessary to locate the above 35 shells which were found on rocks and the stipes and holdfasts of L. digitata.

Strangford Point, Strangford Lough, Co. Down (J5950)
(1) 10.iii.1984. Sublittoral, 10-12m (AL and BR). 38 white and 2 variegated shells.
Common. The variegated shell is rarer here with only two specimens found during a half hour dive.

Cloghy Rocks. Strangford Lough, Co. Down (J5948)
(1) 3.vii.1984. Littoral. 69 white and 30 variegated shells.
(2) 11.x.1984. Littoral, (with JCA). 50 white and 30 variegated shells.
Common. Shells were collected on L. digitata and rocks. Some white shells were found in the middle shore level on Ascophyllum nodosum (L.), no variegated shells were found at this level.

Discussion

It is clear that C. zizyphinum is widespread in Ireland but confined to particular habitats. Topshells are common sublittorally and in tidal rapids. In general exposed shores are not densely populated with this topshell, while areas such as Achill Island and Hook Head where the shores are subject to heavy exposure to wave action have quite large populations of this topshell in nearby shallow offshore water. C. zizyphinum has a small aperture relative to the size of the shell and is practically helpless out of water because of the weight of the shell (O'Loughlin, 1988). This contributes to the absence of this species from exposed shores. Algal cover on each shore is an important influence on the distribution of C. zizyphinum. For example, at shore like Kearney Pt. where there is 15% algal cover, this topshell is rare, while at Ballyhenry Pt. where there is nearly 100% cover, topshells are common.

All the tidal rapids examined had large populations of this topshell. With the exception of the Aughris Head site all these rapids are in sheltered areas where mud is the predominant substrate in the surrounding region. The speed of water flowing through the rapids would be sufficient to dislodge the shells, but most shells were found on the sheltered side

of rocks or in crevices in the rapids (O'Loughlin and Aldrich, 1987b). They therefore avoid the fast water flow. The flooding tide provides relief, because it gradually rises up the rapids, rather than reversing the flow of water, immersing the entire area. The rapids keep a channel free of mud and provide a richer habitat than the surrounding coastline.

Apart from Clew Bay and Strangford Lough, C. zizyphinum was not common on ordinary rocky shores. Outside these two locations shells were most abundant sublittorally or in tidal rapids. The western coast of Ireland is generally very exposed and only in sheltered inlets like Muckinish Bay, Aughinish Bay, Clew Bay and Mulroy Bay would one expect to find large numbers of this topshell. The east and south-east coasts of Ireland have very few rocky shores suitable for C. zizyphinum, and to collect any significant number of shells dive collections would have to be employed.

In Strangford Lough C. zizyphinum is to be found in almost any shore or offshore area. The distribution of colour morphs found in this study is compared with the previous records. In Table 1 the relative proportions of variegated and white shells at all sites described above is compared to previous records (Seed, 1979; Roberts and Kell, 1987). In the Strangford Lough area the proportions do not differ much at Kearney Pt., Barr Hall, Granagh Bay, The Dorn, Audley's Rocks and Cloghy Rocks. Fewer white shells were found in this study at Ballyhenry Pt. than in either previous study. Seed (1979) collected all observable specimens as was the case in this study. Roberts and Kell (1987) collected only the first 25 specimens regardless of colour or size and this may account for any observed differences. The most noticeable differences in proportions of colour morphs is at Big Rock and Strangford Pt. In both cases the collections here are dive collections. Both Seed (1979) and Roberts and Kell (1987) made shore collections only. This suggests that the white shell is more common sublittorally in some areas than in the corresponding inshore littoral area. The white shell also appeared to be more common sublittorally than at the shore at Ballyhenry Pt.,,though no count was made. Some researchers suggest that the white shell prefers areas of fast flowing water (J. Nunn, pers. comm.; Erwin and Picton, 1987) though this does not explain the distribution of this form further up into sheltered areas of Strangford Lough (Seed, 1979; Roberts and Kell, 1987).

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TABLE 1: Proportions of colour shells in Ireland.
V/W = Percentage of variegated/white shells.

Site	V/W	Seed (1979)	Roberts and Kell (1987)
Kearney Pt.	100/0	100/0	100/0
Barr Hall	50/50	39/61	
Granagh Bay	72/28	86/14	
Big Rock	24/76	49/51	43/57
Ballyhenry Pt.	72/28	38/62	48/52
The Dorn	0/100	0/100	0/100
Audley's Rocks	17/83	8/92	-
Strangford Pt.	5/95	15/85*	70/30⊕
Cloghy Rocks	25/75	23/77+	-
Dalkey Sound	98/2	-	-
All other sites	100/0	-	-

* = Swan Island (300m from Strangford Pt.)
⊕ = Strangford South of Roberts and Kell (1987)
+ = Black Islands of Seed (1979)

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Bull. Ir. biogeog. Soc. No. 12 (1989)

THE IRISH ELATERID AND BUPRESTID FAUNA (COLEOPTERA: ELATERIDAE AND BUPRESTIDAE).

Martin C. D. Speight

Summary

The Irish species list for the beetle family Elateridae is up-dated, with 24 species now listed, including the following two species which are recorded for the first time: Ampedus pomonae and Athous subfuscus. The composition of the Irish elaterid fauna is discussed, in comparison with the elaterid faunas of Great Britain and Northern France. The situation of the closely-related family Buprestidae is considered in the same say, focusing on the question of why there are no definite records of any buprestid species from Ireland. It is concluded that absence from Ireland, of many of the deciduous forest elaterid species known from both Great Britain and Northern France, is caused either directly or indirectly by man's forest clearance activities. It is suggested that the characteristically low summer temperatures experienced in Ireland and forest clearance by man have both contributed to the absence from Ireland of most of the buprestids found in adjacent parts of Europe. It is argued that other absentee buprestids became extinct with the disappearance of indigenous conifers. It is suggested that Agrilus viridis and Trachys minutus may yet be found in Ireland, if more intensive collecting activity were conducted at appropriate locations.

Sommaire

La liste des elaterides irlandais est revisée. La présence de vingt-quatre espèces est confirmée. Deux espèces sont signalées pour la premier fois: Ampedus pomonae et Athous subfuscus. La composition de la faune est comparée à celle de la Grande Bretagne et à celle du nord de la France. Le problème de l'absence totale des buprestides en Irlande est examiné. Il est suggeré que les elaterides forestiers sont sous-représentés en Irlande parce que les forêts ont été abattues par l'homme. Mais l'absence des buprestides depend également des influences climatiques, en particulier de la fraicheur relative de l'été irlandais. Pour conclure il est suggeré que les espèces Agrilus

viridis et Trachys minutus puissent être découvertes un jour en Irlande.

Introduction

For many families of Coleoptera, Johnson and Halbert (1902) represents the most recent, if not the only, systematic revision of the Irish fauna. The Elateridae and Buprestidae are two families which have been neglected since then. A revision of the Irish Buprestidae does not present the usual difficulties attendant upon a faunal revision, because there are no verifiable records of buprestid species from the island! But why are buprestids apparently absent from Ireland? Revision of the Irish elaterid fauna presents more normal problems, though there is perhaps a greater amount of nomenclatural chaos involved than is usual. The genus Ampedus has still not received adequate revision at European level and when the results of present revisionary work are completed it would seem inevitable that nomenclatural change, involving Irish species, will be necessary. Here, the Irish elaterid list is up-dated, using nomenclature currently in use. The larvae of Irish elaterid species, with the exception of Ampedus pomonae and Selatosomus melancholicus can be identified using Van Emden (1945). Click beetle larvae are known as "wireworms" and those of a few species, noteably in the genera Agriotes and Athous, have on occasion proved a problem in agriculture, due to their consumption of grass roots.

In considering both elaterids and buprestids, comparisons are made here between the faunas of Ireland, Great Britain and Northern France, so lists of the elaterids and buprestids from these parts of Europe are provided in appendices. In a subsequent paper (Speight and Mendel, in press), ecological notes on the elaterid species known from Ireland will be given, together with available distribution records. Distribution records are given in the present account only for Ampedus pomonae and Athous subfuscus which are added to the Irish list in this text.

Johnson and Halbert (1902) record 21 species of Elateridae and no species of Buprestidae from Ireland. Some of the elaterid species were included by them on the basis of very insubstantial data. One of them is now removed from the Irish list (see below). Since publication of Johnson and Halbert's list five elaterids have been added to the Irish list. Three of these are now removed from the list (see below). Together with the two species added during course of the present account, the Irish elaterid fauna now comprises 24 species (plus one species as yet unidentified - see under Ampedus praeustus, below), as compared with 68 recorded from Great Britain and 80 recorded from Northern France. The buprestid fauna of Ireland remains at 0 species, with the exception of unverifiable references to the occurrence of one species (discussed below) and reports of imported specimens of another (O'Connor and Nash, 1986). In contrast, 11 species of buprestid are recorded from Great Britain and 41 species from Northern France.

The interpretations of species and nomenclature used in the present account follow Leseigneur (1972) for the Elateridae, modified by changes given in Pope (1977) and Zeising (1983). The nomenclature used for Buprestidae follows Schaefer (1949, 1955, 1984) with modifications according to Bílý (1982) and Cobos (1986). In the various lists incorporated into the present account the genera are listed alphabetically and the species are presented in alphabetical order under each genus.

Check list: Irish Elateridae

The following check list of the elaterids known to occur in Ireland shows, where they differ, the names under which these species appeared in Johnson and Halbert (1902) and other more recent works likely to be consulted by anyone working on elaterids in Ireland. The names of species added to the Irish list in the present text are preceded by the symbol *. The names of other species added subsequent to Johnson and Halbert (loc. cit.) are preceded by the symbol +. With the exception of Prosternon tessellatum, a distinctive species unlikely to have been confused with any other by Donisthorpe (1937), Irish specimens of the named species listed have been seen by the author. The un-named Ampedus species referred to is included on the basis of the remarks in Mendel (1988). This may be the same species as that referred to here as

A. pomonae (Steph.), sensu Leseigneur (1972). Hopefully, revisionary work currently being conducted by Mr. Mendel will decide the correct nomenclature of this insect.

Of the named species listed below, all but Athous subfuscus and Prosternon tessellatum are represented in the National Museum of Ireland collections by Irish material. P. tessellatum is represented by British material. It is hoped that material of A. subfuscus will be added to the museum collections shortly.

ACTENICERUS

sjaelandicus (Müller, 1764)

Corymbites tessellatus (Johnson and Halbert, 1902)

ADRASTUS

pallens (Fabricius, 1792)

Adrastus limbatus (Johnson and Halbert, 1902)

AGRIOTES

lineatus (L, 1767)

obscurus (L, 1758)

AGRYPNUS

murinus (L, 1758)

Lacon murinus (Johnson and Halbert, 1902)

AMPEDUS

balteatus (L, 1758)

*pomonae (Stephens, 1830)

pomorum (Herbst, 1784)

Elater pomorum (Johnson and Halbert, 1902)

Elater praeustus (Halbert, 1922)

sp. nr. praeustus (Fabricius, 1792)

Elater pomonae (Donisthorpe, 1902)

Elater praeustus (Donisthorpe, 1917)

Elater praeustus (O'Mahony, 1929)

ATHOUS

+campyloides Newman, 1833

Athous difformis (O'Mahony, 1924, 1929)

haemorrhoidalis (Fabricius, 1801)

hirtus (Herbst, 1784)

Athous niger (Johnson and Halbert, 1902)

*subfuscus (Muller, 1764)

CTENICERA

cuprea (Fabricius, 1775)

Corymbites cupreus (Johnson and Halbert, 1902)

Corymbites pectinicornis (Stelfox, 1947)

DALOPIUS

marginatus (L, 1758)

Dolopius marginatus (Johnson and Halbert, 1902)

DENTICOLLIS

linearis (L, 1758)

Campylus linearis (Johnson and Halbert, 1902)

HYPNOIDUS

riparius (Fabricius, 1792)

Cryptohypnus riparius (Johnson and Halbert, 1902)

MELANOTUS

erythropus (Gmelin in L, 1789)

Melanotus rufipes (Johnson and Halbert, 1902)

PROSTERNON

+tessellatum (L, 1758)

Corymbites holosericus (Donisthorpe, 1938)

SELATOSOMUS

aeneus (L, 1758)

Corymbites aeneus (Johnson and Halbert, 1902)

bipustulatus (L, 1767)

Corymbites bipustulatus (Johnson and Halbert, 1902)

incanus (Gyllenhal, 1827)

Corymbites quercus (Johnson and Halbert, 1902)

+melancholicus (Fabricius, 1798)

Corymbites aeneus (Stelfox, 1936)

SERICUS

brunneus (L, 1758)

Sericosomus brunneus (Johnson and Halbert, 1902)

ZOROCHROS

minimus (Boisduval and Lacordaire, 1835)

Cryptohypnus dermestoides (Johnson and Halbert, 1902)

Cryptohypnus quadriguttatus (Johnson and Halbert, 1902)

Elateridae to be added to the Irish List

The two species whose names are preceeded by an asterisk in the above list are added to the known Irish fauna based on the following records:-

Ampedus pomonae

Kerry: 29 June 1934, Glencar (V7285), coll. A. W. Stelfox, det. MCDS, confirmed J. Chassain in NMI.

Glencar is the "entomological paradise" from which Donisthorpe (1917) collected his enigmatic A. praeustus specimens "on the road". Since Donisthorpe's time the area has sadly been greatly changed by extensive conifer plantations, which have obliterated much of the natural vegetation. Stelfox's specimen unfortunately carries no habitat data. It may well also be the same species as the Irish specimen tentatively consigned to A. praeustus by Mendel (1988). All that can be said is that the A. pomonae record included in the present account refers to the same species as is currently recognised as A. pomonae in Leseigneur

(1978) and by other continental coleopterists. In Great Britain there are a few records of A. pomonae from SE England, but the most recent British literature on elaterids, that of Joy (1932) is quite appalling and almost guaranteed to lead to misdetermination.

Athous subfuscus

Offaly: 12 May 1988, All Saints bog (N0010), swept from open valley-bog vegetation, coll. and det. MCDS.

All Saints Bog is one of the remaining examples of a more or less intact raised bog. Its particular interest resides in the large birch wood which covers much of its central area. Several insect species not known elsewhere in Ireland are now recorded from All Saints.
A. subfuscus now has a most unlikely distribution in the British Isles, being known from the Irish Midland locality given above, from a small cluster of adjacent sites in SE England and from a much larger cluster of sites on the Orkney Isles. According to Leseigneur (1972) it is in France largely a woodland species, and is generally distributed there.

Elateridae doubtfully recorded from Ireland

There are no definite records of any of the following six click beetles from Ireland. Until their presence in Ireland can be confirmed they should be excluded from the Irish list. The circumstances of each are discussed below.

Ampedus cinnabarinus (Eschscholtz, 1829)
Ampedus praeustus (Fabricius, 1792)
Ampedus sanguineus (L, 1758)
Cidnopus aeruginosus (Olivier, 1790)
Ctenicera pectinicornis (L, 1758)
Stenagostus villosus (Fourcroy, 1785)

Ampedus cinnabarinus

See under A. sanguineus, below.

Ampedus praeustus

This insect was added to the Irish list by Donistorpe (1917), on the basis of specimens collected "on a road at Glencar, Co. Kerry", and first published as A. pomonae, by Donisthorpe (1902). One of these specimens is in the collections of the British Museum (Natural History) in London. Of this specimen Mendel (1988) says "The surviving specimen is unlike typical A. praeustus, but cannot easily be assigned to another species of Ampedus." It remains to be seen whether Mr. Mendels's revision of Ampedus will result in this specimen being consigned to A. praeustus, or some other species. It does not seem that A. praeustus sensu auct Brit. is the same species as has been given this name in continental Europe. It would be interesting if A. praeustus were to be found in Ireland, as it is absent from both Great Britain and Northern France (records of A. praeustus from the Foret de Fontainebleau, in the Paris basin, given by Gruardet (1930) apparently relate to A. cardinalis: J. Chassain, pers. comm.). A further record of A. praeustus in Ireland is given by Halbert (1922), based on specimens "dug out of an old Alder stump" at Powerscourt, Co. Wicklow. He refers to Donisthorpe's (1917) note, suggesting that on the basis of what Donisthorpe says, Irish records of A. pomorum should be referred to A. praeustus. The Powerscourt specimens mentioned by Halbert (collected by O'Mahony), labelled as A. praeustus, are in the National Museum of Ireland, in Dublin. Examination shows they belong to A. pomorum. Examination of the other Irish material of A. pomorum in the NMI collections has not brought to light any specimens of A. praeustus. Similarly, examination of Irish specimens of other Ampedus species has not located any Irish A. praeustus. At present, all that can be said is that there are no definite records of A. praeustus from Ireland.

Ampedus sanguineus

In discussing A. pomorum, Johnson and Halbert (1902) comment on a note in Haliday's manuscript list of Irish insects, which refers to "Elater sanguineus" as having been found at Powerscourt, Co. Wicklow. There are no known Irish specimens of A. sanguineus and Johnson and Halbert suggest the record probably refers to A. cinnabarinus (as "E. lythropterus"). Equally, however, there are no known Irish specimens

of A. cinnabarinus. The considerable confusion surrounding the identification of specimens belonging to this group of species makes it quite possible that Haliday's note referred to a specimen of A. pomorum. It is a tragedy that the old oak woodland at Powerscourt was destroyed by commerical forestry activities, because if A. cinnabarinus did occur there in the past it is certainly unlikely to be found there now. A. sanguineus is regarded as extinct in Great Britain. The existing British records, from the Salisbury plain (Wiltshire) and the New Forest (Hants) (Mendel, 1988) are peculiar, in that A. sanguineus is recognised as a species associated with conifers. If it was an indigenous British insect associated with conifers in Great Britain, the only indigenous conifer available would be Pinus sylvestris, which is believed to have become extinct in southern England before the onset of the scientific period. Further, one wonders why there are no records of this elaterid from the existing areas of indigenous P. sylvestris, in Scotland? For A. sanguineus to have been present in conifers in southern England during the nineteenth century would imply that perhaps it was an early importation which has subsequently, and unaccountably, died out. Leseigneur (1972) reports that in France the range of this species has been considerably extended through the expansion of conifer plantations. The association of A. sanguineus with conifers would also argue against this beetle having survived in Ireland into the nineteenth century. Finally, it makes part of the content of Haliday's note on the supposed occurrence of A. sanguineus at Powerscourt strong evidence for the beetle found having been misdetermined, because Johnson and Halbert (1902) quote Haliday's note as saying "Among peat earth, in rotten branch of oak tree". A. cinnabarinus is principally associated with Quercus, but, on occasion, A. pomorum has also been found in the rotten wood of that tree. In Great Britain, A. cinnabarinus is now largely confined to parts of the valley of the R. Severn and localities close to the south coast of England (Mendel, 1988), but it would be difficult to use that information in weighing the likelihood of occurrence of A. cinnabarinus in Ireland. More importantly, the larvae of A. cinnabarinus predate those of the lesser stag beetle, Dorcus parallelipipedus (L.), an insect recorded only once from Ireland, during the nineteenth century. In Northern France A. cinnabarinus is said by Leseigneur (1972) to be frequent. Gruardet (1930) records it as inhabiting both Quercus, Betula and Pinus sylvestris in the Forêt de Fontainebleau.

Cidnopus aeruginosus

Johnson and Halbert (1902) refer to one Irish record for this species, which they were unable to verify. There are no subsequent records and no Irish specimens of this species are known. There is no obvious reason why C. aeruginosus should be absent from Ireland. In Great Britain the species is most frequent from southern Wales northwards. In France it occurs primarily in mountainous parts, but is known from the Paris basin. Leseigneur (1972) suggests it may be found as easily at poorly-drained localities in regions with a cool climate, as elsewhere. Perhaps the presence of C. aeruginosus in Ireland would be revealed by intensive survey aimed at its discovery? At present, all that can be said is that there is insufficient evidence for the presence of this insect in Ireland for it to be retained on the Irish list.

Ctenicera pectinicornis

This elaterid was added to the Irish list by Stelfox (1947), on the basis of a specimen collected 29 May 1944, at an altitude of 1800 feet near L. Diheen, in Co. Tipperary. This specimen is in the collections of NMI and examination has proved it to be a large female of Ctenicera cuprea. This determination was kindly checked and verified by M. Jacques Chassain (Thomery, France). There are no other definite records of C. pectinicornis from Ireland, though, according to Stelfox (loc. cit.), there is an unsubstantiated reference to Tardy having collected the species in Ireland, recorded by Haliday in his manuscript list of Irish insects.
C. pectinicornis is a species of ancient, unimproved pasture and open, grassy areas within woodland. British records are scattered from the Cotswolds to northern England and Leseigneur (1972) says of the species "Pas rare en montagne" and "très rare en dehors des montagnes", going on to suggest it is found at altitudes from 300m up to 1800m in France. Occurrence of this insect in Ireland might be expected. It is not difficult to distinguish from related species in the male sex, but identification of females can be problematic. Although there is currently no basis for retaining C. pectinicornis on the Irish list it is reasonable to hope that it might be found in Ireland at some point in the future, perhaps on the esker grasslands of the Midlands, for example.

Stenagostus villosus

This click beetle deserves mention here because Ireland is given as part of its range by Leseigneur (1972). Only rarely does Leseigneur make specific reference to a species as occurring in Ireland, but S. villosus is one such instance. Unfortunately, the basis for Leseigneur's citation is not apparent and there do not seem to be any other references to the presence of S. villosus in Ireland. In Great Britain this beetle is widely distributed from the south coast of England to north Wales. Leseigneur (1972) reports S. villosus as found in "à peu près toute la France", but suggests it is everywhere uncommon. Iablokoff (1943) provides information on the habits of S. villosus in forests of the Paris basin, where, in his opinion, this elaterid is associated with the longhorn beetles Cerambyx scopolii Fuessly in Quercus and Aegosoma scabricorne in Fagus and Betula. If this elaterid were dependent on these longhorns it would be very unlikely to occur in either Great Britain or Ireland, since Aegosoma is not recorded from either island and C. scopolii is excessively rare in Great Britain and absent from Ireland. So it is necessary to conclude that S. villosus can survive in an absence of these cerambycids. Perhaps then it could occur in Ireland, if its larvae can make use of the larvae of some of the saproxylics occurring here in Betula. At present, however, there is no adequate basis for including S. villosus on the Irish list.

Buprestidae doubtfully recorded from Ireland

The only definite records of the occurrence of buprestids in Ireland are those concerning imported specimens of the conifer-associated, North American species Buprestis aurulenta L., which has been reported twice (O'Connor and Nash, 1986). There is no evidence that this species has established itself in Ireland, even though North American conifers are now by far the most abundant trees in the island. B. aurulenta has also frequently been imported to Great Britain, but has not established itself there, either (Shaw, 1961). More of a puzzle is the fact that both Schaefer (1949) and Cobos (1986) state that Trachys minutus (L.) is known from Ireland. It may well be that Cobos' (1986) reference to occurrence of T. minutus in Ireland is taken from Schaefer (1949)

I have not seen any Irish specimens of this species and neither have I been able to trace any publication in which any Irish records of this species are given, so at present I have no adequate basis for including it on the Irish list. The larvae of T. minutus mine the leaves of various shrubs and small trees, including Corylus and Salix caprea. On occasion they have also been found mining leaves of Quercus and Ulmus. The larvae may be very abundant on individual trees. Bílý (1982) reporting 50% of the leaves containing larvae, with up to four larvae per leaf. This beetle is not regarded as rare in Great Britain, but it does not seem to reach Scotland (Levey, 1977). It is found throughout France, where it can be very common. It is known in Scandinavia from southern Norway and southern Sweden, as well as from Denmark and southern Finland. Its presence in Ireland would be expected. Its mines would be obvious if present and the fact that the adult hibernates among dead leaves etc. at the bottom of the tree means that it could be found right through the winter.

The composition of the Irish elaterid fauna

One of the elaterids found in Ireland, S. melancholicus, is not known in either Great Britain or Northern France. It is one of a small number of insect species which occur at sea level along the West coast and at quite high altitudes in the mountains of central Europe. Similar, but less extreme distribution patterns are exhibited by other cool climate elaterids, C. cuprea, H. riparius and S. aeneus. These three species, characteristic of boggy moorland and poor grassland, are absent from Northern France but found in Great Britain, where they show a distinct drop in frequency toward the SE of England. Together, these four open country species comprise the only group of elaterids present in Ireland but absent from Northern France. The overwhelming feature of the Irish elaterid fauna is that the majority of species found in Great Britain are absent from Ireland and that an even higher proportion of the elaterid fauna of northern France is absent from Ireland.

Adult elaterids are highly mobile, and active fliers under certain weather conditions, so that they can be found in various situations. Their larvae, by contrast, are largely sedentary, living out their

entire developmental period within the confines of the root zone of a grass tussock or a small patch of rotten wood in a fallen branch. This makes the larval habitats of elaterids reasonably easy to define and allows grouping of the species according to whether their larvae dwell in soil, or rotten wood, etc. Larvae are either root-feeders, in the soil litter and humus horizons or secondary saproxylics, dependent for their food supply on partly-decomposed wood or on the larvae of other elements of the saproxylic fauna. The latter group, whose larvae are to a significant extent predatory, are also rotten wood feeders but they supplement their larval diet by predation and their successful development is apparently dependent upon their predatory activities.

