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The Glasgow Naturalist

The Journal of the
ANDERSONIAN NATURALISTS OF GLASGOW

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EDITORIAL

In this issue of *The Glasgow Naturalist*, the first of the eighteenth volume, it is appropriate to note that the journal achieves its jubilee under its present title this year. Part I of volume I was dated 1908. *The Glasgow Naturalist* is, of course, the successor to a series of journals published by the present Society (The Andersonian Naturalists of Glasgow) and its predecessors, beginning with the *Proceedings of the Natural History Society of Glasgow*. The *Proceedings*, after a false start in 1852, were really under way in 1868, and publication has been more or less continuous since then. Five volumes of the *Proceedings* were published in the years 1868 to 1883, when they were succeeded by the *Proceedings and Transactions of the Natural History Society of Glasgow* (New Series). Eight volumes of the journal under this title were published, dated 1883 to 1908 (though the last part of the last volume did not appear until May, 1911). Some confusion may result from the fact that after 1892 the issued parts bore the title "*Transactions of the Natural History Society of Glasgow* (including the *Proceedings of the Society*)", although they were numbered to continue, and listed by the Society as continuing, the *Proceedings and Transactions* (New Series). In the meantime *The Glasgow Naturalist* had begun publication, and was regarded as forming the Third Series of the *Proceedings and Transactions*. During the period 1893 to 1908, three valuable volumes of the *Annals of the Andersonian Naturalists' Society* were also produced, and two subsequent parts (constituting volume 4, and ending the series) were published in 1914 and 1925.

The Natural History Society of Glasgow (founded in 1851) amalgamated in January 1931 with the Andersonian Naturalists' Society (1885) and the Microscopical Society of Glasgow

(1886) to form the Glasgow and Andersonian Natural History and Microscopical Society, which name was shortened in December 1956 to The Andersonian Naturalists of Glasgow.

As is the case with most journals, *The Glasgow Naturalist* and its predecessors have varied over the years, both in regularity of appearance and in value of content. It is, of course, almost impossible to assess the scientific standing of a journal at any particular time but, measured by the value of particular issues to later workers, it is safe to say that these Glasgow journals had several periods of very high standard. Among the more outstanding publications which could be mentioned are the series of papers published in the eighteenth-eighties by J. A. Harvie-Brown on his visits to, and on the ecology of, the smaller Hebrides; and a palaeobotanical paper of great significance by Robert Kidston in 1900. On the other hand, although *The Glasgow Naturalist* continued publication through both World Wars, it went into decline after each. There was a very bad patch in the nineteen-twenties, when issues were nine years in arrears and for some years no scientific papers were published, and present readers will remember the irregularity of issue and lack of scientific content for some years after 1947. The standard was restored between 1951 and 1954 by the efforts of the present Editor's predecessor, Miss Mabel G. Scott, and the then members of the Publishing Committee. From the attitude of The Royal Society, in awarding Grants-in-aid for specific papers published, and of the various authorities abstracting scientific literature throughout the world, it can be assumed that *The Glasgow Naturalist* is once again a journal of some standing. Without false pride, The Andersonian Naturalists of Glasgow can be satisfied that, on this jubilee of *The Glasgow Naturalist*, one of their constitutional objects—that of encouraging the study of natural history by publishing transactions—is again being carried out.

—W. D. R. H.

PLANT RECORDING IN CLYDESDALE

By R. MACKECHNIE

(MS. received 24th March, 1958, being the Presidential Address delivered on 11th February, 1958)

Recording the distribution of plants and animals is by tradition one of the activities of all Natural History Societies. During the past four years this activity, in so far as it concerns flowering plants and ferns, has been linked to the requirements of the Distribution Maps Scheme organised by the Botanical Society of the British Isles. When that scheme is completed it is anticipated that the energies of our local recorders of all forms of plant and animal life will be diverted to assembling the records for the new Clyde Card Catalogue.

With recording so much in our thoughts it seemed appropriate that I should address you this evening on the subject of plant recording in Clydesdale. By this very appropriate name the county of Lanark was formerly known, and to that county my remarks will chiefly apply; in particular to its earlier records and the people who made them. I should perhaps forestall your criticism by admitting that this account is unlikely to be the last word on the subject; there are some possible sources of information still untapped.

What seems to be the earliest record of a Lanarkshire plant (and, indeed, the first record of this plant in Scotland) is John Ray's discovery of the club-moss *Lycopodium alpinum*, in 1661, on Anderkin (Lowther) Hill, near Wanlockhead. It is noteworthy that this first recorded species should be a mountain plant, in a county not essentially hilly, and gratifying that it should stand to the name of so outstanding a naturalist. The record was made at the time when Ray, studying divinity at Cambridge, was finding himself at variance with ecclesiastical authority. Soon after this he decided to leave the University and devote himself to natural history. Ray's scientific achievements, accomplished in a country suffering from the aftermath of civil war, have been summed up for us by Canon Raven in his account of Ray's life:—" His greatness is that, in a time of transition and universal turmoil, he saw the need for precise and ordered knowledge, set himself to test the old and explore the new, and by dint of immense labour in the field and in the study, laid the foundations of modern science in many branches of zoology and botany. He studied, corrected and collated the existing literature; he collected, identified, investigated, described and classified

mammals, reptiles, fishes and insects, cryptogams and all known plants; he contributed richly to the advance of geology, and made observations in astronomy and physics; he was a pioneer in the study of language, and first revealed the importance of dialect and folk speech; he did as much as any man of his time to develop a new understanding and interpretation of religion; more, perhaps, than any man he enabled the transition from the mediaeval to the modern outlook." His true greatness lies, it seems to me, not only in his great achievements but in the effect they had on himself; an earlier biographer assures us that he remained "humble, courteous and affable" in his conversation, "strictly just" in his dealings with others, and all told combined within himself so many admirable qualities that he must remain a model for naturalists of all time.

A much less familiar name is that of Dr. John Hope. An Edinburgh man, he became an M.D. of Glasgow, a Fellow of The Royal Society and, in 1761, Regius Keeper of the Edinburgh Botanic Garden and Professor of Botany in the University. Among his students was J. E. Smith, and he almost certainly helped Lightfoot to plan his Scottish tour. His botanical diary, published in the "Notes from the Royal Botanic Garden," contains list of plants found in the Edinburgh district in 1765 and also, and of greater interest, a list of the sheets in his own herbarium. Dr. Fletcher tells me that he cannot trace this collection, which is a pity, because the list contains several records of much importance. The sheets were listed in accordance with the Linnaean system of classification, then becoming popular; it lasted till about 1820, when it was superseded by the "natural system" of Bentham and Hooker.

Hope's plants came from both Scotland and England; several were from Arran and Skye. From the former he had specimens of *Hypericum elodes* ("Loch Ramsey"), and *Inula helenium* and *I. (Pulicaria) dysenterica*, both from Kildonan. From Skye he had *Eriocaulon*, the pipewort (Sligachan) and *Schoenus ferrugineus*. The locality of the latter was not specified, but if the record could be substantiated it would antedate by fully a hundred years Brebner's discovery of the plant in Perthshire.

It is not always easy to identify Hope's names with any in current use; in particular his "*Arenaria lacifolia*" and "*Saxifraga geum*" ("plentifully on the hills between Inveraray and Taymouth") present problems. Nor can one always be sure of his localities; he repeatedly refers to "Lochend," and while many of these references probably apply to the

Lochend near Leith there are others in Haddington, Kirkcudbright and even Inverness. But his record of *Typha latifolia* from "Lochend Lochrin" strongly suggests the Coatbridge area. A Dr. Irwin had sent him, from the Glasgow area, specimens of *Epimedium alpinum* ("naturalised") and "*Omphalodes verna*," and he had *Ornithopus perpusillus* and *Jasione montana* from Hamilton.

Hope had a pupil, one James Robertson, who was active about 1780. He was the discoverer of *Eriocaulon* in Skye, where he presumably went in the course of his work—he was "employed by the Commissioners of the Annexed States to make a botanical survey of the distant parts of Scotland." This attractive occupation, which we nowadays undertake at our own expense, may have come about in consequence of the '45 rebellion. Robertson seems to have lived near Glasgow, perhaps in Hamilton, for several Hamilton plants in Hope's herbarium came from him—*Veronica montana*, *Melica nutans*, *Malva moschata*, *Serapias latifolia* (*Epipactis helleborine*), *Staphylea pinnata*, *Circaea alpina*, *Ribes alpinum*, *Hypericum humifusum*, *Cardamine impatiens*, *Tragopogon porrifolius*, and from Carnwath he sent *Osmunda* (*Botrychium*) *lunaria*.

The Rev. John Lightfoot, a Gloucestershire man and chaplain to the Dowager Duchess of Portland, travelled in Scotland with Thomas Pennant in 1772, and in consequence wrote "*Flora Scotica*", published in 1777. He acknowledges his indebtedness to the Rev. John Stewart, minister at Killin and later at Luss, who accompanied him in the Highlands and Hebrides and assisted with the "Flora." Stewart was, says Lightfoot, "A most accurate observer of nature's works, and critically versed in the Erse language and in the manners and customs of his country." In addition, he "has the finest private garden and is the best botanist in Scotland." It is, indeed, quite likely that Lightfoot had reason to be grateful to Stewart for assistance in matters other than purely botanical; for an unaccompanied English divine, travel in the Highlands and Islands of Scotland so soon after the '45 might have been a hazardous business.

It would be surprising if "*Flora Scotica*" abounded in Lanarkshire records; there are, in fact, about 20:—Cartland Rocks: *Galium mollugo*, *Campanula latifolia*, *Vicia sylvatica*, *Polypodium aculeatum* (*Polystichum lobatum*), *Trollius europaeus*; Crawford and Leadhills: *Meum athamanticum*, *Viola grandiflora* (*V. lutea*?), *Salix pentandra*; Carnwath: *Betula nana*; and Chatelherault: *Jasione montana*, *Epipactis latifolia* (*E. helleborine*).

Even in those days the Falls of Clyde seems to have been a show-place; Lightfoot writes of "famous falls" and "celebrated falls," and refers repeatedly to Corra Linn, with considerable elasticity in the spelling of the name. This fall, which later inspired a Wordsworth ode, and the others at Bonnington and Stonebyres, became equally well-known for their flora during the nineteenth century. A hydro-electric scheme which robbed the river channel of much of its water came into operation in the early years of the present century; the vegetation suffered and the area is now neglected by field botanists. A survey, aimed at ascertaining how much of the former botanical glory remains, seems to be indicated. "*Flora Scotica*" records *Pyrola rotundifolia*, *Trollius europaeus*, *Saxifraga granulata* and *Vicia orobus* from Corra Linn. The remaining Lanarkshire records are of *Cicuta virosa* ("on the side of Loch-End"), *Epilobium (Chamaenerion) angustifolium* ("among the rocks to the east of Kirk o' Shotts") and *Neottia nidus-avis* ("towards Lanark").

The local minister, the Rev. David Ure, published in 1793 a "History of Rutherglen and East Kilbride," listing more than 120 flowering plants; the list is of interest in being probably the first list of plants for a specific part of the county. Apart from *Lastrea (Dryopteris) cristata*, a probable error, none of the plants listed is unlikely for a country parish, though local botanists would probably be hard put to it to find such plants as *Polystichum lonchitis*, *Scutellaria minor* and *Pilularia globulifera* there now.

The Statistical Account of Scotland, edited by Sir John Sinclair, appeared in 20 volumes over the period 1790-1798. The volumes are not arranged by counties; each deals with a random assortment of parishes, apparently put together in the order in which they reached the editor. The parochial accounts, by the local ministers, are full of interesting information, usually of a practical and statistical nature, but those I have examined were not very informative about natural history.

The prototype of all Clydesdale floras appeared in 1813 when the "*Flora Glottiana*" of Thomas Hopkirk of Dalbeth was published. Hopkirk was a man of substance; his grandfather, a Tobacco Lord, could afford to pay a fine of £20 for refusing nomination to the Town Council. There was a town house near the junction of Dunlop Street and Argyle Street and, later, the country house at Dalbeth. Hopkirk, who was the founder of the Glasgow Botanic Garden, made little use of Lightfoot's records, but frequently quoted Ure's list. He defined the area covered by his "*Flora*" as being "the

country within a few miles of the River Clyde from the Falls above Lanark to its junction with the sea."

The "*Flora*," with its 700 odd species of flowering plants and ferns, is a fascinating book. Some of the records, such as *Circaea alpina*, are dubious; in those days *C. alpina* and *C. intermedia* were not clearly distinguished. Others, including *Betula nana* from Carnwath, are almost certainly errors; this last he quoted from Lightfoot. And what can one make of *Carex depauperata* from Balvie? On the other hand, Hopkirk clarifies Lightfoot's record of *Pyrola rotundifolia* from Falls of Clyde as probably intended for *P. media* (which in those days included *P. minor*). Fashions in agriculture and architecture have changed since Hopkirk's day; then flax was a common crop, and the dodder (*Cuscuta* spp.) parasitised it. Cornfield weeds included the annual cornflower (*Centaurea cyanus*), the poppy (*Papaver rhoeas*) and flax (*Linum usitatissimum*) as well as charlock (*Sinapis arvensis*). Corn cockle (*Agrostemma githago*) and Venus' comb (*Scandix pecten-veneris*) were "common in cultivated fields." and the houseleek (*Sempervivum tectorum*) was "frequent on walls and housetops." *Aquilegia vulgaris* grew "in pastures and on banks of rivers, frequently," and *Teesdalia* "abundantly at Tollcross." The rosebay (*Chamaenerion angustifolium*) was still sufficiently scarce to be localised ("about the banks of the Clyde at Barncluith") and ivy-leaved toadflax (*Cymbalaria muralis*) was "rare on old walls." There are no records of *Hippuris*, *Lemna trisulca*, *Ranunculus lingua* or *Lysimachia (Naumbergia) thyrsiflora*, so presumably Possil Marsh has altered since then, nor do the sedges *Carex fulva (C. hostiana)* and *C. binervis* receive mention.

Hooker, in his "*Flora Scotica*" (1821), quotes liberally from Hopkirk for records of Clydesdale plants, but does not add any of his own, and indeed there seem to have been no published additions until 1832. Then there appeared Patrick's "Popular Description of the Indigenous Plants of Lanarkshire." Little is known of the Rev. William Patrick, author of this first and only Flora of the County of Lanark; by one story he was a "stickit" doctor, and if that is the case medicine's loss undoubtedly was botany's gain. The 20 years which had passed since the "*Flora Glottiana*" appeared had made little difference to the basic flora of the county. *Teesdalia* and *Ornithopus perpusillus* were still in sandy fields at Tollcross, *Agrostemma githago*, *Centaurea cyanus* and *Sinapis arvensis* still grew among the corn and wheat, and flax and houseleek were not yet rarities. But some significant newcomers appear in these pages—*Ranunculus lingua*, *Stellaria glauca (S. palustris)* ("bog beyond Possil"), *Sedum reflexum* ("Craignethan Castle") and *Rosa arvensis* ("in hedges").

The last I have seen in but one Lanarkshire station, and one must suspect a misidentification here. More dubious still are the records of *Cerastium aquaticum* (*Myosoton aquaticum*) ("by the Clyde, etc.") and *Rubus chamaemorus* ("with the former species (*R. saxatilis*) in woods at Cleghorn and Bonnington"). There were signs of increase in a few species—for example rosebay (called here "Persian willowherb") had four localities, and the yellow toadflax (*Linaria vulgaris*) had become "occasional." On the other hand a little cornfield weed, pheasant's eye (*Adonis annua*), mentioned by Hopkirk, is not recorded by Patrick.

The New Statistical Account (1841) was an improvement on its predecessor in two respects; each volume was a county one, and more attention was paid to natural history. The latter feature was probably due in part to the growing interest in natural science. In Lanarkshire the treatment was uneven; of 41 parishes only 16 supplied plant lists, and in several cases the lists were extracts from Patrick's book.

Mention may here be made of the activities of John Hutton Balfour, the occupant from 1846 to 1878 of the chair of botany in Edinburgh. He was an enthusiastic field botanist and, as his diaries published in 1902 show, tireless in organising and leading excursions. The parties of students and friends which he led were, by current standards, enormous, quite often over 100. If, as seems likely, most of the members collected plants, one can imagine the effect of such a visit on the vegetation of a small and choice habitat—unless, of course, strict control on picking was maintained. Balfour visited Lanarkshire nine times between 1848 and 1869. Seven of these trips were to the Lanark area, and the average size of the party was over 100, with a maximum of 143 in 1859. On the first visit, in 1848, the most interesting plants recorded were as follows:—Cartland: *Vicia orobus*, *Galium boreale*, *Jasione montana*, *Daphne laureola*; Corra Linn: *Trollius europaeus*, *Aquilegia vulgaris*, *Saxifraga oppositifolia*, *Galium pusillum* (*G. pumilum*); and Bonnington Linn: *Vicia orobus*, *Equisetum umbrosum* (*E. pratense*).

The subsequent visits yielded some noteworthy additions:—*Trifolium striatum*, *T. filiforme* (*T. micranthum*), *Pyrola ? media* ("not in flower"), *Circaea alpina*, *Pyrola minor*.

A visit to the Wishaw district in 1853 yielded *Circaea lutetiana*, *C. alpina* and *Equisetum umbrosum*, while Cathcart, Busby and East Kilbride, in 1859, produced:—*Vicia sylvatica*, *Pyrola secunda* (*Ramischia secunda*), *Plantago maritima*, *Ophioglossum vulgatum*, *Epipactis latifolia* (*E. helleborine*).

The increasing public interest in natural science during the second half of the nineteenth century had a stimulating effect on naturalists. Natural History Societies came into being, and one of the earliest was the Natural History Society of Glasgow. Founded in 1851 by nine men, its first ordinary member was Roger Hennedy. A native of Belfast, Hennedy became in 1863 the occupant of the chair of botany in Anderson's College, the fore-runner of the Royal College of Science and Technology. By 1865 he had in print the first edition of his "Clydesdale Flora"; prepared originally for his students, its popularity became general, and for almost 70 years it served as a guide to the local flowering plants and ferns for successive generations of local naturalists. When the British Association first came to Glasgow, in 1876, the local committee produced a booklet listing the "Fauna and Flora of the West of Scotland"; the flowering-plant records came "chiefly from Mr. Hennedy's Clydesdale Flora." Hennedy died just after the Association's visit, but the "Flora," then in its third edition, reached its fifth and final one in 1891. The Andersonian Naturalists' Society had its origin in 1885, and one can imagine that there must have been some rivalry between this new body and the older Natural History Society. During this period, too, that great botanist H. C. Watson introduced his plan for plant recording by vice-counties, instead of by parishes, and when Peter Ewing of Uddingston, the foremost local field-worker of his day, published his "Glasgow Catalogue of Native and Established Plants" in 1892, the species were listed on the vice-comital basis.

With the second British Association meeting in Glasgow, in 1901, there appeared what must still be reckoned the most complete biological survey of the Clyde Valley—the "Fauna, Flora and Geology of the Clyde Area." Dr. Patton's paper on the "Vegetation of the Tinto Hills," published in the *Annals of the Andersonian Naturalists' Society*, 1925, set the standard for a type of investigation which might usefully be carried out elsewhere in the county. In 1928 the British Association again met in Glasgow; for this meeting a biological Card Catalogue was prepared by the local committee. And when, in 1933, Mr. Lee's "Flora of the Clyde Area" became available, additional plant records which had been accumulating for almost 40 years became readily accessible to all who were interested, together with what still remained verifiable and valid from the older "Floras." With this volume, and the "Additions" published in *The Glasgow Naturalist*, 1953, the field botanist in the Clyde Valley can claim to be better equipped than are most of his kind in com-

parable areas of Britain.

With the results of nearly three centuries of botanical investigation at our disposal we have a reasonably complete picture of Clydesdale's vegetation. Botanically, the area is twice divided—once by nature and again by man. The Southern Upland Fault marks off one third of Lanarkshire as properly belonging to the Southern Uplands. This part of the county is a land of smooth, rounded hills, usually flat-topped and steep-sided; the marks of glaciation can still be seen, and much of the rock is overlaid by boulder clay and peat. While much of the land is over 1,000 feet above the sea, there is little over 2,000 feet and none at 2,500 feet. Thus, although hilly, the country is unsuited by altitude and soil to carry a rich mountain flora; there is, too, a general lack of the rocky outcrops which most arctic-alpine plants favour. Most of the uncultivated ground has the character of upland moor, dominated either by grass (*Nardus stricta*, *Molinia coerulea*) or heather (*Calluna vulgaris*), with the usual associated plants. It is unlikely that this part of the county has been thoroughly explored by field botanists; it is also improbable that spectacular botanical discoveries will be forthcoming from it in the future. The list of known "mountain" species is a short one; grouped according to J. R. Matthews' division of our flora into geographical elements it comprises the following:—Arctic-alpine: *Thalictrum alpinum*, *Saxifraga stellaris*, *Carex bigelowii*, *Lycopodium alpinum*, *L. selago*; Arctic-subarctic: *Rubus chamaemorus*; Continental northern: *Sedum villosum*, *Meum athamanticum*, *Galium boreale*, *Cirsium heterophyllum*; Northern montane: *Saxifraga hypnoides*; and Alpine: *Cryptogramme crispa*, *Cochlearia alpina*.