Species groups which can be recognised among the elaterids considered here may be defined as follows:

1. Species with larvae that feed on plant roots (and, to some extent, other soil inhabitants) in the soil, in various open-country situations, including dune systems, grassland, moorland and sandy river margins: group s.

2. Species whose larvae feed on roots (including tree roots) in woodland soils: group ds.

3. Species whose larvae feed on the rotting wood of deciduous trees: group d.

4. Species whose larvae feed on rotten wood and on the larvae of other saproxylics (including other click beetle larvae), in the rotting wood of deciduous trees: group dp.

5. Species whose larvae feed on the rotting wood of conifers: group c.

These categories are not entirely exclusive, there being some species with root-feeding larvae that may occur in open country situations as well as in woodland and others which are to be found in the rotting wood of particular deciduous trees as well as in the wood of certain conifers. But in the vast majority of cases a species can be classified as belonging to one of these broad groups. The larval habitat group

into which each of the listed elaterids can be put is indicated in Appendix 1. The number of species belonging to each group in the Irish, British and Northern French faunas is shown in Table 1.

TABLE 1. The number of species belonging to each larval habitat groups in Ireland, Britain and Northern France.

Faunal List	Number of species in each species group					
	Gp.s	Gp.ds	Gp.d	Gp.dp	Gp.c/d	Gp.c
Ireland	15	2	5	1	1	0
Great Britain	31	6	12	11	5	1
Northern France	34	9	16	13	2	1

From Table 1 it appears that there are considerable differences between the balance of the Irish fauna and the balance of the British and Northern French faunas. Thus, the ratio of open country elaterids (s) to deciduous forest elaterids (ds + d + dp) is nearly 2:1 in the Irish fauna, but 1:1 in the British and French faunas. The least well-represented group in the Irish fauna is deciduous forest species dependent to a significant extent upon other saproxylics for larval food supply, with less than 10% of the regionally available species represented in Ireland, contrasting noticeably with the situation for the British and Northern French faunas. Because nearly all of the species in the predatory category are primarily associated with Quercus, rather than with shorter-lived trees like Alnus, Betula and Salix, it follows that oak-associated old deciduous forest elaterids are absent from Ireland, almost en bloc. Essentially, then, elaterids associated with different types of habitat are not represented in Ireland to the same extent and any hypothesis put forward to explain the constitution of the Irish elaterid fauna would have to take this into account. As in the case of the Cerambycidae (Speight, 1988) the main problem with the Irish elaterid fauna is not to explain why particular species are present, but to explain why large numbers of species associated with a dominant indigenous vegetation type, oak forest, are absent. Again, certain hypotheses can be explored:

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1. The Irish sea prevented access of elaterid species to Ireland, during the postglacial.

2. The absentee elaterids reached Ireland during the postglacial but were unable to maintain populations there, due to lack of appropriate environmental conditions.

3. The absentee species reached Ireland during the postglacial but subsequently became extinct due to man's activities.

4. The absentee species reached Ireland during the postglacial and are still present in Ireland, but have not yet been discovered there due to insufficient biological recording activity in the island.

The Irish Sea as a zoogeographical barrier, preventing colonisation of Ireland by Elateridae

Earlier during the present century there was a popular view, promoted by influential individuals like Praeger, that the absence from Ireland of many organisms found in adjacent parts of Europe is due to the Irish Sea functioning as a barrier to colonisation during the postglacial. Adoption of this view caused difficulties in explaining how the indigenous flora and fauna had arrived in Ireland, which were overcome by adoption of three further notions, namely that a proportion of the species had survivied the ice-ages in situ, located on refugia now submerged by rising post-glacial sea-levels, that most of the rest of the species had crossed to Ireland using a land-bridge, now also submerged by rising sea levels, and that the species whose presence could not be explained in either of these ways had been introduced to Ireland by man. That there was a useable land-bridge between Great Britain and Ireland early in the post-glacial now appears unlikely and I have pointed out elsewhere (Speight, 1986) that refugia and land-bridge notions are anyway largely irrelevant to the colonisation of Ireland by small, fully flighted organisms like insects. Essentially, a 20 mile stretch of salt water is not a very effective barrier and the constitution of the fauna gives no real support to either the land bridge or refugia notions. This is as true for the elaterids as for other insects.

These insects can and do fly under the climatic conditions occurring in Ireland. Very few of the Irish elaterid species could have survived on refugia of the character postulated by promoters of the refugium notion, as can be seen from the habitat requirements indicated in Appendix 1. And if most of the Irish elaterids had to arrive in Ireland by crossing over on a land bridge why isn't the rest of the British deciduous forest elaterid fauna present in Ireland as well, except for the few species associated with trees not indigenous to Ireland? As with the cerambycids, which I've pointed out (Speight, 1988) are renowned for their abilities to colonise even remote oceanic islands, Ireland's elaterid fauna shows and under-representation of deciduous forest species. If the Irish Sea is acting as a barrier to colonisation by elaterids it is difficult to understand how the present fauna could have arrived at all, in the absence of a land-bridge functioning until far into the post-glacial climatic optimum. And if such a land-bridge existed, it is even more difficult to understand the absence from Ireland of so many deciduous forest elaterids and why species with predatory larvae should be pariticularly affected - unless some factor operated subsequently to cause their eradication.

Ireland as an unfavourable environment for the establishment of Elateridae

It may well be that some of the elaterids associated with well-drained, sandy soils in open country and found today in SE England and/or Northern France would be unable to establish themselves in Ireland if they did reach the island. Open ground is not a natural component of the Irish countryside, away from the coast, except in various sorts of peatland. And peatland would not normally provide appropriate habitats for elaterids requiring sandy soils. But it is difficult to argue for the absence from Ireland of species associated with the rotten wood of oak trees on such a basis, given that there are grounds for believing there were extensive tracts of oak forest in Ireland until man cut the trees down. Similarly, it might be argued that open country species would be prone to extermination due to climatic change, since open country is not buffered against effects of climate. But again, this does not help to explain the massive gaps in Ireland's woodland elaterid

fauna - a tree trunk rotting on a forest floor represents an environment to a marked extent buffered against the vagaries of climate, and where the trees can survive their associated saproxylics can be expected to do likewise. Examination of Dajoz (1965) and Palm (1959) shows that most of the deciduous forest elaterids found in Great Britain but unknown from Ireland occur from central Sweden to the southern end of the Pyrenees, indicating tolerance of a range of climatic conditions sufficient to encompass what is found in Ireland.

Man's activities in Ireland, as a cause of extermination of Elateridae

Three of the old-forest elaterids found in Great Britain and Northern France are usually found in association with Fagus, a tree not indigenous to Ireland, and, even though these species are known also to utilise Quercus, it could be argued that lack of an appropriate host tree could have prevented their establishment in Ireland. But that still leaves 25 absentee old-forest elaterids unaccounted for, species that are for the most part associated with Quercus, supposedly the dominant tree in indigenous Irish forests. Even more than in the case of many of the absentee cerambycids (see Speight, 1988), the critical habitat for these elaterids occurs almost exclusively in over-mature, moribund and dead trees, since they are associated with wood already part-decomposed by brown-rot fungi and other saproxylics - none of these elaterids are primary saproxylics, that make use of undecomposed wood.

In considering the cerambycids (Speight, loc. cit.), it was concluded that human activity, especially removal of over-mature trees of the long-lived species like Quercus and Ulmus, represented the most plausible explanation for the particular composition of the Irish cerambycid fauna and was responsible for the loss of cerambycid species from the island. Whether or no the composition of the open-country elaterid fauna can be explained in other ways, it is difficult to find any explanation for the composition of the Irish deciduous forest elaterid fauna than that it is primarily a consequence of man's forest clearing activities. The virtual absence of deciduous forest elaterids whose larvae are predatory on larvae of other saproxylics in rotting wood is particularly telling -

the cerambycids, cetoniids and lucanids used as food by the larvae of these click beetles are themselves either absent or excessively rare in Ireland today, due to the extreme scarcity of their habitat. In this case man's forest clearing activities can be regarded as indirectly responsible for the click beetles' absence, in that clearing the forest has swept away the click beetles' food supply. This group of old forest click beetles with predatory larvae is now, as a group, the most threatened component of the British elaterid fauna also, with more than half of its species included on the Red Data List for British insects (Shirt, 1987). Were it not for the survival of ancient trees in a few parks attached to stately homes and in one or two well-known old royal hunting forests, these species would doubtless also be absent from Great Britain today. It is not only in Great Britain that such insects are regarded as threatened. These same elaterids appear on the Austrian Red List, for example (Franz, 1983).

How do the few conifer-inhabiting elaterids fit into the scenario of a fauna whose woodland component has been apparently so battered by human activities? Their presence in Scotland, where relict stands of indigenous P. sylvestris still survive, would be expected. That they are largely absent from Northern France, where indigenous conifers are absent or have disappeared, is equally unsurprising. I have argued elsewhere that the almost total absence of records of conifer-associated old-forest insects from Ireland is due firstly to disappearance of indigenous P. sylvestris before the onset of the scientific period (Speight, 1985a), and secondly to the lack of habitats suitable for saproxylics in the recently established commercial conifer plantations. The lack of conifer-associated elaterids in Ireland can simply be viewed as an example of this general situation. It is a moot point whether man's activities were primarily reponsible for the disappearance of pine as a native tree in Ireland. Data provided by McCracken (1971) show that the uses to which pine timber was put in Ireland must surely have hastened the indigenous pine on its way, even if not dictating its disappearance.

The level of biological recording activity in Ireland, as a factor determining which elaterids are known from Ireland.

Even if, as suggested above, the absence from Ireland of certain open-country elaterids occurring in adjacent parts of Europe can be explained on climatic grounds, there remain some 12 species, in the British fauna alone, whose absence cannot so easily be explained. Among these there are two, in particular, whose absence is surprising. These species, Fleutiauxellus maritimus (Curtis) and Selatosomus impressus (Fabricius), are not infrequent in Scotland (Mendel, 1988). F. maritimus is a species of sandy river or lake margins and might be expected around L. Conn or L. Neagh. S. impressus is a more montane species, not confined to the vicinity of water and found both in open country and woodland. Other open country species, Agriotes sputator among them, occur with reasonable frequency in Great Britain, to as far north as the Scottish lowlands. But has biological recording activity in Ireland been sufficient to detect these species here, were they to occur? The distribution maps in Mendel (1988) show a total of some 4000 British records for the elaterid species known also from Ireland. The total number of Irish distribution records for Elateridae is approximately 400. This suggests that, assuming species are no more localised in Ireland, on average, than they are in Great Britain, any species represented in Great Britain by fewer than 10 records would be unlikely to have been detected in Ireland so far, even if present here. While this conjures up the intriguing observation that if scale of collecting effort alone dictated which species were so far recorded from Ireland, elaterids added to the Irish list in future would be most likely to be species that are excessively rare in Great Britain because the more widely distributed species would have been found in Ireland already if they were present, it also suggests that 22 of the British elaterids apparently absent from Ireland, including the deciduous woodland species Ampedus cinabarinus (Eschscholtz), A. elongantulus (Fabricius), A. nigrinus (Herbst) and A. sanguinolentus (Schrank) should be known here already.

Each of the following species is known in Great Britain from less than 10 records:

Adrastus rachifer (Fourcroy), Ampedus nigerrimus (Lacordaire), A. ruficeps (Mulsant and Guillebeau), A. rufipennis (Stephens), A. sanguineus (L.), A. tristis (L.), Anostirus castaneus (L.), Athous subfuscus (Müller), Cardiophorus erichsoni du Buysson, C. gramineus (Scopoli), C. ruficollis (L.), Dicronychus equiseti, (Herbst), Elater ferrugineus L., Lacon querceus (Herbst), Limoniscus violaceus (Müller), Megapenthes lugens (Redtenbacher), Melanotus punctolineatus (Pelerin), Negastrius pulchellus (L.), N. sabulicola (Boheman), Selatosomus angustulus (Kiesenwetter), S. cruciatus (L.), Synaptus filiformis (Fabricius), Zorochros gramineus (Scopoli).

Only one of these species, A. subfuscus, has yet been found in Ireland. Of the three species known in Great Britain from more than 10 but less than 20 records, both A. pomonae and A. pomorum are recorded from Ireland. The third of the species in this category is A. cardinalis (Schiödte).

Ireland's absent buprestids

The list in Appendix 2 includes more than 20 buprestids whose larvae inhabit the dead wood of deciduous tree species indigenous to Ireland. Among these buprestids, seven are known from Great Britain. The list includes nine species attached to herbs or shrubs, the plants involved also being indigenous to Ireland. Five of those buprestids occur in Great Britain. A third group, of 10 species, is attached to conifers, and all of these buprestids can be found associated with either Juniperus or P. sylvestris. One of these conifer buprestids has been recorded from Great Britain.

If the buprestids are considered in isolation, their total absence from Ireland suggests the operation of some general factor, since the species associated with all types of habitat are equally affected. It is recognised that buprestids are sun-loving insects. Bílý's (1982) remarks about the faunistics of the Scandinavian species begin with the statement "Buprestids are rather rare in Fennoscandia and Denmark. This is explained by the ecological needs of these beetles, which are

usually extremely xerophilous and heliophilous". Levey's (1977) remarks about distribution of buprestids in Great Britain commence with the statement "In Britain Buprestidae are mainly confined to south-eastern England. Their restricted distribution is apparently related to climate, as the larval host plants are widely distributed in Britain". In the case of buprestids, such remarks relate not only to the species whose larvae are associated with herbs and shrubs, and which might be expected to respond to the character of the local climate because their environment is not buffered against its fluctuations, but also to the wood-boring species. The larvae of sparoxylic buprestids inhabit those parts of standing dead trees and fallen timber that are avoided by most other elements of the saproxylic fauna - the hard, dry wood of standing trunks exposed in open clearings and the highest, most exposed parts of timber that has fallen into the open (see Speight, 1989). So, can the absence of buprestids from Ireland be explained simply in terms of Ireland's climatic regime?

Ireland's climate during the winter is unlikely to influence buprestids greatly unless mild winter conditions have adverse effects on these insects - winters over much of continental Europe inhabited by the buprestids listed in Appendix 2 are much harsher than those experienced in Ireland. However, the dependence of buprestids upon high summer temperatures may well have a bearing upon the absence of these beetles from Ireland. The data presented in Rohan (1975) show that Irish summer temperatures are on average similar to those reached in Bergen (Norway) and Fort William (Scotland). In southern Norway (i.e. South of Bergen) higher summer temperatures are reached than those occurring in Ireland. North of Bergen the converse is true. Of the 28 buprestid species recorded from Norway in Bílý (1982), all but four occur from the south of the country northwards to the vicinity of Bergen, but not further north. It would be convenient to interpret this situation as a demonstration of the effects of summer temperatures on buprestid distribution, but the host plants for the buprestids concerned show a similar distribution in Norway - they hardly occur North of Bergen either. Two of the four more widely distributed buprestids, Anthaxia quadripunctata (L.) and Melanophila acuminata (Degeer), are associated with Pinus. The third, Agrilus viridis (L.), is associated with Betula,

Salix and other deciduous trees. The last is Trachys minutus, associated primarily with Corylus and Salix. The host plants of these insects range widely North of Bergen. In Great Britain, only Agrilus viridis (L.) and Trachys troglodytes Gyllenhal in Schoenherr (associated with Scabiosa and Succisa) reach Scotland, although oak and pine, for example, are widely established there. So if the distribution data for buprestids in Norway were interpreted as suggesting that the beetles range more or less as far North as their host plants, we are then left with the problem of explaining that while the host plants exist in Scotland and Ireland, the buprestids do not!

The above is a very simplistic consideration of the relation between summer temperatures and buprestid distribution, based on consideration of only part of the range of buprestids in Europe. The presence of more than 20 buprestid species in the Danish fauna (see Appendix 2), most of which are also in Great Britain, suggests that, for these buprestids, their total absence from Ireland and restriction of British distribution to SE England is due to operation of more factors than just summer temperature effects. Nonetheless, it is difficult to escape the conclusion that the low summer temperatures usually experienced in Ireland would have significantly increased the problems encountered by buprestids in either establishing or maintaining populations in the island and could well act to restrict their occurrence to the SE of Ireland, within the area perhaps from Kilkenny to the coast of Wexford and Waterford. To judge from the situation in Scandinavia, if Pinus sylvestris were still extant as a native tree in Ireland, the buprestids A. quadripunctata and M. acuminata might be expected to occur here despite low summer temperatures. If neither of these two conifer associated buprestids can be expected to occur here now, due to loss of indigenous conifers, and most other buprestids could not be expected to occur here now because of climatic influences, the expected Irish buprestid fauna would still comprise at least three species, again judging from Scandinavian and British data. Two of these three, A. viridis and T. minutus, are both associated with Corylus and Salix. The third, T. troglodytes, uses Knautia, Scabiosa and Succisa as food plants. The apparent absence of these three buprestids would seem to have little to do with the disappearance of Irish woodland cover, Scabiosa etc.,

being widely distributed open country plants and there being plenty of Betula, Corylus and Salix around today, with no evidence for virtual disappearance of any of these plants at any point subsequent to their arrival in Ireland during the postglacial. There are no other obvious reasons for the absence of these three buprestid species from Ireland, so perhaps intensive collecting effort aimed at finding them would reveal their presence. It is apposite that unsubstantiated literature references to the occurrence of buprestids in Ireland relate to only one species, T. minutus, probably the most likely European species in this beetle family to occur here.

To summarise, if buprestids are treated in isolation, no clear picture emerges of the factors responsible for their absence from Ireland. In all probability climatic factors, the disappearance of native pine and a lack of intensive collecting effort aimed at their discovery contribute to the situation, but the central problem remains, that habitat appropriate for species like A. viridis and T. minutus, and even A. angustulus and A. laticornis, seems to be present in Ireland, but the insects are not. Taken in the context of a general under-representation of old-forest insect species in Ireland and the strong arguements in favour of explaining absence of deciduous forest long-horn beetles and click-beetles in terms of man's forest clearance activities, it is not reasonable to assume that buprestids would have been unaffected by man's activities. The scarcity in Ireland of habitats appropriate for insects dependent upon old and dying oak trees, for instance, is abundantly clear simply from a count of old oak trees and the present scarcity of old oaks in Ireland is entirely a consequence of man's activities. Remaining areas of old woodland are particularly scarce in the SE of the island, where many of the missing buprestids might be most expected to occur. However, entomological activity in Kilkenny and Waterford has also probably been less than anywhere else in the island. If there are buprestids still extand in Ireland, the climatic changes consequent upon the "greenhouse effect" should cheer them tremendously and, unless other factors are limiting their abundance, cause a population explosion sufficient to make their detection inevitable, even at present low levels of entomological activity in the SE!

Acknowledgements

I am grateful to Jim O'Connor for access to the collections of the National Museum of Ireland and to Robert Nash for the opportunity to examine material from the Ulster Museum, in Belfast. M. Jacques Chassain very kindly checked the determination of various specimens and provided reference material of species not available to me. Robert Blackith and Howard Mendel both read over earlier drafts of this text and made helpful suggestions on its content. Mrs. Brenda Leonard of the Royal Entomological Society library has been most persevering in hunting down obscure references.

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APPENDIX 1: The Elateridae known in Ireland, Great Britain and Northern France.

The lists presented here for Great Britain and Northern France are derived from the sources given below. Species given as doubtfully recorded from Great Britain are those stated to occur there by Leseigneur (1972), but not included as British by Mendel (1988). One species, Ampedus quercicola du Buysson, given below as occurring in Great Britain, is not mentioned in Mendel (1988). The basis for this record is a specimen collected by the author from within the trunk of a rotten birch tree in Dames Slough Inclosure, New Forest (Hampshire), on 20th. February 1960. Having failed to identify this specimen myself I sent it to M. Jacques Chassain for his opinion. He kindly named it for me, concluding that it belonged to A. quercicola. This species is also given as occurring in Great Britain by Leseigneur (1972).

Symbols used in larval habitat column: c = rotten wood of conifers; c/d = rotten wood of conifers and deciduous trees; d = rotten wood of deciduous trees; dp = rotten wood of deciduous trees containing appropriate prey (larvae of other saproxylic insects); ds = soils in deciduous forest; s = soils in open country (grassland, moorland); u = larval habitat unknown; (B) = Alnus, Betula or Salix; (B/Q)= Alnus, Betula or Salix, ± Quercus; (F) = Fagus; (Q) = Quercus

Headings of distribution data columns: IR = Ireland; GB = Great Britain (data from Mendel, 1988); NF = Northern France (data from Leseigneur, 1972; Gouillart, 1987).

Symbols used in distribution data columns: + = recorded; - = no records; ? = doubtful record(s); I = imported specimens only; t = threatened with extinction.

APPENDIX 1 (Contd.)

SPECIES	LARVAL HABITAT	IR	GB	NF
Actenicerus sjaelandicus	s	+	+	+
Adrastus limbatus	s	-	-	+
A. pallens	s	+	+	+
A. rachifer	s	-	+	+
Agriotes acuminatus	ds	-	+	+
A. gallicus	s	-	-	+
A. lineatus	s	+	+	+
A. obscurus	s	+	+	+
A. pallidulus	ds	-	+	+
A. pilosellus	ds	-	-	+
A. soridus	s	-	+	+
A. sputator	s	-	+	+
A. ustulatus	s	-	-	+
Agrypnus murinus	s	+	+	+
Ampedus balteatus	c/d(B)	+	+	+
A. cardinalis	dp(Q)	-	t	+
A. cinnabarinus	dp(B/Q)	?	t	+
A. elongantulus	dp(B/Q)	-	+	+
A. fontisbellaquei	dp (Q)	-	-	+
A. megerlei	d(Q)	-	-	+
A. nigerrimus	d(Q)	-	t	+
A. nigrinus	c/d(B)	-	+	-
A. nigroflavus	d(B)	-	-	+
A. pomonae	d(B)	+	+	+
A. pomorum	d(B)	+	+	+
A. praeustus	c/d(Q)	?	-	-
A. quercicola	dp(Q)	-	+	+
A. ruficeps	d(Q)	-	t	+
A. rufipennis	dp(B/Q/F)	-	t	+
A. sanguineus	c	?	e	+
A. sanguinolentus	d(B/Q)	-	+	+
A. tristis	c/d(B)	-	t	-

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APPENDIX 1 (Contd.):

SPECIES	LARVAL HABITAT	IR	GB	NF
Anchastus acuticornis	dp (Q)	-	-	+
Anostirus castaneus	ds/s	-	t	+
A. purpureus	Malus/Pyrus	-	-	+
Athous bicolor	s	-	+	+
A. campyloides	s	+	+	+
A. haemorrhoidalis	s	+	+	+
A. hirtus	d(Q)	+	+	+
A. niger	s	-	+	+
A. subfuscus	ds/s	+	t	+
A. vittatus	ds	-	+	+
Cardiophorus asellus	s	-	+	+
C. erichsoni	d(Q)	-	+	+
C. gramineus	d(Q)	-	+	+
C. nigerrimus	ds	-	-	+
C. ruficollis	c	-	+	+
C. rufipes	ds	-	-	+
Cidnopus aeruginosus	s	?	+	+
C. minutus	s	-	+	+
C. parvulus	u	-	-	+
C. pilosus	s	-	-	+
Ctenicera cuprea	s	+	+	-
C. pectinicornis	s	-	+	+
Dalopius marginatus	ds/d	+	+	+
Denticollis linearis	d(B/Q)	+	+	+
Dichronychus cinereus	s	-	-	+
D. equiseti	s	-	+	+
Elater ferrugineus	dp(Q)	-	t	+
Fleutiauxellus maritimus	s	-	+	-
F. quadripustulatus	s	-	+	+
Harminius undulatus	c/d(B)	-	t	-

APPENDIX 1(Contd.):

SPECIES	LARVAL HABITAT	IR	GB	NF
Hypoganus cinctus	d(B/Q)	-	-	+
Hypnoidus riparius	s	+	+	-
Idolus picipennis	u	-	-	+
Ischnodes sanguinicollis	d(Q)	-	+	+
Lacon quercus	dp(Q)	-	t	+
Limoniscus violaceus	d(F/Q)	-	t	+
Limonius aeneonigra	s	-	-	+
Megapenthes lugens	dp(Q)	-	t	+
Melanotus erythropus	c/d(F/Q/B)	+	+	+
M. punctolineatus	s	-	t	+
Negastrius pulchellus	s	-	t	+
N. sabulicola	s	-	t	+
Procraerus tibialis	dp(Q)	-	t	+
Prosternon tesselatum	d(B/Q)/ds	+	+	+
Selatosomus aeneus	s	+	+	-
S. angustulus	s	-	t	-
S. bipustulatus	dp(Q)	+	+	+
S. cruciatus	ds	-	+	+
S. impressus	s	-	+	-
S. incanus	s	+	+	+
S. latus	s	-	-	+
S. melancholicus	s	+	-	-
S. nigricornis	u	-	+	+
Sericus brunneus	ds	+	+	+
Steganostus villosus	dp(Q)	?	+	+
Synaptus filiformis	s	-	t	+
Zorochros minimus	s	+	+	+
Z. quadriguttatus	s	-	-	+

APPENDIX 2: The Buprestidae known in Ireland, Great Britain, Northern France and Denmark.