The Clyde leaves the high ground near Tinto Hill, where it crosses the Southern Upland Fault and enters the Midland Valley of Scotland, in which it completes its course. Between Lanark and Hamilton the river and its tributaries have cut narrow, gorge-like courses in the soft sandstone. The river-bank is often steeply sloping, and well covered by deciduous woodland. The native flora of the region is rich and varied, and is enhanced by a number of introduced species; some of these have arrived fortuitously, and others have been brought in by the landed proprietors in the process of beautifying the great estates. Where the lie of the land permitted, there have developed the rich fruit-growing and farming lands of the Middle Ward. This part of the county is not only attractive scenically—it is also rewarding to the botanist, as the following selection from the large number of recorded species will show:—

Ranunculus auricomus, *R. lingua*, *Trollius europaeus*, *Rumex hydrolapathum*, *Vicia orobus*, *V. sylvatica*, *Salix pentandra*, *Cicuta virosa*, *Naumbergia thyrsoflora*, *Scrophularia umbrosa*, *Melampyrum sylvaticum*, *Lathraea squamaria*, *Neottia nidus-avis*, *Epipactis helleborine*, *Paris quadrifolia*, *Arum maculatum*, *Butomus umbellatus*, *Potamogeton densus*, *Carex pendula*, *C. aquatilis*, *Millium effusum*, *Melica nutans*, *Phyllitis scolopendrium*.

Indeed, the plant life in this stretch of the Clyde Valley must compare favourably in variety and general interest with that occurring in any similar area in Southern Scotland.

As the course of the river approaches the north-west corner of the county, and the city of Glasgow, the pastoral beauty of the middle reaches gives way to a harsher and often more squalid scene. What once were pleasant river-banks have become, apparently, the battle-ground of a variety of conflicting human interests. In one place building is in progress, in another demolition proceeds; here the land is being covered by ever-growing spoil heaps, there it is being cleared for some fresh activity. In the Southern Uplands the marks of glaciation on the land impress one as being there for all time, but here in the lower valley the earth is scarred as by a fretful child, unable to decide what it really wants. For the botanist there remains little but the hardier species of roadside plant and the weeds of cultivated ground and railway embankment. Within living memory the river-bank between Carmyle and Cambuslang, and the sandpits of Tollcross and Shettleston, have lost all but a few of their more interesting plants. However, the present partiality of the builder seems to be for good farming land, and that usually involves little loss botanically, while on the credit side it may be noted that we have become aware of two new, man-made habitats, the coup and the bing.

In the early years of the century much of Glasgow's domestic rubbish went by trainloads to coups a few miles beyond the city boundary. In Lanarkshire there were notable examples at Monkland Sidings near Coatbridge, and beyond Gartcosh. These were the happy hunting-ground of Robert Grierson, an Irishman who made Glasgow his home for 50 years. He combed the coups assiduously for alien species, and from time to time published in *The Glasgow Naturalist*, and in the press, accounts of his discoveries. Many were the botanical curiosities which he exhibited at Society meetings; I remember especially a seedling date palm. When, in volume nine of our journal, he summed up his work among the aliens, the final list included such unlikely neighbours as orange,

vine, maize and an arctic poppy. In the preface he laments "the city is burning most of its rubbish now; possibly this is good for the public health, but it is ruinous for my work."

The dictionary declares a bing to be "a pile or heap of anything"; in fact, just as the coup became the repository of the debris from the home, the bing has arisen to serve the same purpose for the foundry, the factory and, especially, the mine. Colonisation of the bing by plants depends on several factors, including the nature of the material and the age of the heap. I have for some time thought that we have, in the bing, a ready-made opportunity to watch plant succession happening, for most bings become clothed by some kind of vegetation in the end. It appears that the same idea has suggested itself elsewhere, for recent issues of both the *School Science Review* and the *Journal of Ecology* contain articles on bing ecology. It seems that the first plants to colonize bings are usually annuals with wind-borne seeds, such as *Senecio viscosus* and *Reseda luteola*. These tend to be succeeded by such perennials as *Tussilago farfara*, *Artemisia vulgaris*, *Plantago lanceolata*, *Chamaenerion angustifolium*, *Lolium perenne*, and *Festuca ovina*.

Occasionally less common species, such as *Linaria vulgaris* and *Echium vulgare*, become locally abundant, and the largest and most flourishing colony of *Pyrola minor* which I have ever seen grew on a Lanarkshire bing. In the end herbaceous plants may give way to woody ones, and some of our older bings are covered by scrub birch and willow, though I do not know of any local example of trees succeeding these shrubs, as apparently has happened in the south.

The bing flora usually settles down and becomes eventually part of the landscape. On the other hand, the coup adventives rarely survive their first winter, and, like the lost corn-field weeds referred to earlier, would require continuous annual introduction to persist; few become established. However, during the past hundred years several plants, unknown or rare in Hopkirk's day (and, in some cases, in Henedy's) have become prominent features of our flora. Chief among these, the rosebay willowherb (*Chamaenerion angustifolium*) was a rare plant in 1860. It seems probable that we owe its present abundance to introduction from the mainland of Europe, or from America. It produces seeds in abundance and disperses them most effectively; it also possesses a well-developed perennating rhizome, but perhaps the chief factor in its success is its toleration of recently burned ground. It seems possible that the introduced plant may differ genetically from the native one—a local plant, of rocks and scree, not

always flowering. With the rosebay we must class Canadian pondweed (*Elodea canadensis*) which appeared in Britain some 120 years ago, and spread until its range extended almost literally from Land's End to John o'Groats, and which now seems to be a diminishing species, though still common enough. A more recent arrival from the New World is pineapple weed (*Matricaria matricarioides*), which from its first record in Britain (Carnarvon, 1871) has increased till it is now known from close on 100 vice-counties. This plant shares with its compatriot, the rush *Juncus tenuis*, one very desirable quality for would-be immigrants—neither minds being stepped on; indeed, they seem to thrive on it. There are a few other species, more recently arrived and still making their way, upon which it would be well to keep a watchful eye—the little creeping New Zealand willowherb (*Epilobium pedunculare*); policeman's helmet (*Impatiens glandulifera*) from the Himalaya; a coarse, dock-like plant (*Polygonum cuspidatum*) from Japan, and at least two Composites from the mainland of Europe, the orange hawkweed (*Hieracium aurantiacum*) and a blue sowthistle (*Cicerbita* sp.).

There is, of course, no finality in biological recording; within the span of one human life, and the compass of one district, species flourish and decline—sometimes for reasons not at all obvious. Some of the familiar plants of childhood are scarcer fifty years later, or have gone altogether, but there are always others on the way in. It is just this slow change in our organic environment that makes the recording of it so fascinating, and so much worth while as a long-term policy. This year recorders in the Clyde Valley have a double incentive; the meeting of the British Association in Glasgow in September, and the completion of the first phase of the Distribution Maps Scheme referred to earlier. The records being made for the latter project are based on the latest geographical unit, the 10 km. square of the National Grid. When the results of this survey become available we shall have the most detailed account so far of the flora of Clydesdale—and we can safely forecast that some of the results will surprise us.

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THE MAMMAL FAUNA OF THE CLYDE AREA

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It is now rather more than fifty years since the appearance of Watt's list of *Land Mammals of the Clyde Faunal Area*. The present list has been modified and brought as up-to-date as possible by the inclusion of more recent distribution records. Watt's original records are retained where they are believed to be still valid. The marine mammals (whales and seals) have been included in the list and the latest nomenclature employed (Matthews, 1952).

Watt (1905) listed the land mammals inhabiting the Clyde drainage area. The present list covers a rather larger territory based on an alternative method of geographical separation. The Clyde Area can be defined, for the purposes of the present paper, as the region comprising the following Watsonian vice-counties; Ayr (75), Renfrew (76), Lanark (77), Dunbarton (99), Stirling (86), West Perth (87), Clyde Islands (100), Kintyre (101) and Argyll (98). The figure in brackets is the vice-county number and only this has been used in the list.

The Clyde Area is an extensive tract encompassing a considerable variety of terrain. To the north are the Scottish Highlands. These large expanses of exposed heather moors and deer forests support a typically highland fauna which includes species such as the pine marten and wild cat which are very rare or absent from the rest of Britain. To the south are the sheep hills of the Southern Uplands whilst in the central region around the Firth of Clyde and in the lowlands of Lanark and Stirling are large expanses of fertile agricultural land. Such diversity of terrain is reflected in the variety of the mammal fauna. Furthermore, as the southern boundaries of the Highlands fall within the region, both highland and southern races of certain species are represented, *e.g.* the water vole and field vole. The precise distributional boundaries (should they exist) of these subspecies still remain undefined and will only be determined after the accumulation of a large number of accurate distribution records.

The changes in the mammal fauna over the last fifty years are several. The polecat is now apparently extinct in the area and in the absence of confirmatory records I have omitted

it, together with the harvest mouse and lesser horseshoe-bat, from the list. Two mammals have been introduced to the fauna. They are the musk-rat, whose existence is due to escapes from a Perthshire farm in 1927, and the grey squirrel which was originally introduced into Dunbarton in 1892. Other modifications include the recognition of a number of subspecies of rodents.

It is doubtful whether any species of mammal that is inhabiting the area has been overlooked although it is appreciated that many of the records are incomplete. This shortcoming can be rectified by continued observation. It must also be remembered that mammals have no respect for county boundaries which are somewhat artificial divisions. Their distribution will be much more influenced by the types of habitat available to them.

I would like to express my gratitude to Mr. C. E. Palmar who has provided a considerable amount of information as well as drawing my attention to material in the Glasgow Museum, Kelvingrove. I am also grateful to Dr. F. C. Fraser, Mr. I. J. Linn and Mr. J. D. Hamilton for the help they have given. The data these gentlemen have provided are followed by their initials. Records obtained from specimens in the Kelvingrove and British Museums have been listed as KM and BM respectively.

ORDER INSECTIVORA

Erinaceus europaeus L. Hedgehog

Common in all Clyde parishes (Watt, 1905).

76—Common (Malloch and Hall, 1915).

77—Rutherglen (Watt, 1905).

86—King's Park, Stirling (Sword, 1907-08).

98—Innellan, Glen Masson (Watt, 1905); Portalloch (Millais, 1904 - 06); present (Barrett-Hamilton and Hinton, 1910-21); Dalmally (albino) (Burnett, 1952).

99—Loch Lomond, Arrochar, Luss (Watt, 1905); alongside Loch Long (Barrett-Hamilton and Hinton, 1910-21).

100—Bute (Barrett-Hamilton and Hinton, 1910-21; Renouf, 1931); Rothesay, Bute, 1937 (KM).

101—Present (Barrett-Hamilton and Hinton, 1910-21).

Sorex araneus castaneus Jenyns Common Shrew

All over the area (Watt, 1905).

75—Ailsa Craig (Watt, 1905).

- 76—Thornliebank (Watt, 1905); common (Malloch and Hall, 1915).
 86—Widely distributed, King's Park, Stirling (Sword, 1907-08).
 98—Common (Harvie-Brown and Buckley, 1892).
 99—Luss (Delany, 1957).
 100—Arran, Bute (Watt, 1905; Barrett-Hamilton and Hinton, 1910-21; Renouf, 1931); Great Cumbrae (Barrett-Hamilton and Hinton, 1910-21; Renouf, 1931).
 101—Sanda (Barrett-Hamilton and Hinton, 1910-21).

Sorex minutus L. Pygmy Shrew

- 76—Near Paisley (Watt, 1905).
 77—Upper Lanarkshire (Watt, 1905).
 98—Common (Harvie-Brown and Buckley, 1892).
 100—Arran, Bute (Watt, 1905; Renouf, 1931); Great Cumbrae (Watt, 1905).

Neomys fodiens bicolor Shaw Water Shrew

- All counties except Argyll (Watt, 1905).
 75—North Ayrshire (Millais, 1904-06).
 86—Upper reaches of the Carron (Millais, 1904-06); "not rare," King's Park, Stirling (Sword, 1907-08).
 98—Present (Millais, 1904-06; Barrett-Hamilton and Hinton, 1910-21); Ardgartan, 1956 (CEP).
 100—Arran (Watt, 1905; Renouf, 1931); Bute (Renouf 1931); Pladda (McWilliam, 1934).

Talpa europa L. Mole,

- Common within the area (Watt, 1905).
 76—Common (Malloch and Hall, 1915).
 86—Common in the King's Park, Stirling (Sword, 1907-08).
 87—Ochils (Barrett-Hamilton and Hinton, 1910-21); common Benglass, Glenfalloch, 1947 (CEP).
 98—Coire an Tee (Watt, 1905).
 100—Bute (Barrett-Hamilton and Hinton, 1910-21; Renouf, 1931).

ORDER CHIROPTERA

Pipistrellus pipistrellus (Schreber) Pipistrelle

- 75—Wemyss Bay, Portencross (Watt, 1905).
 76—Thornliebank (Watt, 1905); common (Malloch and Hall, 1915).

- 77—Carmichael (Watt, 1905).
 86—Common in King's Park, Stirling (Sword, 1907-08).
 99—Row (now Rhu), Luss (Watt, 1905).
 100—Arran (Watt, 1905).

Myotis daubentoni (Kuhl) Daubenton's Bat
 76—Neilston (Malloch and Hall, 1915).
 86—Common in King's Park, Stirling (Sword, 1907-08).

Myotis nattereri (Kuhl). Natterer's Bat
 98—Inveraray (Watt, 1905).

Plecotus auritus (L.) Long-eared Bat
 76—Paisley, Glenderston, Barrhead, Thornliebank (Watt, 1905); occasional (Malloch and Hall, 1915).
 98—Torcastle (Millais, 1904-06).
 99—Garscadden, Luss (Watt, 1905).
 100—Arran (Watt, 1905).

ORDER LAGOMORPHA

Oryctolagus cuniculus (L.) Rabbit
 Abundant in whole area (Watt, 1905); evidence of recent increases in many places after myxomatosis (CEP).
 75—Lady Island (Troon) (Watt, 1905); Ailsa Craig (Barrett-Hamilton and Hinton, 1910-21).
 76—Abundant (Malloch and Hall, 1915).
 86—Plentiful in King's Park, Stirling (Sword, 1907-08).
 98—Eilean Aoidh and Liath Eilean (Loch Fyne) (Watt, 1905).
 99—Inchmoan, Inch Tavannach (Loch Lomond) (Watt, 1905).
 100—Arran, Bute and the Cumbraes (Watt, 1905).
 101—In Knapdale, myxomatosis did not make serious inroads and rabbits remained fairly common (CEP).

Lepus europaeus occidentalis de Winton (British) Brown Hare
 Common generally (Watt, 1905).
 76—Moderately common (Malloch and Hall, 1915).
 77—Not uncommon in Hamilton - Lanark area (CEP).
 86—Present in King's Park, Stirling (Sword, 1907-08).
 100—Arran, Bute, absent Great Cumbrae (Watt, 1905); present on Great Cumbrae (Barrett-Hamilton and Hinton, 1910-21).

- Lepus timidus scoticus* Hilz. (Scottish) Blue, or Mountain Hare
 Uplands of every county in the area (Watt, 1905);
 widely distributed in hills over 1,500 ft. (Barrett-
 Hamilton and Hinton, 1910-21).
- 75/77—Common on Ayrshire-Lanark border and in
 southern Ayrshire (Ritchie, 1929).
- 76—Frequent on hills; 300 killed on Misty Law in one
 season (Malloch and Hall, 1915).
- 86—Buchanan, Loch Lomond district (Watt, 1905);
 Touch and Gargunock Hills (Sword, 1907-08).
- 87—Frequent at Flanders Moss (nearly at sea level)
 (CEP).
- 98—Dunoon, Inveraray (Watt, 1905); Lismore, Appin,
 Ardochattan, Kilmun (Harvie-Brown and Buckley,
 1892).
- 99—Luss, Arrochar, Loch Lomond district (Watt, 1905).
- 100—Arran (Barrett-Hamilton and Hinton, 1910-21).
- 101—Kintyre (Macintyre, 1951).

ORDER RODENTIA

SUBORDER MYOMORPHA

- Clethrionomys glareolus britannicus* (Miller)
 (British) Bank-Vole
- 76—Paisley (Watt, 1905); common (Malloch and Hall,
 1915); Cathcart, 1948 (CEP)
- 77—Lesmahagow (Watt, 1905); Cadzow (Millais, 1904-
 06); Stockbriggs (BM).
- 86—Arable lands (Millais, 1904-06); Kinbruck (BM);
 Torrance, 1938 and 1950s (CEP).
- 87—Dunblane (BM).
- 98—Loch Aweside (Millais, 1904-06); Taynult (MJD).
- 99—Luss (Watt, 1905; Delany, 1957).
- 100—Bute (Barrett-Hamilton and Hinton, 1910-21;
 Renouf, 1931).
- Microtus agrestis* (L.) Field or Short-tailed Vole
 Common throughout area (Watt, 1905).
- 76—Common (Malloch and Hall, 1915).
- 86—Present in King's Park, Stirling (Sword, 1907-08); a
 plague in the Carron Valley (Charles, 1956).
 (No subspecies given in these records.)
- Microtus agrestis hirtus* (Bellamy)
 (English) Short-tailed Vole
 “. . . the lowlands of Scotland, but does not extend
 into the highlands.” (Matthews, 1952).

- Microtus agrestis neglectus* (Thompson)
(Scottish) Short-tailed Vole
77—Present (Barrett-Hamilton and Hinton, 1910-21).
98—Glen Finart (Findlay and Middleton, 1934; subspecies confirmed by Elton, Davis and Findlay, 1935); Fearnoch Forest (MJD).
100—Near Kilchattan, Bute (Barrett-Hamilton and Hinton, 1910-21); "an absolute plague" on Bute (Renouf, 1931).
- Microtus agrestis exsul* Miller Hebridean Vole
100—Arran (Barrett-Hamilton and Hinton, 1910-21; Renouf, 1931).
101—Gigha (Barrett-Hamilton and Hinton, 1910-21).
- Arvicola amphibius* (L.) Water-Vole
Common in mainland waters (Watt, 1905).
75—Ballantrae (Watt, 1905).
76—Black variety from Harelaw Dam (Watt, 1905); common (Malloch and Hall, 1915).
86—Present in King's Park, Stirling (Sword, 1907-08).
87—Melanistic specimen from Aberfoyle (KM); 2,305 trapped in basins of Forth and Earn, 1932-34 (Munro, 1935).
98—Tighnabruach (Watt, 1905).
(No subspecies given in these records.)
- Arvicola amphibius amphibius* (L.) (British) Water-Vole
Extends to north of the watershed of the Clyde (Barrett-Hamilton and Hinton, 1910-21).
100—Bute (Renouf, 1931).
- Arvicola amphibius reta* Miller (Highland) Water-Vole
North of the watershed of the Clyde (Barrett-Hamilton and Hinton, 1910-21)
98—Present (Barrett-Hamilton and Hinton, 1910-21).
100—Bute (Renouf, 1931).
- Ondatra zibethica* (L.) Musk-Rat
87—Five females and five males escaped from Feddal in 1927. Reported from Ardoch, Orchil, Banks of River Allan and Carsebreck Loch (M'Naughton, 1930-31); 945 trapped in basins of Forth and Earn, 1932-34 (Munro, 1935).

Apodemus sylvaticus sylvaticus (L.)
(Mainland) Long-tailed Field-Mouse

Apparently common over whole mainland area
(Harvie-Brown and Buckley, 1892; Watt, 1905;
Malloch and Hall, 1915; Sword, 1907-08).

- 86—Torrance, 1951 (KM).
99—Luss (Delany, 1957).
100—Bute (Hinton, 1914).

Apodemus sylvaticus hebridensis (de Winton)
Hebridean Field-Mouse

- 100—Cumbrae, Arran (Hinton, 1914).

Mus musculus domesticus Ruddy (Western) House-Mouse

Apparently common over whole area (Harvie-Brown
and Buckley, 1892; Watt, 1905; Sword, 1907-08;
Malloch and Hall, 1915).

Rattus rattus (L.) “Black” Rat

- 76/77/99—Watt (1905) records it from Glasgow, Greenock
and Paisley although he claims it was never common.
Probably extinct in 76 (Malloch and Hall, 1915).
Glasgow docks (Matheson, 1939); one albino and
five normal individuals collected in 1937 and 1938
(KM).

Rattus norvegicus (Erxleben) “Brown” Rat

- Widely distributed; first appeared in area in early
1700s (Watt, 1905)
75—Ailsa Craig (Watt, 1905).
76—Common everywhere (Malloch and Hall, 1915).
86—Present in King’s Park, Stirling (Sword, 1907-08).
87—1,745 trapped in basins of Forth and Earn, 1932-34
(Munro, 1935).
98—Sgat Mhor (Loch Fyne) (Watt, 1905).
99—Inchmoan (Loch Lomond) (Watt, 1905).
101—Sanda, Sheep Island and Glunimore (Watt, 1905).