Symbols used in list: + = recorded; - = no records; ? = doubtful record(s); I = imported specimens only; t = threatened with extinction.

Column headings: IR = Ireland; GB = Great Britain (data from Levey, 1977); NF = Northern France (data from Schaefer, 1949, 1955, 1984); DK = Denmark (data from Bílý, 1982).

Symbols used in larval habitat column: c = rotten wood of conifers; d = rotten wood of deciduous trees; u = larval habitat unknown; (B) = Alnus, Betula or Salix; (B/Q) = Alnus, Betula or Salix, + Quercus; (F) = Fagus; (Q) = Quercus; U = Ulmus.

SPECIES	LARVAL HABITAT	IR	GB	NF	DK
Agrilus angustulus	d(Q/Corylus)	-	+	+	+
A. betuleti	d(B)	-	-	+	-
A. biguttatus	d(Q/F)	-	t	+	-
A. cinctus	Sarrothamnus	-	-	+	-
A. convexicollis	d(Fraxinus)	-	-	+	-
A. cyanescens	d(B/Q)	-	-	+	+
A. guerini	d(B)	-	-	+	-
A. laticornis	d(Q)	-	+	+	+
A. obscuricollis	d(B/Q)	-	-	+	-
A. olivicolor	d(C/F/Corylus)	-	-	+	-
A. pratensis	d(B/Populus)	-	?	+	-
A. sinuatus	d(Crataegus/Malus)	-	t	+	+
A. subauratus	d(B/Populus)	-	-	+	-
A. sulcicollis	d(Q/F)	-	-	+	+
A. viridis	d(B/Q/Salix)	-	t	+	+
Anthaxia cichorii	d(Malus/Prunus)	-	-	+	-
A. godeti	c(Pinus)	-	-	+	-
A. manca	d(Ulmus/Populus)	-	-	+	-
A. nitidula	d(Prunus)	-	t	+	-
A. quadripunctata	c	-	?	-	+
A. sepulchralis	c	-	-	+	-

APPENDIX 2 (Contd.)

SPECIES	LARVAL HABITAT	IR	GB	NF	DK
Aphanisticus emarginatus	Juncus	-	+	+	-
A. pusillus	Juncus/Carex	-	+	+	+
Buprestis aurulenta	c	I	I	-	-
B. haemorrhoidalis	c	-	-	-	+
B. novemmaculata	c	-	-	-	+
B. rustica	c	-	?	-	-
Chrysobothris affinis	d(B/Q/F)	-	-	+	+
C. chrysostigma	c	-	?	-	+
Coroebus elatus	Potentilla	-	-	+	-
C. florentinus	d(Q)	-	-	+	-
C. rubi	Rubus	-	-	+	-
C. undatus	d(Q/F)	-	-	+	-
Dicerca berolinensis	d(F/C)	-	-	+	-
Eurythraea quercea	d(Q)	-	-	+	-
Habroloma geranii	Geranium	-	-	+	+
Lampra festiva	c(Juniperus)	-	-	+	-
Melanophila acuminata	c	-	+	+	+
Nalanda fulgidicollis	d(Q)	-	-	+	-
Ovalisia solieri	d(Ulmus)	-	-	+	-
Phaenops cyanea	c(Pinus)	-	-	+	-
Poecilonota variolosa	d(Populus)	-	-	+	-
Trachys fabricii	Malva	-	-	+	-
T. minutus	d(B/Corylus/Salix)	?	+	+	+
T. scrobiculatus	Mentha	-	+	+	+
T. troglodytes	Scabiosa/Knautia	-	+	+	+

Bull. Ir. biogeog. Soc. No. 12 (1989)

CLONMACNOISE HERITAGE ZONE, CO. OFFALY, IRELAND: ASSESSMENT OF CONSERVATION VALUE BASED ON LEPIDOPTERA RECORDED FROM 1983 to 1987.

K. G. M. Bond

Abstract

During the years 1983 - 1987, Clonmacnoise Heritage Zone, Co. Offaly, Ireland, was visited on twelve occasions with the aim of assessing the composition and uniqueness of the lepidopterous fauna. Visits were arranged to allow representative sampling over the major activity period, May to September. In all, 285 species of microlepidoptera and macrolepidoptera were recorded, representing about 21% of the currently known Irish fauna. Species composition and diversity are assessed for the following four types of habitat within the Zone:

1) limestone pavement and associated scrub;
2) eskers;
3) lake-shore fen and carr;
4) raised bog.

The lepidopterous fauna of the raised bog is compared with that found in other studies of this habitat type, and an attempt is made to characterise the species obligatorily associated with this habitat (i.e. the tyrphobionts). The significance of each habitat is assessed in terms of the proportions of rare or local species which are found in it.

Zusammenfassung

Um die Zusammensetzung und Einzigartigkeit der Schmetterlingsfauna der Clonmacnoise Heritage Zone in Mittelirland zu bewerten, wurde das Gebiet im Zeitraum 1983 - 1987 zwölfmal untersucht. Die Erfassung fand im Zeitraum der grössten Flugtätigkeit statt, d.h. vom Mai bis September. Insgesamt wurden 285 Mikro- sowie Makrolepidopterenarten festgestellt, d.h. etwa 21% der derzeit bekannten irischen Arten. Innerhalb des Gebietes wurden die Artenzusammensetzung und Vielfältigkeit nach vier Biotopen ausgewertet:

1) Deckenkarst, z. T. mit Gebüsch;
2) Esker am Rande des Hochmoores;

3) Schilfgebiete und Niedermoor;

4) Hochmoor.

Die Artenzusammensetzung des Hochmoores wird mit der aus anderen Studien verglichen, und es wird versucht, die Tyrphobionten dieses Biotops zu charakterisieren. Die Bedeutung jedes Biotops wird nach dem Anteil der seltenen oder Lokalen Arten bewertet.

Introduction

Clonmacnoise Heritage Zone contains an unusually large range of distinct habitats within a relatively small area. The presence or absence of various Lepidoptera species in each of these habitats may be a useful indicator of the dependence of the species on each habitat type, especially in the case of the smaller, less mobile species.

Several lists of Lepidoptera from raised bogs have been produced recently, e.g. Elsner et al. (1981) (south Bohemia), Fowles (unpublished) (Wales), Mikkola and Spitzer (1983) (central and northern Europe), Spitzer (1975, 1981) (south Bohemia), and although most of these deal only with the macrolepidoptera, Spitzer (1975, 1981) has also included treatment of the microlepidoptera. During the present study, a number of the latter, especially members of the Elachistidae, which are otherwise poorly known from Ireland, were recorded from the raised bog, including one species (Biselachista serricornis) (Stainton)) which has not been found elsewhere in Ireland (Bond, 1984).

Many of the species found commonly in raised bog habitat are also found commonly in other habitats in Ireland, such as blanket bog, cliff-top heath and mountain slopes. An attempt is made here to separate these from the strictly tyrphobiont species, although this is often difficult in view of the limited knowledge of the habitat associations of many Irish Lepidoptera, especially among the smaller species. Comparison with British data often shows a tendency for species to be less stenotopic in Ireland, e.g. Leptidea sinapis (L.) and Pararge aegeria (L.) are woodland species in Britain, but are often to be found in more open biotopes in Ireland. For this reason, literature sources must be used with caution when referring to Irish conditions.

Methods

Sampling was carried out on the 12 different occasions in the Clonmacnoise Heritage Zone (Table 1).

TABLE 1. Sampling programme.

Dates	Mercury vapour trap used	Habitats visited (grid refs., see Table 2)
14.vi.83	No	Raised bog
5.vii.83	Yes (raised bog)	Esker, raised bog
20.vii.83	No	Raised bog (very limited survey only)
13.viii.83	No	Raised bog, esker
24.viii.83	Yes (raised bog)	Raised bog
24-25.ix.83	Yes (raised bog)	Esker, lake/fen, raised bog
14.vi.84	No	Limestone pavement, raised bog
12.viii.86	Yes (Limestone pavement)	Limestone pavement, esker
19-21.ix.86	Yes (fen)	Esker, lake/fen, limestone pavement
21-22.v.87	No	Esker, lake/fen, raised bog, limestone pavement
28.v.87	No	Esker, limestone pavement
13.vii.87	No	Lake/fen, limestone pavement, raised bog

Where sampling was carried out at two or more points which were close to each other, and which shared basically similar habitat, these were combined to produce a single numbered site (see Fig. 1 and Table 2). The sampling methods involved beating or tapping the vegetation, netting flying specimens, and on five occasions the use of a mercury vapour trap (see Table 1).

TABLE 2. List of sites.

Site No.	Name	Grid Ref(s).	Habitat
1	Clorhane (quarry)	M988276	disused quarry with pond, on S. margin of Clorhane, bog margin and *Ulex* to south.

TABLE 2 (Contd.)

Site No.	Name	Grid Ref(s).	Habitat
2	Clorhane (S.W.)	M983278, M985277 M986279, M986280	Corylus wood, Euonymus/ Prunus spinosa, spruce.
3	Clorhane (west)	M983279	margin of limestone pavement and Corylus, etc. scrub.
4	Clorhane (N.W. limestone pavement)	M985280, M986278	limestone pavement, isolated Corylus, Euonymus, Rhamnus, P. spinosa; herbs include Rhinanthus, Thymus, Rosa pimpinellifolia, Lotus corniculatus.
5	Clorhane (NNW margin)	M987280, M988280	similar to 4, but more open, with more grasses and sedges.
6	Clorhane (N.E.)	M992280, M993281 M994281, M995280	limestone pavement, calcicole flora, isolated Crataegus and P. spinosa.
7	Clorhane (S.E.)	M993276	Corylus woodland and scrub; conifers, P. spinosa, Euonymus, limestone outcrops.
8	esker near Clonmacnoise	N024313	grassy esker slope, well grazed.
9	eskers North of Mongan Bog	N032312, N035314 N036312	steep esker slopes with Crataegus, P. spinosa, knapweed and Thymus.
10	Clonascra (esker and quarry)	N044314, N045314 N045315, N046311	quarry on esker slopes, Ulex,and Crataegus scrub.
11	Finlough (north shore and margin)	N030298, N031298 N033298, N037297	lakeside fen, Salix and Betula scrub, sedges, rushes, Phragmites, Typha

TABLE 2 (Contd.)

Site No.	Name	Grid Ref(s.)	Habitat
12	Mongan Bog (S. margin)	N031302, N032301 N032302, N034303 N037303	raised bog margin, Calluna/ Myrica/Salix spp./Betula pubescens
13	Mongan Bog (N. margin)	N032311	Betula copse, Ulex, Calluna, grasses.
14	Mongan Bog (central part)	N030304, N031304 N031306, N032305 N032306, N033306 N034307, N037305	Calluna, Erica, Sphagnum, lichens, extensive pools with pondweed, etc.
15	meadow south of Mongan Bog	N033301	small pastures, road verge, hedges with Crataegus, Ligustrum, Fraxinus.
16	Mongan Bog (S.E. Margin)	N038302	roadside hedgerow about 50m from bog margin, isolated Quercus.
17	Mongan Bog (eastern part)	N043309, N042310	similar to site 14, but rather drier due to drainage and peat-cutting nearby.

Permanent genitalia slides using Euparal were prepared for over 70 species to aid in the determination of doubtful specimens. Visits were arranged as far as possible to provide adequate coverage of the months of greatest activity, but it is certain that additional visits at other times, e.g. April, late June and late July, would have produced many further species. Sampling on the eskers was greatly hindered by strong winds, and on such occasions it was far more productive to sample on the sheltered (leeward) side of the scrub at Clorhane. The unusually warm and still weather which occurred during the first extensive survey of Mongan Bog on 5th July 1983 contributed greatly to the large and interesting catch obtained then.

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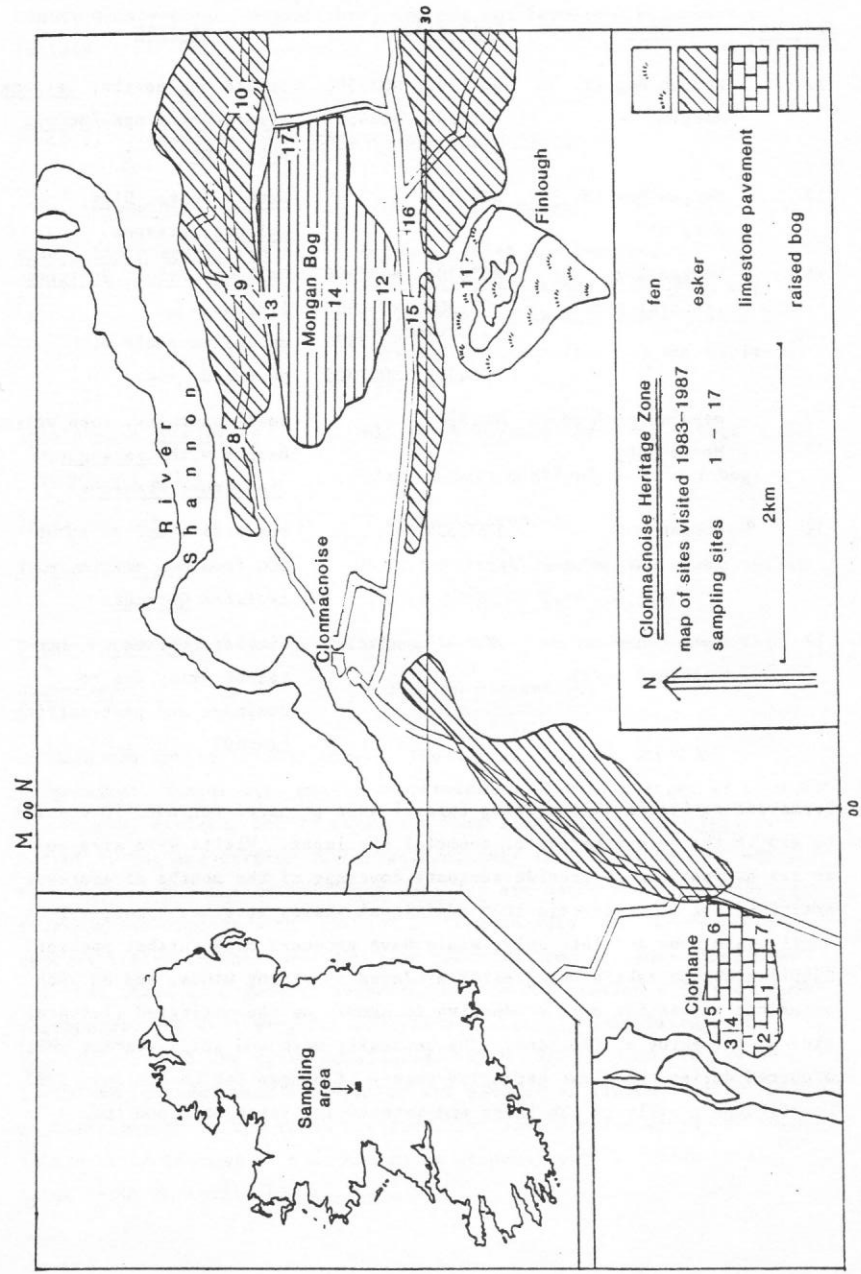
FIGURE 1. Clonmacnoise Heritage Zone.



Results

This survey, carried out over a total of 16 days spread over the years 1983 - 1987, produced a total of 285 species (see Table 3), representing about 21% of the currently known Irish lepidopteran fauna.

There are few comparable regional surveys of the Irish Lepidoptera, however Bradley and Pelham-Clinton (1967) recorded about 640 species from the Burren region of County Clare in a survey covering a total of 82 days spread over the months of April to September in the years 1951 - 1965.

The more important records obtained from the Clonmacnoise area include two species new to Ireland, both taken at Mongan Bog, viz. Biselachista serricornis (Stainton) (Elachistidae), mentioned above and Aristotelia ericinella (Zeller) (Gelechiidae). While B. serricornis is unknown from any other Irish locality, A. ericinella was also found near Ardee, County Louth, and at Mouds Bog, County Kildare, both raised bog sites, and both in August 1984 (Bond, unpublished). Another significant record from Mongan Bog was Dichrorampha simpliciana (Haworth) (Tortricidae). This species, whose foodplant is Artemisia vulgaris according to Emmet (1979), was previously considered to be only doubtfully Irish (Beirne, 1941).

One species of special importance taken at Clorhane is Teleiodes wagae (Nowicki) (Gelechiidae). This species has only recently been noted as occurring in Ireland (Sattler, 1980), and it has more recently been found at three sites in Britain (Emmet, 1988). The previous Irish specimens were taken in the Ballyeighter and Burren areas of County Clare, and at the time were erroneously determined as Teleiodes notatella (Hübner) (Bradley and Pelham-Clinton, 1967). The larvae were found on Corylus avellana in County Clare, and this is presumably also the foodplant in Clorhane. Three specimens have been recorded at Clorhane, in May and June.

Another species of interest, which was taken at Clorhane as well as on an esker just north of Mongan Bog, is Dichrorampha aeratana (Pierce and Metcalfe). The only published record of this species in Ireland is from the Burren, County Clare (Bradley and Pelham-Clinton, 1967), but it appears to be less rare than this would suggest, as two specimens bred from Leucanthemum vulgare taken in County Antrim have recently been detected in

the H. G. Heal collection at NMI (Bond, unpublished).

In an attempt to assess the uniqueness of the fauna of each habitat, rare species, species with a local distribution, and those which tend to be restricted to one or few habitats in Ireland have been identified from the overall list in Table 3. This selection is based on the Irish literature records as well as on some recent, unpublished information, and is inevitably somewhat subjective in view of our limited knowledge of the Irish lepidopterous fauna, and in particular of the species composition and distribution in the Irish midlands.

TABLE 3. Lepidoptera recorded in Clonmacnoise Heritage Zone 1983 - 1987 with distribution by sites (see Table 1).
(Nomenclature and classification based on Schnack (1985)).

Species	Sites
Micropterix calthella (L.)	2, 4, 5
**Eriocrania chrysolepidella (Zeller)	5
Eriocrania sangii (Wood)	12
Hepialus humuli (L.)	6
Stigmella lapponica (Wocke)	9, 11, 13
Stigmella betulicola (Stainton)	11
Stigmella microtheriella (Stainton)	1, 16
**Stigmella catharticella (Stainton)	4
Stigmella oxyacanthella (Stainton)	10
Stigmella hybnerella (Hübner)	10
Stigmella floslactella (Haworth)	9
Stigmella salicis (Stainton)	9
Stigmella plagicolella (Stainton)	10, 13
Stigmella continuella (Stainton)	11
Stigmella aurella (Fabricius)	2, 6
Stigmella hemargyrella (Kollar)	1
*Trifurcula eurema (Tutt)	4
Ectoedemia occultella (L.)	13
Nematopogon schwarziellus Zeller	2

TABLE 3 (Contd.)

Species	Sites
Monopis laevigella (Denis and Schiffermüller)	4
Gracillaria syringella (Fabricius)	12
Aspilapteryx tringipennella (Zeller)	14
Parornix anglicella (Stainton)	6
Parornix devoniella (Stainton)	4
Parornix torquillella (Zeller)	4
Phyllonorycter quercifoliella (Zeller)	16
Phyllonorycter oxyacanthae (Frey)	10
Phyllonorycter maestingella (Müller)	1
Phyllonorycter coryli (Nicelli)	5, 6, 9
Phyllonorycter ulmifoliella (Hübner)	13
Phyllonorycter nicellii (Stainton)	4, 5
Argyresthia goedartella (L.)	13
Argyresthia spinosella Stainton	4, 7
Argyresthia bonnetella (L.)	6, 10
Argyresthia albistria (Haworth)	2, 6, 9
*Yponomeuta plumbella (Denis and Schiffermüller)	4
Pseudoswammerdamia combinella (Hübner)	7, 5
*Paraswammerdamia albicapitella (Scharfenberg)	6
Plutella xylostella (L.)	4, 14
Ochsenheimeria urella Fischer von Rösslerstamm	5, 6
**Leucoptera lotella (Stainton)	4
Glyphipterix simpliciella (Stephens)	4, 5, 11, 12
Glyphipterix schoenicolella Boyd	14
Glyphipterix thrasonella (Scopoli)	2, 4, 11
Depressaria pastinacella (Duponchel)	6, 14
Agonopterix propinquella (Treitschke)	14
*Agonopterix kaekeritziana (L.)	6
Agonopterix nervosa (Haworth)	10
Agonopterix ulicetella (Stainton)	10, 14
*Agonopterix capreolella (Zeller)	5
Pleurota bicostella (Clerck)	14
*Elachista gleichenella (Fabricius)	17
*Elachista alpinella Stainton	14

TABLE 3 (Contd.)

Species	Sites
*Elachista subnigrella Douglas	4
Elachista canapennella (Hübner)	4, 6
Elachista rufocinerea (Haworth)	4
*Elachista cerusella (Hübner)	14
Elachista argentella (Clerck)	6, 12
**Elachista gangalbella Zeller	5
*Biselachista cinereopunctella (Haworth)	5
**Biselachista serricornis (Stainton)	17
*Biselachista albidella (Nylander)	14
Cosmiotes freyerella (Hübner)	12
Coleophora deauratella Lienig and Zeller	5
Coleophora tamesis Waters	14
*Coleophora murinipennella (Duponchel)	4
Coleophora alticolella Zeller	5, 7
*Mompha locupletella (Denis and Schiffermüller)	11
*Limnaecia phragmitella Stainton	11
Blastobasis lignea Walsingham	6
*Eulamprotes atrella (Denis and Schiffermüller)	6
*Aristotelia ericinella (Zeller)	14
**Teleiodes wagae (Nowicki)	4, 5
Bryotropha senectella (Zeller)	6
Neofaculta ericetella (Geyer)	14
Micificarma mulinella (Zeller)	6
*Scrobipalpa artemisiella (Treitschke)	5
*Syncopacma taeniolella (Zeller)	10
Hypatima rhomboidella (L.)	11
Syndemis musculana (Hübner)	2, 4, 5
*Aphelia viburnana (Denis and Schiffermüller)	14
*Clepsis senecionana (Hübner)	11
Clepsis spectrana (Treitschke)	14
Clepsis consimilana (Hübner)	14
Capua vulgana (Frölich)	2, 5
Pseudargyrotoza conwagana (Fabricius)	12

TABLE 3 (Contd.)

Species	Sites
*Eulia ministrana (L.)	4
Cnephasia stephensiana (Doubleday)	5
Eana osseana (Scopoli)	6
Croesia holmiana (L.)	6, 10
Acleris laterana (Fabricius)	2, 17
Acleris rhombana (Denis and Schiffermüller)	2, 3
Acleris aspersana (Hübner)	11
Acleris variegana (Denis and Schiffermüller)	9, 11
*Acleris hyemana (Haworth)	14
*Cochylimorpha straminea (Haworth)	3, 11
Agapeta hamana (L.)	6, 14
Agapeta zoegana (L.)	6
Eupoecilia angustana (Hübner)	14
Aethes cnicana (Westwood)	11
*Aethes piercei Obraztsov	13
Olethreutes lacunana (Denis and Schiffermüller)	2, 5, 6, 12
*Olethreutes schulziana (Fabricius)	14
*Olethreutes rivulana (Scopoli)	5
Hedya pruniana (Hübner)	4, 7, 14
Endothenia marginana (Haworth)	4, 14
Bactra lancealana (Hübner)	12, 14
*Bactra furfurana (Haworth)	1
*Ancylis uncella (Denis and Schiffermüller)	13
Ancylis unguicella (L.)	14
*Ancylis geminana (Donovan)	12
Ancylis badiana (Denis and Schiffermüller)	2, 5
Epinotia solandriana (L.)	4
Epinotia ramella (L.)	13
Epinotia tetraquetrana (Haworth)	13
Epinotia tenerana (Denis and Schiffermüller)	5, 6
Epiblema cynosbatella (L.)	2
Epiblema scutulana (Denis and Schiffermüller)	11
Epiblema cirsiana (Zeller)	12
Eucosma cana (Haworth)	5, 6, 14

TABLE 3 (Contd.)

Species	Sites
Eucosma campoliliana (Denis and Schiffermüller)	11
Pammene rhediella (Clerck)	12
Cydia succedana (Denis and Schiffermüller)	5, 11, 12, 14
*Cydia gallicana (Guenée)	6
*Dichrorampha simpliciana (Haworth)	14
Dichrorampha plumbana (Scopoli)	5
*Dichrorampha aeratana (Pierce and Metcalfe)	2, 9
Anthophila fabriciana (L.)	7, 12, 17
Schreckensteinia festaliella (Hübner)	2, 4, 5, 6
*Amblyptilia punctidactyla (Haworth)	9, 10
Emmelina monodactyla (L.)	6
Aphomia sociella (L.)	14
*Pyla fusca (Haworth)	14
*Elophila nymphaeata (L.)	14
*Cataclysta lemnata (L.)	14
*Donacaula mucronella (Denis and Schiffermüller)	14
Chrysoteuchia culmella (L.)	4, 12, 14
Crambus pascuellus (L.)	7, 12, 14
Crambus lathoniellus (Zincken)	1, 4, 5, 12, 13, 14
Crambus perlella (Scopoli)	14
Agriphila tristella (Denis and Schiffermüller)	6, 9, 11, 13
Agriphila straminella (Denis and Schiffermüller)	6, 9, 11, 13
*Agriphila geniculea (Haworth)	6
Scoparia pyralella (Denis and Schiffermüller)	4
Eudonia mercurella (L.)	6
*Pyrausta purpuralis (L.)	4, 9
*Opsibotys fuscalis (Denis and Schiffermüller)	4, 5
Udea lutealis (Hübner)	2, 3, 6, 12, 13, 14
Udea olivalis (Denis and Schiffermüller)	12
Nomophila noctuella (Denis and Schiffermüller)	11, 14
*Erynnis tages (L.)	2, 4, 5, 11
Leptidea sinapis (L.)	2, 4, 7, 12
Pieris brassicae (L.)	9, 11, 12

TABLE 3 (Contd.)