SUBORDER SCIUROMORPHA

- Sciurus vulgaris leucourus* Kerr (British) Red Squirrel
Present on all mainland counties (Ritchie, 1920);
absent from Bute, although at one time present (Watt,
1905); present Arran (Shorten, 1957); not recorded
from Renfrew and Lanark (Shorten, 1957).

- Sciurus carolinensis* Gmelin Grey Squirrel
Steadily spreading within the area.
- 86—Around Drymen, The Carse of Stirling (Shorten, 1954) ; Killearn, 1950 (KM) ; Finnich Glen, Blanefield, Craigmaddie, Lennox Castle, Torrance, Leckie, Touch, Torwood, Sauchieburn, Bannockburn, Dunmore Park (Shorten, 1957).
- 87—Falls of Leny, Callander, Doune, Gartmore, Muckart, Dollar (Shorten, 1954) ; Commonhedge Hill, Cowden Castle, Glendevon, Rednock, Invertrossachs, Farmston, Muckle Burn (Shorten, 1957).
- 99—Released at Finnart, Loch Long in 1892 (Shorten, 1954), and now widespread within the county (Shorten, 1954, 1957).

ORDER CARNIVORA

SUBORDER FISSIPEDIA

- Vulpes vulpes* (L.) (Northern) Fox
- 75—Cunningham and Kyle (Watt, 1905).
- 76—East Renfrew, Eaglesham (Watt, 1905) ; common (Malloch and Hall, 1915) ; Muirend (City of Glasgow), various recent records (CEP).
- 77—Carmichael, Milton, Lockhart, Gartcosh (Watt, 1905).
- 86—Loch Lomondside (Watt, 1905) ; Gargunnoch Hills (Sword, 1907-08).
- 87—Ochils (Sword, 1907-08).
- 98—Common (Harvie-Brown and Buckley, 1892) ; Carrick Castle, Benmore, Glen Masson, Poltalloch (Watt, 1905).
- 99—Loch Lomondside (Watt, 1905).
- [100—Absent from Arran and Bute (Watt, 1905).]
- Meles meles meles* (L.) (European) Badger
- 75—Montfode (Ardrossan), Ardneil (W. Kilbride), Glogarnock, Kilkerran (Watt, 1905) ; local and patchy (Neal, 1948).
- 76—Finlaystone, Langbank (Watt, 1905) ; Inverkip Woods (Malloch and Hall, 1915) ; local and patchy (Neal, 1948).
- 77—Gillbank, Carluke, Jock's Gill, Milton Lockhart (Watt, 1905) ; extremely scarce (Neal, 1948).
- 86—Campies, Strathblane Hills, Campsie, Aucheneck, Ballikinvain, Killearn (Watt, 1905), north of Loch Arklet (CEP).
- 87—Local (Darling, 1947).

- 98—Occasional in north Argyll (Darling, 1947); frequent in mid- and south Argyll in mountains (CEP).
 99—Luss, Arrochar, Glenfalloch, Murroch Glen (Watt, 1905); local and patchy in south-east of county, absent elsewhere (Neal, 1948); Tarbet, 1956 (CEP).
 100—Present on Arran (Millais, 1904-06); absent from the county (Neal, 1948).
 [101—Absent (Neal, 1948).]

Lutra lutra (L.) Otter

- Throughout the area; from Sanda to upper reaches of the Clyde at Carmichael (Watt, 1905).
 75—Rivers Doon and Ayr (Watt, 1905); Ardrossan, 1943 (KM).
 76—Frequent; Gryffe, Locher, Ardpatrik Water, Black Cart, Castle Semple (Malloch and Hall, 1915).
 98—Common (Harvie-Brown and Buckley, 1892).
 99—Luss, about 1956 (JDH).
 100—Bute (Renouf, 1931).

Martes martes martes (L.) (European) Pine-Marten

- 98—Occasional in north Argyll (Darling, 1947).
 101—One trapped west of Lochgilphead, near Loch Sween, about 1944 (IJJL); single specimen from Knapdale early 1950s (CEP).

Mustela erminea stabilis Barret-Hamilton (British) Stoat

- Common throughout the area (Harvie-Brown and Buckley, 1892; Watt, 1905; Malloch and Hall, 1915; Sword, 1907-08).
 87—36 trapped in basins of Forth and Earn, 1932-34 (Munro, 1935).
 100—Absent Arran, present Bute (Watt, 1905; Millais, 1904-06); Bute (Renouf, 1931; KM, coll. 1936).

Mustela nivalis nivalis L. (European) Weasel

- Common throughout the area (Harvie-Brown and Buckley, 1892; Watt, 1905; Malloch and Hall, 1915; Sword, 1907-08).
 87—57 trapped in basins of Forth and Earn, 1932-34 (Munro, 1935).
 100—Absent Arran (Watt, 1905); present Bute (Watt, 1905; Renouf, 1931).

- Felis silvestris grampia* Miller (Scottish) Wild Cat
 87—Resident in Loch Ard and Allean Forests and occasional in Strathyre Forest (Taylor, 1946).
 98—Resident in Ardgarten, Barcaldine, Benmore, Glenbrantor, Glenduror and Inverliever and Eridine Forests; occasional in Fearnoch, Glenfinart and Inverinan Forests (Taylor, 1946); Glen More, Lochgoilhead, 1943 (CEP).
 101—Resident in Knapdale Forest (Taylor, 1946); present in Knapdale, 1957 (CEP).

SUBORDER PINNIPEDIA

- Phoca vitulina* L. Common seal
 All round Clyde coasts (CEP).
 75—Ardrossan, regular (CEP).
 98—Along west coast (Sandars, 1937).
 99—Near Bowling (Millais, 1904-06).
 101—Along west coast (Sandars, 1937).
- Odobenus rosmarus* (L.) Walrus
 100—A single specimen seen in Ettrick Bay, Bute, Aug., 1884 (Kerr, 1949).

ORDER UNGULATA

- Dama dama* (L.) Fallow Deer
 Herds formerly kept on a number of estates in the area (Watt, 1905); present distribution probably as below.
 98—West coast (Parnell and Cameron, 1933); Inveraray (Whitehead, 1953a).
 99—Inchconnachan (Loch Lomond) resident, both black and normal animals occur (CEP).
 101—Near Carradale (Whitehead, 1953a).
- Sika nippon nippon* (Temminck) Japanese Sika
 101—Liberated at Carradale, 1893. Present at Campbeltown, Glen Lussa, Torrisdale (Whitehead, 1953c); present in Carradale since 1950 (CEP).
- Cervus elephas scoticus* Lönnerberg (British) Red Deer
 Present in all counties north of the Edinburgh-Glasgow Road (Whitehead, 1953d).
 75—Loch Doon area, 1948 (CEP); present (Whitehead, 1953d).

100—Present on Arran (Watt, 1905 ; Parnell and Cameron, 1933 ; Darling, 1947 ; Whitehead, 1953*d*) ; absent Bute (Darling, 1947).

101—Absent (Darling, 1947) ; present since 1950 (CEP).

Capreolus capreolus thotti Lönnberg (British) Roe

“ Not a county in Scotland where one or two pairs cannot be found wherever locality is suitable.”
(Whitehead, 1953*b*).

100—Bute (Watt, 1905).

Capra hircus hircus L. Feral Goat

86—Ben Lomond (CEP).

87—Ben Venue (CEP).

100—Arran, Holy Island and Bute (Watt, 1937).

ORDER CETACEA

SUBORDER ODONTOCETI

Phocaena phocaena (L.) Common Porpoise

Common in Clyde estuary (Malloch and Hall, 1915).

75—Lendalfoot, Feb. 1951, (FCF).

76—One seen in White Cart at Paisley, Oct., 1906 (Malloch and Hall, 1915).

87—Alloa, Jan., 1933 (Fraser, 1946).

100—Kildonan, Arran, Jul., 1927 (Fraser, 1934) ; Millport, Cumbrae, Jun., 1955 (FCF).

101—Southend, Kintyre, Sep., 1938 (Fraser, 1953).

Delphinus delphis L. Common Dolphin

100—Kildonan, Arran, Sep., 1932 (Fraser, 1934).

Lagenorhynchus albirostris (Gray) White-beaked Dolphin

Taken in Clyde, Sep., 1879 (Millais, 1904-06).

75—Girvan, Jul., 1946 (Fraser, 1953).

87—Alloa, Feb., 1923 (Harmer, 1925) and Apr., 1933, (Fraser, 1946).

Tursiops truncatus (Montagu) Bottle-nosed Dolphin

75—Ballantrae, Apr., 1933 and Jul., 1945 (Fraser, 1946-1953).

87—Alloa, May, 1940 (Fraser, 1953).

101—Ugadale, Apr., 1931 (Fraser, 1934).

Orcinus orca (L.) Killer

87—Alloa, Mar., 1932 (Fraser, 1934).

- Grampus griseus* (Cuvier) Risso's Dolphin
86—South Alloa, Aug., 1919 (Harmer, 1921).
- Delphinapterus leucas* (Pallas) White Whale, Beluga
86—Stirling, Oct., 1932 (Fraser 1934).
- Hyperoödon rostratus* (Muller) Bottle-nosed Whale
76—Port Glasgow, Nov., 1948 (FCF).
99—Ardmore, Nov., 1923 (Harmer, 1925); Row (now
Rhu), Oct., 1941 (Fraser, 1953); Kilcreggan, Sep.,
1955 (FCF).
- Ziphoïd whale stranded at Girvan (75), July, 1919 (Harmer,
1921).

SUBORDER MYSTICETI

- Balaenoptera acutorostrata* Lacepède
Lesser Rorqual, Piked Whale
75—Girvan, Aug., 1929 (Fraser, 1934).
- Balaenoptera* sp.
101—Machrihanish, Nov., 1918 (Harmer, 1919).

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**LUZULA LUZULOIDES (LAM.) DANDY &
WILMOTT, AN ALIEN WOODRUSH**

By R. MACKECHNIE

(MS. received 6th March, 1958)

The Society's Training Excursion to Dougalston Estate on 6th July last provided what seems to be one of the few records for this woodrush in the Glasgow district. A single clump was found in the grass at the edge of one of the carriageways.

Luzula luzuloides is almost as tall as the familiar *L. sylvatica*, but is a more slender plant, with narrower, grass-like leaves. Its most conspicuous feature is the whitish flower, tinged with red. It is a native of Central Europe, but has been known as an established introduction in Britain for many years.

I believe that there are other instances of the occurrence of this plant in the Clyde area; it would be interesting to have these put on record.

CAREX PAUPERCULA MICHX. IN RENFREWSHIRE

By R. MACKECHNIE

(MS. received 6th March, 1958)

One of the less likely by-products of the Society's Exhibition in the Glasgow Museum last June was the discovery of this sedge, new to the county of Renfrew. A small colony of the plant was found on the moorland west of Eaglesham on 16th June, while collecting samples of moorland vegetation for the Exhibition due to open on the following day.

Carex paupercula belongs to the Section *Limosae* of the genus *Carex*; there are three British representatives, all elegant plants with gracefully drooping spikelets. All inhabit bogland; the rarest, *C. rariflora*, is a mountain plant with a restricted distribution in Central and North Scotland. *C. limosa* is the commonest species, and is widely but locally distributed in spongy bogs throughout Britain. The present species is a rare plant in all of its few British vice-counties. It favours moorland ditches choked with bog moss, and resembles *C. limosa* in appearance; it is usually a taller plant, with flatter leaves, longer bracts and more numerous spikelets.

The only other known station in the Clyde area is on the Kilpatrick Hills in Dunbartonshire. An interesting feature of the new locality is that it is within a mile or two of a well-known station for *C. limosa*.

ADDITIONS TO THE BRYOPHYTE FLORA OF THE CLYDE AREA, 1957

By A. C. CRUNDWELL

Department of Botany, University of Glasgow

(MS. received 25th February, 1958)

Of nine bryophyte species and varieties added to the flora of the Clyde Area in 1957 no less than five are from the Ayrshire coast. Two of these, *Pottia recta* (Sm.) Mitt. and *P. starkeana* (Hedw.) C.M. var. *brachyodus* Wils., both southern calcicole species, were growing together on bare soil between the main road and the shore at Woodland Bay, just south of Girvan. *P. recta* was reported by Stirton from Bowling, Dunbartonshire, but the record is not authenticated by any specimen. The other three Scottish localities are all from the east: Burnmouth, Berwickshire; King's Park, Edinburgh; and Sanday, Orkney. *P. starkeana* var. *brachyodus*, previously unrecorded for Scotland, seems to be a good species, but there is doubt as to its correct name. Dr. E. F. Warburg is at present working on a revision of the British species of this section of *Pottia*.

At Stevenston, on damp sandy ground at the back of the dunes, were found *Riccardia incurvata* Lindb. and *Bryum salinum* Hagen ex Limpr. The former, a rare but widely distributed non-maritime species, has two other Scottish localities: Pease Dean, Berwickshire, and the Sands of Barry, Angus. *Bryum salinum* is a halophyte which in Britain has hitherto been confused with *B. inclinatum*. The only other Scottish records so far are from St. Cyrus, Kincardineshire, and from the Isle of Jura, but it will probably prove to be not uncommon. It is apparently a northern species, though it reaches south at least to Somerset.

Amblystegium serpens (Hedw.) B., S. & G. var. *salinum* Carr., rather plentiful in turf in a saltmarsh just south of West Kilbride, has not previously been recorded from the Clyde Area, but it is an inconspicuous moss, and it may well be present in other localities.

Leiocolea heterocolpos (Thed.) Buch has been found in fair quantity on earth-covered Old Red Sandstone rocks in the Finnich Glen, Stirlingshire. This calcicole species is known from a few localities in the Killin district of Perthshire and from four other places in Scotland: Creag Choinnich and near Glen Callater, Aberdeenshire; Glen Fee, Angus; and the Mosspeeble Burn, Dumfriesshire. As it is a rather conspicuous plant its rarity in Scotland is probably genuine.

Hypnum cupressiforme Hedw. var. *mamillatum* Brid., found on a fallen tree-trunk near the Falls of Clyde, Lanarkshire, has only one other Scottish locality, a wood by Loch Veyatie, Wester Ross. Nevertheless, it is probably much commoner than the records suggest, for it has certainly been much overlooked. Both its status and its distribution are in need of investigation.

The critical species of *Plagiothecium*, those of the *silvaticum-denticulatum* complex, have had little attention paid to them in Britain. *P. denticulatum* (Hedw.) B., S. & G., *P. succulentum* (Wils.) Lindb. and *P. silvaticum* (Turn.) B., S. & G. are all common in the Clyde Area. *P. curvifolium* Schlieph. has been found in Mugdock Wood and on a stump in a damp birchwood to the west of Blanefield, both in Stirlingshire, and also on a stump in a conifer plantation on Stone Hill, south of Lanark. There are no other published Scottish localities, but though it is certainly commoner in southern England it is probably not rare in Scotland, and the half dozen Scottish records of *P. denticulatum* var. *aptychus* Spr. probably refer to this species. A plant from Ben Vorlich, Dunbartonshire, collected by J. Dickson, has been named *P. curvifolium*, but it seems to go better under the very closely related *P. laetum* B., S. & G., a species hitherto unknown from the British Isles. This will be dealt with more fully elsewhere.

AN ACKNOWLEDGMENT

The Council of the Society wish once again to acknowledge their indebtedness to The Royal Society for a substantial grant towards the cost of publication of the following papers in a previous issue (Volume XVII, Part 5) of *The Glasgow Naturalist*.

- (1) "Additions and corrections to the moss flora of Dunbartonshire."
- (2) "Notes on the Hydromedusae of the Clyde Sea Area with new distribution records."
- (3) "A key to the British species of the genus *Cyclops* O. F. Müller."
- (4) "Notes on the food and parasites of Pike (*Esox lucius*) in Loch Lomond."

JOHN R. LEE

*A series of tributes on the occasion of his ninetieth birthday,
26th May, 1958*

The staff of the Botany Department in the University of Glasgow have always greatly appreciated the kindly interest Mr. Lee has taken in the work of the department and particularly in the herbarium, of which he was appointed Honorary Curator by the University Court in 1938. On his visits to the department he is always welcome and his wise counsel has been freely given and gratefully received. His friendly interest is also evident in the generous gift to the University Botany Department of his own very beautifully arranged herbarium of British plants. In it every specimen has been carefully prepared and meticulous care is evident in the identifications—it is a model of what a herbarium should be. The handsome cabinet in which it is contained was constructed by Mr. Lee's great friend and fellow botanist, Peter Ewing. We owe a great debt to Mr. Lee for his many writings about Scottish plants and for his excellent *Flora of the Clyde Area*. As well as having an extensive knowledge of British plants he is a recognised authority on the subject of British mosses.

It gave great satisfaction to all his botanist friends in Glasgow when in 1950 the honorary degree of Master of Arts was conferred on him by the University in recognition of his distinguished contributions to botanical science.

Although he has attained the age of ninety years and now finds that climbing mountains and roaming over the countryside are too arduous pursuits, his interest in botanical matters is as lively as ever. We all look forward to enjoying his friendship and company for many years to come and congratulate him for all that he has achieved over the years, and wish him well.

John Walton.

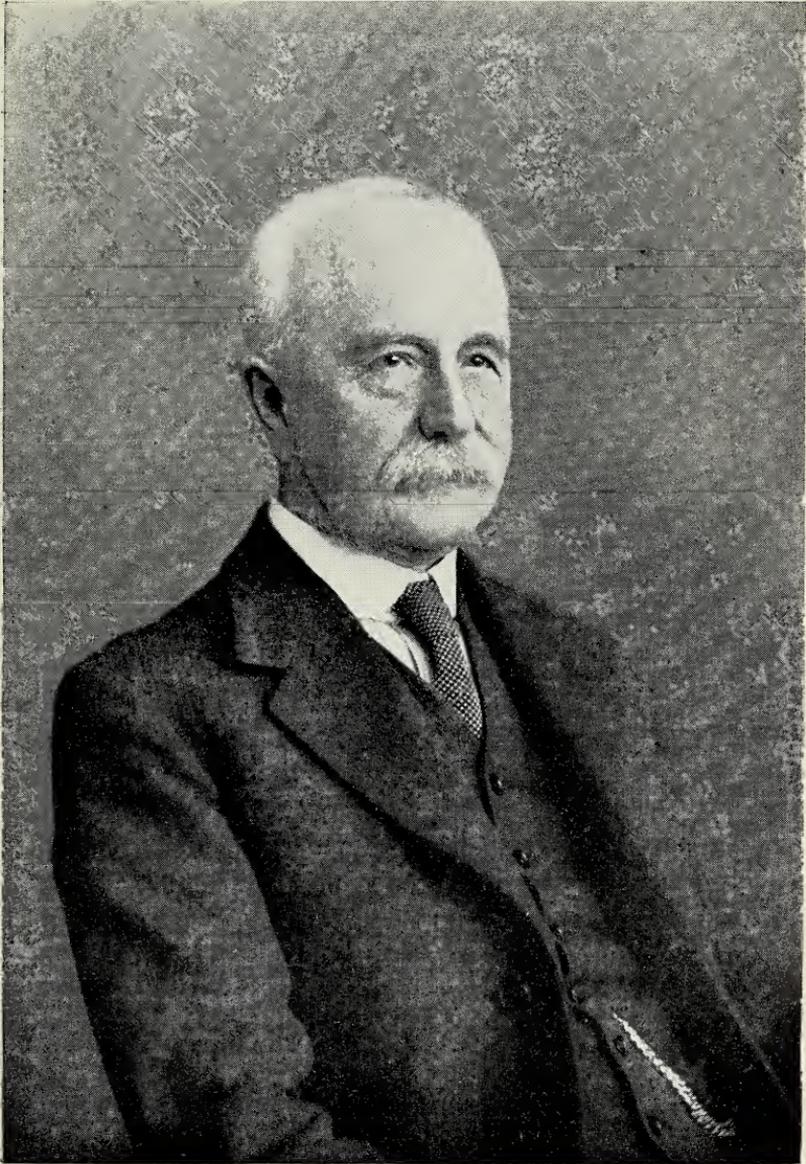
Those who have read Mr. Lee's paper on "The Flora of the Arrochar Mountains" (1905, *Ann. Anderson. Nat. Soc.*, 3, 80-126) will realise that from early in the Society's history he has been intensely interested in alpine plants. These mountains being in the Clyde Area, it was natural that they should be explored by the Society; and Mr. Lee naturally became the leader of the local alpine botanists. But he also responded to the grander call of the Breadalbanes: Laoigh, Cam Creag, Heasgarnich and Lawers with its surrounding peaks. First Hugh Boyd Watt and then Peter Ewing were

leaders of parties to these parts; but from 1909 Mr. Lee became the guide to those botanists whom he described as the 'Lawers specialists': Mrs. Ewing, Robert McLean, Mr. and Mrs. George Lunam, Professor J. Jack and James Jack of Airdrie, to mention a few. These alpine excursions, usually for a week in July, continued with very few breaks until the climbing of Munros became too strenuous for him. In 1952, Mr. Lee was present at the Centenary Excursion to Lawers.