Species	Sites
Pieris rapae (L.)	2
Pieris napi (L.)	2, 5, 7, 12
Anthocharis cardamines (L.)	5, 9, 12
*Gonepteryx rhamni (L.)	17
Inachis io (L.)	9, 12
Vanessa atalanta (L.)	10
Aglais urticae (L.)	11, 17
*Hipparchia semele (L.)	6, 11
Maniola jurtina (L.)	5, 6, 9, 10, 11, 12
Aphantopus hyperantus (L.)	5, 6, 9, 11, 12
*Coenonympha tullia (Müller)	14, 17
Coenonympha pamphilus (L.)	5, 11
Pararge aegeria (L.)	2, 4, 5, 6, 9
Lasiommata megera (L.)	1, 2, 5, 9, 11, 15
Callophrys rubi (L.)	12, 13
Lycaena phlaeas (L.)	9, 12, 15
Polyommatus icarus (Rottemburg)	9, 10, 11
Falcaria lacertinaria (L.)	14
Drepana falcataria (L.)	14
Pseudoterpna pruinata (Hufnagel)	14
Geometra papilionaria (L.)	13
Iodis lactearia (L.)	2, 4, 5, 7
*Cyclophora albipunctata (Hufnagel)	14
Scopula immutata (L.)	5
**Idaea muricata (Hufnagel)	12
Idaea biselata (Hufnagel)	9
Idaea aversata (L.)	6
Scotopteryx chenopodiata (L.)	6
Scotopteryx mucronata umbrifera (Heydemann)	11
Orthonoma vittata (Borkhausen)	3, 11
Xanthorhoe ferrugata (Clerck)	2, 4, 6, 14
Xanthorhoe montanata (Denis and Schiffermüller)	5, 7, 14
Xanthorhoe fluctuata (L.)	6, 14
Epirrhoe alternata (Müller)	2, 4, 5, 6, 7, 12, 14

TABLE 3 (Contd.)

Species	Sites
Camptogramma bilineata (L.)	6
Cosmorhoe ocellata (L.)	3
*Coenotephria salicata latentaria (Curtis)	6
Eulithis testata (L.)	14
Eulithis populata (L.)	6, 14
Chloroclysta truncata (Hufnagel)	2, 3, 4, 5, 11
Thera britannica (Turner)	2
Electrophaes corylata (Thunberg)	2
Hydriomena furcata (Thunberg)	3, 6
*Rheumaptera hastata (L.)	13
Euphyia unangulata (Haworth)	6
*Perizoma bifaciata (Haworth)	6
Eupithecia exiguata (Hübner)	2
*Eupithecia pygmaeata (Hübner)	10
*Eupithecia satyrata callunaria Doubleday	14
Eupithecia absinthiata (Clerck)	6
Eupithecia subfuscata (Haworth)	4
Eupithecia subumbrata (Denis and Schiffermüller)	4, 14
Eupithecia nanata (Hübner)	12, 14
Eupithecia virgaureata Doubleday	14
*Asthena albulata (Hufnagel)	4
Abraxas grossulariata (L.)	2, 3
Lomaspilis marginata (L.)	2, 12, 14
*Semiothisa clathrata (L.)	2, 4, 14
Petrophora chlorosata (Scopoli)	2
*Plagodis pulveraria (L.)	5
Opisthograptis luteolata (L.)	2, 6, 8, 14
Selenia dentaria (Fabricius)	6
Cleorodes lichenaria (Hufnagel)	14, 17
Ematurga atomaria (L.)	12, 13, 14, 17
Cabera pusaria (L.)	2, 5
Lomographa temerata (Denis and Schiffermüller)	2, 14
*Dyscia fagaria (Thunberg)	14

TABLE 3 (Contd.)

Species	Sites
Macrothylacia rubi (L.)	14, 17
Saturnia pavonia (L.)	14
Smerinthus ocellata (L.)	14
Laothoe populi (L.)	14
Deilephila elpenor (L.)	14
Phalera bucephala (L.)	6, 14, 16
Pheosia tremula (Clerck)	14
Eligmodonta ziczac (L.)	14
Orgyia antiqua (L.)	14
Calliteara pudibunda (L.)	6
*Thumatha senex (Hübner)	14
Nudaria mundana (L.)	5
Eilema lurideola (Zincken)	6
Spilosoma lubricipeda (L.)	14
Spilosoma lutea (Hufnagel)	6, 14
Phragmatobia fuliginosa (L.)	14
Tyria jacobaeae (L.)	5, 6, 9, 14
Rivula sericealis (Scopoli)	5, 6, 11, 12
Hypena proboscidalis (L.)	6, 12
*Phytometra viridaria (Clerck)	14
Euclidia glyphica (L.)	1, 4, 5, 15
Diachrysia chrysitis (L.)	6
Plusia festucae (L.)	14
Autographa gamma (L.)	3, 5, 6, 11, 14, 17,
Autographa pulchrina (Haworth)	5
Autographa iota (L.)	6
Abrostola trigemina (Werneburg)	14
Abrostola triplasia (L.)	6
Rusina ferruginea (Esper)	14
Phlogophora meticulosa (L.)	14
Apamea monoglypha (Hufnagel)	6, 14
Apamea lithoxylea (Denis and Schiffermüller)	14
Oligia fasciuncula (Haworth)	14
Mesapamea secalis (L.)	6

TABLE 3 (Contd.)

Species	Sites
Mesapamea secalella Remm	6
Photedes pygmina (Haworth)	14
Luperina testacea (Denis and Schiffermüller)	14
Amphipoea lucens (Freyer)	14
*Gortyna flavago (Denis and Schiffermüller)	3
*Celaena haworthii (Curtis)	14
*Celaena leucostigma (Hübner)	14
Nonagria typhae (Thunberg)	14
Hoplodrina blanda (Denis and Schiffermüller)	14
Caradrina morpheus (Hufnagel)	14
Atethmia centrago (Haworth)	14
*Anarta myrtilli (L.)	12, 14
Melanchra pisi (L.)	12, 14, 17
Lacanobia oleracea (L.)	14
Orthosia gracilis (Denis and Schiffermüller)	12
Mythimna impura (Hübner)	6, 14
Agrotis segetum (Denis and Schiffermüller)	14
Agrotis exclamationis (L.)	6
Agrotis ipsilon (Hufnagel)	14
Ochropleura plecta (L.)	6, 14
Noctua pronuba (L.)	3, 6, 14
Noctua comes Hübner	6, 11
Noctua fimbriata (Schreber)	14
Noctua janthina (Denis and Schiffermüller)	6, 14
Paradiarsia glareosa (Esper)	14
Lycophotia porphyrea (Denis and Schiffermüller)	14
Diarsia mendica (Fabricius)	14
Diarsia rubi (Vieweg)	3, 14
Xestia triangulum (Hufnagel)	6
Xestia baja (Denis and Schiffermüller)	6
Xestia xanthographa (Denis and Schiffermüller)	6, 14

* of local occurrence in Ireland, usually confined to certain habitats

** rare in Ireland, very few records, including little known or easily overlooked species of microlepidoptera

The most noteworthy abundance observed was an estimated 1000 individuals of Crambus pascuellus (L.) (Pyralidae) seen around dawn on 5th July 1983. This species is reported to feed on "grasses, especially on Poa spp." (Emmet, 1979). The specimens were noted in abundance both on the centre of the bog and on its margins. By contrast, in the other habitats there was no noticeable preponderance of any single species, and the high number of species recorded on the raised bog (see Table 10) is probably due to a combination of greater sampling effort and favourable weather. In Table 4, the Diversity Index of Margalef (1951), where diversity, $d = \frac{n - 1}{\ln N}$ indicates that the raised bog diversity is lower than that of the limestone pavement.

TABLE 4. Diversity of various habitats based on the Diversity Index of Margalef (1951)

Habitat	no. of spp. (n)	no. of individuals (N)	diversity (D)
limestone pavement	155	641	23.83
esker	32	120	6.48
lake/fen	34	59	8.09
raised bog (sites 12-14, 17)	150	1580	20.23

Note: sites 15 and 16 are excluded from the raised bog totals because they are on the bog margin, and are therefore considered to be unrepresentative of the raised bog fauna.

Table 5 - 8 list the local or rare species, as defined above, while Table 9 lists several further species which occurred in unusual abundance on the raised bog.

Tables 5 - 8: Local or rare species (see Table 3), and notably abundant species, occurring in each habitat, with reported pabulum for each species based on Emmet (1979), Higgins and Riley (1970) and Skinner (1984), unless otherwise stated.

TABLE 5. Local or rare species occurring in Type 1 habitat (limestone pavement).

Species	Reported pabulum
Eriocrania chrysolepidella	Corylus
Stigmalla catharticella	Rhamnus
Trifurcula eurema	Lotus, esp. L. corniculatus
Yponomeuta plumbella	Euonymus europaeus
Paraswammerdamia albicapitella	Prunus spinosa
Leucoptera lotella	Lotus corniculatus or L. uliginosus
Agonopterix kaekeritziana	Centaurea nigra or Knautia
Agonopterix capreolella	Pimpinella saxifraga (Daucus, Falcaria, Sium, but not in Britain or Ireland)
Elachista subnigrella	Bromus erectus
Elachista gangalbella	Brachypodium sylvaticum (Dactylis, but not in Britain or Ireland)
Biselachista cinereopunctella	Carex flacca
Coleophora murinipennella	Luzula campestris or L. multiflora
Eulamprotes atrella	Hypericum perforatum
Teleiodes wagae	Corylus avellana (Langmaid, 1980)
Scrobipalpa artemisiella	Thymus drucei
Eulia ministrana	"... various trees and shrubs; also on Vaccinium myrtillus..."
Cochylimorpha straminea	Centaurea nigra
Olethreutes rivulana	Filipendula ulmaria, Genista spp., Orchis spp., etc.
Bactra furfurana	Scirpus lacustris or Juncus subuliflorus
Cydia gallicana	Daucus, Angelica sylvestris, Heracleum sphondylium
Dichrorampha aeratana	Leucanthemum vulgare
Agriphila geniculea	grasses
Pyrausta purpuralis	Mentha arvensis or Thymus drucei
Opsibotys fuscalis	Rhinanthus, Melampyrum pratense or Solidago virgaurea
Erynnis tages	Lotus corniculatus
Hipparchia semele	"... various grasses - Aira, Triticum, Festuca, etc...."

TABLE 5 (Contd.)

Species	Reported pabulum
Coenotephria salicata	Galium spp.
Perizoma bifaciata	Odontites verna
Asthena albulata	Corylus, Betula, etc.
Semiothisa clathrata	Medicago sativa, Lotus spp. Trifolium spp.
Plagodis pulveraria	Salix & Betula.

TABLE 6 Local or rare species occurring in Type 2 habitat (eskers)

Species	Reported pabulum
Syncopacma taeniolella	Lotus corniculatus, Trifolium, Medicago spp.
Dichrorampha aeratana	Leucanthemum vulgare
Amblyptilia punctidactyla	Stachys sylvatica, Aquilegia, Erodium cicutarium, Primula spp., Geranium spp.
Pyrausta purpuralis	Mentha arvensis or Thymus drucei
Eupithecia pygmaeata	Cerastium arvense

TABLE 7. Local or rare species occurring in Type 3 habitat (fen, lake shore)

Species	Reported pabulum
Mompha locupletella	Epilobium alsinifolium, E. palustre E. montanum, E. lanceolatum
Limnaecia phragmitella	Typha angustifolia, T. latifolia
Clepsis senecionana	Myrica, Vaccinium myrtillus
Cochylimorpha straminea	Centaurea nigra
Erynnis tages	(see Table 5)
Hipparchia semele	(see Table 5)

TABLE 8. Local or rare species occurring in Type 4 habitat (raised bog).

Species	Reported pabulum
Elachista gleichenella	Carex flacca, C. echinata, C. paniculata, Luzula pilosa
Elachista alpinella	Carex spp., esp. C. acutiformis
Elachista cerusella	Phalaris arundinacea, Phragmites
Biselachista serricornis	Carex sylvatica, or probably other Carex spp.
Biselachista albidella	Eriophorum angustifolium or Carex spp. esp. C. acuta
Aristotelia ericinella	Calluna
Aphelia viburnana	Vaccinium, Erica, Myrica
Acleris hyemana	Calluna or Erica
Aethes piercei	Succisa
Olethreutes schulziana	Vaccinium oxycoccus or Calluna
Ancylis uncella	Erica spp., Betula spp.
Ancylis geminana	Salix spp. (not S. repens)
Dichrorampha simpliciana	Artemisia vulgaris
Pyla fusca	Erica, Vaccinium spp.
Elophila nymphaeata	Potamogeton spp., Hydrocharis, Sparganium spp., other aquatic spp.
Cataclysta lemnata	Lemna spp.
Donacaula mucronella	Carex riparia, Phragmites, Glyceria maxima, possibly other Carex spp.
Gonepteryx rhamni	Rhamnus, Frangula
Coenonympha tullia	Rhynchospora alba, Eriophorum
Cyclophora albipunctata	Betula
Idaea muricata	Potentilla palustris
Rheumaptera hastata	Myrica gale, Betula
Eupithecia satyrata	"...polyphagous on a wide range of plants, including Calluna..."
Semiothisa clathrata	(see Table 5)
Cleorodes lichenaria	lichens
Lyscia fagaria	Calluna, Erica
Thumatha senex	lichens and mosses including Peltigera canina

TABLE 8 (Contd.)

Species	Reported pabulum
Phytometra viridaria	Polygala vulgaris
Celaena haworthii	Eriophorum spp.
Celaena leucostigma	Iris pseudacorus, great fen-sedge
Anarta myrtilli	Calluna, Erica

TABLE 9. Notably abundant species on Type 4 habitat (raised bog).

Species	Reported foodplants
Neofaculta ericetella	Erica spp. or Calluna
Olethreutes schulziana	Vaccinium oxycoccus or Calluna
Crambus pascuella	grasses, especially Poa spp.
Ematurga atomaria	mainly on Erica and Calluna
Callophrys rubi	Ulex, Cytisus, Calluna, Vaccinium, etc.
Melanchra pisi	Cytisus, Pteridium, Betula, Ulmus, Rumex, etc.
Lycophotia porphyrea	Calluna, Erica cinerea

The total number of species recorded from each habitat, and the number of these in the rare and local categories, as defined above, are presented in Table 10.

TABLE 10. Comparison of the proportions of local/rare species in various habitats.

Habitat	total no. of spp.	no. of local/rare spp.	% local/rare spp.
limestone pavement	155	31	20
eskers	32	5	16
lake/fen	34	6	18
raised bog (sites 12-14, 17)	150	31	21

From Table 10 it can be seen that the proportion of local/rare species does not appear to vary greatly between sites, but much more sampling of the esker and lake/fen habitats would be needed to provide a more reliable assessment.

Discussion

Esker and Lake/fen Sites

As these sites have not been so extensively sampled as the others, for reasons discussed earlier, it is difficult to draw useful conclusions from the results so far. However the number of local or rare species is surprisingly high in both habitat types, suggesting that further intersting species await discovery.

It was noted during the survey that the flora, and the resulting insect fauna, varied greatly from one esker site to the next. In general, bare, heavily-grazed slopes provided the poorest fauna, while sites with long grass and associated herbs were much richer, as were the areas adjacent to Prunus spinosa scrub. Perhaps the most interesting esker sites were the steep stony slopes, which seemed to be an important locality for the grayling butterfly (Hipparchia semele). A short visit to Sugarloaf Hill, just west of Shannonbridge, in County Roscommon, and therefore a short distance outside the heritage Zone, vividly illustrated the importance of these stony slopes. Two species, Zygaena filipendulae (L.) and Odezia atrata (L.) which are very local and rarely seen inland over most of Ireland were observed here. The two species, Z. filipendulae and O. atrata, were however not seen in the Heritage Zone.

Limestone Pavement

The lepidopterous fauna of the limestone pavement and its associated hazel scrub proved to be rich and diverse. The most productive areas appeared to be in the southwestern part, where many geometers could be found amongst the hazel scrub, and the open limestone pavement at the northwestern corner of the area, which was particularly rich in microlepidoptera. The northern part, with small herb-rich clearings within hazel scrub also proved to

be rich in species, including the local dingy skipper butterfly (Erynnis tages). The eastern part of Clorhane was also rich in species, but in 1987 the effect of agricultural encroachment was noticed, when the felling and burning of hawthorn, and the building of silage pits were observed.

Raised bog

In view of the rapid disappearance of this type of habitat from much of Ireland, particular emphasis has been placed on recording the fauna of this habitat, and an attempt has been made to identify the indicator species of Lepidoptera for this habitat, with particular reference to the Irish situation.

In recent years, several useful papers on the subject of raised bog insect faunas have appeared, and for the Lepidoptera that of Mikkola and Spitzer (1983) is particularly pertinent.

As can be seen from Table 8, 31 local or rare species have been noted on the raised bog, while a further seven are recorded as unusually abundant there in Table 9. A number of species from both of these categories are present presumably as a result of the abundance of their foodplants (e.g. Erica, Calluna, etc.), and can be found in other habitats where these are also abundant, e.g. blanket bog, mountainside and cliff-top. Others occur there because they are found primarily on the bog margin where their foodplants (e.g. Betula, Salix) occur, and a few, such as the brimstone butterfly (Gonepteryx rhamni), are presumably accidentals which are observed on transit. If we remove all these categories we are left with a group of potentially tyrphobiont species (i.e. species obligatorily associated with peatlands) (Mikkola and Spitzer, 1983: 221), although the species composition of this group will vary somewhat from one area to another, as pointed out by these authors. In Table 10 an attempt is made to provide a list of Irish tyrphobiont Lepidoptera, based mainly on the Mongan Bog material. Several other species which have not been recorded from the Heritage Zone may also be good indicators of raised bog, at least in Ireland, e.g. Catoptria margaritella (Denis and Schiffermüller), which was seen in large numbers on raised bog near Daingean, County Offaly on 22 July 1976 (Bond, pers. obs.), and Xenolechia aethiops (Humphreys and

Westwood) which has been observed at two raised bog sites, both in County Offaly (Bond, unpublished) and has not been seen elsewhere in Ireland.

TABLE 11. Possible Irish tyrphobiont Lepidoptera

Species	Notes
Biselachista serricornis	Only one Irish specimen known. "... mainly in boggy areas with Carex and Eriophorum and shaded, humid places in forests". (Traugott-Olsen and Nielsen, 1977)
Aristotelia ericinella	All Irish records from raised bogs
Coenonympha tullia	More or less confined to raised bogs
Idaea muricata	Very local species
Thumatha senex	Very few Irish records, but occasionally occurs in other habitats too
Celaena haworthii	A few records from mountain areas too
Anarta myrtilii	? also on blanket bog

Mikkola and Spitzer (1983) compare the degree of association of tyrphobiont species with peatlands between 1) Central Europe; 2) Southern and Central Finland, and 3) Lapland. They list Celaena haworthii as having strong association with peatlands only in Central Europe; while both Coenonympha tullia and Idaea muricata are noted by them as having a strong association with peatland in Fennoscandia (but the majority of species listed by them have not been recorded from Ireland). They point out that there is a general weakening of the association with peatlands northwards, and that very few species are strongly associated with peatlands in all the zones considered. With this in view, it may be useful to consider that a number of the species in Tables 8 and 9 behave as tyrphobionts in the Irish midlands, but have a wider range of habitats in the north and west of the country, a tendency clearly shown by the large heath butterfly (C. tullia).

A list of invertebrates recorded on Cors Fochno NNR near Aberystwyth, Wales (Fowles, unpublished) includes the Lepidoptera recorded on the area of raised bog. Among the more significant species recorded there are: C. margaritella, C. tullia, I. muricata (which is also very local in Britain), Thumatha senex, Anarta myrtilli and C. haworthii. Although these records are without quantitative data, the occurrence of this group of species, many of them extremely local in Wales, reinforces the overall impression of their close association with peatlands. These species are also local in Ireland and have all been recorded in Mongan Bog, with the exception of C. margaritella which has however been recorded from a raised bog in Co. Offaly (see above).

Summary

The uniqueness of the faunas of each of the four habitat types studied in this survey confirm the belief that Clonmacnoise Heritage Zone contains a rich range of habitat within a relatively small area. Although further work is needed, particularly on the eskers and Finlough, the diverse nature of the species composition in all four types is shown by the large proportion of the less common species found. This supports the argument for a policy of integrated conservation of the whole area, with particular emphasis on preserving the remaining area of relatively unspoilt raised bog.

Acknowledgements

I acknowledge assistance with field expenses provided by EC Contract 6611/12 (TCD). I wish to thank Julian Reynolds for his continuing guidance and assistance, and Jim O'Connor for his useful comments. Without the enthusiasm and perseverance of Jervis Good it is likely that some of the more interesting species would have been overlooked. My thanks are also due to Ingvar Svensson (Kristianstad, Sweden) for his help in determining some of the more difficult specimens.

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Bull. Ir. biogeog. Soc. No. 12 (1989)

STETHOPHYMA GROSSUM (L): A FURTHER MIDLAND RECORD WITH COMMENT ON THE STATUS OF THIS GRASSHOPPER IN IRELAND (ORTHOPTERA: ACRIDIDAE).

Peter J. Foss and Martin C. D. Speight

Until publication of Dr. de Courcy Williams' (1985) record of Stethophyma grossum (L.) from Woodfield Bog (N2636), in Co. Offaly, the known distribution of this species in Ireland had not changed since the 19th century (see Cotton, 1982), when it was known from counties Mayo, Galway, Kerry and Cork. The following year, 1986, saw publication of a second midland record (Good, 1986) for S. grossum, again in Co. Offaly, from Mongan Bog (N0330). We are now able to record this large and distinctive grasshopper from a third Co. Offaly locality, All Saints Bog (N0010), where one of us (PF) collected a mature female specimen on 14 September 1988. Identity was confirmed in the field by MS, and the specimen then released. These three records represent a substantial extension to the known range of this rare grasshopper in Ireland, as can be seen from the distribution map shown in Fig. 1.

In Ireland, S. grossum occurs in Molinia caerulea (L.) dominated bog in sheltered localities at low altitude. Its occurrence at the edge of the birch wood located in the centre of All Saints Bog is thus not atypical, though the birch wood itself is somewhat exceptional (Cross, 1987). The specimen was found in an area with occasional Molinia tussocks, interspersed among large pleurocarpus moss hummocks covered by the creeping stems of Vaccinium oxycoccus L. Small (less than 1m tall) Betula pubescens Ehrh. saplings were frequent in the vicinity.

Around L. Inagh (Co. Galway) one of us (MS) has noticed a tendency for S. grossum to extend its range away from the lake shore, up the hillside in a young conifer plantation which has been treated with fertiliser, giving rise to an abundant growth of Molinia. In conifer plantations where a closed canopy develops as the trees mature, such an extension of the territory occupied by S. grossum would evidently be short-lived. But within less successful plantations, where tree growth is stunted, such as those bordering L. Inagh, open grassy areas can be expected to persist, perhaps providing for a more permanent increase in the

populations of this very local insect. Some limited food choice experiments were carried out by one of us (MS) some years ago, using adult specimens of S. grossum from the L. Inagh population. These demonstrated a definite preference for Molinia. Eriophorum angustifolium Honck. was also eaten preferentially, but was ignored for Molinia when the latter was available. In addition, the species would eat Luzula sylvatica (Huds.) and Vaccinium myrtillus L., though not from choice. It was found not to eat either Calluna vulgaris (L.) or Potentilla erecta (L.) Rausch.

In Great Britain, S. grossum occurs on quaking bog (scraw) and is known today from only four areas (Haes, 1979), having become extinct in the East Anglian fenland from which it was also known previously. S. grossum is included in the British Red Data Book for Insects (Shirt, 1987). It has, however, been successfully introduced to one nature reserve in southern England, suggesting it may be possible to re-establish this species on sites from which it has disappeared, given appropriate management.

The recent discovery of populations of this grasshopper on three Midland bogs distant from its previously known Irish sites suggests that it is still under-recorded in Ireland, particularly in central parts of the island. These new records also demonstrate how totally the insect fauna of the Midland bogs has been ignored until recently - if such a distinctive insect has been overlooked there until now. Further interesting records from the Midlands can be expected, now that the fauna of this region is finally receiving attention.

Despite its large size (the body length of adult females typically measures more than 3cm, the male is slightly smaller) S. grossum is a secretive insect, more likely to move away through the vegetation than to take flight, when disturbed. It also has a scarcely audible, monosyllabic, call. Further, it matures very late in Ireland, adults typically occurring from mid-August into September, though in hot summers, such as occurred in 1975 and 1976, it matures appreciably earlier, adults then being recorded in July.

Although S. grossum is apparently still more widely distributed in Ireland today than in Great Britain, in the absence of intensive collecting effort aimed specifically at establishing its present distribution here it is difficult to assign it to any particular status category: wetland drainage has proceeded apace in recent years and although S. grossum occurs in one National Park and two national nature reserves in Ireland, it could well be valid to class it as vulnerable here. No other Irish grasshopper reaches the size of S. grossum. Perhaps botanists and other naturalists visiting Midland bogs with Molinia dominated areas would care to keep a look-out for this insect, in case further sites on which it survives can be located. It can be easily recognised from the coloured figures in Ragge (1965) but, unfortunately, does not seem to have ever been figured in any book dealing specifically with Irish wildlife.

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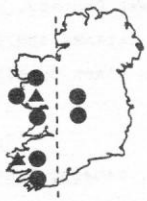
FIGURE 1. Distribution of Stethophyma grossum (L.) in Ireland.



Solid triangles indicate pre-1900 records only; solid circles to the west of the dashed line indicate records from both 19th and 20th centuries. The solid circles to the east of the dashed line are based on records from Midland raised bog sites, from which S. grossum was first recorded in 1985 (see text). (Mapped on the UTM grid, using 50km grid-square units)

Bull. Ir. biogoeg. Soc. No. 12 (1989)

OBSERVATIONS ON THE IRISH DISTRIBUTION OF A PLANT WITH SERIOUS PUBLIC HEALTH IMPLICATIONS: GIANT HOGWEED (HERACLEUM MANTEGAZZIANUM SOMMIER AND LEVIER).

Michael Wyse Jackson

"Turn and run,
Nothing can stop them,
Around every river and canal their power is growing....
....Fashionable country gentlemen had some cultivated wild gardens,
In which they innocently planted the Giant Hogweed throughout the land,
Soon they escaped, spreading their seed, preparing for an onslaught on the human race"

From 'The Return of the Giant Hogweed' by Genesis, 1971.

Introduction

Heracleum mantegazzianum Sommier and Levier, the Giant Hogweed, is a member of the Umbelliferae native to the north-west Caucasus mountains in the U.S.S.R., where it grows in wet places by streams and forest margins (Grossheim, 1967). It is a very striking plant on account of its great stature - it may grow up to 5m tall.

The plant has been spreading widely along rivers, canals, lakeshores and into damp waste ground and other damp habitats in the last few decades, in both Britain and Ireland. It seeds itself freely and grows vigorously, especially along rivers where it usually forms large stands that overshadow and restrict the growth of the indigenous herbaceous vegetation. According to Colgan (1904) the fruits are "often wind-borne for long distances". J. P. O'Connor (pers. comm. 1987) has seen fruits of Giant Hogweed floating down the Dargle river. The naturalized populations of Giant Hogweed in Ireland have doubtless originated from seed from plants originally grown for decorative purposes in parks and gardens. The rapid spread of the plant recently is exemplified quite well, though perhaps in a somewhat alarmist fashion, by the song-extract above. It has consequently, been the cause for some public concern in Britain and Ireland.

The major cause for concern, however, is the fact that this plant is a very serious human health hazard. It produces a highly toxic sap that is excreted

through bristles along the stem and leaves. The active ingredient of this sap is called Fourocoumarin which, on contact with skin, permanently damages the skin's ability to filter ultra-violet light from the sun's rays. Its effect is to produce a permanent sun burn, accompanied by rashes, blistering and swelling of the skin. This burning will re-occur every time sunlight reaches the damaged tissue, often years after the initial encounter with the plant (Powell, 1988). Clearly this dangerous plant must be eradicated from Ireland.

Recently in Ireland there has been much publicity concerning the health-hazard the plant poses, following a number of bad cases of dermatitis amongst children (e.g. Irish Times article, 18th July 1986). I have personally heard accounts from people whose children have had severe burns from this plant and who subsequently had to receive skin grafts. St. Columcille's Hospital in Loughlinstown, Co. Dublin (close to large stands of H. mantegazzianum) regularly has to treat patients for Giant Hogweed-induced burns during the summer months.

It is an offence in Northern Ireland and in Britain "to plant or cause to grow in the wild" H. mantegazzianum, under schedule 9, part 2 of the Wildlife (NI) Order, 1985 and the Wildlife and Countryside Act, 1981, respectively. Corresponding legislation is necessary in the Republic of Ireland to prevent further spread of this species and to ultimately eradicate it. The most effective method of eradication is by spot spraying with a glyphosphate herbicide (brand names such as "Round-up" or "Tumbleweed"). These herbicides eventually break down in sunlight and so there is no permanent damage to the soil structure (Powell, 1988).

Nomenclature

There are a number of names that have been used for Giant Hogweed in both Britain and Ireland - H. villosum Fischer ex Sprengel, H. mantegazzianum and H. giganteum Fischer ex Hornem.

H. villosum was the name used by some earlier authors, e.g. Colgan (1904) and Carrothers et al. (1947), for plants naturalized in Ireland. This name has been rejected however, by such authors as Brummitt (1968),

Mandenova (1951) and Grossheim (1967), who synonymised it under H. stevenii Mandenov., H. antasiaticum Mandenov. and H. leskovii Grossh.

H. mantegazzianum is the name currently used for the plant naturalized in Ireland. There is little doubt that the plant described by Sommier and Levier (1895) is the same as those naturalized in Ireland. The description of H. mantegazzianum in Mandenova (1951) agrees almost perfectly with Irish specimens in DBN. In Grossheim (1967) and Mandenova (1951) H. mantegazzianum is the only species of Heracleum that is said to attain the size of the Irish plants, so it is reasonable to assume that they belong to this species.

H. giganteum, used by some earlier authors, e.g. Niven (1880), Anon. (1888) and Anon. (1889), is an earlier name for Giant Hogweed that Brummitt (1968) provisionally assigns to H. mantegazzianum. However, before H. giganteum can be accepted as having priority as the correct name, type specimens and Hornemann's description must be consulted. For the purposes of this study the name H. mantegazzianum is used throughout.

Introduction of H. mantegazzianum to Ireland

It is rather difficult to be certain of the exact date of introduction of H. mantegazzianum to Ireland on account of the rather confused nomenclatural and taxonomic histories of this and other south-west Asian species of Heracleum.

The date of its introduction to Britain is given as 1893 in Chittenden (1951). However, there are earlier records for Giant Hogweed (as H. giganteum) being grown in Britain (Niven 1880, Anon. 1888). According to Anon. (1888), Giant Hogweed was introduced into Britain by Thomas Moore as a decorative garden plant.

The earliest published mention of Giant Hogweed in Ireland is in Anon (1889) (reference to seeds of H. giganteum available for exchange from the National Botanic Gardens). This infers that the plant was growing at Glasnevin for several years prior to 1889, since it is, according to Stewart and Grace (1984), monocarpic and takes up to five years to flower. Colgan (1904) records the presence of H. villosum naturalized at

Blackrock Park, Dublin as early as 1902. He also mentions that the plant is "much grown in parks and shrubberies".

Records of distribution in Ireland

This paper gives, in detail, as many of the sites for this species and the hybrid with H. sphondylium in Ireland that are known to the author. No excuses are made for the fact that some of the records have been previously published, on the contrary it is felt that in a synthesis such as this the omission of previously published records would be misleading. Since this paper forms the basis for a potential eradication programme, as much relevant site and locality detail as possible is included. The number of vice-counties in which H. mantegazzianum is recorded (Scannell and Synnott, 1987) is here increased from 23 to 29 (probably 30). Similarly, the number of vice-county records for the hybrid is provisionally increased from 4 to 7 (possibly 8). See Fig. 1 for the distribution of H. mantegazzianum in Ireland.

Records for each vice-county are arranged in chronological order and comprise, where possible, the locality, grid-reference, date and record source. In some cases grid-references were not supplied with the localities and it was thought better not to give one for these in order to avoid inaccuracies. The following records for H. mantegazzianum were recorded during the period 1970-87 by various recorders and are new or updated records included in the forthcoming Flora of the North-East of Ireland (Ed. 3): H38 8) to 16), H39 10) and 11), H40 11) to 13). Grid references are not included for these records.

DBN indicates that there is a specimen in the Herbarium of the National Botanic Gardens at Glasnevin. The only stations for H. mantegazzianum mapped in Perring and Walters (1962) included in this listing are the earliest vice-county records or otherwise unrecorded stations. Records extracted from Perring and Walters (1962) or Clegg and Grace (1974) refer only to the unlocalised presence of the species in one Irish 10 X 10 km grid-square, for example R62. Dublin records (vice-county H21) are allocated to the districts defined by Colgan (1904).

The following contributed records and are abbreviated in the text as noted: S. Beesley (S.B.), K. Bond, C. Brady (C.B.), N. Dawson (N.D.), D. Doogue (D.D.), J. Good, P. Hackney, G. Hannon, D. L. Kelly, J. G. D. Lamb, D. S. Lambert (D.L.), C. Moriarty, E. Ní Lamhna, E. Nic Lughadha, R. H. Northridge (R.N.), M. Norton (M.N.), J. P. O'Connor (J.O'C), H. O'Donnell (H.O'D), T. O'Mahony (T.O'M), The late H. O'Reilly (H.O'R.), J. A. N. Parnell, P. Reilly (P.R.), S. Reynolds (S.R.), B. S. Rushton, M. J. P. Scannell (M.S.), G. Sharkey, M. Sheehy Skeffington (M.S.S.), D.M. Synnott (D.S.), D. A. Webb (D.W.), P. Whelan, M. B. Wyse Jackson (M.W.J.), P. S. Wyse Jackson.

H. mantegazzianum

H1 S. Kerry

1) "A few fleeting leaf rosettes seen on the sandy north bank of the Roughty", (V9672, 15.ix.1977, O'Mahony (1980). The "dimorphic petiole hairs" mentioned in the above article should have read as monomorphic petiole hairs (T. O'Mahony, pers. comm., 1987); 2) Dungloe Castle Hotel, Beaufort, near Killarney, vii.1983, J. O'Malley.

H3 W. Cork

1) Parish of Aughadown (= Aghadown), W. of Skibbereen, 8.vii.1959, leg. J. E. O'Donovan. DBN. Recorded as H. villosum.

H4 Mid Cork

1) "Hedgerows near Kanturk", 1972. M. Daly, in O'Mahony (1975); 2) "A few plants by the roadside at Coachford bridge", W463718, 1974, O'Mahony (1975). 2) should have read "A few plants by the roadside at Rooves bridge, near Coachford" (T. O'Mahony pers. comm., 1987; 3) Leades House, Bealnamorrive, W391761, 28.viii.1981, K. Bond.

H5 E. Cork

1) Thoroughly naturalized about the castle at Castlelyons village, W840927, 1970-1973, T.O'M, M. Daly, in O'Mahony (1975); 2) Vienna Woods House grounds, near the hotel, W721732, 1976, M. Daly; 3) Fringing the damp roadside on the right bank of the North Bride River, just E. of the little hamlet of Aghern, W8992, vii.1986, T.O'M.

H8 Limerick

1) "For nearly a mile along Newport River above Bunkey bridge", E. H. Bennis in Praeger (1939). Recorded as H. giganteum Fisch.; 2) R62, Perring and Walters (1962); 3) On the banks of the Newport River by the road between Annacotty and Newport in the area of the county boundary, 1967, M. V. OBrien; 4) On the edge of the Foynes road just beyond the Limerick city docks, S.R.; 5) Along the Mulkear River just S. of Annacotty, near the main Dublin-Limerick road and a few plants along the main road itself, S.R.; 6) A thick grove by the river, Annacotty Bridge, 21.vii.1974, leg. M.S. DBN; 7) By R. Shannon between Sarsfield Bridge and the Treaty Stone, Limerick city, 1986. P. S. Wyse Jackson, 1988, M.W.J.; 8) Near Hospital, R73, 19.ix.1986, K. Bond and J. Good; 9) Castleconnell, close to the footbridge over the R. Shannon. Large isolated clumps under riverside park benches, R655622, Summer 1987, P. Whelan.

H9 Clare

1) Parteen, R577602, 1979, Farrell (1982); 2) R. Blackwater, to Lax Weir, ix.1983, J. Campbell; 3) N. of Mountshannon, c. 1985, G. Sharkey; 4) Along the W. bank of the R. Shannon in small isolated tufts about 20 to 50m apart between R638613 (Close to Belle Isle House) and R650613 (by the ruined church at Angler's Rest Bar), Summer 1987, P. Whelan; 5) Abundant for over a mile on a tributary of the R. Shannon near Clonlara, R613615, Summer 1987, P. Whelan.

H10 N. Tipperary

1) "For nearly a mile along Newport River above Bunkey bridge", E. H. Bennis in Praeger (1939). Recorded as H. giganteum Fisch.; 2) Abundant on the N. side of Newport village, R726621, post 1982, H.O'D.; 3) On an island in the Little Brosna river at Bunrevan House near Birr, 8.ix.1983, A. Hart fide J. G. D. Lamb (pers. comm., 1987). The boundary between v.c. H10 and v.c. H18 runs along the Little Brosna river. It is unclear from this record or from the 6" map as to which vice-county this record belongs. Thus, this record is here provisionally allocated to both H10 and H18; 4) by Little Brosna River, Bunrevan, N. Tipperary, 14.ix.1983, leg. A. Hart. DBN. The specimen in DBN was

collected a few days after the first mention of the Bunrevan population, but it is labelled as having originated from H10. A recheck of the Bunrevan population would doubtless confirm the plant from both H10 and H18; 5) "On the banks of the Newport River in Co. Tipperary", Hart (1984). The population naturalized at Bunrevan seems to have originated as a result of planting in the grounds of Bunrevan House (Hart, 1984).

H13 Carlow

1) "Roadside south of Fenagh House", Booth (1979).

H15 S.E. Galway

1) At entrance to Rinville estate on peninsula at head of Galway Bay, M340225, post 1982, H.O'D. Apparently gone now (M.S.S. pers. comm., 1987).

H16 W. Galway

1) "Well naturalized on rocky ground about 1km W of Costelloe Lodge (L9527), and sparingly on roadsides near the lodge, 1968-1977.", Webb (1982) and Webb and Scannell (1983).

H17 N.E. Galway

1) Roadside outside of Tuam, on the Galway Road, 31.vii.1976, leg. M.S. DBN; 2) By the Tuam road (T11) a few hundred metres west of the bridge over the R. Clare at Claretuam, M405490, post 1982, H.O'D., M.S.S.

H18 Offaly

1) On an island in the Little Brosna river at Bunrevan House near Birr, 8.ix.1983, A. Hart. See notes under H10.

H19 Kildare

1) At the N.E. corner of Carton estate, within the grounds. Carton, E. of Maynooth, N9638, 1974, D.D.; 2) in the grounds of Lyons estate, near the old pond, N9729, 1974, D.D.

H20 Wicklow

1) "Widely naturalized on river banks from Bray to Powerscourt", 1972, Carvill and Curtis (1973); 2) By the R. Dargle at Bray, O2417, O2518, O2618, 1978-1987, M.W.J.; Bray river, O2518, viii.1982. J.O'C.; 3) Roadside near Bray, O249178, 12.vi.1986. M.W.J.

H21 Dublin

District 4:

1) "By the river at Anna Liffey House below Lucan", Praeger (1951); 2) Tolka river at Finglas Bridge, 1978, D.S.; 3) "In the grounds of St. Brendan's Hospital", 1981. D.D., J.R. Akeroyd; 4) "In abundance on the banks of the river Tolka.....at Glasnevin". 3) and 4) in Wyse Jackson and Sheehy Skeffington (1984); 5) on derelict land near the Garda Headquarters at Phoenix Park, O135350, 1987, J.A.N. Parnell; 6) O0935, 1983-87, M.N.; 7) Cardiffs Bridge, adjacent to the R. Tolka, O1138, 1983-87, M.N.; 8) Banks of the R. Tolka, O1237 to O1537 inclusive, 1983-87, M.N.; 9) Along the R. Tolka (Abbotstown area), O0838, 28.ii.1987, J.O'C.

District 5:

1) Banks of Tolka river at Drumcondra, O162367, 1984-1987, M.W.J.; 2) About 2-300 metres E. of Portmarnock railway station in ditch on N. side of the road, O2342, 26.ix.1985, M.W.J., S.J. Neville; 3) Along the course of the small river that runs from Kinsealy to Portmarnock Bridge, O2143, O2242, O2243, O2342. Found also on roadsides and in laneways near the railway station and the paper factory, Portmarnock, E. Nic Lughadha; 4) On a site where a house was being built, on the road to the Greenhollows quarry at Howth, O2836, E. Nic Lughadha.

District 6:

1) Clondalkin, O0530, vii.1983; 2) Streamside, S.W. of Rathcoole, O0025, 18.v.1986, H.O'R., P.R., C.B.; 3) Roadside ditch, E. of Newcastle, O0129, 15.v.1987, C.B., H.O'R.

District 7;

1) "Wild by an old abandoned house by the tram line near Jobstown,

Tallaght, 1903", Colgan (1904). 1) recorded as H. villosum Fisch.; 2) Growing at the S. side of the Chemistry building T.C.D. and on the mound at the N. side of the rugby pitch, for several years in the 1940s. Gone by the 1950s, D.W.; 3) At foot of tree planted on pavement outside ANCO, Baggot St., Dublin city, 25.v.1982, leg. M.S. DBN; O1732, 3.vi.1982, M.W.J. Now gone; 4) One plant as a weed in garden of house beside football ground, Milltown rd., O1630, 15.v.1987, M.W.J. Now gone; 5) A few plants in a roadside waste area about 1km W. of the Cherry Orchard Hospital, Ballyfermot, O0733, 10.ix.1987, M.W.J.

District 8:

1) "A couple of plants on the railway opposite Blackrock Park, 1902-1903, and abundant on the banks of a drain outside the park, 1903", Colgan (1904); 2) "Several plants on the Vico Road opposite to the entrance to Killiney Hill, 1902-1903", Colgan (1904); 3) "One plant on the railway opposite Kingstown Park, 1903", Colgan (1904). 1), 2) and 3) recorded as H. villosum Fisch.; 4) Abundant along the Shanganagh river by Commons Rd., Loughlinstown. Also scattered throughout the wood on the N. side of the river, O2522, 3.iv.1983, S.R., H.O'R.; 5) Stream banks at Loughlinstown, O2323, 24.v.1983, S.R., H.O'R.; 6) Along the Shanganagh river near the coast, O2623, 17.vi.1983, S.R., H.O'R.; 1983;1985. M.W.J.; 7) Old estate with stream, W. Loughlinstown, O2423, 21.iv. 1984, S.R., H.O'R.; 8) One plant on roadside N. of Scalp. Now gone. O2120, 5.v.1984, S.R., H.O'R; 9) Foxrock, O2125, 29.ix.1984, H.O'R; 10) Many plants in a field just outside a large walled garden with a lake to S. of Leopardstown Park Hospital, O2025, 3.v.1985, S.R., H.O'R.; 11) Carrickmines, O2224, 14.v.1985, H.O'R.; 12) Cork Abbey, N. of Bray O2619, 18.v.1985, S.R. H.O'R.; 13) One young plant on Killiney coast, O2624, 26.v.1985, S.R.; 14) By edge of Shanganagh river between road and railway, O2523, 30.vi.1985, S.R.; 15) One plant growing in grass beside the pavement on the bridge over the Dodder at Milltown (Alex. College), O1630, 5.vii.1985, M.W.J.; 16) By the lake in the walled garden mentioned above, O2025, 22.vii.1985, S.R., H.O'R.; 17) Little Bray, O2518, 3.ix.1986, H.O'R.; 18) Blackrock College, O2029, 15.v.1987, J. Doyle.

H22 Meath

1) "Pilton demesne", 1957, McClintock (1960); 2) Bank of R. Boyne, Glenmore, Oldbridge, 18.iv.1964, leg. D.S. DBN; 1985, D.S.; 3) By road near the dovecote, about a quarter of a mile E. of Whitecross, Julianstown, c. 1975, M. Ward; 1986. D.S.

H23 Westmeath

1) Waste ground by the Presbyterian Church, Bunbrosna. "Overgrown with a forest of Heracleum mantegazzianum over ten feet high", 8.vi.1957, Brunker and King (1957).

H25 Roscommon

1) In a neglected garden and also naturalized at the margin of a nearby wood, Clonalis House, near Castlerea, M6681, vii.1982, J.O'C.

H27 W. Mayo

1) One plant by the road, near Westport Quay, L9683, 22.iv.1989, M.W.J.

H28 Sligo

1) G33, in Perring and Walters (1962); 2) G62, in Perring and Walters (1962); 3) Lissadell, C. Moriarty; 4) G63, in Clegg and Grace (1974); 5) G64, in Clegg and Grace (1974); 6) G72, in Clegg and Grace (1974); 7) In the entrance to a large estate just S. of Strandhill and W. of Knocknarea, G6135, 1983, M.S.S.

H30 Cavan

1) H41, in Perring and Walters (1962).

H31 Louth

1) By the road and R. Boyne at Obelisk Bridge, Oldbridge, 1967 onwards, D.S.; 2) By the R. Dee and roadside at Cappagh Bridge, about 1.5 miles N. of Dunleer, 1967 to 1987, D.S.

H32 Monaghan

1) H63, in Clegg and Grace (1974); 2) On the Monaghan side of the border

at Cloghmore, H5631, E. Ní Lamhna.

H33 Fermanagh

1) "Naturalised by stream at Maguire's bridge", Praeger (1939). Recorded as H. giganteum Fishch; 2) on bank of Tempo river near Maguire's bridge, H3439, i.1981, R.N.; 3) Bank of Ballycassidy river, H2351, 1984. R.N.; 4) Waste ground by roadside, H1956, 1984. R.N.; 5) Silverhill quarry, H2145, 11.vii.1987, R.N.; 6) Maheracross Bridge, Ballinamallard, H2852, R.N.; 7) Beside bridge in Ballinamallard village, H2652, 1987, R.N.; 8) Crevinishaughy Island, Lower L. Erne, H1659, 1987, R.N.; 9) Unshaded right bank of Colebrook river, near Ross Lough, S.W. of Lisnakea, H335326, 15.vi.1987, D.L. Kelly

(H34 E. Donegal)

1) "Coollooney", McClintock (1959). Almost certainly refers to Collooney in Sligo, (G62) (McClintock in litt., 1988) from where the species is recorded in Perring and Walters (1962).

H35 W. Donegal

1) In woodland perimeter. W. side of Lough Esk. (= L. Eske), 15.vii.1970, leg. M.S. DBN.; 2) G67, in Clegg and Grace (1974).

H36 Tyrone

1) "Abundant along edge of stream near Killyglass bridge, Castlecaulfield", T. Greer in Praeger (1939); 2) Ballygawley, H6357, Gillespie; 3) Parkanaur, H7361, 1956, M.P.H. Kertland; 4) Donaghmore, H7765, 1956, M.P.H. Kertland; 5) S.W. of Omagh, H47, 1956, M.P.H. Kertland; 6) Drum Manor, H7677, 1973, J. Harron; 7) Gortin, H4985, 1973, J. Harron; 8) N. of Fardross, H5249, 1976, D.L.; 9) Favour Royal, H6152, 1976, D.L.; 10) Trillick, H3355, 1976, D.L.; 11) Frequent by rivers in Cookstown area, H87, 1980, I. McNeill; 12) Crannagh, H5893, 1980s, I. McNeill; 13) Derrycreevy, H7952, 1982, J. Harron; 14) Killygavanagh Bridge, H784663, 1986, I. Rippey; 15) Findermore, H5150, 1987, J.S. Faulkner, I. McNeill; 16) Laragh, H543873, 1987, I. McNeill; 17) Owenreagh river, S. of Rousky, H857854, 1987, J. Harron; 18) "Frequent from Cookstown down to L. Neagh. Well established on the Torrent R. downstream to about two miles below

Coalisland." in Harron and Rushton (1987); (19)) "Tynan Abbey", D. McClintock (1959). Tynan Abbey is in Armagh but is about one mile from the border with Tyrone. McClintock's record is either erroneous or else it rather unclearly means that the plant occurs on the Tyrone side of the R. Blackwater near Tynan Abbey. See the first records for Armagh.