Mr. Lee, during an excursion to Blae Loch, Lugton, on 27th April, 1940, with Mr. R. Prasher (left), and Mr. R. H. Johnstone (right).

It was an inspiration as well as an education to accompany Mr. Lee on these mountain excursions. The novice was initiated by him and received as much guidance and enlightenment as those more acquainted with the mountain flora.



JOHN R. LEE, M.A.

Mr. Lee has long advocated the preservation of our boreal floral heritage, and it has been more than a disappointment for him when rare species have disappeared. Such an instance occurred when a solitary specimen of *Saxifraga aizoides* forma *aurantiaca* had been carried away from its habitat in the cleft of a boulder when Lawers Burn was in high flood, and again when *Saxifraga rivularis* had been eradicated from one of its localities long kept secret.

Mr. Lee has long been an expert arctic-alpine botanist, and I am sure that he, like his associates on these mountain expeditions, has many happy memories of them.

Donald Patton.

Few people are spared to celebrate their ninetieth birthday, but John R. Lee's wonderful enthusiasm for life has kept him young in mind and spirit. As he looks back over the years I am sure he will recall many happy memories of hours spent on excursions and in field work with the members of our Society.

During the past twenty-five years it has been my privilege to join in many of these excursions, but from 1940 onwards, when I was appointed Botanical Convener, my closer association has enabled me to take particular notice of his kindly disposition and his genial manner of imparting information. His patience, especially to beginners, has impressed me greatly, nothing being too trifling for his attention. When division of opinion arose "The Boss" always had the last word, and all eagerly gathered round to hear his undisputed verdict.

The unflagging zeal of this great master of botany has led to a series of coach tours being arranged. In this manner his company and expert advice has continued to be enjoyed. On the occasion of an outing to Ballantrae and district, the party halted at Lendalfoot to visit the memorial to the late Charles Berry, but Mr. Lee set off with a friend for a short walk, returning like a jubilant schoolboy waving a specimen of *Geranium columbinum* in triumph over his head.

Space prevents me from recording many other episodes during excursions, but special mention should be made of the annual visit of the Botanical Section to the Blackwood district, where the members have enjoyed the kind hospitality of Mr. and Mrs. William Scott, with whom Mr. Lee has formed a close friendship over a large number of years.

In conclusion I feel our motto should be—"Long may he flourish," and I leave him to ponder on the following lines:—

"Still o'er these scenes my memory wakes,
And fondly broods with miser care,
Time but th' impression stronger makes,
As streams their channels deeper wear."

Richard Prasher.

Mr. Lee has contributed too much to our knowledge of the local flora for it to be possible to review in detail all his work; but one outstanding event must by no means be left unmentioned. Twenty-five years have now elapsed since the publication in 1933 of his *Flora of the Clyde Area*. This is neither so long a time in the history of field botany, nor even of one's own share in it, that there should be any real difficulty in reconstructing the botanical scene of those days. Yet, perhaps because so much has happened in the years between, I do find it difficult to think myself back to those more frugal days. Consider the fare on which our interest was sustained then. On the national scale, the great floras of Sowerby and J. D. Hooker were respectively seventy and sixty years old, and Bentham's *Handbook*, then in its seventh edition, was not keeping pace with events in the field. The smaller *Manual of Babington*, with its inadequate descriptions and lack of keys, was not a satisfactory guide for beginners; still less was the current edition of *Hayward's Botanists' Pocket Book*, in which species descriptions were reduced almost to vanishing point. Locally, the systematic botanist was no better served; he had to depend for guidance on one or other of the five editions of *Hennedy's Clydesdale Flora*, and the youngest of these—long out of print—had reached the ripe age of forty-two. In it there were keys to the genera, but not to the species. Judging solely on this evidence, one might conclude that in the early years of this century the practice of field botany was declining.

In fact, the reverse was the case, as the annual reports of the exchange clubs during the first quarter of the century show. The material for new floras was accumulating in the pages of these reports, and in 1933 field-work in the Clyde Valley was restored to an even keel by the publication of Mr. Lee's *Flora*. Those whose interest has been aroused since that date will hardly appreciate what a difference the publication of this book made to local workers. Many years of careful work had gone to its preparation; years of checking old records, of noting—and making—new ones; and of preparing and testing keys for the identification of all grades of

flowering plant, from the class to the variety. And all in a book of size and price suitable, as the publishers say, for every pocket.

All this is, of course, a matter of history. Less easily assessed is the impetus which his presence and personality have given to field botany in the west of Scotland over so many years. It is surely no accident that, in our own Society, the botanical section is so strong; it is certainly true that many of us owe what competence we now possess to the help over the early hurdles so freely given by this wise and patient man.

R. Mackechnie

Most amateur botanists start by being interested in vascular plants. Only a small proportion ever turn their attention to bryophytes and still fewer succeed in becoming expert in both groups. Mr. Lee has been one of these few. He started the study of mosses in 1895, and of liverworts a few years later. His natural flair for taxonomy, coupled with his capacity for hard careful work, soon made him the leading authority upon them in Glasgow. In this he is the successor of the late Peter Ewing and the latest, but by no means the least, of a long line of distinguished Glasgow bryologists, starting from Thomas Hopkirk at the beginning of the nineteenth century.

He should not however be thought of purely as a taxonomist, in the strictest sense of the word. In his work on bryophytes, as on other plants, he has never regarded the naming of a specimen as an end in itself, but merely as a means of learning more about it. The breadth of his interests is shown by the diversity of his many contributions on bryophytes to *The Glasgow Naturalist*; those, for instance, on the moss flora of tree trunks and on the structure of the peristome.

Mr. Lee contributed records to the first edition of the *Census Catalogue of British Mosses* in 1907 and made many subsequent contributions to our knowledge of the flora of the Clyde Area. He joined the British Bryological Society on its formation in 1925 and for many years took an active part in the work of that society. In recognition of his services to bryology he was made an honorary member in 1956, an honour at present held only by three other living British botanists.

His herbarium, which he generously presented to Glasgow University, is in constant use, and is both a permanent record of work of a very high quality and a tool for research for others who seek to follow in his footsteps.

A. C. Crundwell.

NEW AND NEWLY-CONFIRMED DISTRIBUTION
RECORDS OF NON-MARINE MOLLUSCS IN THE
WEST OF SCOTLAND (IVth PAPER)

By W. RUSSELL HUNTER

(Revised to 31st January, 1958)

Earlier notes in this journal (Hunter, 1952, 1953, 1955 ; see also Ellis, 1952, 1954, 1956) report new distribution records up to July, 1955. The present paper is based mainly on collections of molluscs taken and determined by the author in the years 1955-57. Generous assistance has again been received from Mr. A. E. Ellis, the Recorder of the Conchological Society, who has examined specimens of most of the species mentioned (including all those constituting vice-comital records), and confirmed the author's identifications of them, has corrected two misidentifications by the author (both noted below), and has given much additional help in correspondence. Once again, it is a pleasure to record indebtedness to Professor C. M. Yonge, C.B.E., F.R.S., and to Dr. H. D. Slack, F.R.S.E., for their continued interest and help, and to my wife for her help in the field and in the laboratory.

Distribution records of nineteen species are noted here, including seven new vice-comital records (marked thus * below), and confirmed occurrences for certain other species for which verified records are scanty, as a result either of difficulty in specific determination, or of limited environmental range. In addition to those reported in the present series in this journal, other recent new records for Scotland have been reported elsewhere : for the Isle of Skye by Hunter (1957*a*), and for Hirta, St. Kilda, by Hunter and Hamilton (1958). A review of the spreading distribution of *Potamopyrgus jenkinsi* (Smith) in Scotland has also been published (Hunter and Warwick, 1957). As in the earlier papers, nomenclature and systematics used here follow those of Ellis (1951).

**Valvata cristata* Müller, Flat Valve Snail.

The collection of this snail from the Forth and Clyde Canal between Old Kilpatrick and Bowling, near the site of the western end of the Antonine Wall, establishes a new record for vice-county 99 (Dunbarton). In this locality living snails of the species were remarkable for the abundance of protozoa attached to their shells. These epizöons included species of *Carchesium* and *Epistylis*, which the present writer

has earlier found on a variety of freshwater snails in the West of Scotland, including *Planorbis albus* and *P. leucostoma*. This lot of *V. cristata* also bore large numbers of *Platycola* sp., a ciliate protozoan secreting a horny case of characteristic "blister-shape" with an aperture like a letter-box slot, which ciliate is found less generally in this area.

Lymnaea (Galba) truncatula (Müller), Dwarf Pond Snail.

No new vice-comital record of this common species is reported, but in view of its economic importance it is worth noting two newly-confirmed natural populations, and a probable introduction. This snail was collected from marshy ground at the north-west end of the Caaf Reservoir near Dalry, Ayrshire, by the author; and in marshy ground at disused mineworkings, half a mile north of South Alderston Farm, Bellshill, Lanarkshire (collected and determined by Mr. A. D. Berrie). Besides these two natural populations the species was present in abundance in the summer of 1957 in a "lagoon" in shore deposits in front of G. U. Field Station, Rossdhu, Loch Lomond. It is significant that other workers at the Field Station had earlier been bringing water and vegetation from the marshes at the outfall of the River Fruin where this species was recorded (Hunter, 1953) some years ago.

Planorbis (Anisus) vortex (L.), Whirlpool Ram's-horn.

Many living specimens of this snail were collected by Mr A. D. Berrie in an artificial pond a quarter of a mile west of Culthenove, by Stirling, Stirlingshire (actually on a tributary of the Bannock Burn). This is not a new vice-comital record, the species being already recorded for Stirlingshire (v.-c. 86), but it is a relatively uncommon snail recorded only from a few widely scattered localities in Scotland. Mr. A. D. Berrie and the author are indebted to Mr. A. E. Ellis for confirming their tentative identification of the species.

Planorbis (Armiger) crista (L.), Nautilus Ram's-horn.

Minute planorbid snails collected by Mr. A. D. Berrie from a pond at disused mineworkings, half a mile north of South Alderston Farm, Bellshill, Lanarkshire, were identified by the author as this species. This is not a new vice-comital record, and the species is probably widespread in lowland Scotland although there are relatively few confirmed occurrences, including, however, Loch Lomond (Hunter, 1953) and the loch system around Bishop Loch (Hunter, 1957b).

Succinea (Oxyloma) pfeifferi Rossmässler, Pfeiffer's Amber Snail.

Although no new vice-comital record of this species is reported, newly-confirmed occurrences are worth noting since records dating from before 1933 for *Succinea* spp. cannot be regarded as completely authentic. This amphibious snail has now been collected living on wooden lock-gates and rubbing timbers at several places in the Forth and Clyde Canal between Bowling and Old Kilpatrick, Dunbartonshire.

**Acanthinula aculeata* (Müller), Prickly Snail.

Two minute shells found in leaf-litter from Hamilton Park, Lanarkshire, proved to belong to this species. The author is indebted to Mr. R. A. Crowson who found them while sorting out beetles from the litter. This provides an authenticated record of the species for vice-county 77—although a relatively common land snail, it was listed in the last Census (Ellis, 1951) as "requiring confirmation" for this area.

Hygromia (Trichia) striolata (C. Pfeiffer), Strawberry Snail.

No new vice-comital record is reported of this widely dispersed species, but its collection in a number of localities in the West of Scotland has allowed some observations to be made on variation in shell-form. The "typical" form of the species is larger, widely umbilicate, and relatively flat, and is found throughout southern and eastern England. This shell-form has recently been found in collections from Largs, Ayrshire, from one locality in Garelochhead, Dunbartonshire, and (collected by Mr. W. M. Hutchison) from a garden in Giffnock, Glasgow. Specimens collected in the author's garden (Cardross, Dunbartonshire) and at another locality in Garelochhead, conform to the form said to be prevalent in the north-west of the British Isles. They have a higher spire and appear to have the columellar part of the peristome lip reflected, and have a more narrow umbilicus (corresponding to var. *minor* Jeffreys). A few Cardross specimens have heavier shells than normal with more marked sculpture [simulating that of *Helicella (Candidula) caperata* (Montagu)]. It is perhaps significant that *H. striolata* is one of the snails most readily dispersed by man, being transferred from garden to garden attached to plants or in soil. The existence of both shell-forms in the West of Scotland suggests some genetic element in the determination of those characters: that the higher-spired, more narrowly umbilicate form is not merely a phenotypic response to more northern climatic conditions.

* *Monacha (Ashfordia) granulata* (Alder), Silky Snail.

Living specimens of this snail have been collected at the foot of a "dry-stane" sandstone wall in Cardross, Dunbartonshire, between the author's garden and an overgrown field-entry lane in which the commonest plant is sweet cicely (*Myrrhis odorata*). This establishes a new vice-comital record for Dunbarton (v.-c. 99).

Margaritifera margaritifera (L.), Pearl Mussel.

A specimen of this bivalve was collected on the Stirlingshire bank of the Endrick Mouth during the low water of early summer 1957 when large numbers of *Anodonta anatina* (see below) were being collected. This is not a new vice-comital record, the Pearl Mussel being already recorded for vice-county 86, but may be the first authenticated record from the Loch Lomond area. The present writer has been told of a fisherman's report of Pearl Mussel in the River Falloch at the north end of the loch, but he has never seen a specimen and there is none from this locality in any of the available museum collections. This species has also been collected recently by a group of underwater swimmers in Loch Lubnaig (West Perth, v.-c. 87) and a specimen authenticated by the author.

Anodonta anatina (L.), Goose Mussel.

Numbers of recently dead mussels of this species were collected in and around the mouth of the Endrick Water, Loch Lomond, during the low water conditions of June, 1957. The species was originally recorded (Hunter, 1955) for both vice-counties 86 (Stirling) and 99 (Dunbarton) on the basis of the collection of a single specimen higher up the Endrick Water. In 1957, apart from very many long-dead and damaged shells, over thirty fresh specimens were collected by hand from shallow water on the Stirlingshire shore. [Thanks are due to Mr. A. E. Ellis for correcting the author's misdetermination of a small proportion (3/31) of these shells as *A. cygnea*. This Loch Lomond population is made up entirely of *A. anatina*. Mr. A. E. Ellis has kindly supplied authenticated specimens of both species from elsewhere and points out in correspondence that most earlier Scottish records for *A. cygnea* are erroneous and that it has been properly authenticated for only three vice-counties in Scotland.] The shallows where the collections were made stretch from the "Old Endrick Mouth", which lies just north of the present outfall, round through the tangle of little sandbank islands and channels to the north-east bank of the Endrick Water about half a mile above the outfall.

Although several fully mature specimens were taken, the majority collected were relatively young (perhaps three years old), and this may be significant. It is likely that these conditions of high temperature and low water occur in this part of Loch Lomond not annually but at irregular intervals. It seems possible that around the margin of a deeper area where *A. anatina* can live normally to full maturity (perhaps to ten years old), there lies a belt of shallower water, otherwise suitable as a habitat for the mussel, but periodically becoming too shallow and warm for the survival of the young mussels which have colonized it since the last period of low water.

**Sphaerium (Musculium) lacustre* (Müller).

Living specimens of this bivalve have been collected in the Forth and Clyde Canal between Old Kilpatrick and Bowling, establishing a new record for Dunbarton (vice-county 99). From this locality it has been possible to collect complete series of growth stages both of this species and of its congener, *S. corneum*, which will be of value for comparative purposes. This well-established and strongly breeding population of *S. lacustre* contrasts with the populations in the Monkland Canal which were reported (Hunter, 1955) as probably extinct.

The remaining eight reports concern species belonging to the genus *Pisidium*, the bivalves which, though minute, can be numerically most important in the bottom faunas of a variety of fresh waters. In the genus, several species are difficult to determine and some show considerable phenotypic variation. Only very few distribution records have been published of *Pisidium* spp. in the West of Scotland.

Pisidium amnicum (Müller) and *Pisidium henslowanum* (Sheppard).

Although a survey of *Pisidium* spp. in Loch Lomond and its associated waters is still incomplete, some account of the distribution of these two, more readily determined, species can now be given. Both species are fairly common down to 4m. along the south-east shores of the loch, and relatively abundant around the Endrick Mouth, and in the lower reaches of the Endrick Water itself. On the western shores, *P. amnicum* has occurred more frequently than *P. henslowanum*, but both species rapidly become less common sampled from south to north. Off Arden and the Fruin Mouth they are not infrequent, but around G. U. Field Station *P. amnicum* is relatively un-

common and *P. henslowanum* rare. Neither species has occurred in any collection north of Rosdhu Point in the "lowland" region of Loch Lomond, nor anywhere in the "highland" part. Further, neither species has ever occurred in offshore collections in depths of over 6m., in which collections *P. casertanum* (Poli) is the only common species. In summary, *P. amnicum* and *P. henslowanum* are limited to the marginal waters of the southernmost part of lowland Loch Lomond. This forms a significant parallel to the distribution of freshwater snails in Loch Lomond (Hunter, 1957b), where fourteen species occur in the lowland section, but only seven of them have been found to extend into the highland part of the loch. Similar species-distributions are known for several other bottom-living animals, for example corixid bugs (Slack, 1957). As a generalization, many species of benthic animals occurring in Loch Lomond must be limited in their distribution to the lowland loch or to specific habitats occurring only within it. Both species are regarded as hard water forms by Boycott (1936) and Ellis (1940). No new vice-comital records are involved above; *P. henslowanum* was recorded for Dunbartonshire (99) in an earlier paper in this series (Hunter, 1955). Apart from its distribution in the Loch Lomond area, *P. amnicum* has also recently been collected alive at several localities in the Forth and Clyde Canal near Old Kilpatrick.

Pisidium casertanum (Poli).

This species is ubiquitous in Loch Lomond, as it is throughout western Scotland. It is the only common species in offshore collections in depths of over 6m., and is often the most abundant species in collections from shallower water, except in certain southern parts of lowland Loch Lomond. It occurs down to a depth of at least 62m., having been taken at this depth in the profundal mud of the "Luss Basin."

**Pisidium conventus* Clessin.

A new record for Dunbarton (vice-county 99) is established by the collection of this rare bivalve in the deepest trough of Loch Lomond (the "Tarbet deep," 190m.). Details of this finding are given elsewhere (Hunter and Slack, 1958), and it has considerable significance as an example of an Arctic relict species occurring in the deepest profundal fauna of Loch Lomond.

**Pisidium subtruncatum* Malm.

This species has been collected in Loch Lomond in shallow water over clean sand in the bay east of Ross Priory, Dunbartonshire. This establishes a new vice-comital record for vice-county 99.

Pisidium lilljeborgi Clessin.

A specimen in a collection dredged from a depth of 2m. off the Field Station, Rosdhu, was allocated to this species by Mr. A. E. Ellis, correcting a misidentification by the author. This may be the first authenticated occurrence in Loch Lomond itself, the earlier vice-comital record (Boycott, 1933) for Dunbarton (v.-c. 99) resulting from the collection of the species in 1931 by D. K. Kevan and A. R. Waterston in Lochan Dubh, near Ardlui, the specimens being subsequently authenticated for Census purposes by C. Oldham.

Pisidium hibernicum Westerlund.

Specimens of this species have occurred in several collections made in depths of around 2m. near the Field Station on the western shore of lowland Loch Lomond. Besides typical specimens there are other forms present that have a superficial resemblance to poor, thin-shelled *P. nitidum*. Although *P. hibernicum* has occurred in several localities/collections, it is never numerically frequent—other species such as *P. casertanum* being always much more abundant in each collection. This is probably the first record of the species in Loch Lomond itself, the earlier vice-comital recording (Boycott, 1933) for Dunbarton (v.-c. 99) referring to Lochan Dubh, near Ardlui (see *P. lilljeborgi* above).

**Pisidium nitidum* Jenyns.

The collection of several living specimens of this species in the Forth and Clyde Canal at the Bowling locality mentioned above (see entry under *Valvata cristata*) established a new vice-comital record for Dunbarton (v.-c. 99).

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A NOTE ON RAINFALL IN THE WEST OF SCOTLAND

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(*MS. received 10th December, 1957*)

The hydrographic regime of a coastal area is well known to be markedly influenced by fresh water entering the sea. The data to be presented are an essential preliminary for a programme concerned with the general hydrography of the Firth of Clyde and the west coast of Scotland. Information is required concerning the average rainfall over the drainage areas, its variation, the resultant run off and its distribution along the coast line.

Along three sections of the Scottish coast that border the Atlantic the absence of any major dominating estuaries leads to a more or less uniform drainage; such is the case along the north, on the west between Cape Wrath and the Firth of Lorne and over the western side of the Kintyre Peninsula. By contrast, a vast area of the western Highlands drains into the Firth of Lorne and the remainder enters via the Firth of Clyde: in each case fresh water enters the sea on what may be termed a narrow front and may, therefore, be expected to affect profoundly and in a distinctive manner the hydrographic conditions over the Continental Shelf. These drainage areas will be considered separately and, in addition, that of the Firth of Clyde, which is of particular interest, will be treated under three subdivisions, namely, the mainland, the islands, and the sea and sea lochs (taken together). The extent of these drainage areas is given in Table 1.

TABLE 1.
Drainage areas of the West of Scotland.

	sq. miles.	sq. km.
1. North Coast	1,076	2,787
2. West Coast	2,254	5,838
3. Firth of Lorne	1,797	4,655
4. West Kintyre	261	677
5. Clyde Sea Area		
(a) Mainland	3,197	8,280
(b) Islands	210	543
(c) Sea and Lochs	1,375	3,560
Total	4,782	12,383
Total mainland areas	8,585	22,237

Source and treatment of data.

The general average rainfall was computed as described below for each drainage area, using the values of the mean annual rainfall for the standard period 1881 - 1915, given in recent volumes of British Rainfall. When comparing individual stations over the period 1932-1952 with these values, only those stations were used that had uninterrupted entries for this twenty-year period.

The general rainfall over an area is usually computed by plotting the data for the individual stations on a chart, drawing isohyets lines at appropriate intervals, and then measuring the enclosed areas by planimeter. The position of an isohyets between two stations is frequently estimated subjectively after taking into account topographical features ; for accuracy such adjustments require considerable experience. The alternative is to assume that rainfall is a linear function of the distance between stations or to apply the elaborate construction of Whittaker and Robinson (1924). When the distances between stations are small the errors involved in linear interpolation may be neglected. In this case the following non-graphic method, the advantages of which have been stressed by Sette and Ahlstrom (1948), may be used. A series of polygons are drawn by constructing the perpendicular bisectors of the lines drawn from each station to all of the surrounding stations. The rainfall at the central station is assumed to extend to the limits set off by each surrounding polygon ; the weighting introduced by summing the areas of these polygons is equivalent to the assumption of linear interpolation between stations.

Apart from the absence of subjective errors (of great advantage to those not constantly dealing with rainfall charts) the method is particularly convenient when comparing data from a long series of years ; once the stations are selected and the polygons established, no further charting is required—only arithmetical computation is involved. Should on any occasion a station entry be missing it must be inserted in the approved fashion by calculation from the weighted means of the surrounding stations and the means for the standard period.

The general average rainfall.

The general average rainfall (standard period) for the areas given above and shown in Table 1 (see also Fig. 1) together with its volume are presented in Table 2.

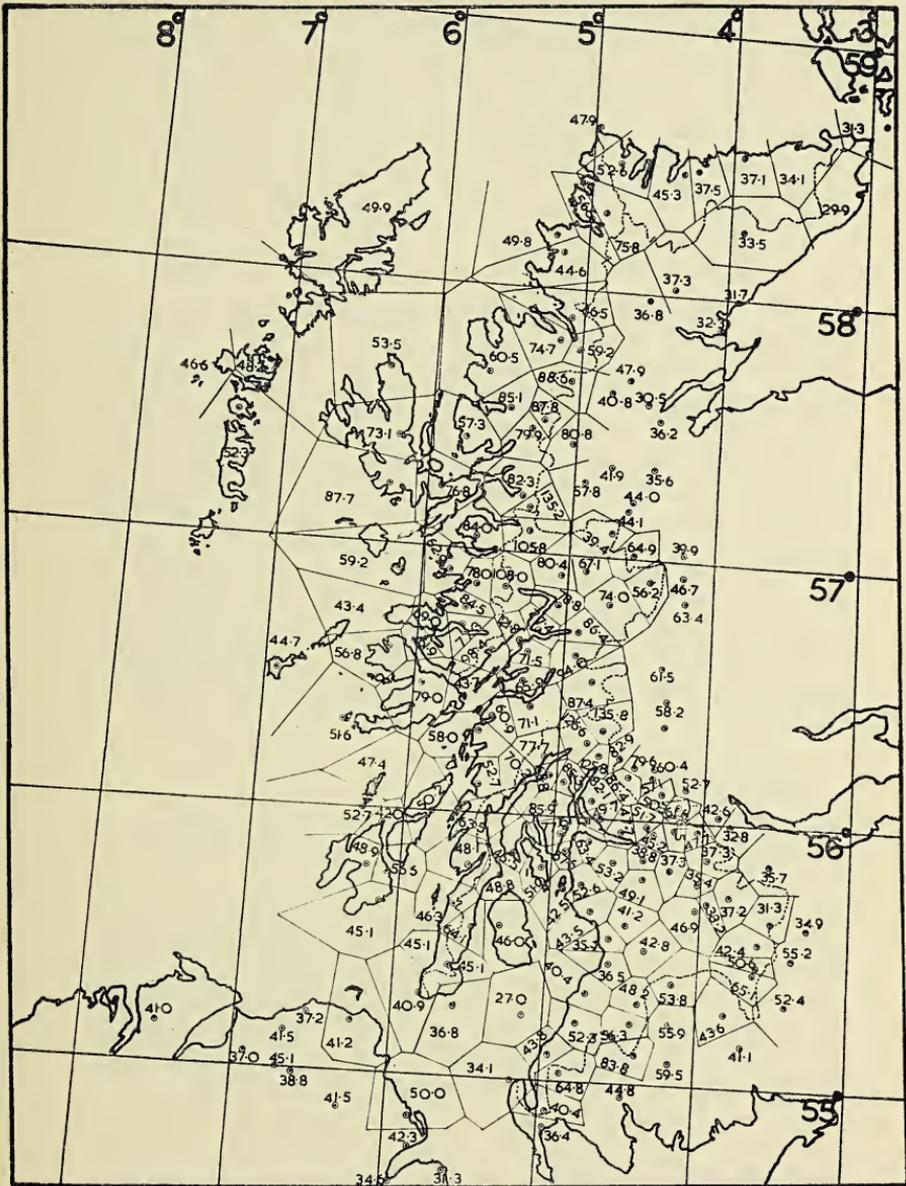


FIG. 1—West and north coasts of Scotland, showing drainage areas, rainfall at stations \odot and polygons set up as described in text.

TABLE 2.
Average annual rainfall and its volume : standard period
1881-1915.

	in.	c. met. x 10 ¹⁰
1. North coast	41.29	0.292
2. West coast	73.55	1.091
3. Firth of Lorne	77.98	0.922
4. West Kintyre	50.22	0.086
5. Clyde Sea Area—		
(a) Land	55.24	1.162
(b) Islands	47.87	0.066
(c) Sea and Lochs	42.74	0.387

The high orographical rainfall associated with the mountainous western region is clearly marked. Equally evident is the major contributions made by water entering the sea from the Firth of Lorne and the Clyde ; the two values are similar, each being of the same order as the whole of the remainder of the west coast drainage. As already noted both these large volumes of water enter the sea on a narrow front—one at the southern limit of the west coast of Scotland through the passage between the Mull of Kintyre and Northern Ireland, and the other only some fifty miles to the north. Their effect on the hydrography of the coastal regions is seen by an inspection of Figure 2 in which the mean values of the surface salinity for August (month of most records) are plotted, the data being taken from the *Bulletin Hydrographique* (1910-1948).

Annual rainfall 1932-1952.

Although meagre, there is some hydrographic data for these years, and the annual rainfall has, therefore, been computed and set out in Table 3.

It is also of interest to examine the correlation between individual stations and the drainage area of which they form a part. The correlation coefficients for this 21 year period have been calculated and are given in Table 4. Further for the station in each area with the highest correlation coefficient the regression of the annual area rainfall on the station value has been determined : the results are given in Table 5.

Rainfall and run off.

The volume of water entering the sea from any drainage area is the excess of rainfall over evaporation and retention ; over the sea itself only the two former variables are operative. The best estimate is obtained by gauging the rivers. The

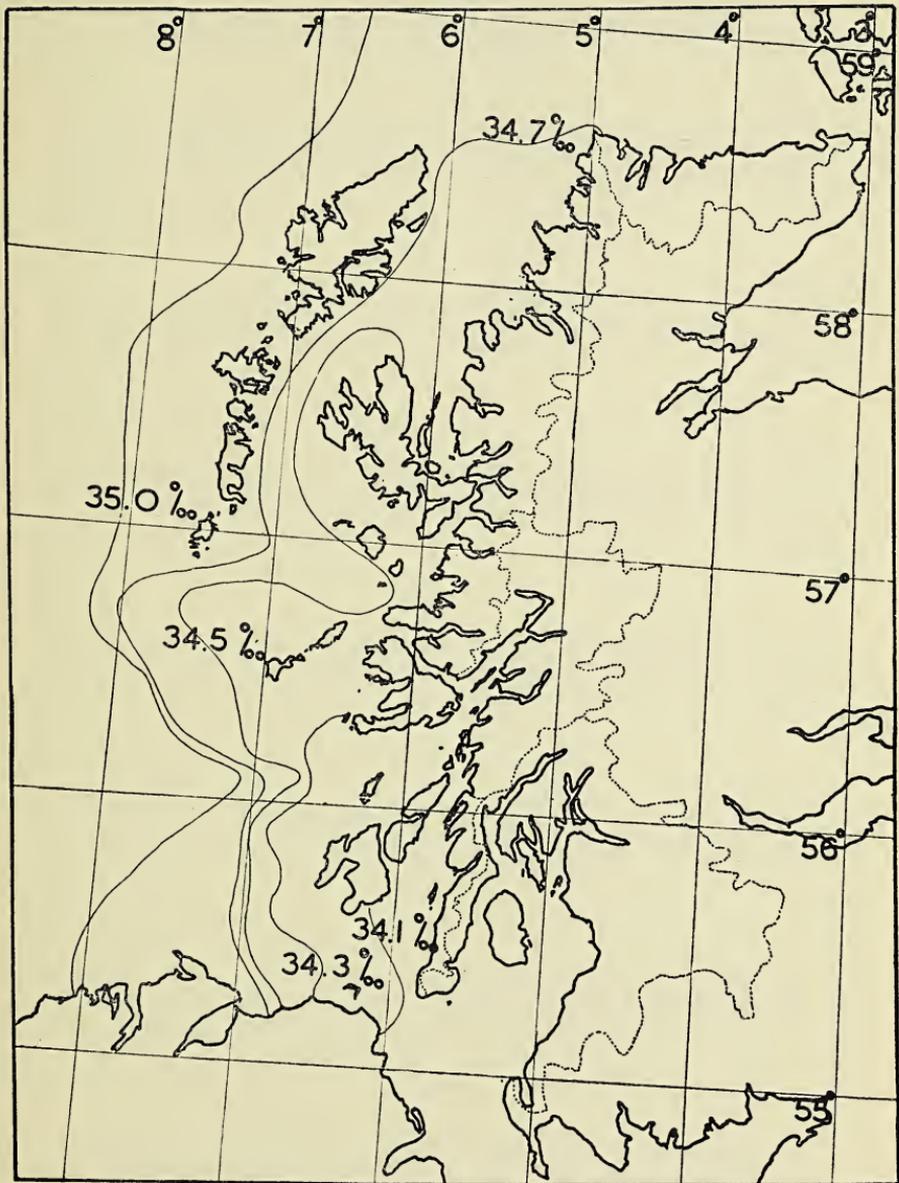


FIG. 2.—West and north coasts of Scotland, showing mean surface salinity using all available data from *Bulletin Hydrographique* for month of August.

TABLE 3
Annual rainfall 1932-1952 : West of Scotland

Year	North	West	Firth of Lothne	Mull of Kintyre	Clyde Sea Area-Land	Clyde Sea Area-Sea	Clyde Sea Area-Islands
1932	51.49	73.08	86.37	58.44	59.97	46.71	46.66
1933	39.53	58.92	63.14	47.75	43.68	35.11	40.35
1934	55.54	76.18	85.67	57.88	60.33	48.22	55.39
1935	48.22	75.70	82.74	60.88	58.33	46.17	46.74
1936	44.71	58.13	66.95	52.70	53.87	44.76	43.99
1937	39.24	49.01	57.14	49.19	46.56	39.59	45.08
1938	63.79	98.88	114.25	64.21	71.56	54.26	60.06
1939	42.82	55.95	67.49	48.27	53.62	41.73	46.15
1940	44.95	68.34	69.30	53.71	51.80	45.54	45.97
1941	48.79	53.65	58.74	41.39	42.98	33.89	37.51
1942	50.89	67.79	81.88	62.65	57.20	48.52	54.35
1943	44.39	74.78	94.22	62.25	64.35	50.24	57.96
1944	51.65	70.75	78.51	57.23	60.88	49.02	57.49
1945	44.22	58.40	69.45	50.51	54.98	41.31	47.22
1946	41.01	66.27	73.02	50.25	53.14	42.20	48.20
1947	37.59	55.71	69.58	45.23	52.91	40.92	46.02
1948	42.61	72.98	94.66	65.74	72.08	55.96	61.66
1949	45.40	82.47	95.18	59.54	62.54	48.16	54.71
1950	49.71	77.04	87.77	56.70	61.69	47.36	53.65
1951	41.55	64.17	74.39	53.85	57.04	46.48	54.89
1952	42.74	66.68	68.81	49.82	48.02	41.47	47.84
Average	46.22	67.61	78.06	54.67	56.54	45.12	50.09

TABLE 4
Correlation coefficients (1932-1952) between area and station rainfall

Clyde Sea Area (Land)	Onich ... .. .	.9427
Kilsyth	Loch Treig ... .. .	.9774
Lennoxtown	Loch Lochy ... .. .	.8091
Skipness Castle	Loch Arkaig ... .. .	.9850
Inverary	Loch Spey ... .. .	.9534
Largs	Aberchalder ... .. .	.5679
Greenock and Shaws W.W.	Fort William ... .. .	.9493
Dougarie Lodge	Kinlochleven ... .. .	.9827
Kilmacolm	Duror ... .. .	.8870
Strathblane and Duntochar		
Stonhouse	Mull of Kintyre	
Airdrie	Poltalloch ... .. .	.9325
Hamilton	Ardrishaig ... .. .	.9508
Carluke	Largie Castle ... .. .	.7624
Prestwick and Auchinervie	Skipness Castle ... .. .	.8848
Maybole and Culzean Castle	Carradale ... .. .	.9183
Biggar	Mull of Kintyre ... .. .	.4894
Crawford		
Elvanfoot	West	
Durisdeer	Glenshiel (Kyle) ... .. .	.6834
Girvan	Loch Nevis ... .. .	.9435
L. Bradan and L. Finlass ...	Kingairloch Morven ...	.6052
Colmonell and Ballantrae ...	Loch Sunart ... .. .	.9248
Castle Kennedy	Gruline ... .. .	.7187
Cumbræ	Loch More ... .. .	.9054
Ardrishaig	Ullapool ... .. .	.9040
Craræ Lodge	Cape Wrath ... .. .	.4757
Ben Lomond (Duchray) ...	Loch Duich ... .. .	.9521
Glenfinlas and Garelochhead	Arisaig House ... .. .	.9397
Ardlamont	Lismore ... .. .	.7427
Helensburgh	Morven and Sound of Mull ...	.8876
Strathblane and Kilpatrick Hills	Inverbroom and Braemore	.8054
Kippen and Stirling	Skye (Duntolm) ... .. .	.4682
	Applecross ... .. .	.9341
	Achnashellach ... .. .	.9512
Firth of Lorne	North	
Kingairloch	Wick ... .. .	.5869
Lismore	Thurso ... .. .	.7192
Barcaldine	Pentland Skerries Lt. Ho. ...	.4170
Poltalloch	Strathly-Melvick ... .. .	.7039
Inverary	Skerray Borgie ... .. .	.7695
Craræ Lodge	Lairg ... .. .	.6272
Glenshiel (Kyle)	Loch More ... .. .	.6698

TABLE 5.

Regression of area rainfall on station rainfall.

C.S.A. (Land). (32 stations)	Typical Station—Cumbrae. $Y=1.1714X+4.25$	($r=0.9871$)
KINTYRE. (6 stations)	Typical Station—Ardrishaig. $Y=0.6406X+10.38$	($r=0.9508$)
FIRTH OF LORNE. (16 stations)	Typical Station—Loch Arkaig. $Y=0.8592X+11.18$	($r=0.9850$)
WEST. (16 stations)	Typical Station—Loch Duich. $Y=0.7347X+7.59$	($r=0.9521$)
NORTH. (7 stations)	Typical Station—Skerry Borgie. $Y=0.8316X+11.58$	($r=0.7695$)

available data have been considered by Penman (1950) who finds that a value of 14 in. per year is the best estimate of the loss for this area. The value of 14 in. is obtained both from estimates of evaporation and directly from one river gauging station (River Garry, Inverness-shire).

The water balance of the Firth of Clyde.

Addition of water to the estuary takes place by drainage from the south-western land area and by rainfall over the sea and lochs. If we assume a mean annual loss over the land of 14 in. then the mean net addition *i.e.* run off is:—

(i) from the mainland $55-14=41$ in.

(ii) from the islands $48-14=34$ in.

Using the areas shown in Table 1 this gives a total mean annual addition of 2.17 c. miles (0.91×10^{10} c. metres) of water.

The net addition directly to the sea is the excess of rainfall over evaporation. Rainfall estimation over the sea has been discussed by Glasspoole (1949) and Bowden (1950). At present it appears that the best estimate is that obtained using the rainfall at surrounding stations; this has been done taking into account the Ailsa Craig station (which gives very low values) by the method previously described (p. 46). The general rainfall so calculated is 42.74 in. (Table 2.) The loss by evaporation must be estimated since there are no direct observations. The relevant data have been given by Barnes (1955). We will follow the method given by Bowden (1948), but in the absence of more detailed observations, and since we are at present interested in long period means, mean values only for the five year period will be used.

First we calculate,

$$R = 0.66 (\theta_w - \theta_a) / (\epsilon_w - \epsilon_a) \quad \dots \quad \dots \quad \dots \quad 1.$$

where,

θ_w = mean sea surface temperatures ($^{\circ}\text{C}$)

θ_a = mean air temperature ($^{\circ}\text{C}$)

ϵ_w = water vapour pressure at sea surface (mb.)

ϵ_a = water vapour pressure in the air (mb.)

The relevant values are :—

$\theta_w = 10.12^{\circ}\text{C}$

$\theta_a = 9.67^{\circ}\text{C}$

$\epsilon_w = 12.35$ mbs.

$\epsilon_a = 9.98$ mbs.

This gives a mean value for R of 0.126, agreeing well with Bowden's value of 0.12. We may therefore use Bowden's value of k (0.108) in calculating the evaporation by Sverdrup's method (1937).

We have :—

$$E = k (\epsilon_w - \epsilon_a) W \quad \dots \quad \dots \quad \dots \quad \dots \quad 2.$$

where,

E = the mean evaporation (mm./day)

W = mean wind velocity (m./sec.)

The relevant values are :—

W = 5.795 m./sec.

ϵ_w, ϵ_a = as above (mean relative humidity = 83%)

Hence, E = 1.483 mm./day = 21.3 in./year.

For the Irish sea, Bowden found 21.5 in. by this method and 24.4 in. from the heat balance.

For this sea area the mean net annual addition of fresh water is $(42.74 - 21.3) = 21.44$ in. Adding this to the drainage from the land gives a value of 2.64 c. miles of fresh water. On the average, therefore, there must be a loss of this volume which is some 8% of the total volume of the basin. However, much mixing of the fresh with the saline water takes place and there must be an inflow of more saline water to maintain the salt balance; the actual exchange of water will therefore be greater.

Summary.

1. Attention is directed to the importance of coastal drainage as a factor influencing the hydrographic regions of inshore waters.

2. The relevant data regarding rainfall and run off together with their variation and distribution over the coast are given for the north and west coasts of Scotland.

3. A large proportion of the run off from the Highlands drains by either the Firth of Lorne or the Firth of Clyde.

4. It is calculated that some 2 cubic miles of fresh water on the average enter the Firth of Clyde each year, that is 8.4% of the volume of the basin, taking the natural southern limit conforming to the land drainage area as a line between Glen Borogdail (Borgadel) and Corsewall Point. This is similar to the value given by Mill (1892) whose results were, however, based on much more restricted data, and who took the southern limit as a line from Cove Point to Milleur Point.

5. There is much mixing of this fresh water in the Firth of Clyde and the annual exchange of water must be greater than this so that the salt balance is preserved.

Thanks are due to Miss Ann Lawson for her part in performing many of the laborious computations involved in the data.

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ADDITIONAL ASSOCIATES OF *ARTEMISIA*
NORVEGICA FRIES VAR. *SCOTICA* HULTÉN IN
 WESTER ROSS

By B. W. RIBBONS and R. MACKECHNIE

(MS. received 27th March, 1958)

In July, 1957, a visit was made to the original Ross-shire locality for this rare plant, first discovered in Britain in 1950. The primary object was to photograph the plant in its habitat ; at the same time a number of associated species additional to those mentioned in published lists was noted. In view of the interest aroused by the discovery of this plant in Scotland, it is thought desirable to make available as much information about its ecology as possible.