H37 Armagh

1) Tynan Abbey grounds, H7542, 1956, M.P.H. Kertland; 2) N. of Tynan, H74, 1960; 3) E. of Tullynawood, H82; 4) N. of Belleek, H92. 2) to 4) were recorded in 1950s-1960s by M.P.H. Kertland and others; 5) Eleven Lane Ends, Markethill, J0039, 1960, M.P.H. Kertland; 6) Coney Island, L. Neagh, H9364, 1971, J.S. Faulkiner; 7) R. Bann at Moyallen, J0350, 1972, J. Harron; 8) W. of Bannfoot, L. Neagh, H9562, 1973, J. Harron; 9) R. Callan at Carganamuck, H8749, 1974, N.D.; 10) Armagh city by small river, H8746, 1975, N.D.; 11) S. of Lissummon on roadside dump, J0432, 1975, N.D.; 12) Drumbanagher estate, Poyntzpass, J0536, 1975, N.D.; 13) Ballymoyer Forest, H9630, 1976, N.D.; 14) Grounds of Ardress House, H9155, 1976, N.D.; 15) R. Bann at Derrybrughas, J0059, 1977, N.D.; 16) One plant at Killycomain, Portadown, J0254, 1977, I. Rippey; 17) One plant on the embankment between the Newry canal and the river at Fathom, J0924, 1978, N.D.; 18) Cloughreagh, Bessbrook, J0527, 1978, N.D.; 19) Craigmore, Bessbrook, J0628, 1978, N.D.; 20) R. Blackwater at Maydown, Benburb, H8151, 1978, N.D.; 21) N. of Camlough, near Newry D.C.dump J0328, 1979. N.D.; 22) Newry to Camlough road W. of the Daisy Hill Hospital, J0727, 1979, N.D.; 23) One plant at Ardmore Bay, L. Neagh, J0163, 1983, N.D.; 24) One plant at Lisbane quarry, Tandragee, J0444, 1983, N.D.; 25) R. Blackwater at Milltown, Benburb, H8051, 1987, J. S. Faulkner; 26) "Lakeshore on the W approach to the mouth of the Upper Bann." in Harron and Rushton (1987); 27) Along a small stream c.2 miles N. of Newry, J0728, 7.xii.1987, J.O'C.

H38 Down

1) "By shore near Mountstewart", 1945-1946, Carrothers et al.(1947); 2) "By River Lagan, Belvoir Park, near 2nd locks", 1945-1946, Carrothers et al. (1947). 1) and 2) both recorded as H. villosum Fisch.; 3) "R. Lagan, both sides of the river at Annadale", 1970, P. Hackney in Kertland (1972);

4) By R. Bann at White Bridge, J0449, 1977, I. Rippey; 5) Abundant by the R. Bann at Gilford Bridge, J0648, 1977, I. Rippey; 6) Belvoir Park, J3469, 1980-85, S.B.; 7) Well established by the canal at Newry, J087276, vi/vii.1987, P.R.; 24.vi.1987, M.W.J., D.W.; 8) Rowallane; 9) Along R. Bann between Lawrencetown and the White Bridge near Moyallan, probably derived from Gilford Castle grounds; 10) By the R. Lagan near Magheralin; 11) Newry R.; 12) Quarry in Narrow Water Forest; 13) Kilbroney R. at Rostrevor; 14) Near lake at Aghnamoira; 15) Grounds of Downshire Hospital, Downpatrick; 16) Tillysburn; 17) Half a mile from Portaferry Harbour, J55, 1987, G. Hannon. For 8) to 16) see notes on records above.

H39 Antrim

1) "By River Lagan at several places between 1st and 2nd locks", 1945-1946, Carrothers et. al. (1947); 2) "At Whitehead and Magheramorne", 1945-1946, Carrothers et al. (1947). 1) and 2) both recorded as H. villosum Fisch.; 3) "Tip at Whitehead", 1969, P. Hackney; 4) "R. Bann N of Portglenone", 1970, J. Harron. 3) and 4) in Kertland (1972); 5) Whitehead, near railway J475915, 1973-76, S.B.; 6) By R. Lagan Belfast, J341705, 1974, A. Preston; 7) J49, in Clegg and Grace (1974); 8) D21, in Clegg and Grace (1974); 9) By R. Bann, Bracknamuckley, C970053, 10.v.1986, S.B., J. Wilde; 10) Ardmore Point on L. Neagh; 11) Glen at Runkerry. For 10) and 11) see notes on records above.

H40 Derry

1) R. Roe at Ballycarton, C676292, 1966, Belfast Naturalists' Field Club; 2) "Downhill", 1970, D.L.; 3) "Ballinderry R., frequent from Drapersfield" (H813767) "to L. Neagh" (H9580) "and N. of Ballinderry waterfoot" (H955812), 1971. J. Harron; 4) "R. Bann at Kilrea Bridge and N. of Invernoe Burnfoot", 1971, J. Harron. 2) 3) and 4) in Kertland (1972); 5) Moyola river at Newbridge,, H9590, 1980s, L. McNeill; 6) Lissan Water at Drumglass, H8081, 1983, L. McNeill; 7) Castle river at Drenagh, C688232, 1983, D.L.; 8) Castle river at Ardmore, C699214, 1984, D.L.; 9) R. Bann at Mountsandle, C853306, 1985, D.L.; 10) Frequent along the Lissan Water, 1987, L. McNeill; 11) Along R. Roe about three quarters of a mile (1.2km) upstream of the Roe Bridge at Bellarena; 12) Coleraine; 13) Streamside at Aughnacleagh, Portglenone. For 11) to 13) see notes on records above.

H. mantegazzianum x H. sphondylium

The hybrid between these two species was first recorded by Praeger (1950, 1951) from Dublin. Weimarck et al. (1979) made an intensive study of the two species and their hybrid and were able to provide some features that characterize the hybrid. It is on the whole intermediate between both parents for the following characters: stem height, diameter of primary umbel, number of rays in the primary umbel, fruit length and width, width of dorsal vittae, leaf length and width, hair length on the dorsal leaf surface. F1 hybrid pollen is usually more than 92% inviable and tends to be shorter and narrower than either of the parents (M.B. Wyse Jackson and J.A.N. Parnell unpubl.). Care must be taken in identifying the hybrid since H. sphondylium is a variable species that in some cases may quite closely resemble the hybrid. This may in part be attributable to the fact that the hybrid can occasionally backcross with H. sphondylium (Weimarck et al., 1979). Further research is required before the full extent of the hybrid and the putative backcross in Ireland is known.

The list below is made up of all the published records and unpublished records communicated to the author. Unfortunately the majority of the records are not accompanied by a voucher specimen. Those records for which the author has seen specimens and is satisfied as to their hybrid status are preceded by an asterisk. Other records may well be correct but remain to be confirmed with a specimen.

H5 E. Cork

1) Field record of a single plant of what appeared to be the hybrid in Vienna Woods House grounds, near the hotel, W721732, 1976, T.O'M, M. Daly. No specimen seen.

(H10 N. Tipperary)

1) H10, in Scannell and Synnott (1987). The voucher specimen in DBN (By Little Brosna River, Bunrevan, N. Tipperary, 14.viii.1983. leg. A. Hart) on which this record is based appears to be H. sphondylium. Fruit, leaf and umbel characters fit H. sphondylium much better than the hybrid. The pollen is also only c. 1% inviable.

H13 Carlow

1) *"Near Fenagh House", Booth (1979). DBN (4 sheets)- Fenagh, Co. Carlow. Roadside outside demesne - two species plentiful, many hybrids, 16.vi.1974, leg. E. Booth, M.S. The specimens in DBN agree well with the morphological characters of the hybrid. The pollen is c. 99% inviable.

H21 Dublin

1) "With the parents by the river at Anna Liffey House below Lucan, the first parent a garden escape", Praeger (1951). The first ever mention of the hybrid is in Praeger (1950) as H. giganteum x H. sphondylium though this record is unlocalised. It obviously refers to the record in Praeger (1951). There was no specimen collected;
2) A single, spontaneous plant near the label, at the Oak Class, National Botanic Gardens, Glasnevin, 1987, D.S.

H22 Meath

1) By road near the dovecote, about a quarter of a mile E. of Whitecross, Julianstown, 1975, D.S. No specimen collected.

H28 Sligo

1) H28, in Scannell and Synnott (1987). DBN (3 sheets)- Inside walls in a wood. W. of Knocknarea, 30.vii.1975, leg. M.S., D. McClintock. This record must be regarded as somewhat uncertain as the specimens in DBN are morphologically closer to H. sphondylium than the hybrid but most of the pollen is inviable (c. 97%).

H31 Louth

1) Roadside at the N. end of the station for H. mantegazzianum, at the Cappagh Bridge over the R. Dee, 1.5 miles N. of Dunleer, 1987, D.S. No specimen seen.

H38 Down

1) Belvoir Park, Belfast, J344697, 1977, D.L. Included in the forthcoming Flora of the North-East of Ireland (Ed. 3). No specimen seen.

H40 Derry

1) R. Roe at Ballycarton, C676292, 1971, D.L. No specimen seen.

Note added in press

Since going to press, a specimen of H. mantegazzianum, labelled in W. H. Harvey's handwriting, from Phoenix Park, Dublin has been uncovered in the herbarium of Trinity College Dublin. Since Harvey died in 1866 this specimen predates the earliest known record for the species in the British Isles (Niven, 1880) by at least 14 years.

Acknowledgements

I am very grateful to the many people who communicated records or the lack of them to me, and who permitted me to use them. I am particularly indebted to the members of the Dublin Naturalists' Field Club Plant Group and to Dr P. Hackney who gave me access to records collected by various recorders and due to be published in the forthcoming floras of Dublin and of the North-East of Ireland (Ed. 3).

I would like to thank Miss M. J. P. Scannell, Mr D. M. Synnott and Dr E. C. Nelson for their help and for lending specimens from DBN. I would also like to thank Dr P. Wyse Jackson for his helpful comments on an earlier draft of the manuscript. I am most grateful to Prof. D. A. Webb for his advice and encouragement and for help with Russian literature.

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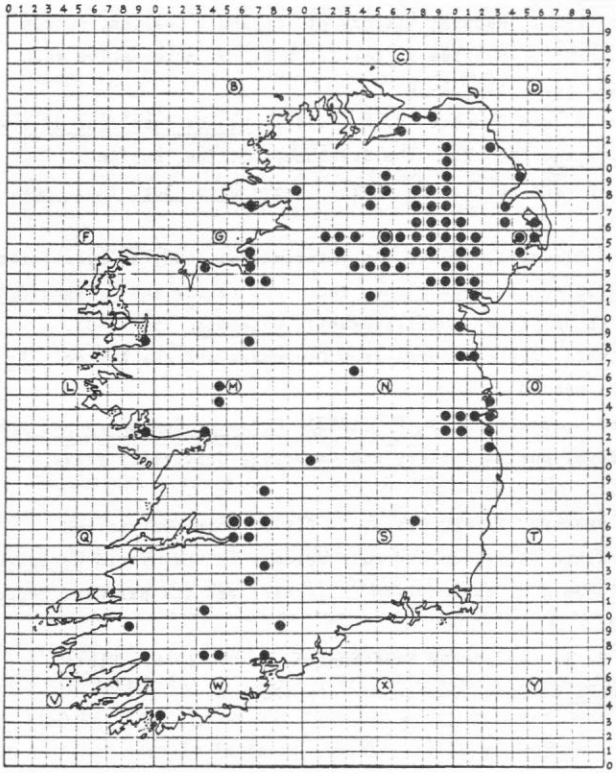
FIGURE 1. Distribution of Heracleum mantegazzianum in Ireland.



Bull. Ir. biogeog. Soc. No. 12 (1989)

THE ODONATA (INSECTA) OF CO. FERMANAGH, IRELAND.

Brian Nelson, Robert Northridge and Ian Rippey

The history of dragonfly recording in Fermanagh is brief as prior to 1983 the only published records from the county refer to a single record of Brachytron pratense (Müller) given in King and Halbert (1910), and the records collected by Sir C. Langham around Tempo (Langham, 1920). Langham recorded twelve Odonata species within a mile radius of his home, which is the complete Fermanagh list apart from B. pratense, Ischnura pumilio (Charpentier), Coenagrion lunulatum (Charpentier) and Sympetrum sanguineum (Müller). The latter two species, however, were not known to occur in Ireland at this time. With the inception of a dragonfly recording scheme in Ireland in the late 1970s much more recording has been done in Fermanagh and elsewhere in Ireland and the broad distribution of species is now better known. This paper presents the results of dragonfly recording in Fermanagh and examines the distribution of the species.

Methods

The vast majority of the records were collected between 1983 and 1986, though some date back to the late 1970's. All refer to field records of adults which were identified using the criteria given in Hammond (1983). As the adults of all the Irish species of dragonfly (this vernacular term is used in the broad sense to cover all Odonata species) can be readily identified in the field, or from photographs, there was no need to take specimens, which in any case is not justifiable in the interests of conservation.

Results

Records have been collected from 157 sites. A site is defined as a locality where there is water in which dragonflies are likely to breed e.g. a lake, stretch of a river or bog pool. The geographical distribution of the sites is given in Fig. 1, which also gives an indication of the number of species found at each site. Full details of the species recorded at each site are given in the appendix. As definite

proof of breeding of each species at each site was not looked for, it cannot be assumed that any particular species breeds at every site at which it was recorded, so their distribution may be slightly exaggerated. This is unlikely to apply in many cases to the damselflies (zygoptera), as by their nature they rarely travel far from their breeding sites. The Anisoptera (large dragonflies) species are much more mobile and the uncertainty of this factor is likely to be greater. As a result records of single adult Anisoptera away from any obvious breeding site have been excluded.

Table 1 lists the number of sites at which each species was recorded and gives information on the habitat preference of each species. Sixteen out of the twenty-two resident Irish dragonfly species have been recorded so far in Fermanagh. As previously mentioned the only additions to the Fermanagh list since 1920 have been C. lunulatum, which was recorded in Ireland for the first time in 1981, and in Fermanagh in 1984 (Nelson, 1985), S. sanguineum (first record in 1983; Nelson 1986) and I. pumilio (first record 1987; this paper). The distribution patterns of dragonflies within Fermanagh will now be discussed both in terms of sites and the individual species.

Sites

The larvae of all Irish dragonflies are aquatic and this need for open water is undoubtedly the single most important factor influencing their distribution. Co. Fermanagh has more freshwater habitat, much of it still in its natural state, than any other county in northern Ireland and it would appear that the county should have some important dragonfly habitat. There are five large lakes, either entirely or partly, within the county, including the two large loughs of Upper and Lower Lough Erne which occupy the centre of the county, and therefore divide it naturally into eastern and western parts. There are numerous drumlins in the Erne valley, especially around Upper Lough Erne, and the interdrumlin hollows are filled with many small loughs. Botanically these lowland loughs around Upper Lough Erne are very rich and have large populations of a number of rare Irish plants including Stratiotes aloides L., Cicuta virosa L., Sium latifolium L. and Lathyrus palustris L. On either side of the Erne valley, there are low limestone and sandstone hills and these also have many small rock-basin lakes. Fermanagh still has some areas of bogland

but these are now largely confined to the upland, though there are still some small areas of cutover bog in the lowlands.

Fig. 1 shows the distribution of sites visited in this survey. Each site is classified according to the number of species recorded. Ten or more species have been recorded from ten sites, the maximum number being thirteen species; at 58 sites between five and nine species were recorded and at 89 sites four or fewer species were recorded. The average number of species recorded at all sites is 4.3.

The number of species recorded at each site will have been influenced by the number of visits and especially the timing of these visits. Under-recording at sites will have occurred if they were only visited in early summer, thereby missing the late emerging Aeshna and Sympetrum species, or equally if no early visit was made thereby missing the flight period of the few early species, especially B. pratense. In this paper we have taken adequate coverage to mean that a site has been visited twice with at least one visit in early summer (taken as before 1st July) and at least one after the 1st July. Of the 157 sites documented here 48 sites fulfill the criteria of adequate coverage. These are marked by an asterix in the appendix and Table 2 provides a breakdown of the occurrence of each species at these sites. The average number of species recorded at these 48 sites is 6.3, which is clearly greater than the average for all 157 sites and is a better figure against which to judge the richness of any particular site. The average number of species recorded at all 115 lake sites is 4.5; 33 of the well-covered sites were lakes and at these the mean number of species recorded was 7.1, implying that under-recording has occurred. The corresponding figures for the bog sites are the same at 4.3 species per site. This clearly shows that in Fermanagh at least the richest dragonfly habitat is provided by the lakes.

Within the county the distribution of sites is not random and largely reflects the distribution of lakes. These are most abundant amongst the drumlins of the Erne valley, especially close to Upper Lough Erne, and in the hills in the west of the county. There are few lakes in the south-west of the county and in the east along the Tyrone border and there are correspondingly fewer records from these areas. The distribution of the

best sites is interesting as there is clearly a concentration of good dragonfly sites in the hills immediately south of Lower Lough Erne and around the south end of Upper Lough Erne. The sites surveyed in the north of the county and in the hills in the south east were generally poor in species. There are also a considerable number of low quality sites in the centre of the county between the two Lough Ernes; a lot of these sites are small areas of bog and stretches of river which naturally support few species.

Within the county four main habitat types can be identified; though these share many species, each has a characteristic fauna. These are the lakes, areas of moorland and lowland bogs, rivers and lastly miscellaneous sites such as flooded quarries. Each of the 157 sites has been classified according to one of these habitat types. A few sites have two habitat types. At these sites there was an additional area present of a second habitat which added significantly to the species present but which would have been difficult to separate as a different site.

Table 1 shows the distribution by habitat of each species. The percentage of the total number of records for each species in each habitat gives a crude measure of the habitat preference of each species. If a species showed no habitat preference one would expect the percentage of records in each habitat to approximate to the percentage representation of the habitat type in the 157 sites. For instance 92% of all records for Enallagma cyathigerum (Charpentier) were at lakes though these comprised just 71% of the sites surveyed suggesting that this species has a marked preference for lake sites.

115 of the sites were classified as lakes making this the predominant habitat type. This classification covers the whole range of lakes from the shores of the large loughs to small well-sheltered loughs. Within this range there was a distinct difference in the species recorded. The large loughs provide poor dragonfly habitat. This is probably due to the generally high degree of exposure resulting in rocky shores with no emergent vegetation

and deep, cold water. They therefore resemble upland oligotrophic loughs. Much of the shoreline around the north end of Lower Lough Erne, on both Lough Macneans and Lough Melvin is of this type. However, much of Upper Lough Erne is relatively shallow and the fauna of this lough resembles that of the small lakes. There are few species in these lakes but E. cyathigerum is typically present. Sympetrum danae (Sulzer), Libellula quadrimaculata L., Pyrrhosoma nymphula (Sulzer) and Aeshna juncea (L.) may also occur at some sites.

The sheltered bays of the large loughs usually allow the development of stands of emergent vegetation and generally their dragonfly fauna resembles that of small lowland lakes. With shallower water which heats up quickly in summer these lakes and bays are a rich aquatic habitat. A sheltered situation and the close proximity of rich feeding areas are other important habitat features favouring dragonflies. Lakes with intensively grazed shorelines tended to have fewer than expected individuals, and species diversity decreases with increasing eutrophication. However, altitude does not appear to affect species diversity greatly as upland lakes, providing they are well sheltered and shallow, can be rich sites. For example Lough Alaban (H070438) supports 12 species of dragonfly, whilst the nearby Lough Hamul (H065414) has only four. Lough Alaban lies at an altitude of 245m whereas L. Hamul is at an altitude of 195m, but is a larger, deeper and more exposed lake.

All but one of the Fermanagh dragonfly species were recorded at lakes. The following species were recorded frequently at these sites and over 80% of the records of these species were at lake sites: E. cyathigerum, Coenagrion puella (L), C. pulchellum (van der Linden), Ischnura elegans (van der Linden), Aeshna grandis (L.), Lestes sponsa (Hansemann) and B. pratense. In contrast the lakes are a relatively unimportant habitat for A. juncea, Calopteryx splendens (Harris) and S. danae. Of the rarer species I. pumilio has not been recorded at any lake in Fermanagh, whilst all the recorded sites for the other two rare species, C. lunulatum and S. sanguineum are lakes.

In other parts of Northern Ireland, especially around the south shore

of Lough Neagh, cutover bog is the richest dragonfly habitat, with up to 13 species recorded at some sites. The combination of suitable feeding areas and many small pools which are found on these areas provide excellent dragonfly habitat. A limited amount of peat-cutting by hand is essential on these sites to maintain open areas of water. In Fermanagh there is only a small and decreasing area of this habitat, but a few rich areas of cutover bog were found in this survey to the south-west of Lisnaskea (Gortgranagh and Monelegny H356293) and also around Florencecourt (Drumanacabranagher H210356).

The fauna of these bogs is distinctive with a predominance of the larger dragonflies amongst the species. L. quadrimaculata, P. nymphula, S. danae and A. juncea were the most commonly recorded species on bogland sites. Overall this habitat is especially important for S. danae (59% of records) and A. juncea (42% of records) and to a lesser extent for Sympetrum striolatum (Charpentier), L. quadrimaculata and P. nymphula. The damselfly species, apart from Pyrrhosoma, tend to be scarce and E. cyathigerum is usually absent. Where the bog is small and there is little open water then the fauna is inevitably much poorer and eventually only species which are tolerant of very dry bogs remain, P. nymphula and L. quadrimaculata. With increasing altitude and greater degree of exposure the number of species also declines.

Rivers are undoubtedly the poorest habitat but are of interest as they support one species which does not occur on lakes or bogs. This is C. splendens which prefers muddy-bottomed and generally slow-flowing rivers and does not occur on rapid-flowing, rocky, upland streams. These rivers are therefore the one wetland habitat in Fermanagh where one would expect not to see any dragonflies. P. nymphula is the only other species which was frequently found along rivers in the county. Several other species may occur along very sluggish rivers and streams, but this is not an important habitat for any other dragonfly species.

Species

Aeshna grandis (L.) Brown hawker.
This is one of the two species of Aeshna which occur in Ireland, these being the largest Irish species of Odonata. A. grandis is predominantly a lowland lake species and its distribution in Fermanagh reflects this as it is most common on the small lakes and sheltered bays around Upper Lough Erne. However it also occurs at well-sheltered upland lakes especially those in afforested areas e.g. L. Alaban (H070438) and Braade (H043548). A. grandis is frequently seen hawking at the edges of woodlands and up to 15 individuals have been seen in a small area close to the shores of Upper Lough Erne.

Aeshna juncea (L.) Common hawker.
This is the upland and bogland equivalent of A. grandis and though there have been records from lowland lakes these were probably of stray individuals. In Fermanagh most records of A. juncea are from hilly regions in the west of the county. Like A. grandis this species frequently hunts along woodland edges and rides though it is rarely seen in large concentrations.

Brachytron pratense (Müller) Hairy dragonfly
This species superficially resembles A. juncea but as their flight periods do not coincide in most years identification is rarely difficult. The species also differ in habitat choice as Brachytron occurs in similar situations to A. grandis. In Fermanagh, Brachytron is widely distributed in lowlying parts, though it has been recorded at 250m. This species tends to be solitary with rarely more than 3-4 individuals present at a site at any one time. A characteristic of males is their habit of slowly patrolling the edge of ponds and lakes by flying low over the water often amongst the emergent plant stems. In many parts of Britain, Brachytron, is much less common than is the case in Fermanagh and Ireland as a whole.

Libellula quadrimaculata L. Four-spotted chaser.
L. quadrimaculata is certainly the most widespread and possibly the commonest large dragonfly species. In Fermanagh it occurs in all habitats (apart from rivers) from tiny areas of bogland to large loughs and exposed areas of moorland, though it prefers areas of shallow water. At highly favoured localities it can be common with many males vigorously defending small territories beside lakes or pools.

Sympetrum danae (Sulzer) Black darter.
This, the smallest but most distinctive of the three species of Sympetrum found in Ireland, was recorded occasionally on moorland and at small lakes but its preferred habitat, as can be seen from Table 1, is lowland bog. In Fermanagh S. danae has mostly been recorded in the west and north of the county, where it often occurs in large numbers.

Sympetrum sanguineum (Müller) Ruddy darter.
This is the rarest large dragonfly in Fermanagh. It was first recorded in 1983, and has subsequently been found at five sites, all lowland lakes or bays on Upper Lough Erne. S. sanguineum appears to favour quite eutrophic sites which have dense beds of emergent vegetation. Elsewhere in Northern Ireland it has been recorded at lowland cutover bogs as well as at small loughs.

Sympetrum striolatum (Charpentier) Common darter.
This species is often considered to be the most common Anisoptera species in Britain and Ireland. However in Fermanagh though it has a wide distribution, it is rather local and never very numerous. Most records are from small lakes but areas of bog are also a significant habitat. The reasons for the relative scarcity of this species in the county are unknown as in some years, particularly 1984, it has been extremely common but recently it has been less frequently recorded.

Calopteryx splendens (Harris) Banded demoiselle.
This is the only strictly riverine species that has been recorded in Fermanagh. There have been records from lakes which are probably of stray individuals, though it certainly breeds along the sluggish channels around the islands in Upper Lough Erne. In Fermanagh, C. splendens is locally distributed in the lowlands. It is most common along the Sillees and Arney Rivers in the west of the county and on the rivers and streams that drain into Upper Lough Erne. There are no records from any of the rivers that flow into Lower Lough Erne, apart from the Ballinamallard River.

Coenagrion lunulatum (Charpentier) Irish damselfly.
This species was only discovered in Ireland in 1981 in Co. Sligo (Cotton 1982). The first Fermanagh colony was found in 1984, intriguingly at

a lake just three miles from Sir C. Langham's home in Tempo. A total of seven sites are now known and in addition there is a record from a roadside verge, which is not mapped in Fig. 1, though the record is plotted in 10km square records. C. lunulatum in Fermanagh occurs at small lakes, though in Armagh the habitat is cutover bog. These lakes are mostly in hilly areas, at altitudes between 85 and 310m. The emergent vegetation is sparse and generally typical of a mesotrophic lake with species such as Carex rostrata Stokes and Scirpus lacustris L. However one exceptional site was discovered in 1986 at a eutrophic lowland lough.