Blakelock (1953) gives an excellent account which includes the finder's list of associated plants, and the flowering plants in this list are quoted by Raven and Walters (1956), together with a longer list compiled by Lousley and McClintock.

The following species which accompany the *Artemisia* on the mountain spur where it was first discovered are not included in the accounts already published :—

Lycopodium selago, *L. alpinum*, *Juniperus communis* ssp. *nana*, *Potentilla erecta*, *Calluna vulgaris*, *Empetrum hermaphroditum*, *Euphrasia* sp., *Carex pilulifera*, *C. bigelowii*, *Agrostis canina* ssp. *montana*, *Nardus stricta*.

After examining specimens from Scotland, Hultén (1954) decided to establish a variety *scotica* since the material did not agree with the Norwegian *Artemisia norvegica*. The Scottish plant is much smaller and usually has single heads and less dissected leaves. In particular the basal leaves of the variety tend to be cuneate rather than subpalmate and the primary lobes are merely 3-5 dentate instead of possessing long secondary lobes.

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A LIMESTONE FLORA ON BEN SGULAIRD*

By A. SLACK

(MS. received 29th November, 1957)

In 1768, Mr. James Robertson published a short note regarding a new species of *Astragalus* which he had found in Sutherland during the previous summer. He had also seen the same plant in high gravelly ground in Upper Lorne. This was the first indication of the existence of any interesting plants in the Ben Sgulaire area, though that hill is not mentioned in his account.

In 1777, Lightfoot published his "*Flora Scotica*" in which he makes reference to Ben Sgulaire under *Astragalus uralensis* (now known as *Oxytropis halleri*). This *Oxytropis* is by him recorded as growing "on Carn Dearg, one of the lower heads of Ben Sgular in Glen Creran," where it was found by Mr. Stuart. A similar entry appears under *Dryas octopetala*, and a very similar one under *Juncus triglumis*. It seems probable that Lightfoot got some information from James Robertson, or Professor Hope, and also from Mr. Stuart, for Lightfoot apparently spent only one day, 10th August, 1772, in the Oban area and would hardly have had time to visit Ben Sgulaire.

As neither *Dryas* nor *Oxytropis* had been recorded on Ben Sgulaire since Lightfoot's day, I became interested, and spent many a day exploring the glens and bens in this area.

Unfortunately, "Carn Dearg" does not appear on any map I have yet seen, and for some years I achieved no success, but during a chance discussion with a lady in Benderloch I learned that a shepherd had brought her a specimen of *Dryas octopetala* from a nearby hill. Unfortunately the shepherd lived in an inaccessible spot, but I took an early opportunity of visiting him only to find he was getting on in years and could not recall the plant at all. Visiting some of his haunts brought little reward, but in July, 1957, I came across a more promising area than before. Moss campion was abundant, all the flushes had quantities of yellow saxifrage (*Saxifraga aizoides*) and purple saxifrage (*Saxifraga oppositifolia*) and a grass, *Helictotrichon pratense*, appeared which is a fair sign of rock basic enough to support *Dryas*. A little further on *Galium pumilum* occurred, but it was now evening and there was no time for further exploration.

*Argyll—v. c. 98—27/04.

Returning in August and going beyond the previous area yielded at once several bosses of undoubted limestone, positively crammed with *Silene acaulis*, *Saxifraga oppositifolia* and *Galium pumilum*, but no *Dryas*. Other plants unusual at these altitudes except on limestone crags included *Rosa spinosissima*, *Asplenium viride*, and *Anthyllis vulneraria*.

The afternoon wore on, but just as hope was evaporating I trod on the tiniest leaves of *Dryas*. Thereafter, its usual associates began to be seen. First *Carex capillaris*, then *Draba incana*, *Arabis hirsuta*, and *Potentilla crantzii*.

The finest discovery of the day I had, however, made just before finding the *Dryas*. Growing abundantly on the limestone bosses was *Arenaria norvegica*, its little white flowers still in good condition in spite of the dampness of the day and the lateness of the season. This plant has not been recorded before from Main Argyll (v.-c. 98), though it was found in 1952 by Wallace and MacLeay in Morvern, Argyll (v.-c. 97). Apart from these recent discoveries, *Arenaria norvegica* also occurs in Shetland, West Sutherland, and Rhum. Abroad it occurs in Iceland, Norway, Sweden and Finland. Ben Sgulaire therefore represents its southernmost extension.

Oxytropis halleri and *Juncus triglumis* still elude rediscovery on Ben Sgulaire.

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**LIST OF FIRST ARRIVALS OF SUMMER BIRDS IN
CLYDE AREA IN 1957. COMPILED FROM REPORTS OF
MEMBERS AND FRIENDS**

By THOMAS ROBERTSON

<i>Bird</i>	<i>Date</i>	<i>Locality</i>	<i>Average Date over 63 years</i>	<i>Earliest Date, 1956</i>
Lesser Black- backed Gull	Feb. 11	Clyde at Glasgow Bridge	Mar. 6	Mar. 6
	Mar. 9	Wemyss Bay		
	Mar. 9	Bute		
Sand Martin	Mar. 13	Hamilton (3 birds)	April 7	April 10
	Mar. 17	Merryton, Hamilton (12 birds)		
	Mar. 24	Endrick Mouth		
Chiffchaff	Mar. 16	Kingscross, Arran	April 6	Feb. 20
	Mar. 29	Overtoun, Dumbarton		
	April 6	Bridge of Weir		
Wheatear	Mar. 19	Craigallion, Milngavie	Mar. 24	Mar. 19
	Mar. 23	Aberfoyle		
	Mar. 24	Endrick Mouth		
Swallow	Mar. 31	Kilbirnie Loch	April 10	April 12
	April 6	Balfroon Station		
	April 8	Loch Ard		
Willow Warbler	April 5	Bearsden	April 12	April 19
	April 6	Gartmore Station		
	April 7	Kingscross, Arran		
White Wagtail	April 8	Culzean, Ayrshire	April 4	April 15
	April 19	West Kilbride		
	April 28	Hamilton		
Terns (Common and Arctic)	April 8	Culzean	May 1	April 11
	May 4	Brodick		
	May 16	Dalry		
Sandwich Tern	April 8	Culzean, Ayrshire	—	April 14
Common Sandpiper	April 15	Loch Fad, Bute	April 13	April 14
Redstart	April 19	Wester Kames, Bute	April 26	April 21
	April 27	Loch Lomond		
	April 30	Whistlefield		
Cuckoo	April 20	Dalry	April 22	April 18
	April 24	Shalunt, Bute		
	April 27	Kingscross, Arran		

<i>Bird</i>	<i>Date</i>	<i>Locality</i>	<i>Average Date over 63 years</i>	<i>Earliest Date, 1956</i>
Tree Pipit	April 22	Rhubodach, Bute	April 23	April 22
	April 30	Whistlefield		
	May 4	Duchray Water, Kinlochard		
Common Whitethroat	April 23	Kingscross, Arran	May 1	May 3
	May 1	Dalry		
	May 2	Ardmore, Craigendoran		
Yellow Wagtail	April 23	Kingswells, Fenwick	April 21	—
	April 28	Hamilton		
Corncrake	April 25	Dalry	April 25	April 22
	April 25	Monkton		
	May 1	Dumbarton		
Grasshopper Warbler	April 27	Loch Lomond	May 5	May 10
	April 28	Kingscross, Arran		
	May 19	Lochwinnoch		
Sedge Warbler	April 27	Loch Lomond	May 2	May 3
	May 5	Dalry		
	May 5	Lochwinnoch		
Whinchat	May 4	Duchray, Kinlochard	April 28	April 26
Wood Warbler	May 4	Kinlochard	May 2	April 22
House Martin	May 5	Lochwinnoch	April 25	April 13
Swift	May 16	Glasgow	May 2	May 7
	May 17	Bridge of Weir		
	May 17	Dalry		
Spotted Flycatcher	May 23	Shalunt, Bute	May 10	May 5
Garden Warbler	May 25	Duchray, Kinlochard	May 8	—

The dates for the Sand Martin are the earliest ever recorded, the previous best being March 22.

SESSION XXVII—1957

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NOTES FROM EXCURSION AND SECTIONAL REPORTS
(1957)

(Full reports may be consulted at the Library)

At the time of going to press, reports on only three excursions are to hand. These are summarised as follows:—

1. General excursion, joint with the University Extra-mural Botany Class, to Lesser Cumbrae on 12th May.—Mr. J. Boyd reports that there was an attendance of thirty. Though the ornithologists were represented, the main work of the excursion was the listing of flowering plants and ferns for the B.S.B.I. Maps Distribution Scheme. Nearly 200 species were recorded, a good result for so early in the year. A striking feature of the island was the complete dominance of the tree flora by the elder, other species being present only as rare and isolated individuals. Among the herbs, of particular interest was the commonness of *Corydalis claviculata* and the occurrence of *Anagallis tenella*, *Lycopus europaeus* and *Asplenium marinum*. Three mosses new to vice-county 100 were seen: *Sphagnum squarrosum* Pers. ex Crome, *Bryum alpinum* With. var *viride* Husn., and *Hedwigia integrifolia* P. Beauv. This last species is known from only one other locality in the Clyde area—Knockdolian Hill, Ayrshire.

2. Botanical excursion to Howwood and district, Renfrewshire, on 1st June.—Mr. R. Prasher reports that despite an attendance of only four members the excursion was enjoyable and profitable. About 150 plants were recorded for the Maps Scheme, the most interesting being *Meum athamanticum*, in considerable quantity, and a fine clump of *Leucorchis albida*.

3. General excursion to Loch Lomond on 29th June.—Mr. A. Slack reports that eighteen members met at Balmaha and went by boat to the island of Creinch. The complex geology of the island, on the line of the Highland Boundary Fault, results in a very varied flora. Most of the interesting plants were found on the north-west shore, where there is basic drainage from the serpentines, etc. Plants seen here included *Orchis fuchsii*, *Trollius europaeus*, *Viburnum opulus*, *Rubus saxatilis*, and also *Aquilegia vulgaris*, which had every appearance of being wild. After walking round the island the party was taken to the huts of Glasgow University Field Station at Rossdhu. Apparatus used in investigating the hydrography and biology of the loch was explained to the party, who also examined microscopically living plankton collected that afternoon and saw a representative collection of local freshwater mollusca.

About twenty other general and sectional excursions were held during the year, but no reports of these are available. In the Botanical Section there was special emphasis on the recording of vascular plants for the B.S.B.I. Maps Scheme.

DIGEST OF THE PROCEEDINGS OF THE SOCIETY.

(Unless otherwise stated, ordinary meetings of the Society were held in The Royal College of Science and Technology, Glasgow).

8TH JANUARY, 1957.

Mr. Robert Mackechnie presided over a meeting held in the Glasgow Museum, Kelvingrove.

Two new members were admitted to the Society: Mrs. Flora M. Elder, B.Sc., 27 Mitchell Drive, Rutherglen, and Miss Alice J. Johnstone, 55 Holehouse Drive, Glasgow, W.3.

The President noted that this was the first meeting of the Society under its new title "The Andersonian Naturalists of Glasgow." A programme of scientific films arranged by Mr. C. Eric Palmar and Mr. B. W. Ribbons was then shown.

6TH FEBRUARY, 1957.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Three new members were admitted to the Society: Mr. Robert J. C. Cowan, 75 Ormonde Avenue, Glasgow, S.4; Miss Jean B. McKellar B.Sc., 18 Nethervale Avenue, Glasgow, S.4; and Mr. John Young, 179 Reidvale Street, Glasgow, E.1.

Dr. K. B. Fraser of the University of Aberdeen gave a lecture entitled "The Nature of Virus."

12TH FEBRUARY, 1957.

Mr. Robert Mackechnie presided over the Annual General Meeting.

Reports of the Society's activities were read, and it was noted that the membership of the Society on 31st December, 1956, was 244, made up of 234 ordinary members, 4 life members, 4 honorary members and 2 corresponding members. New office-bearers were elected (see p. 60). A discussion on "The local society in the community of to-day" was then opened by Mr. B. W. Ribbons, Delegate to the Assembly of Corresponding Societies of the British Association.

12TH MARCH, 1957.

Mr. Robert Mackechnie presided.

Seven new members were admitted to the Society: Miss Jessie P. Muir, 19 Hertford Avenue, Glasgow, W.2; Mrs. E. Mackechnie, 9 Skirving Street, Glasgow, S.1; Mr. Peter D. Rowe, 31 St. Ronan's Drive, Glasgow, S.1; Mr. John G. C. Campbell, B.Sc., Dept. of Bacteriology, Royal College of Science and Technology, Glasgow, C.1; Miss Ann Burns, 616 Tollcross Road, Glasgow, E.2; Miss Ray Burns, 616 Tollcross Road, Glasgow, E.2; and Miss Annie Laird, B.Sc., 14 Haldane Place, Murray III, East Kilbride.

Dr. H. S. D. Garven gave a lecture entitled "The plants and birds of Manchuria."

The death of Mr. Nicol Hopkins was intimated, and Mr. T. Robertson paid tribute to his work in the Society since 1921.

15TH APRIL, 1957.

Mr. Robert Mackechnie presided over a meeting held in the Department of Zoology, University of Glasgow.

Three new members were admitted to the Society: Miss Dorothy McTeague, B.Sc., Department of Botany, University of Glasgow; Mr. Alexander Ferguson, 22 Todhills, East Kilbride, and Mrs. Mona G. R. Ferguson, 22 Todhills, East Kilbride.

Mr. Bruce Campbell, the secretary of the British Trust for Ornithology, gave a lecture on the habitats of British birds.

13TH MAY, 1957.

Mr. Robert Mackechnie presided.

Two new members were admitted to the Society: Mr. David K. Paton, 42 Hawthorn Walk, Cambuslang, and Mrs. Amy Cross, B.Sc., 556 Tollcross Road, Glasgow, E.2.

Mr. A. C. Crundwell, of the Department of Botany, University of Glasgow, lectured on the plant life of an area of Spitsbergen which he had visited in the summer of 1954.

17TH JUNE, 1957.

An Exhibition and President's Reception was held in the Glasgow Museum, Kelvingrove, by kind permission of the Director of Museums and Art Galleries.

The Exhibition was designed to illustrate certain environmental factors controlling the distribution of plants and animals, and was open to the public for the following four days.

24TH SEPTEMBER, 1957.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Five new members were admitted to the Society: Miss Margaret Moffat, 21 Allanshaw Street, Hamilton; Mrs. Edith Dempsey, 24 Dowanside Road, Glasgow, W.2; Miss Rhona M. Dickson, 5 Lochaline Drive, Glasgow, S.4; Miss Joan M. L. Munro, 15 Woodend Drive, Glasgow, W.3, and Mrs. Elsie Conway, B.Sc., Ph.D., Department of Botany, University of Glasgow.

Dr. A. M. M. Berrie gave a lecture on the desert flora of the Great Sonoran Desert in the United States of America, showing coloured slides of the plants.

The President intimated the deaths of three members of the Society: Mr. James S. Nicol, a former vice-president, Professor Sir John Graham Kerr F.R.S., and Mr. Robert MacLean.

15TH OCTOBER, 1957.

Mr. Robert Mackechnie presided over a meeting held in the Glasgow Museum, Kelvingrove.

Three new members were admitted to the Society: Mr. James L. Summers, 11 Dalvait Road, Balloch; Mr. Hugh Gemmell, A.M.I. Mech.E., 2 Jane Street, Glasgow, S.W.1, and Mr. James Taggart, B.Sc., Clydebank, Kilreggan.

Professor T. Neville George gave an illustrated lecture with the title "Climate and landscape in the United States."

8TH NOVEMBER, 1957.

Mr. Robert Mackechnie presided over a meeting in the Department of Botany, University of Glasgow, in association with the University Department of Extra-mural Education. The meeting was open to the public.

Professor W. H. Pearsall delivered a lecture, illustrated by lantern slides, on British bogs.

12TH NOVEMBER, 1957.

Mr. Robert Mackechnie presided.

Dr. H. R. Fletcher, F.R.S.E., of the Royal Botanic Garden, Edinburgh, lectured on "The history of the discovery of the Scottish Flora."

10TH DECEMBER, 1957.

Mr. Robert Mackechnie presided over a meeting held in the Glasgow Museum, Kelvingrove.

A programme of scientific films arranged by Mr. C. Eric Palmer and Mr. B. W. Ribbons was shown.

THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month, except during July and August, usually in the Royal College of Science and Technology, but from time to time in the University and the Glasgow Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are : for Ordinary Members, twenty shillings ; for Junior Members, ten shillings, and for Family Members, five shillings. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary* :—

CHARLES M. MORRISON, M.A.,
119 BALSHAGRAY AVENUE,
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THE GLASGOW NATURALIST

Copies of many back numbers of the journal and of its predecessors, including the *Proceedings and Transactions of the Natural History Society of Glasgow*, are available for purchase by members of the Society and others. Enquiries regarding these should be addressed to the *Librarian* :—

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THE GLASGOW NATURALIST

The Journal of the
ANDERSONIAN NATURALISTS OF GLASGOW

Vol. XVIII. Part 2

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HABITATS OF THE FIELD MOUSE ON FAIR ISLE IN SPRING, 1956

By JIRO KIKKAWA

Bureau of Animal Population, Oxford University; now at
Department of Zoology, University of Otago, Dunedin,
New Zealand; communicated by H. N. Southern, Bureau
of Animal Population, Oxford University

(MS. received 12th May, 1958)

INTRODUCTION

The Fair Isle Field Mouse (*Apodemus sylvaticus fridariensis*), first described by Kinnear in 1906, has been neglected by taxonomists since the work of Hinton (1914) and Barrett-Hamilton and Hinton (1915). Its life-history and population dynamics are also very little understood. The ecological distribution of this endemic form, and its daily activity rhythm in early summer at so high a latitude (59° 32' N.) are particularly interesting to study. The only other small mammal there is the House Mouse (*Mus musculus*).

This paper gives some indication of the habitat preferences of *Apodemus* on Fair Isle in the early breeding season when the numbers are lowest. During trapping, a small number of specimens, including skulls, were prepared and are deposited in the British Museum (Natural History) and in the Bureau of Animal Population at Oxford. Measurements and other details are given in the appendices, together with some comments on taxonomy.

The work was done while I was holding a scholarship from the British Council. I am very grateful to Mr. K. Williamson of Fair Isle Bird Observatory for his valuable suggestions and for allowing me to use observatory equipment and to

SMITHSONIAN
INSTITUTION JUL 14 1959

publish information on a subject which he himself is studying ; and to Mr. H. N. Southern for help in preparing this paper. I am also indebted to members of the Hope Department of Entomology at Oxford, for identifying stomach contents of mice.

DESCRIPTION OF THE AREA STUDIED

Fair Isle, lying between Orkney and Shetland, is about 3 miles long from SSW to NNE and about $1\frac{1}{2}$ miles broad. The coastal cliffs, mainly Old Red Sandstone, vary in height from 50 ft. on the east side to 600 ft. on the west, providing many fine inlets ('geos') and supporting large colonies of breeding sea-birds.

The most important habitat division on the island is due to human habitation. This has produced a contrast between heather and grassland, which divide the island into two distinct parts.

In the north, except for Bu Ness and Skroo where Sheep's Fescue (*Festuca ovina*), Yorkshire Fog (*Holcus lanatus*) and Sea Plantain (*Plantago maritima*) grow, the ground is predominantly covered with Ling (*Calluna vulgaris*), which reaches up to 712 ft. at Ward Hill, the highest point of the island. In sheltered areas the ling grows more than a foot high and the layer of peat beneath is comparatively thick. Bell heather (*Erica cinerea*), Juniper (*Juniperus communis* var. *sibirica*), Field Woodrush (*Luzula campestris*) and, in wet places, Heath Bedstraw (*Galium hercynicum*), Bearberry (*Empetrum nigrum*) and Mat Grass (*Nardus stricta*) grow among the ling. At Burrashield and Vaasetter, where grasses are abundant and sheep grazing is intensive, the ling is only about two inches high, but at the top of the hill, where wind and weather initiate erosion, patches of bare ground with no peat deposit are frequent among the prostrate, inch-high ling.

Surrounding the village which lies near the south end of the island are heavily grazed pastures and old crofts. Here and there are houses deserted when the village population declined to about 45. In the pasture the following are commonly found : Tormentil (*Potentilla erecta*), Ragwort (*Senecio jacobaea*), Field Buttercup (*Ranunculus acris*), Devil's Bit Scabious (*Succisa pratensis*), Yarrow (*Achillea millefolium*) and *Poa* spp. In marshes and wet places there also occur Ragged Robin (*Lychnis flos-cuculi*), Narrow-leaved Cotton Grass (*Eriophorum angustifolium*), Jointed Rush (*Juncus articulatus*) and Star Sedge (*Carex echinata*). Thrift (*Armeria maritima*) is abundant along the cliffs and, where Fulmars (*Fulmarus glacialis*) and Puffins (*Fratercula arctica*) are breeding, the following plants also appear in abundance: Sea Campion (*Silene maritima*), Scurvy Grass (*Cochlearia offic-*

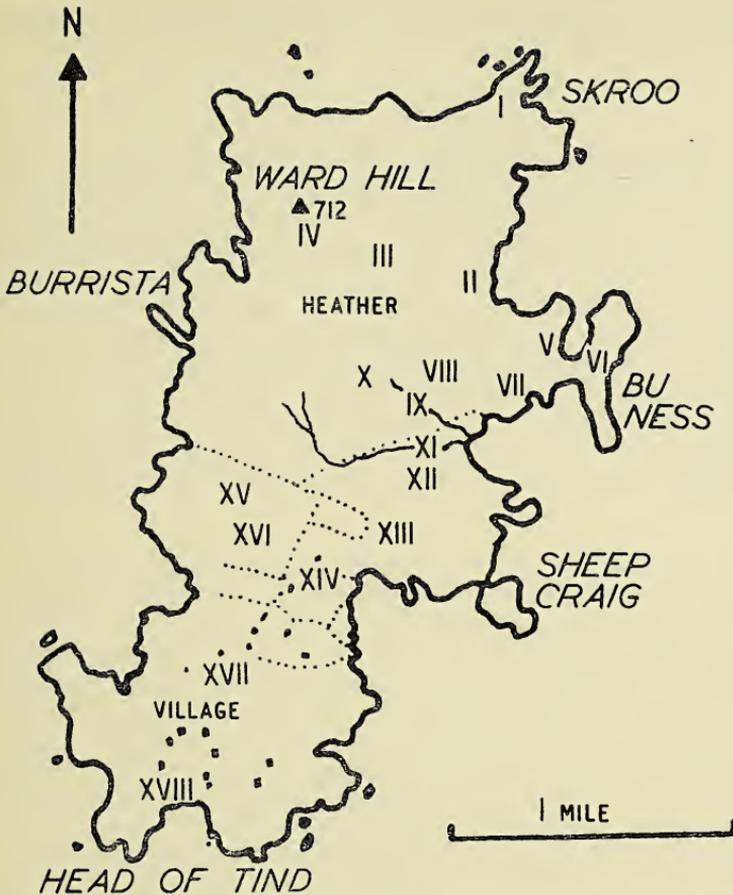


Fig. 1—Map of Fair Isle, showing trapping stations; for further explanation, see text.

inalis), Bird's Foot Trefoil (*Lotus corniculatus*), Sheep's Bit (*Jasione montana*) and (by the stream) Blinks (*Montia lamp-rosperma*).

The entire island except Sheep Craig has a dense population of multi-coloured rabbits, so dense on some of the pastureland that they made a bewildering pattern when they were disturbed into darting for their burrows. Such a density makes it almost certain that any break-back traps set for mice would be sprung by rabbits. In these pastured areas the rabbits and the sheep compete to keep the sward low, but in the heather area round Ward Hill grazing is less intense and the following species of breeding bird appear: Arctic Skua (*Stercorarius parasiticus*), Great Skua (*Stercorarius skua*), Eider Duck (*Somateria mollissima*), Oyster-catcher (*Haem-*

atopus ostralegus), Lapwing (*Vanellus vanellus*) and Wheatear (*Oenanthe oenanthe*).

TRAPPING METHODS

Trapping of field mice was carried out for three weeks (2 to 22 May, 1956) at eighteen localities (see map) in different habitats. A combination of Longworth live-traps and break-back traps was used in an attempt to estimate the numbers of mice. The intention was to derive from the break-back catches recapture figures for the marked mice previously caught in live-traps and released. The Longworth traps were baited with oats and placed 15 yards apart either in a straight line through the heather, pasture, marsh, cultivated field and shore, or along the stone dykes and ditches. They were also placed in houses and barns, ruins and walled enclosures, but in these places they were set irregularly and more closely together.

Most of the trapping was done in the heather areas and the procedure was as follows: to begin with, two trap lines were laid 15 yards apart, the trap positions on each line staggered in relation to those on the other. The space between traps on each line was also 15 yards and each line contained five traps. The positions were not moved during prebaiting (a preliminary period of free access to food in the traps), but during actual trapping the lines were moved forward progressively each day, thus covering about four acres in twelve days. The mice thus caught were measured, marked, and released at once from their points of capture. Break-back traps were dispersed irregularly each day over the area covered by the previous day's live-trapping. They were baited with margarine. This was the method used at Swey (Table I, IIIa), but it was unsuccessful since the total catch was too small to be analysed properly.

In some places where break-back traps were liable to be sprung and carried away by rabbits or sheep, no trapping of this kind was done. Elsewhere they were set normally just after sunset (about 10 p.m. B.S.T.), being secured to heather or small pegs with string, and taken up early the next morning. Even with these precautions a few traps were lost on the cliffs and among heather. Longworth traps could not be used on the cliffs because of the difficulty of lodging them securely. In only a few of the localities were the traps prebaited owing to shortage of traps, but unsprung traps were carefully examined and left down if there was evidence of mice visiting them.

TABLE I.—Trapping intensity and catches of mice in Longworth and break-back traps at different localities in Fair Isle

No.	Locality	Habitat	Area or distance trapped	Longworth traps			Breakback traps		
				Days of trapping	Trap nights	Mice caught	Days of trapping	Trap nights	Mice caught
I	Skroo	pasture	90 yd.				1	6	0
IIa	Furse	roadside	75 yd.				1	5	0
IIb	"	cliff	75 yd.				1	5	0
IIIa	Swey	heather	4.05 acres	12	120	6	12	125	8(4)
IIIb	"	short heather	1.5 acres	2	20	0	2	19	0
IV	Ward Hill	ditch	150 yd.	1	10	0	1	10	0
V	North Haven	house, dyke, shore	3 acres	8	22	4	7	20	5(2)
VI	Bu Ness	pasture	90 yd.	1	6	0			
VII	Mavers Geo	cliff	90 yd.				1	9	2
VIII	Eas Brecks	heather	250 yd.	2	20	2			
IX	Burn of Vatstrass	marsh	500 yd.	2	34	0			
X	Homis Dale	stone enclosure	1 acre	1	8	2	1	10	1(1)
XI	Funniquey	cliff	80 yd.				1	8	0
XIIa	Gilsetter	dyke	90 yd.	1	6	0			
XIIb	"	short heather	0.5 acre	2	8	0			
XIIIa	Vaasetter	dyke I	180 yd.	1	12	1	1	12	0
XIIIb	"	dyke II	180 yd.	1	12	0	1	12	0
XIV	Barkland	ruin	0.5 acre	1	14	1*	1	9	1*(1*)
XVa	Huni	dyke	180 yd.	1	12	0			
XVb	"	pasture	180 yd.	2	12	0			
XVI	Pund	ruin	0.5 acre	1	12	0			
XVIIa	Shirva	cultivated field	0.5 acre	2	12	0			
XVIIb	"	house	—	2	2	2*			
XVIII	South Harbour	ruin, shore	1.5 acres	2	20	0			

NOTE.—An asterisk denotes a house mouse: all the rest are field mice. In the last column the figures in brackets indicate the number in the break-back catch of mice which had been caught and marked just previously in live traps. At IIIa traps were prebaited for 2 days at the beginning and at V for 3 days in the course of the trapping. At VI, IX, X traps were prebaited for 1 day. At VIII, XVIIa and XVIIb trap positions were not changed.

The weather was exceptionally unfavourable for May. During the first week a southerly gale with occasional showers blew every day except the 5th May. At the beginning of the second week it rained hard and the wind changed to west, then on the following day to the south, increasing in strength even more than during the first week. The weather remained like this until the middle of the third week when the wind changed from S.W. to N.N.W. bringing a very cold spell with rain and hail. After that it became calmer. For many days it was dangerous to work near the cliff and the strong winds sometimes made it difficult to secure traps in open areas, like the fields. Even in the shelter of the dyke there was one occasion when some of the traps were wrenched from position and the two components pulled apart. Only during the last three days was there sunshine.

RESULTS

The trap catches are summarised in Table I. As the main purpose of trapping was to detect the original habitat of *Apodemus* on Far Isle, or at any rate its present focus of distribution, traps were set in different habitats as well as in different parts of the island. The more elaborate system of trapping (see p. 68) was used only at Swey, where the wide and uniform expanse of heather appeared to hold the island's main breeding population. Even so, the catches were poor at first. Between here and Ward H'ill nothing was caught, either in the short heather with patches of bare ground (IIIb) or along the ditch leading to the top of the hill (IV). At North Haven (V) there was no sign of mice on the beach, but out of four caught in live traps and marked near the dyke and the warehouse two were recaptured in the Bird Observatory building. Here the total catch of seven included three juveniles. In Mavers Geo (VII) a line of traps was set down the cliff face and caught two mice. On Eas Brecks traps were spread widely the last two days before departure in an attempt to check a big area for presence or absence of mice. Two females were caught. At the Burn of Vatstrass (IX) two trap lines of a total length of 250 yards were set on two areas and, in spite of leaving them prebaited for a day, no mice were caught. The stone enclosures in Homis Dale (X) are on the heather moorland at the bottom of Swey and some of them are protected enough to allow weeds to grow up inside. Live traps caught a pair of *Apodemus* in one of these enclosures and the female was caught again next day by a break-back in another enclosure. One male was caught in a Longworth trap along the dyke at Vaasetter (XIIIa), but did not turn up in the break-backs on the following day. Barkland (XIV) is a ruined house, deserted since 1951, but at least one house

mouse (*Mus musculus*) was living there while trapping was being done. On the other hand at Pund (XVI), deserted over ten years ago and used now only as shelter for sheep, there was no sign of mice at all. The only other locality where mice were caught was Shirva (XVIIb), one of the houses in the village, and here two house mice entered a trap on successive nights.

BREEDING

Of the 21 adult *Apodemus* caught 9 were females; of these 5 were pregnant, 3 were lactating and the remaining one was perorate. One of the pregnant females, caught in a break-back trap at Swey on 10 May, had five embryos. All the males had descended testes. Three juveniles caught at North Haven all measured 80 mm. (nose to anus) and weighed 11 to 14.4 g. They came from the warehouse and, in spite of the fact that trapping began early in May there, it was not until the 16th that they were caught. This suggests that they had just left the nest. It looks, therefore, as if breeding had started at North Haven in late April or perhaps earlier.

Table 2. Stomach contents of field mice collected in May, 1956 on Fair Isle.

<i>Specimen</i> No.	<i>Sex</i>	<i>Habitat</i>	<i>Stomach contents</i>
1	♀	stone enclosure	Noctuidae larvae 19, Araneae 9, Caribidae adult 1, seed 1.
2	♂	heather	Noctuidae larvae 1, sheep wool.
3	♀	"	Noctuidae larvae 2.
5	♀	"	Noctuidae larvae 20, Araneae 5.
6	♀	"	Noctuidae larvae 13, Araneae 2.
7	♂	"	Noctuidae larvae 9, Tipulidae larvae 4, Elateridae larvae 1, Araneae 1.
8	♂	"	Noctuidae larvae 2, heather bud 1, root 1.
9	♀	"	Noctuidae larvae 9.
10	♂	"	Noctuidae larvae 12.
14	♂	cliff	Sheep wool, straw, undetermined fragments.
15	♀	"	Chilopoda 2, Diptera larvae 5, undetermined fragments.

FOOD-HABITS

Both porridge oats and margarine proved attractive baits for *Apodemus*. Some light was thrown on their natural food by examining the stomach contents of the animals that were trapped. This examination showed some differences in diet according to habitat (Table 2), but the most striking general feature was the predominance of animal food. Those collected in heather especially had their stomachs full of caterpillar fat-bodies, which seemed to form their main food at that

time. Cuticular parts had been chewed and shredded up, so that most of the caterpillars found in the stomachs were unidentifiable, but *Charaeas (Cerapteryx) graminis* (L.), *Lycophotia porphyrea* (Schifferrmüller) and *Triphaena pronuba* (L.) were distinguished with certainty. The adults of these Noctuid species were reported to be common on Fair Isle in summer (Hardy, 1956).

DISCUSSION

The total of mice trapped is so small that any discussion of their populations is bound to be confined to a few points of general interest indicating lines of further investigation. No mice were caught on pasture or marshy ground and there are no records of *Apodemus* in the village during the spring. These facts suggest an uneven distribution related to the plant communities. The main breeding population seems to be in the northern half of the island, where it is centred in the heather habitat. This was the main habitat other than the crofts, where Kinnear (1906) found the species living.

A very rough indication of numbers at Swey (IIIa), using the capture-recapture method of estimation, gives a minimum density of 6 pairs in 4.05 acres. Though the trap catches were so small, there are some indications that the true density was not much, if at all, higher than this. The recaptures were made by the entirely different method of break-back trapping (which should reduce trap "addiction"), the sex ratio was equal (5 males and 5 females) and one marked pregnant female travelled 83 yards between the Longworth and break-back traps, indicating quite a wide range of movement. One can conclude, therefore, that in this area the breeding population is small but widely spread.

However, such factors as the distribution of cover, available food and the presence of house mice and rabbits do also seem to affect the distribution of the *Apodemus* population, for some individuals were breeding in the marginal habitats and had probably survived the severe winter there.

Heather more than 5 inches high provided a cover system criss-crossed with runways established under the heather 'canopy' while weathering and erosion provided holes for underground sheltering. Nevertheless in shorter heather (about 2 inches high), where there were many such holes, there were no mice, except where the dyke provided good shelter for them. Dykes were also present in the heavily grazed pasture areas, but here they were inhabited by rabbits and *Apodemus* was apparently absent.

Undoubtedly both the inhabited and the ruined houses can provide suitable shelter and living quarters so long as food is obtainable and the mice are not too much disturbed

by man. Boyd (1956) reported that in May, 1955 the largest catches of *Apodemus* on St. Kilda were from the ruins at Village Bay. No house mice were present there during the trapping. On Fair Isle one of the three ruined buildings in which traps were set contained at least one house mouse. This was a male caught in a Longworth trap on 8th May and recaptured the next day in a break-back in an outhouse some distance from the main building. However, these ruins were outside the range of the main breeding population of *Apodemus*. Some village houses seemed to be visited regularly by house mice (e.g. XVIIb) but not by *Apodemus* in the spring. On the other hand the Observatory buildings were inhabited not by house mice but by *Apodemus*, whose numbers were considerable compared with those in the heather habitat (IIIa) and whose breeding season seemed to have started even earlier. Perhaps an explanation lies in the situation of the Observatory for, though it is on the edge of the main breeding range of *Apodemus*, it is some distance from the village where house mice live. (House mice did once occupy the North Haven area for Mr. Williamson informs me that one was caught there in 1948.) Conditions in the Observatory area are especially favourable in winter, when food is less accessible elsewhere and this fact may account for the presence of mice on the adjacent cliff (VII).

The few stomachs examined suggest that caterpillars form the main food in spring of the mice living in the heather habitat. There is little general information about the food of *Apodemus*; what has been done has mainly concentrated on whether it differs from the bank vole (*Clethrionomys glareolus*) by feeding more on seeds than on fruits (Sviridenko, 1940; Matthews, 1952; Miller, 1954). The last author noted a comparatively higher proportion of mice eating insect larvae in spring in Wytham Woods near Oxford, though his results are only given in percentage occurrence. My own results appear to be in agreement with previous reports, but further investigation is needed, extending to other seasons of the year, before a proper comparison can be made between the food of *Apodemus* on Fair Isle and its food in other parts of Britain and the continent. Since oats proved an attractive bait, the Fair Isle mice probably take plant food when it is available.

Ravens (*Corvus corax*), skuas, great black-backed gulls (*Larus marinus*) and occasionally, migrating predatory birds, which inhabit the island for varying periods of time, may all prey on the mice, whose activity is not limited to night time in the summer, but it is unlikely that this predation can affect their numbers substantially. Little daytime activity was detected during the course of trapping, but observation with a red torch at a point near the Observatory revealed two

marked male *Apodemus* visiting the trap at twilight (9 p.m.) and at dawn (3 a.m.) as well as during the night (irregularly between 10.30 p.m. and 1 a.m. B.S.T.).

When the population of *Apodemus* increases in summer in its main breeding centre, one may expect it to disperse into other habitats and so it is found sometimes together with house mice in hay stacks in the autumn (Williamson, 1954). Kinnear (1906) also noted that it was found in corn ricks when they were threshed during the winter. These field mice may ultimately starve; they may move back to their original headquarters in the heather; or there may be a seasonal ebb and flow between them and house mice. The fate of such a dispersal could only be determined in detail by a much wider study carried on through all seasons of the year.

SUMMARY

1. In order to discover the ecological distribution of the Fair Isle field mouse in spring, trapping was carried out for three weeks in May, 1956, at eighteen localities in different habitats on the island.

2. Twenty-four field mice were caught, but only in the northern half of the island, where they were breeding on heather moor, on a cliff face and in the Bird Observatory buildings. They were apparently absent from marshy ground and from short pasture. In the village, in the southern part of the island, three house mice were caught. Where they were encountered, both these species existed at a relatively low population density.

3. Cover, availability of food and the presence of house mice and rabbits were considered to be responsible for the distribution of field mice on Fair Isle. The best cover system was to be found in high heather, where field mice had the benefit of natural runways and holes concealed under the heather. The stomachs of field mice caught in this habitat contained mainly caterpillars.

4. Little daytime activity of either species was detected during trapping but in a short period of activity a field mouse may travel 80 yards or more.

5. To understand the distribution and density of this form more information is needed about the factors limiting the winter population.

APPENDIX I

A note on taxonomy

A satisfactory clarification of the taxonomic groupings of the forms of *Apodemus sylvaticus* would require large series of specimens of each form, so that a comprehensive study could be made. However, there are two points about the colouration of the Fair Isle form which are worth drawing attention to here.

1. The bright reddish-brown colour of the upper parts, emphasised as a feature distinguishing it from other forms, appears to be limited to the larger specimens only. Among the 50 specimens collected by Mr Williamson in recent years (deposited in the Royal Scottish Museum) very bright ones all weighed over 40g. ; those below 30g. were similar in colour to the mainland form and had a dark middle line on the dorsum. This last was an even more distinctive feature in animals under 25g. in weight, mainly juveniles. This suggests that the brightness in colour is linked with increase in body size. Most of the early collections (between 1905 and 1907) are composed of very large specimens with bright colour on the back, though a dark specimen was described by Williamson (1954).

2. The yellowish chest spot was invariably present in the specimens examined. The size of the spot was usually small, seldom exceeding 10mm. in length and 2.5mm. in breadth. In no case did it form either a collar round the neck or a long streak reaching down the belly. This character seemed to be more stable in the Fair Isle than in the mainland form.

APPENDIX II

Measurements of external characters of Field Mice and House Mice collected in May, 1956, on Fair Isle.