Coenagrion puella (L.) Azure damselfly.
This species is quite widely distributed in the county. Its preferred habitat is sheltered, shallow lakes. C. puella avoids very exposed lakes and rivers and it is virtually absent from lowland bogs in the Fermanagh, though it occurs on some bogs in the east of the province.

Coenagrion pulchellum (van der Linden) Variable damselfly.
C. pulchellum, which is very similar to C. puella in appearance, is slightly less widely distributed in Fermanagh than the latter. The two species often occur together and in equal abundance but on cutover bog C. pulchellum is much the commoner of the two. The widespread distribution of this species in Fermanagh contrasts with the situation in Britain, where in many areas C. pulchellum is uncommon or rare (Welstead and Welstead, 1984; Benton, 1985).

Enallagma cyathigerum (Charpentier) Common blue damselfly.
Enallagma was the third most frequently recorded species in the county but was also the most restricted in habitat choice with 92% of records from lakes. It is virtually unrecorded at bogland sites in Fermanagh or elsewhere in Northern Ireland. However Enallagma tolerates a high degree of exposure and is occasionally the only damselfly species to be found on upland or very exposed sites.

Ischnura elegans (van der Linden) Blue-tailed damselfly.
This is the most widespread species of Odonata in Fermanagh and was recorded at over 66% of the sites visited. It occurs in all habitats except for very exposed lakes and rivers but shows a distinct preference for small lakes.

Ischnura pumilio (Charpentier) Scarce blue-tailed damselfly.
This species was recorded in Fermanagh for the first time in 1987 when three colonies were discovered. The initial colony was found at a shallow pool in a disused limestone quarry and subsequently at a second quarry site which was deliberately searched for it and at a third site, a shallow pool in heathland. The species clearly likes shallow water and will clearly tolerate quite alkaline conditions. In view of its rather unusual, but distinctive, habitat choice this species has probably been missed elsewhere in the county. The transitory nature of the habitat may also mean it is sporadic in its occurence.

Lestes sponsa (Hansemann) Common emerald damselfly.
The habitat preferences of L. sponsa are for well-vegetated small lakes and to a much lesser extent for cutover bog and like most species it avoids very exposed upland sites. At favoured localities this can be an extremely abundant species e.g. at Mill Lough (H243383). The species is widely distributed in Fermanagh especially around Upper Lough Erne.

Pyrrhosoma nymphula (Sulzer) Large red damselfly.
This is usually the first species of dragonfly to emerge each year. In Fermanagh Pyrrhosoma is one of the most widely distributed species, being found in all habitats, including slow-flowing rivers, though the species is only occasionally found in large numbers. It has also been at quite exposed sites and at sites with virtually no visible water.

Discussion

The most important habitat features which dragonflies require are firstly areas of unpolluted freshwater in which the larval stage lives, and secondly rich feeding areas close to the breeding site for the adults to feed in. These conditions are met at many sites in Fermanagh. Though most of the agricultural land in lowlying parts of the county consists of improved pasture, the fringing vegetation around most of the lakes is still relatively intact. The generally unintensive agriculture practised in the county has also not caused widespread eutrophication of the lakes. Though the specific factors which determine the distribution of individual species are poorly understood it is clear that many of the small lakes in Fermanagh provide suitable habitat for many of the Irish Odonata. There are few other

areas in the north of Ireland which can boast such a diversity and abundance of dragonfly habitat. This is the outstanding feature of Fermanagh which this survey has highlighted.

Only one of the sixteen dragonfly species recorded from the county can be considered rare. This is C. lunulatum; currently Fermanagh and neighbouring parts of Co. Tyrone are the centre of its known Irish distribution. C. lunulatum is unknown in Britain, and it is also rare in western Europe (Cotton, 1982). In Finland it is most common north of the Arctic Circle (Hämäläinen, 1984), so the presence of C. lunulatum in Ireland is somewhat strange. The other species found in the county are reasonably common elsewhere and more widespread, but with habitat loss some species are undoubtedly declining. In particular the continuing loss of lowland bogs is likely to affect the population of S. danae which is the most typical dragonfly species of this habitat. The increasing eutrophication and pollution of the lakes is however undoubtedly the most serious threat to the dragonfly populations in Fermanagh. The species most under threat are C. lunulatum (and also C. pulchellum) and B. pratense as both these species appear to have declined in Britain and are now considered to be uncommon in many areas (Benton, 1985; Welstead and Welstead, 1984).

This survey we believe has identified the best sites for dragonflies within Fermanagh, though we recognise it is by no means complete, and provides a baseline for monitoring the dragonfly populations in the future. Undoubtedly further survey work would boost the species list for many sites and there is also scope for further work on the exact habitat requirements of all species. In Fermanagh we have used the criterion of 10 species at one site to indicate the best sites. We hope these sites may warrant some form of protection. This figure, which amounts to almost 50% of the Irish fauna, appears to be applicable to other sites in Northern Ireland, and may also be a good criterion for all Irish sites. However certain rare species occur at sites with fewer species and these require special protection. At the following ten sites in Fermanagh ten or more species have been recorded: Lough Alaban (H070438), Cargin Lough (H365273), Coolyermer Lough (H180427), Corracoash and Corraharra Loughs (H355227), Gortgranagh/Monelegny (H356293), Inishcreenry (H304342), Largalinny (H071537), Mill Lough (H243383), Tonnagh Lough (H103535) and Watson's Lough (H307496). All but one of these sites

is a small lake or sheltered bay and all the Fermanagh species of dragonfly have been recorded at least one of these sites. At present only Largalinny, which is a Forest Nature Reserve, and Corracoash and Corraharra Loughs, which are owned by the National Trust, are protected by by any conservation measure. When considering protection of dragonfly habitat, especially lakes it must be stressed that the surrounding habitats are as important as the lake itself.

Acknowledgements

Acknowledgements and thanks are due to Robert Nash (Ulster Museum for advice and encouragement, to the Praeger Committee of the Royal Irish Academy for a grant to assist with fieldwork expenses to B. Nelson in 1985, and to the other members of the Northridge family for assistance in fieldwork.

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TABLE 1. Occurrence of species by habitat in all sites.

Habitat type (see appendix)		I	II	III	IV	Total
Ischnura elegans	No	93	8	3	2	103
	%	88	8	3	2	
Libellula quadrimaculata	No	58	20	0	1	76
	%	73	25		1	
Enallagma cyathigerum	No	67	3	2	2	71
	%	92	4	2	1	
Pyrrhosoma nymphula	No	51	16	4	2	69
	%	69	22	5	3	
Coenagrion puella	No	50	4	1	1	53
	%	89	7	2	2	
C. pulchellum	No	41	9	0	1	49
	%	80	18		2	
Lestes sponsa	No	39	7	0	1	45
	%	83	15		2	
Aeshna grandis	No	39	5	1	1	43
	%	85	11	2	2	
Sympetrum striolatum	No	27	9	0	2	36
	%	71	24		5	
Brachytron pratense	No	28	4	2	1	33
	%	80	11	6	3	
Aeshna juncea	No	20	15	0	1	32
	%	56	42		3	
Sympetrum danae	No	10	16	0	1	27
	%	37	59		4	
Calopteryx splendens	No	4	1	17	0	22
	%	18	5	77		
Coenagrion lunulatum	No	7	0	0	0	7
	%	100				
Sympetrum sanguineum	No	5	0	0	0	5
	%	100				
Ischnura pumilio	No	0	1	0	2	3
	%		33		67	
All sites	No	115	25	19	2	157
	%	71	16	12	1	

TABLE 2. Distribution of species in well-covered sites.

Habitat type (see appendix)		I	II	III	IV	Total
Ischnura elegans	No	32	4	1	1	36
Libellula quadrimaculata	No	27	9	0	1	34
Enallagma cyathigerum	No	23	2	0	1	24
Pyrrhosoma nymphula	No	23	10	1	1	32
Coenagrion puella	No	20	4	0	0	22
C. pulchellum	No	24	5	0	0	24
Lestes sponsa	No	19	3	0	0	21
Aeshna grandis	No	22	2	0	0	22
Sympetrum striolatum	No	13	3	0	1	17
Brachytron pratense	No	16	2	1	0	18
Aeshna juncea	No	13	8	0	0	18
Sympetrum danae	No	7	8	0	0	13
Calopteryx splendens	No	1	0	3	0	4
Coenagrion lunulatum	No	5	0	0	0	5
Sympetrum sanguineum	No	4	0	0	0	4
Ischnura pumilio	No	0	1	0	2	3
All sites	No	36	11	3	2	48

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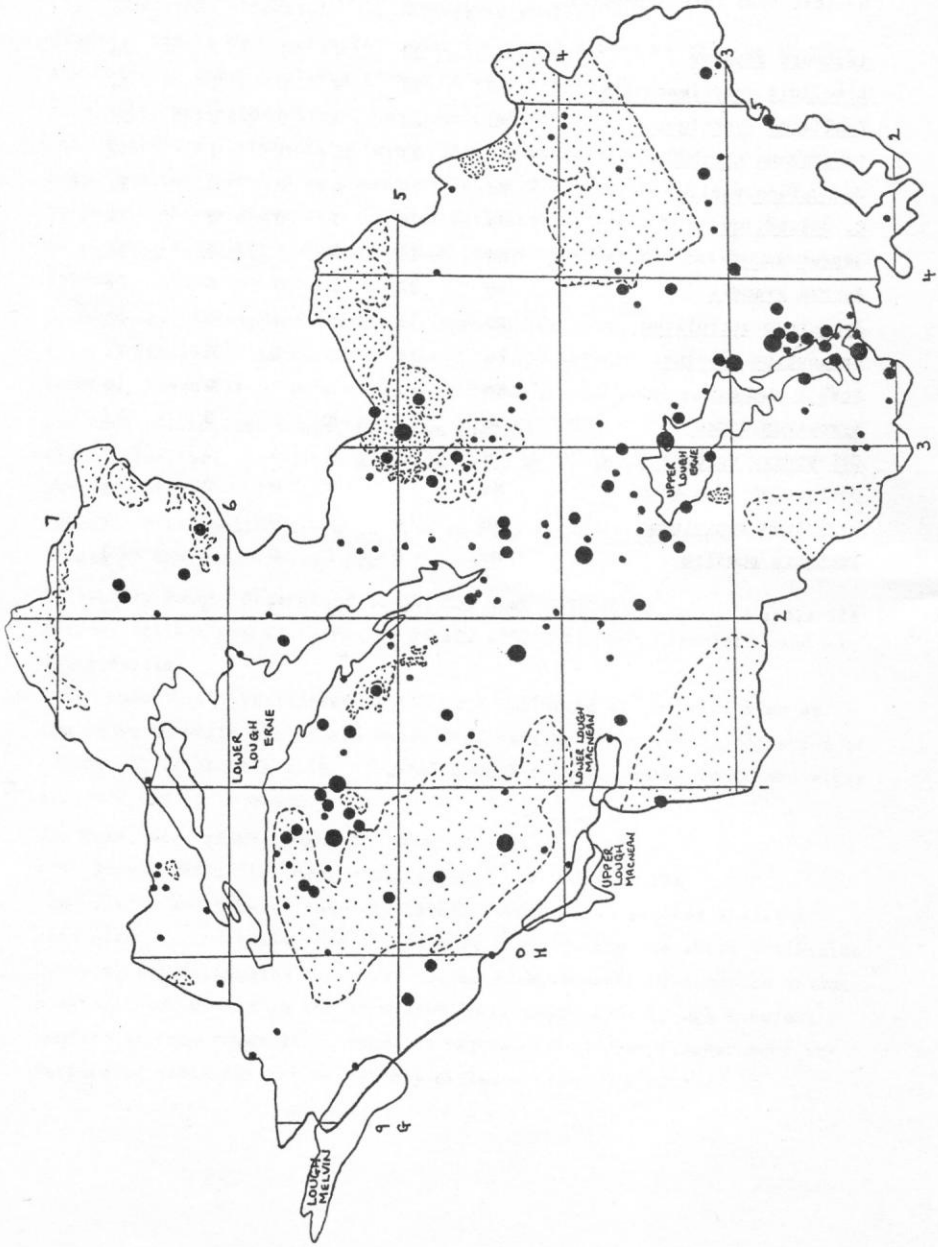
FIGURE 1. Distribution of dragonfly sites in Co. Fermanagh.

● 10+ species; ● 5-9 species; • 1-4 species; land above 150m.



APPENDIX: Inventory of dragonfly sites in Co. Fermanagh.

Sites are listed in grid reference order.

Site types.

I. Small loughs and bays on large loughs.
II Cutover bog and moorland.
III Rivers and streams
IV Other (flooded quarries etc).

Abbreviations used in table

No Number of species
A.g Aeshna grandis (Brown hawker)
A.j Aeshna juncea (Common hawker)
B.p Brachytron pratense (Hairy dragonfly)
Cas Calopteryx splendens (Banded demoiselle)
Clu Coenagrion lunulatum (Irish damselfly)
Cpa Coenagrion puella (Azure damselfly)
Cpm Coenagrion pulchellum (Variable damselfly)
E.c Enallagma cyathigerum (Common blue damselfly)
I.e Ischnura elegans (Blue-tailed damselfly)
I.p Ischnura pumilio (Scarce blue-tailed damselfly)
L.s Lestes sponsa (Emerald damselfly)
L.q Libellula quadrimaculata (Four-spotted chaser)
P.n Pyrrhosoma nymphula (Large red damselfly)
S.d Sympetrum danae (Black darter)
Ssa Sympetrum sanguineum (Ruddy darter)
Sst Sympetrum striolatum (Common darter)

U., Upp. Upper; Lwr. Lower; L. Lough; B. Bridge; R. River; F.N.R. Forest Nature Reserve

* denotes sites visited at least twice with one visit before 1st July, and one after 1st July.

APPENDIX (Contd.)

Site	Grid Ref	No	A.g	A.j	B.p	Cas	Clu	Cpa	Cpm	E.c	I.e	I.p	L.s	L.q	P.n	S.d	Ssa	Sst	Site type
Lough Aguse	G997482	5						♦	♦	♦	♦				♦				I
Lough Aleater	G976494	7						♦	♦	♦	♦		♦	♦				♦	I
River Erne,Belleek	G942588	1				♦													III
‡Farrancassidy	G958573	3		♦				♦								♦			II
Garvros, L, Melvin	G935528	4								♦	♦			♦	♦				I
‡Tullynanny Lough	G980507	3							♦					♦		♦			I
Lough Doo	G986606	2							♦					♦					I
Legalough	H088346	5			♦			♦		♦	♦				♦				I
Upper Lough Macnean	H060397	3									♦		♦					♦	I
‡LOUGH ALABAN	H070438	12	♦	♦	♦		♦	♦	♦	♦	♦		♦	♦	♦	♦			I
Lough Blocknet	H098440	3						♦			♦				♦				I
Lough Formal	H048473	6		♦						♦				♦	♦	♦		♦	I
‡Lough Hamul	H065414	4							♦	♦				♦	♦				I
Lough Lattone	H000455	2								♦								♦	I
‡Lough Achork	H042555	7								♦	♦		♦	♦	♦	♦		♦	I
Lough Anlaban	H054563	2												♦	♦				I
‡Braade	H043548	6	♦	♦				♦			♦			♦	♦				I,II
‡Carrick Lough	H090540	6	♦							♦	♦			♦	♦			♦	I
Carricknagower Lough	H001542	1												♦					I,II
Derryvahon	H055543	1												♦					II
Doagh Lough	H077522	6						♦		♦	♦		♦	♦	♦				I
Dresternan Bridge	H085545	1				♦													III
Glencreawan Lough	H030567	2									♦			♦					I
‡LARGALINNY	H071537	13	♦	♦	♦			♦	♦	♦	♦	♦	♦	♦	♦	♦		♦	I
‡Shean Lough	H068565	8		♦			♦	♦		♦	♦		♦	♦	♦				I
Monawilkin Lough	H084528	7	♦	♦	♦				♦	♦				♦	♦				I
Lough Nabrickboy	H035505	7	♦	♦						♦			♦	♦		♦		♦	I
‡Parabaun Lough	H062572	3		♦							♦			♦					I
‡Lough Slawn	H074560	6		♦						♦			♦	♦	♦	♦			I
‡Spectacle Lough	H095546	5	♦					♦	♦		♦			♦					I
Lough A Waddy	H042648	2								♦					♦				I
Garvary River mouth	H023614	3		♦									♦					♦	I
Tullykeeran	H012641	3		♦										♦		♦			III
Tullynaloob Lough	H037645	3							♦	♦	♦								I
Tullyvocady	H050646	1												♦					II

APPENDIX (Contd.)

Site	Grid Ref	No	A.g	A.j	B.p	Cas	Clu	Cpa	Cpm	E.c	I.e	I.p	L.s	L.q	P.n	S.d	Ssa	Sst	Site type
Tullyvocady Lough	H058646	3			•					•	•								I
Arney R. (Brockagh B.)	H176373	1				•													III
Cushrush, Lwr.L.Macnean	H123377	4			•			•			•			•					I
⁑Five Points	H198379	1													•				II
Lisblake	H147368	6									•		•	•	•	•		•	II
Castletown, Monea	H165493	4						•	•		•				•				I
⁑COOLYERMER LOUGH	H180427	11	•			•		•	•	•	•			•	•	•	•	•	I
Lough Leen	H131454	2						•			•								I
⁑Ross Lough	H144469	7	•		•			•	•		•			•				•	I
Sillees R. (Carr B.)	H129472	1													•				III
Sillees R. (Glencunny)	H196409	1				•													III
Lough Aleen	H137544	5							•	•	•				•			•	I
⁑Sillees R. (Caldrum)	H120531	4			•	•					•				•				III
Castle Archdale	H178596	2								•	•								I
Castlehume Lough	H192505	2								•								•	I
⁑Cullen	H157511	7		•					•		•		•	•	•	•			II
⁑Drumskimly Lough	H134525	7			•		•	•	•		•			•	•				I
⁑Glenross/Rossgweer	H186567	7							•		•		•	•	•	•		•	II
⁑TONNAGH LOUGH	H103535	10	•	•	•			•	•		•		•		•	•		•	I
Camagh Bay, Lwr.L.Erne	H159537	1									•								I
Drumcose Lough	H185506	2									•				•				I
⁑Lowery, Lwr. L. Erne	H108650	4						•			•		•	•					I
Drumderg Lough	H294220	1									•								I
Duvoge River	H294217	1				•													III
⁑Aghakillymaud	H267327	9	•		•			•	•		•		•	•	•			•	I
⁑Arney R. (Drumane B.)	H236365	1				•													III
Lough Barry	H274359	2								•	•								I
Cleenish Island Loughs	H260392	7			•		•	•	•	•	•			•					I
⁑Cornaleck,Upp.L.Erne	H296314	6	•								•		•	•			•	•	I
Corracoash Lough	H247340	5			•				•		•			•	•				I
Lough Derg	H265354	4	•					•			•				•				I
Derryallen Lough	H243332	5						•		•	•			•	•				I
⁑Drumanacabranagher	H210356	7		•	•				•					•	•	•		•	II
Drumhirk Lough	H277373	5						•	•	•	•			•					I
R.Erne,Cleenish viaduct	H257385	1				•													III

APPENDIX (Contd.)

Site	Grid Ref	No	A.g	A.j	B.p	Cas	Clu	Cpa	Cpm	E.c	I.e	I.p	L.s	L.q	P.n	S.d	Ssa	Sst	Site type
‡MILL LOUGH	H243383	10	•		•			•	•	•	•		•	•			•	•	I
Lough Nabodeen	H286368	4								•	•		•					•	I
Rossdoney Quay	H253358	2				•					•								III
Lough Acrussel	H255411	2	•								•								I
Ardhowen	H240432	6	•						•	•	•		•					•	I
Ballaghmore Lough	H217438	4			•				•		•				•				I
‡Ballydoolagh Lough	H284477	5						•	•	•	•				•				I
‡Breandrum Lough	H250432	7	•		•			•	•	•	•				•				I
‡Lough Coole	H255435	5	•		•				•	•	•								I
‡Drumcullion	H242498	2												•	•				II
Drumgay Lough	H247478	3								•	•		•						I
Feddan	H295462	5		•					•		•			•		•			II
Lough Galliagh	H223447	4						•	•		•			•					I
Inishkeen	H250410	4							•	•	•		•						I
Kinarla Lough	H216452	1						•											I
Mullanskea	H288456	2												•	•				II
Racecourse Lough	H243453	1	•																I
‡Silverhill Quarry	H213453	6								•	•	•		•	•			•	IV
Sillees R.(Drumrainy B.)	H230402	1				•													III
Trory Lough	H233477	4						•	•	•	•								I
Drumsloe Lough	H283517	2	•										•						I
‡Killee Lough	H294504	8					•	•	•	•	•		•	•	•				I
Liscreevin Lough	H203577	3						•			•			•					I
Sidaire	H245534	2												•	•				II
‡Tullavy	H243513	4		•										•	•	•			II
Ballinamallard River	H240522	1				•													III
‡Aghagrefin F,N,R,	H212660	7		•				•	•					•	•	•		•	II
Black Lough	H236607	4						•		•	•				•				I
Oghill	H219664	5		•					•				•			•		•	II
Glendurragh River	H203643	1													•				III
Parkhill Lough	H227625	5							•	•	•			•	•				I
Raw Lough	H251618	5						•		•	•			•	•				I
‡CARGIN LOUGH	H365273	11	•	•	•			•	•	•	•		•	•	•			•	I
‡CORRACOASH/CORRAHARRA	H355227	10	•		•			•	•	•	•		•	•	•			•	I
Crom, Upper L. Erne	H363237	3	•							•	•								I

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APPENDIX (Contd.)

Site	Grid Ref	No	A.g	A.j	B.p	Cas	Clu	Cpa	Cpm	E.c	I.e	I.p	L.s	L.q	P.n	S.d	Ssa	Sst	Site type
Derrycanon Lough	H324255	1									•								I
Derrymacrow Lough	H360250	5	•		•			•		•	•								I
Derryvore, Upp. L. Erne	H353237	6	•	•		•				•	•			•					I
Friar's Lough	H360268	6	•	•				•		•	•		•						I
GORTGRANAGH/MONELEGNY	H356293	11	•	•	•	•			•		•		•	•	•	•		•	II
‡Inisherk, Upp. L. Erne	H354254	6	•	•	•						•		•					•	I
Inishfendra, U. L. Erne	H370230	3	•								•		•						I
Killymacken Lough	H330205	4			•					•	•			•					I
Killynacran Lough	H386266	6				•		•			•		•	•				•	I
Killynick	H341203	5	•		•						•			•				•	II
Kilturk Lough	H370260	7	•					•	•	•	•		•	•					I
Moninea	H303213	1												•					II
Lough Nalughoge	H363247	6	•						•	•	•		•	•					I
Ports Lough	H352260	4								•	•		•	•					I
‡Reilly, Upper L. Erne	H342257	7	•	•						•	•			•	•			•	I
Sand Lough	H378262	3								•	•			•					I
Woodford River	H359223	3	•			•				•									III
‡Woodford River	H345201	1				•													III
Lough Corban	H314378	5				•		•			•			•	•				I
Derryhowlaght Lough	H300365	8						•	•	•	•		•	•	•			•	I
Lough Digh	H325324	3	•								•		•						I
Forfey Lough	H385354	3			•						•				•				I
‡INISHCREENRY, U.L.ERNE	H304342	11	•	•	•			•	•		•		•	•	•		•	•	I
‡Inishroosk, U. L. Erne	H316332	6	•		•			•			•			•	•				I
Kilmore Quay, U.L.Erne	H337311	3						•			•			•					I
Lough Napeasta	H395366	5						•	•		•			•	•				I
‡Lough Narye	H396338	5	•					•		•	•		•						I
Tully South	H355305	6		•					•				•	•	•	•			II
Cornafannoge Lough	H337416	4			•					•	•				•				I
‡Derrin Lough	H333484	5		•						•	•			•	•				I
Lough Eyes	H324434	2								•	•								I
Lough Skale	H310441	1								•									I
Tempo R. (Drumlone B.)	H333423	3			•	•									•				III
‡Topped Mountain Lough	H310452	4	•							•	•		•						I
‡WATSON'S LOUGH	H307496	10	•				•	•	•	•	•		•	•	•			•	I

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APPENDIX (Contd.)

Site	Grid Ref	No	A.g	A.J	B.p	Cas	Clu	Cpa	Cpm	E.c	I.e	I.p	L.s	L.q	P.n	S.d	Ssa	Sst	Site type
‡Lough Mulshane	H319509	5		•						•				•	•	•			I,II
Dummys Lough	H487274	5						•		•	•		•				•		I
R.Finn (Gortnacarrow B.)	H434205	4				•		•		•	•								III
‡Kilmacbrack Lough	H405297	5			•					•	•			•	•				I
Ballagh	H430308	1				•													III
Black Lough	H484407	1								•									I
Cornagague Lough	H473303	4	•					•			•		•						I
Lough Corry	H465364	3	•	•						•									I
Lough Cushkeery	H486398	1													•				I
Lough Lea	H403363	2								•	•								I
Mill Lough	H465314	5					•	•	•	•	•								I
Mt. Sedborough Lough	H446310	3			•						•				•				I
Lough Nabraddagh	H493397	1													•				I
Colebrooke R. (Agheeter)	H450464	1				•													III
Creagh	H402473	3		•											•	•			II
‡Inver Lough	H517313	5			•				•	•	•		•						I
Inver Bog	H524309	4	•	•												•		•	II

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A PRELIMINARY LIST OF THE IRISH AUCHENORRHYNCHA (HOMOPTERA).

Michael de Courcy Williams

Introduction

The Irish fauna of Auchenorrhyncha, commonly known as leafhoppers and planthoppers, was first summarised by Halbert (1935) in a paper which dealt primarily with the Irish Heteroptera. In that paper Halbert included a list of 128 named Auchennorrhyncha. Halbert (loc. cit.) also commented at that time on the paucity of published work on which to rely for the group in Ireland. Halbert was able to quote only two of his own earlier works (Halbert, 1907, 1912) as the main source then of published records for Ireland. The group remains little studied here. There have been a number of more recent faunal works which have however dealt primarily with a restricted area, namely the Burren limestone region of Co. Clare (see Richards, 1961; Lansbury, 1965; Morris, 1974). This unique area of limestone pavements with grasslands, scrub and woodlands harbours an exceptional fauna. Chief of those studies is the comprehensive and detailed work by Morris (1974) on the grassland leafhopper fauna. Morris (loc. cit.) coincidently, records 128 species from the Burren, of which 30 were additions to the Irish list. One species, initially recorded by Lansbury (1965) from a single female specimen as Cixius simplex Herrich-Schaeffer ?, has been left out of the current list in order to await confirmation of its status in Ireland. Lansbury's record was included by Morris (1974) in his list of Burren species.

Published records of the occurrence of various species for Ireland, including some first records, are contained in the series of keys to the British fauna by LeQuesne (1960, 1965, 1969) and LeQuesne and Payne (1981). More recently Gillham (1987), LeQuesne (1987) and de Courcy Williams (1989) have noted additional species to the Irish fauna. However, many more additions can be expected.

A summary of our knowledge of the Irish fauna is now appropriate in order to promote both an interest in the fauna and the publication of relevant information. It is hoped that this will be facilitated by the collation of previous records and the updating of the nomenclature of older records as reflected in the check-list presented below. The list is considered

preliminary for two reasons. Firstly, only a proportion of the expected fauna is covered and, as noted above, further additions are anticipated. Secondly the difficulties in making correct determinations in certain genera necessitates further work, both in confirming the older records and in having confidence in adding species to the fauna.

Although a large and difficult group, there have been some taxonomic works of high quality dealing with the Auchenorrhyncha. The keys of Ribaut (1936, 1952), concerned with the French fauna, set an early high standard which highlighted the necessity of making genitalia dissections, and also the need for good illustrations in species identification. LeQuesne (1960, 1965, 1969 and in LeQuesne and Payne, 1981) has published over several years a series of keys, where none previously existed, for the British fauna of Auchenorrhyncha. Recently Ossiannilisson (1978, 1981, 1983) has revised the Fennoscandian species to a very high standard, including keys with species diagnostics that are well illustrated. However, some (60-70) species that are known to occur in Britain are not included in Ossiannilisson's (loc. cit.) keys. The work is nonetheless a valuable reference source for workers here.

The following list of Auchenorrhyncha is based on Halbert (1935), and follows the nomenclature enunciated by Ossiannilisson (loc. cit.) For clarification, specific names which were used by Halbert, but are now considered incorrect, are indicated in brackets and are indented below the currently accepted name. Subsequent to Halbert (1935), 53 species have been added by five authors in nine publications. These additions are indicated in the list by a superscripted number which refers to the publication in which the species is mentioned. These are as follows: 1 = Cross (1974), one addition; 2 = de Courcy Williams (1989), two additions; 3 = Gillham (1987), four additions; 4 = LeQuesne (1960), five additions; 5 = LeQuesne (1965), one addition; 6 = LeQuesne (1969), four additions; 7 = LeQuesne (1987), one addition; 8 = LeQuesne & Payne (1981), five additions; 9 = Morris (1974), 30 additions.

PROVISIONAL LIST OF IRISH AUCHENORRHYNCHA

CICADOMORPHA

CERCOPIDAE

APHROPHORA

alni (Fallén, 1805)

alpina Melichar, 1900
(as myricae Edwards, 1926)

salicina (Geoze, 1778)
(as salicis (DeGeer, 1773))

PHILAENUS

spumarius (Linnaeus, 1758)

NEOPHILAENUS

campestris (Fallén, 1805)

lineatus (Linnaeus, 1758)

CICADELLIDAE

ULOPA

reticulata (Fabricius, 1794)

MEGOPHTHALMUS

scanicus (Fallén, 1806)

CICADELLA

viridis (Linnaeus, 1758)

lasiocarpae Ossiannilsson, 1981[7]

GRAPHOCEPHALA

fennahi Young, 1977[1]
(as coccinea Forster, 1771)

EVACANTHUS

acuminatus (Fabricius, 1794)

interruptus (Linnaeus, 1758)

IDIOCERUS

lituratus (Fallén, 1806)

stigmaticalis Lewis, 1834[2]

METIDIOCERUS

elegans (Flor, 1861)[2]

POPULICERUS

albicans (Kirschbaum, 1868)
confusus (Flor, 1861)
laminatus (Flor, 1861)[9]

TREMULICERUS

tremulae (Estlund, 1796)[9]

IASUS

lanio (Linnaeus, 1761)

ONCOPSIS

alni (Schrank, 1801)
avellanae Edwards, 1920[9]
flavicollis (Linnaeus, 1761)[3]
subangulata (J. Sahlberg, 1871)[3]
tristis (Zetterstedt, 1840)
(as rufusculus (Fieber, 1868))

MACROPSIS

cerea (Germar, 1836)
fuscula (Zetterstedt, 1828)
(as rubi (Boheman, 1845))
impura (Boheman, 1847)
prasina (Boheman, 1852)
(as virescens J. Sahlberg, 1871
nec.Fabricius, 1794)
scotti Edwards, 1920[5]
scutellata (Boheman, 1845)
(as tibialis (Scott, 1874))

AGALLIA

venosa (Fallén, 1806)

EUPELIX

cuspidata (Fabricius, 1775)
(and as producta Germar, 1838)

APHRODES

bicinctus (Schrank, 1776)
(as nervosus (Schrank, 1781))

PLANAPHRODES

bifasciatus (Linnaeus, 1758)
(as tricinctus (Curtis, 1836))

ANOSCOPUS

albifrons (Linnaeus, 1758)
(and as limicola (Edwards, 1908))

flavostriatus (Donovan, 1799)

histrionicus (Fabricius, 1794)

STRONGGYLOCEPHALUS

agrestis (Fallén, 1806)

DELTOCEPHALUS

maculiceps Boheman, 1847

pulicarius (Fallén, 1806)

COSMOTETTIX

panzeri (Flor, 1861)[9]

AROCEPHALUS

punctum (Flor, 1861)[9]

TURRUTUS

socialis (Flor, 1861)

ADARRUS

occellaris (Fallén, 1806)

JASSARGUS

distinguendus (Flor, 1861)
(and as repletus (Edwards, 1908))

MOCUELLUS

metrius (Flor, 1861)

ARTHALDEUS

pascuellus (Fallén, 1826)

PSAMMOTETTIX

albomarginatus Wagner, 1941[6]
cephalotes (Herrich-Schaeffer,1834)
(as normani (Scott, 1881))
confinis (Dahlbom, 1850)
(as thenii (Edwards, 1915))
nodosus (Ribaut, 1925)[6]
putoni (Then, 1898)[6]
sabulicola (Curtis, 1837)
striatus (Linnaeus, 1758)

ALLYGUS

mixtus (Fabricius, 1794)

LIMOTETTIX

striola (Fallén, 1806)

CONOSANUS

obsoletus (Kirschbaum, 1858)

EUSCELIS

incisus (Kirschbaum, 1858)
(as plebejus (Fallén, 1806))
lineolatus Brullé, 1832

STREPTANUS

aemulans (Kirschbaum, 1868)
(as sahlbergi (Reuter, 1880))
marginatus (Kirschbaum, 1858)[9]
sordidus (Zetterstedt, 1828)

MACUSTUS

grisescens (Zetterstedt, 1828)

PALUDA

vitripennis (Flor, 1861)[6]

MOCYDIA

crocea (Herrich-Schaeffer, 1836)

THAMNOTETTIX

confinis (Zetterstedt, 1828)
(as prasina Fallén, 1806)
dilutior (Kirschbaum, 1868)

SPEUDOTETTIX

subfusculus (Fallén, 1806)

IDIODONUS

cruentatus (Panzer, 1799)

LAMPROTETTIX

nitidulus (Fabricius, 1787)
(as splendidulus (Fabricius, 1803))

CICADULA

aurantipes (Edwards, 1894)[9]
frontalis (Herrich-Schaeffer,1835)
(as antennata (Boheman, 1845))
intermedia (Boheman, 1845)
(and as lunulifrons (J.Sahlberg, 1871))
persimilis (Edwards, 1920)[9]
quadrinotata (Fabricius, 1794)

ELYMANA

sulphurella (Zetterstedt, 1828)

SONRONIUS

dahlbomi (Zetterstedt, 1840)

MACROSTELES

fieberi (Edwards, 1889)
frontalis (Scott, 1875)
hovarthi (Wagner, 1935)
(as warioni (Edwards, 1908))
laevis (Ribaut, 1927)[9]
ossiannilssoni Lindberg, 1954[9]
septemnotatus (Fallén, 1806)
sexnotatus (Fallén, 1806)
viridigriseus (Edwards, 1924)[3]

BALCLUTHA

punctata (Fabricius, 1775)

ALEBRA

albostriela (Fallén, 1826)

NOTUS

flavipennis (Zetterstedt, 1826)

FORCIPATA

citrinella (Zetterstedt, 1828)

EMELYANOVIANA

mollicula (Boheman, 1845)[8]

CHLORITA

viridula (Fallén, 1806)

EMPOASCA

decipiens Paoli, 1930[9]

vitis (Gothe, 1875)
(as flavescens (Flor, 1861)
nec. Fabricius, 1794)

KYBOS

betulicola (Wagner, 1955)[8]

smaragdula (Fallén, 1806)[9]

strigilifera (Ossiannilsson, 1941)[9]

EURHADINA

pulchella (Fallén, 1806)

EUPTERYX

atropunctata (Goeze, 1778)[8]
aurata (Linnaeus, 1758)
cyclops Matsumura, 1960[9]
filicum (Newman, 1853)[9]
melissae Curtis, 1837
notata Curtis, 1837
signatipennis (Boheman, 1847)
stachydearum (Hardy, 1850)
urticae (Fabricius, 1803)
vittata (Linnaeus, 1758)

RIBAUTIANA

debilis (Douglas, 1876)[9]
tenerrima (Herrich-Schaeffer, 1834)
ulmi (Linnaeus, 1758)

LINNAVUORIANA

sexmaculata (Hardy, 1850)
(as sexpunctata (Fallén, 1826))

TYPHLOCYBA

bifasciata Boheman, 1851
quercus (Fabricius, 1777)

LINDBERGINA

aurovittata (Douglas, 1875)[9]
(as pandellei (Lethierry, 1876))

FAGOCYBA

carri (Edwards, 1914)[9]
cruenta (Herrich-Schaeffer, 1838)[9]

EDWARDSIANA

avellanae (Edwards, 1888)[9]
bergmani (Tullgren, 1916)[8]
crataegi (Douglas, 1876)[9]
frustrator (Edwards, 1908)[9]
geometrica (Schrank, 1801)
lethierryi (Edwards, 1881)
rosae (Linnaeus, 1758)

ALNETOIDIA

alneti (Dahlbom, 1850)

ARBORIDIA

parvula (Boheman, 1845)

ZYGINA

angusta Lethierry, 1874[8]
flammigera (Geoffroy in Fourcroy, 1785)
tiliae (Geoffroy in Fourcroy, 1785)[9]

FULGOROMORPHA

CIXIIDAE

PENTASTIRIDIUS

leporinus (Linnaeus, 1761)

TACHYCIXIUS

pilosus (Oliver, 1791)

CIXIUS

cunicularis (Linnaeus, 1767)
distinguendus Kirschbaum, 1868
(as brachycranus Scott, 1870)
nervosus (Linnaeus, 1758)
similis Kirschbaum, 1868
(as stigmaticus (Germar, 1818))

DELPHACIDAE

KELISIA

guttula (Germar, 1818)[4]
guttulifera (Kirschbaum, 1868)[9]
pallidula (Boheman, 1847)[9]
punctulum (Kirschbaum, 1868)[4]
sabulicola Wagner, 1952[4]
vittipennis (Sahlberg, 1868)

ANAKELISIA

perspicillata (Boheman, 1845)[9]

STENOCRANUS

fuscovittatus (Stål, 1858)[9]
longipennis (Curtis, 1837)
minutus (Fabricius, 1787)

CHLORIONA

smaragdula (Stål,1853)

EUCONOMELAS

lepidus (Boheman, 1847)
(and as limbatus Fabricius, 1794)

CONOMELUS

anceps (Germar, 1821)

DELPHAX

pulchellus (Curtis, 1833)

DELPHACINUS

mesomelas (Boheman, 1850)

EURYSA

lineata (Perris, 1857)

DITROPIS

pteridis (Spinola, 1839)

STIROMA

affinis (Fieber, 1866) bicarinata (Herrich-Schaeffer, 1835)[9]

CRIOMORPHUS

albomarginatus Curtis, 1833

DICRANOTROPIS

hamata (Boheman, 1847)

MEGAMELUS

notula (Germar, 1880)

MEGAMELODES

quadrimaculatus (Signoret, 1865)

MUELLERIANELLA

fairmairei (Perris, 1857)

LAODELPHAX

striatellus (Fallén, 1826)[4]

HYLEDELPHAX

elegantulus (Boheman, 1843)[4]

JAVESELLA

discolor (Boheman, 1847)
dubia (Kirschbaum, 1868)
(as difficilis Edwards, 1888)
forcipata (Boheman, 1847)
obscurella (Boheman, 1847)
(as discreta Edwards, 1888)
pellucida (Fabricius, 1794)

TYRPHODELPHAX

distinctus (Flor, 1861)

CALLIGYPONA

reyi (Fieber, 1866)[3]

PARADELPHACODES

paludosus (Flor, 1861)[9]

MUIRODELPHAX

aubei (Perris, 1857)

PARALIBURNIA

adela (Flor, 1861)
(as signoreti (Scott, 1870))
clypealis (J. Sahlberg, 1871)[9]

FLORODELPHAX

leptosoma (Flor, 1861)

STRUEBINGIANELLA

lugubrina (Boheman, 1847)

ONCODELPHAX

pullulus (Boheman, 1852)

ISSIDAE

ISSUS

coleoptratus (Fabricius, 1781)

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Bull. Ir. biogeog. Soc. No. 12 (1989)

FIELD NOTES

FIELD EXCURSION TO KILLAKEE WOODS, CO. DUBLIN, 11 FEBRUARY 1989.

Michael Wyse Jackson

Seven people attended this field-meeting, which was intended as an introduction to bryophytes and overwintering invertebrates in the mainly deciduous woods of the Massey estate, Killakee, Co. Dublin (just across the road from the Killakee House (0120238)). On this very wet day, however, only bryophytes were studied, in the woods, on the roadside walls, behind the Killakee House and in the abandoned walled garden of the Massey estate. The field trip was followed up by a laboratory session in the School of Botany, Trinity College, Dublin. Though no obvious rarities were encountered, it was felt that it would be worthwhile listing the species found, for the benefit of those who might wish to visit the site and add to this short inventory. Table 1 lists saxicolous species (all mosses) growing on walls by the Killakee House. Table 2 lists species growing in the woodland or walled garden, on the ground (G), on rotting tree stumps (R) and as epiphytes (E). Nomenclature for the mosses follows Smith (A. J. E. 1978, The Moss Flora of Britain and Ireland. Cambridge University Press, Cambridge), and for the liverworts, Watson (E. V. 1981, British Mosses and Liverworts. 3rd ed. Cambridge University Press, Cambridge).

TABLE 1. Saxicolour species growing on the walls by Killakee House.

Bryum capillare, Cratoneuron filicinum, Grimmia pulvinata, Homalothecium sericeum, Rhynchostegiella tenella, Schistidium apocarpum, Tortula muralis, Tortula ruralis.

TABLE 2. Species growing in the woodland or walled garden.
For abbreviations, see text.

Musci

Amblystegium serpens (G), Atrichum undulatum (G), Brachythecium rutabulum (G), Campylopus introflexus (R), Cirriphyllum piliferum (G), Dicranella heteromalla (R), Dicranum scoparium (G) + (R), Eurhynchium praelongum (G),

Fissidens taxifolius (G), Hypnum cupressiforme var. cupressiforme (G), Hypnum mammillatum (E), Mnium hornum (G), Orthotrichum lyellii (E), Plagiomnium undulatum (G), Pogonatum aloides (G), Polytrichum formosum (G), Thamnobryum alopecurum (G), Thuidium tamariscinum (G), Tortula laevipila var. laevipila (E), Ulota crispa (E), Zygodon viridissimus (E).

Hepaticae

Conocephalum conicum (G), Frullania dilatata (E), Lophocolea cuspidata (R), Metzgeria furcata (E), Pellia endiviifolia (G), Pellia epiphylla (G), Plagiochila asplenioides (G).

Thanks to all involved, especially Drs. D. L. Kelly and Q. C. B. Cronk who were responsible for many of the identifications.

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THE ROSY NEW ZEALAND FLATWORM, GEOPLANA SANGUINEA (MOSELEY): A RECORD FROM WEST CORK (TRICLADIDA: GEOPLANIDAE).

Martin C. D. Speight

Whilst hunting the Kerry Slug (Geomalacus maculosus Allman) along the periphery of its range in Cork, on 4th December 1988 I came across a specimen of this peculiar flatworm by peeling back moss capping a sandstone boulder. The flatworm, which at rest looks like nothing more than a little wrinkled piece of pinkish plastic, was motionless on the underside of the moss, where it lay against the stone. The locality (W1833), near Castletownshend, was rough pasture almost at sea level, with sandstone outcroppings, in this instance on the N face of a gully through which the road passed.

The two previous records of G. sanguinea (Moseley) in Ireland are both (O'Connor et al., 1983) from suburban gardens, one from Belfast and the other from Dublin. In Great Britain the species has been found on the coast of southern England (Poole, Dorset). It is also recorded from the Scilly Isles, off the coast of SW England. It is tempting to suggest there may be no coincidence in the fact that all the British Isles records so far are from localities close to the coast. It will be interesting to see whether records from inland localities are forthcoming. The present instance, of a specimen being found far from any urban centre of any size and as far as it could be from the other Irish records, suggests this unlikely organism may now be very widely distributed in Ireland, even though the first published record from the British Isles dates from only 1981.

I am indebted to Mark Holmes for determining the beast and to Jim O'Connor for drawing my attention to previous Irish records. The specimen on which this note is based now resides in a bottle in the spirit collection of the National Museum of Ireland, in Dublin. It was identified using Ball and Reynoldson (1981).

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Bull. Ir. biogeog. Soc. No. 12

A FURTHER IRISH RECORD OF GEOPLANA SANGUINEA (MOSELEY) (TRICLADIDA: GEOPLANIDAE)

T. Bolger

Large numbers of the planarian, Geoplana sanguinea (Moseley), were found in two gardens at Skull, Co. Cork, during December 1988. They were observed in soil and occasionally moving about on pathways. This is the fourth record of this species from Ireland (O'Connor et al 1983; Speight, 1989) but it is of particular interest as Speight's record is from Castletownshend, which is in the same area of West Cork, and perhaps indicates the presence of a locally widespread population originating from a single introduction.

Little appears to be known about this species. A search through the 1978 to 1988 issues of Zoological Record yielded only three references, Windsor (1979), Jones (1981) and O'Connor et al (1983), all of which simply record new locations for the species. The genus has a widespread distribution, particularly in the southern hemisphere, and occurs in places such as Australasia, South America and Hawaii (Davis, 1986).

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Bull. Ir. biogeog. Soc. No. 12

A NEW IRISH LOCATION FOR GAMMARUS PULEX (L.) (CRUSTACEA: AMPHIPODA).

M. J. Keatinge

In January 1988 the Brittas River in County Wicklow (Grid Reference 00221) was sampled for gammarids. A number of these were, as expected, Gammarus duebeni (Lilljeborg); the remaining animals were identified as Gammarus pulex (L.). G. pulex has now been found in samples from the river and its tributaries between a point 1 km. up-river of Brittas village and its confluence with the Liffey at Ballyward. For much of this stretch it is the only gammarid present. Further studies of its impact on the stream fauna are ongoing.

G. pulex was reported from Ireland as early as 1912 (Sexton, 1912); the animals in question had been collected in Lough Erne and Lough Keenaghan by Major Trevelyan and deposited in the British Museum. Reid (1939) re-examined these and other gammarids from Ireland in the collection, and concluded "that except for a few of the specimens from Lough Erne, all were undoubtedly G. duebeni: the few were G. pulex". Hynes (1951) further examined and identified these remaining 'few' and identified those from Lough Kennaghan as a male and a female Gammarus lacustris Sars, and those from Lough Erne as a male and female G. lacustris and a male and female G. duebeni. Hynes concludes "there are no undoubted records of the occurrence of G. pulex in Ireland".

Strange and Glass (1979) have outlined the introduction, in 1958 and 1959, and subsequent spread of G. pulex through the catchments of Northern Ireland. The present samples from the Brittas river are the first records from a water in the Republic of Ireland.

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Bull. Ir. biogeog. Soc. No. 12 (1989)

BOOK REVIEW

PROVISIONAL ATLAS OF THE TICKS (IXODOIDEA) OF THE BRITISH ISLES.

K. P. Martyn.

62pp. Published by the Biological Records Centre, 1988. £4.00 Stg. Available from ITE Publications, Merlewood Research Station, Grange-over-Sands, Cumbria, England LA11 6JU.

Owing to their small size and the difficulties involved in sampling and identifying them the Acari have yet to receive the attention that they deserve. Thus it is pleasing that at least one group of Acari has been surveyed and the distributions of its members throughout the British Isles mapped. The result is the Provisional Atlas of the Ticks (Ixodoidea) of the British Isles.

The provisional nature of this atlas can not be doubted. The records on which the atlas is based are all derived from museum collections. Past literature records, which would require verification, have not been used. The net result is that the distribution maps are incomplete and patchy. A glance at the coverage map shows that less than half the 10km squares in Great Britain have any records at all. Ireland is especially poorly covered, largely because the bulk of the National Museum of Ireland's collections were on loan and therefore unavailable to the compilers of the atlas.

The book begins with a couple of introductory pages in which are described some general aspects of tick biology, details of the sources from which the atlas was compiled and how the records were processed. These are followed by a checklist and a selected bibliography. The rest of the book consists of the atlas proper. For each species there is a small account of its biology, a distribution map and, most usefully, a numerical statement of the range of hosts used by each tick gleaned from the specimen data labels.

A minor criticism is that several of the maps are poorly reproduced. In some the east coast of Ireland is almost indecipherable. In others records from the Shetland Islands are very difficult to make out as the dots blend in nicely with the rough coastline of the islands. More importantly no

differentiation in the dates of records has been made on the maps. Huge changes have occurred in agricultural practice since the 1950s, with consequent changes in the distribution and abundance of many species. Thus it is important that records from before and after 1950 should be differentiated in an atlas such as this.

Despite its shortcomings this book will be useful to anyone interested in ectoparasites of vertebrates. It also shows how little is known about ticks in the British Isles. For example, more specimens of Ixodes agronophorus have been taken from coypu, a recently introduced species which has been studied because it is a pest, than from any native host species. As taxonomic research seems to be in decline at the moment it is unlikely that this atlas will be updated in the near future, but perhaps its publication will help foster an interest in these important parasites.

P. Somerfield.

REQUEST FOR IRISH RECORDS OF CLADOCERA.

Mr. John Hearn, Scheme Organiser, Cladocera Mapping Scheme, 3 Waverley Way, Carshalton, Surrey, England SM5 3LQ, would like to receive Irish records of Cladocera, published or unpublished, in connection with a planned paper on the distribution of Cladocera in Ireland.

INSTRUCTIONS TO CONTRIBUTORS

1. Manuscripts should follow the format of articles in Bulletin No. 12.

2. Manuscripts should be submitted as typed copy on A4 paper, using double-spacing and 2.5 cm (1 inch) margins.

3. It helps if the copy is clean and not embellished with a mass of super-imposed corrections.

4. Figures should be submitted in a size for reduction to A5 without any loss of detail.

5. Records: please ensure that, at minimum, the following information is incorporated in each record included in a manuscript:-
   (a) latin name of organism.
   (b) statement of reference work used as the source of nomenclature employed in the text. The describer's name should be also given when a zoological species is first mentioned in the text.
   (c) locality details including at least a four figure Irish Grid reference (e.g. M 0978), county, vice-county number and some ecological data about the collection site, plus date of capture.
   (d) collector's name and determiner's name (where different from collector's name), and
   (e) altitude data should be included where relevant.

6. Manuscripts should be submitted to the Editor, Dr. J. P. O'Connor, at the following address:- National Museum of Ireland, Kildare Street, Dublin 2, IRELAND.

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