No.	Species	Sex	Date	Habitat	Body		Tail	Ear	Hind foot	Remarks
					weight	length				
					g.	mm.	mm.	mm.	mm.	
1	<i>Apodemus</i>	♀	8.5.56	stone enclosure	32.55	110	101	15.5	24.0	pregnant 1 flea
2	"	♂	9.5.56	heather	29.70	109	101	15.8	25.0	1 flea 2 mites
3	"	♀	9.5.56	"	32.05	110	100	15.0	24.5	perforate
4	<i>Mus</i>	♂	9.5.56	ruin	18.15	90	83	10.5	18.5	
5	<i>Apodemus</i>	♀	10.5.56	heather	—	—	—	15.0	23.0	5 embryos well developed
6	"	♀	12.5.56	"	33.53	110	98	15.5	23.0	lactating
7	"	♂	15.5.56	"	33.52	111	93	16.0	23.2	1 flea 3 mites
8	"	♂	16.5.56	"	33.38	113	99	16.0	24.0	
9	"	♀	16.5.56	"	31.90	110	102	16.0	24.0	lactating
10	"	♂	16.5.56	"	44.57	122	99	16.0	25.0	
11	"	♂	18.5.56	human habitation	42.07	120	100	16.0	23.5	
12	"	♀	18.5.56	"	14.40	80	75	13.0	22.0	
13	"	juv.	19.5.56	"	14.40	80	80	12.0	22.0	
14	"	♂	19.5.56	cliff	34.20	117	99	16.0	24.0	
15	"	♀	19.5.56	"	36.20	110	98	15.5	24.0	lactating
16	<i>Mus</i>	♀	20.5.56	human habitation	17.85	90	81	11.0	18.0	
17	"	♂	21.5.56	"	26.0	100	90	13.0	20.0	
	<i>Apodemus</i>	♂	3.5.56	human habitation		115				released
	"	♂	6.5.56	"	39.0	117				released 1 mite
	"	♂	6.5.56	heather		120				released
	"	♀	7.5.56	"		113				released pregnant
	"	♂	7.5.56	stone enclosure		114				released
	"	♂	12.5.56	stone dyke		119				released
	"	♀	16.5.56	human habitation	11.05	80	75			released
	"	juv.	21.5.56	"	33.2	112	102			released
	"	♂	21.5.56	heather		109				released
	"	♀	21.5.56	"		107				released pregnant

APPENDIX III

Measurements of the skulls of Field Mice (juvenile*) and House Mice(**) collected in May, 1956, on Fair Isle

No.	Sex	Nasal-supra- occipital length	Zygomatic breadth	Interorbital constriction	Brain-case breadth	Brain-case depth	Nasal	Mandible	Diasteam	Tooth row Max.	Tooth row Mand.
		mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1	♂	27.5	14.0	4.0	12.0	8.0	10.8	14.8	7.5	4.0	4.0
2	♂	28.0	14.0	4.0	12.0	8.0	10.5	15.0	7.8	4.0	4.0
3	♂	27.0	13.8	4.0	10.8	8.0	10.2	15.0	7.8	4.0	4.0
4**	♂	22.0	11.8	4.0	10.0	6.8	7.0	11.2	6.0	3.5	3.0
5	♂	27.0	14.0	4.0	11.2	8.0	10.0	14.8	7.5	4.0	4.0
6	♂	27.5	14.0	4.0	11.5	8.0	10.2	14.5	7.8	4.0	4.0
7	♂	27.8	14.0	4.2	12.0	8.0	10.2	14.8	7.8	4.0	4.0
8	♂	—	13.5	4.0	—	—	10.8	15.0	8.0	4.0	4.0
9	♂	27.0	14.0	4.2	11.8	8.0	10.8	15.0	7.8	4.0	4.0
10	♂	29.0	14.8	4.0	12.0	8.2	11.2	15.2	8.2	4.0	4.0
11	♂	29.0	14.0	4.0	12.0	8.5	11.0	15.5	8.0	4.2	4.2
12*	♂	24.0	12.8	4.0	11.0	7.2	8.2	12.8	6.2	4.0	4.0
13*	♂	24.0	12.8	4.0	11.0	7.5	9.0	13.0	6.8	4.0	4.2
14	♂	28.0	14.0	4.0	12.0	8.5	10.8	15.0	8.0	4.0	4.0
15	♂	28.0	14.2	4.2	12.0	8.2	10.5	15.0	8.0	4.0	4.0
16**	♂	23.0	12.0	3.8	10.2	6.5	8.0	12.0	6.5	3.8	3.2
17**	♂	24.8	13.0	4.0	10.5	7.0	8.8	12.2	6.8	3.8	3.0

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OCCURRENCE OF THE CHONDROPHORE
VELELLA VELELLA (L.) ON WESTERN
SCOTTISH COASTS

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(MS. received 11th February, 1959)

Several reports have been received at this Station during the past few years of the stranding of the chondrophore *Velevella velevella* (L.) [*V. spirans* (Forsk.)] on western Scottish shores, and it is of value to put these on record. We wish to thank correspondents who have kindly sent us reports and specimens.

In 1955 Mr. A. C. Sloan informed us that specimens were washed ashore between 13th and 22nd September at Kiloran Bay, on the north-west coast of Colonsay. In 1957 Dr. S. D. Large of Campbeltown sent several specimens of the skeletons of the floats and sails found on the sands at Machrihanish, Kintyre, at the beginning of September, and simultaneously Mrs. M. G. R. Ferguson of East Kilbride informed us that living specimens, about 5 cms. in length, had occurred in profusion on 1st September on the Ayrshire coast at Croy Sands and Turnberry Bay. The winds in this region of Scotland during the last week of August were persistently from west and north-west, and it is evident that the strandings on the Kintyre and Ayrshire coasts were parts of the same invasion. The Ayrshire report, incidentally, is the first record of the species within the Firth of Clyde, which, being much sheltered from the Atlantic, is poorly situated to receive such invasions. An immediate search of the shores of the Isle of Cumbræ for specimens was fruitless, and doubtless the animals were not carried far within the Firth. In 1958, Dr. Large reported that, on 22nd October, the species was again stranded in numbers at Machrihanish; and he kindly sent specimens, which were up to 5 cms. in length. Throughout the preceding fortnight the winds had been light to moderate, from the west and south-west.

Velevella is widely distributed in the warmer parts of the Atlantic, Pacific and Indian Oceans. In the North Atlantic it seems that its normal area of distribution lies south of about latitude 40°N (Murray & Hjort, 1912), and it is abundant in the area extending westwards from the Atlantic approaches to the Strait of Gibraltar and the region of the Canaries to the region of the Azores. In the western Mediterranean also it is common. It is, however, frequently carried to the Atlantic coasts of Spain, Portugal, France and the British Isles.

Reports in the literature of its occurrence, often in considerable numbers, off western parts of the British Isles are numerous and cannot be detailed here. It is of interest, however, to review records from Scottish waters.

M'Intosh (1875, p. 32), in referring to the western shores of the Outer Hebrides, mentions that 'countless myriads of the little *Veleva* are tossed in autumn on the sand.' Ritchie (1910) reported a mature specimen taken in the autumn of 1904 on the Flannan Isles after a southwesterly gale. Nicol (1936) stated that in 1935 large numbers of living *Veleva* were found on Clachan Sands, North Uist, on 30th July, after several days of westerly winds, and skeletal remains of the floats were found abundantly on 15th August washed ashore on the Island of Muck. She mentioned having seen the species 'about the year 1916' in living condition in Kintyre. Further, she reports (by letter) that numerous skeletons were seen on the Island of Muck in 1954. Beatson (1936) reported that it was abundant on the shore near Orbost Hotel, Skye, in August, 1935, after several days of strong south-west winds. Kerr (1936) stated that he had found the skeletal remains in large quantities at Colonsay in seasons with long-continued south-westerly airs and calm seas. In July, 1937, the species was seen in fair abundance off the west coast of Barra (Forrest, 1938). Campbell (1954) reported a number of living specimens at Canna on 4th August, 1954, and mentioned that dead ones had been found at Canna in the late summer of 1953.

It is likely that *Veleva* arrives in Scottish waters in most years, though in varying numbers. This is supported by the statement by Farran (1933) that 'It seems probable . . . that *Veleva* occurs almost every year off the west coast of Ireland, but it is only when they are drifted shorewards by a favourable wind in unusually large numbers that attention is directed to them.'

In his review of the plankton of the oceanic water-masses approaching the British Isles Fraser (1955) shows how the species, and especially the associations of species, of plankton organisms are of the greatest importance in indicating the sources of the water-masses. In particular, he emphasises the distinctness of the fauna of the North Atlantic Drift Current from the 'Lusitanian' fauna. The latter is defined by him as 'that fauna which, originating in the outflow from the Mediterranean, has become modified by admixture with fauna from the area between the Azores and Bay of Biscay.' *Veleva* is listed as a species characteristic of the Lusitanian fauna.

The occurrence of *Veleva* in western British offshore waters in 1952 and 1954 was reported by Fraser (1953, 1956), who showed that the Lusitanian plankton fauna was strongly

represented in those years in waters west of Scotland. Moreover, in 1954 *Verella* was carried, with some other Lusitanian species, into the northern part of the North Sea.

Reports of the occurrence of *Verella* along the Scottish coasts are, therefore, of value in indicating oceanic influences upon our fauna. Since, however, *Verella*, in the adult stage, is a surface-living form, with a gas-filled float and sail, it is very much more subject to the influence of winds and of wind-induced surface water-currents than are plankton organisms in general. Accordingly, although its main area of abundance in the eastern North Atlantic is the same general region as that in which the Lusitanian fauna has origin, its arrival in British waters may be more directly due to meteorological conditions than to movements of water-masses. The Lusitanian water-mass (which varies in volume and northern extent from year to year) moves up the western side of the British Isles beyond the continental edge as a subsurface current beneath Atlantic Drift water. *Verella*, on the other hand, travels at the surface, and its occurrence in British waters is likely to be determined in considerable measure by meteorological conditions. Its arrival in inshore waters is especially controlled by winds.

In view of the interest attaching to the presence of *Verella* in our waters, any readers who may find or see specimens are invited to send particulars and, if possible, specimens to the author. Particulars desired include information on the abundance of the animals, their condition *i.e.* whether intact and living or skeletons only, precise localities and dates, and weather conditions on the date(s) the animals are seen and during the preceding period. For despatch, whole specimens may be preserved in spirit: ordinary methylated spirit is quite satisfactory. Alternatively, they may be preserved in formalin, diluted to about one-tenth strength with seawater. The skeletal remains of the floats and sails can be sent in the dried state. A number of specimens, if available, would be greatly appreciated, if convenient to send them; though single specimens will be much welcomed. As an aid to identification, a brief description is given. The animal is oblong, reaching a length of about $2\frac{1}{2}$ inches; and it is raft-like, with a vertical sail above and with abundant tentacles and polyps beneath. The "raft" is buoyed up by its gas-filled float; and the float and sail have a skeleton of a thin, horny material, which persists after death. The living animal is of a deep blue colour.

As an invasion of *Verella* may be accompanied by other exotic surface-living animals, such as the floating barnacles, *Lepas* spp., and the pelagic snail *Ianthina*, it is suggested that watch be kept for these or other unusual species when *Verella* is detected.

SUMMARY

1. Records of the occurrence of *Velella velella* (L.) on western Scottish coasts in 1955, 1957 and 1958 are given.
2. Previous reports of the species in Scottish waters are reviewed.
3. Its significance as an indicator of oceanic influences on our fauna is discussed.

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**SOME RECENT RECORDS OF FLOWERING
PLANTS FROM THE CLYDE AREA**

By ELIZABETH R. T. CONACHER

(MS. received 4th October, 1958)

Ranunculus arvensis L. At the edge of an oat field Georgetown, v.-c. 76, June 1957; a single plant only. A rare casual in Renfrewshire.

Beta vulgaris L. ssp. *maritima* (L.) Thell. Among stones on the shore, Little Cumbrae, v.-c. 100*, 1953; det. J. R. Lee. Attempts to refine it on subsequent visits to the island have been unsuccessful.

Utricularia neglecta Lehm. In deep pools on Kilmacolm Moss, v.-c. 76*, August 1958; det. R. Mackechnie. Abundant but not flowering.

Bidens cernuus L. var. *radiatus* DC. Kilmacolm Moss, v.-c. 76, August 1958, abundant. Growing in water, with erect capitula about an inch across.

Picris echioides L. A weed of garden and waste ground at Keppel, Great Cumbrae, v.-c. 100*, August, 1957. New to the Clyde Area.

Allium vineale L. Under trees by R. Gryffe, Bridge of Weir, v.-c. 76*, August 1957; in fair quantity.

Luzula luzuloides (Lam.) Dandy & Wilmott. In garden at Kilmacolm, v.-c. 76, June 1956, det. Kew; and on bank by hedge, Duchal policies, Kilmacolm, 1957.

Carex paupercula Michx. Moorland west of Eaglesham, v.-c. 75*, August 1958, in some quantity; det. R. Mackechnie. Close to the recently discovered Renfrewshire station for the plant (1958, *Glasg. Nat.*, 18, 28).

*New vice-county record.

STRIDULATION OF A WATER BEETLE

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(MS. received 19th January, 1959)

On 2nd October, 1958, Dr. W. Russell Hunter brought me two living male specimens of the Dytiscid water-beetle *Colymbetes fuscus* L., collected during the Andersonian Naturalists' field excursion to the Monkland Canal on 27th September, 1958. The specimens were placed in a small glass dish on my table, while I was occupied with other matters. Before very long my attention was attracted by sounds emerging from the dish—sounds similar in character to those produced by other stridulating Coleoptera, e.g. *Cychrus rostratus* and *Geotrupes* spp. Similar sounds continued to be produced at irregular (and unpredictable) intervals during the rest of the day while the two specimens were confined together. For about two hours I separated the specimens in two similar glass dishes, and during this time no sounds were detected. Overnight one of the specimens escaped, and subsequently the remaining specimen was kept under observation for a few days, but no further sounds were detected. A series of striae on the second visible sternite of the abdomen in this species has been described as a stridulatory organ—and in this connection it may be noted that on one or two occasions when I was watching the beetles while sound was being produced, one of them was resting in a horizontal position at the surface with its hind legs curved in a peculiar way. Prof. Balfour Browne in his *British Water Beetles* (Ray Society, 1950, vol. 2) mentions some old and scattered records of sound-production in this species, but seems disinclined to believe them. It would seem likely that stridulation in *Colymbetes fuscus* is not a defensive reaction as it appears to be in many other beetles (including the well-known southern water-beetle, *Hygrobia tarda*, which stridulates when seized or otherwise molested), but plays some part in the inter-relationships of members of the species.

THE LOWER VERTEBRATES OF THE LOCH LOMOND DISTRICT

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MYRA RUSSELL HUNTER

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(*MS. received 16th February, 1959*)

This paper presents a list of the species of cyclostomes, fishes, amphibians and reptiles known to occur in fresh waters or on land in the Loch Lomond district as defined below. When the first review* of recent biological work on Loch Lomond was being prepared, the inclusion of a complete fauna list for Loch Lomond itself was contemplated. However, such a list was not included, mainly because of the incomplete nature of existing knowledge of several invertebrate groups. On the other hand, knowledge of the distribution of vertebrates such as fishes is better and relatively complete. Further, during the last few years there has been a revival of interest in the possibility of preparing a Clyde Card Catalogue of the flora and fauna of the entire Clyde Area.

When the vertebrate fauna as a whole is considered, there are many accurate species lists of birds for various parts of the Clyde Area (and it is hoped that an up-to-date survey of the avifauna will shortly be produced), and the mammal fauna of the vice-counties constituting the Clyde Area has recently been surveyed in this journal (Delany, 1958). The present list covers the remaining vertebrates (other than birds and mammals) for one part of the Clyde Area—that around Loch Lomond. The Loch Lomond district considered here can be defined as Loch Lomond with the catchment areas of all streams flowing into the loch or into its outfall, the River Leven, along with land areas lying north of the Clyde estuary and east of Loch Long (including the Roseneath peninsula, and the seaboard east of Gareloch and Loch Long to the south of Arrochar). As regards vice-comital recording under the Watsonian system, this area includes the greater part of Dunbarton (vice-county 99) and much of Stirling (vice-county 86). There is, of course, considerable artificiality in using the vice-comital system of recording for aquatic animals. The boundary between vice-counties 99 and 86 passes through the middle of much of Loch Lomond and then continues along the Endrick Water for a few miles of its lower course. As a result, any fishes found swimming generally through the waters of Loch Lomond or living in the lower mature course of the Endrick can justifiably be assigned for record purposes to both vice-counties. This course has been adopted for such species in the present list. (Cases involving

* *Glasg. Univ. Publ., Stud. Loch Lomond*, 1

difficulty of vice-comital recording of freshwater invertebrates in this district have been discussed in Hunter and Slack, 1958, and in Hunter, 1955.) However, for completeness and so that this list can be used as a basis for recording the vertebrates of these two out of the nine "Clyde" vice-counties, those few records in the literature (or made by the present authors) for parts of Dunbarton and Stirling not within the Loch Lomond district, are included here. It must be emphasized that while the Loch Lomond district records can be regarded as nearly complete, this is far from being true for eastern Stirlingshire.

Finally, those species for which actual specimens have been seen and authenticated by workers at Glasgow University Zoology Department and Field Station in the period 1947 to 1958, are distinguished in the list below by the mark **Au**. Of 31 species listed, 27 are so distinguished. There are three earlier lists which include lower vertebrates in the Loch Lomond district: those of Lumsden and Brown (1895), Scott and Brown (1901), and Lamond (1931). Much of these has been valuable, but it is felt that the significant part of the present list consists, not in the quotation of a few species from these earlier authorities without recent confirmation, but in the recording of the majority of species on the basis of actual specimens which have been handled and identified by the authors during the twelve years since the Field Station was set up on Loch Lomond. Systematics and specific nomenclature used here follow those of Norman (1935), modified where appropriate to conform with Fraser-Brunner (1938) and Steven (1957), for fishes, and of Smith (1951) for the amphibians and reptiles. In the names of higher taxa and arrangement, the general textbook of Young (1950) is followed.

Superclass AGNATHA

- | | |
|----------------------------------|---|
| Class Cyclostomata | Order Petromyzontia |
| <i>Petromyzon marinus</i> L. | Sea Lamprey |
| Both 99 and 86, Au . | Loch Lomond and Endrick Water ; almost certainly breeding in the upper part of the Endrick. |
| <i>Lampetra fluviatilis</i> (L.) | Lampern |
| Both 99 and 86, Au . | Loch Lomond. |
| <i>Lampetra planeri</i> (Bloch) | Brook Lamprey |
| Both 99 and 86, Au . | Loch Lomond ; regularly breeds in several streams, including the Cross Burn, alongside the Field Station at Rosdhu. |

Superclass GNATHOSTOMATA

- | | |
|-----------------------------|--------------------------------|
| Class Actinopterygii | Order Teleostei |
| <i>Salmo salar</i> L. | Salmon |
| Both 99 and 86, Au . | Loch Lomond (both highland and |

lowland sections), and certain rivers (Endrick Water, Fruin Water, Rivers Finlas, Luss and Falloch).

- Salmo trutta trutta* L. Sea Trout
Both 99 and 86, Au. Loch Lomond (both highland and lowland sections), Clyde Estuary, and many streams.
- Salmo trutta fario* L. Brown Trout
Both 99 and 86, Au. Loch Lomond (both highland and lowland sections), and other fresh waters throughout the area.
- Coregonus clupeoides* Lacépède Powan
Both 99 and 86, Au. Limited to Loch Lomond, but occurs throughout the loch.
- [*Cyprinus carpio* L. Carp
An introduced species of doubtful distribution; recorded in 'various ponds' in the area by Scott and Brown (1901); no recent records.]
- [*Tinca tinca* (L.) Tench
Recorded for Loch Lomond and the Endrick Water by Lumsden and Brown (1895) and Scott and Brown (1901); no recent records. The localities seem very unlikely as 'Tench-water' and it seems most likely that these older records referred to stocks of introduced fish, of which none have survived.]
- Phoxinus phoxinus* (L.) Minnow
Both 99 and 86, Au. Loch Lomond (possibly limited to lowland section), and in suitable waters throughout area (e.g. the many reservoir-lochs of the Kilpatrick Hills).
- Rutilus rutilus* (L.) Roach
Both 99 and 86, Au. Loch Lomond (limited to lowland section), and Endrick Water.
- Nemacheilus barbatula* (L.) Loach
Both 99 and 86, Au. Loch Lomond (limited to lowland section).
- Anguilla anguilla* (L.) Eel
Both 99 and 86, Au. Loch Lomond, Endrick Water, River Leven, and suitable waters throughout area.
- Esox lucius* L. Pike
Both 99 and 86, Au. Loch Lomond (both highland and lowland sections), Endrick Water, lower River Falloch.
- Gasterosteus aculeatus* L. Three-spined Stickleback
Both 99 and 86, Au. Loch Lomond (probably limited to lowland section), and suitable lochs and ponds throughout area (e.g. Lochan Ghlas Laoigh, Roseneath Peninsula).

- Pygosteus pungitius* (L.) Ten-spined Stickleback
Both 99 and 86, **Au.** Loch Lomond (probably limited to lowland section), and suitable lochs and ponds throughout area (e.g. Dougalston Loch, near Glasgow).
- Cottus scorpius* L. Sea Scorpion (Bullhead)
99, **Au.** Brackish water, Clyde Estuary near Ardmore, Cardross, one juvenile.
- Cottus gobio* L. Miller's Thumb (Bullhead)
? 99 and ? 86. Recorded in Kelvin and tributaries by Scott and Brown (1901); no recent records.
- Perca fluviatilis* L. Perch
Both 99 and 86, **Au.** Loch Lomond (definitely more abundant in the lowland section, and may largely be restricted to it).
- Gobius minutus* Pallas One-spotted Goby
99, **Au.** Brackish water, shore of Clyde Estuary between Dumbarton and Cardross.
- Pholis gunnellus* (L.) Butterfish
99, **Au.** Brackish water, shore of Clyde Estuary between Dumbarton and Cardross.
- Mugil labrosus* Risso. Thick-lipped Grey Mullet
99. Recorded for the River Leven and Clyde Estuary in Lumsden and Brown (1895) and Scott and Brown (1901). It is impossible to state whether or not this stock survives. Any recent netting in these waters has been illegal fishing by poachers, so that if Mullet have been taken recently, they would not be reported. On the other hand, increasing pollution (see Lamond, 1931; Hunter, 1958) may have resulted in local extinction.
- Platichthys flesus* (L.) Flounder
Both 99 and 86, **Au.** Loch Lomond (limited to the lowland section); also abundant on Cardross shore of Clyde Estuary.
- Pleuronectes platessa* L. Plaice
99, **Au.**, possibly also 86. Recorded from Loch Lomond by Scott and Brown (1901), no recent records from fresh water, but occurs on Cardross shore of Clyde Estuary.

Class Amphibia Subclass Urodela (=Caudata)

- Triturus cristatus cristatus* (Laurenti)
Warty Newt (Great Crested Newt)
Both 99 and 86, **Au.** Recent records from oxbows and other ponds on both sides of Endrick Water between Mains and Finnich; and Blackhill Moor near Helensburgh. Brown (1901) lists other localities in Stirlingshire (Campsie, Fintry and Balfron).

Triturus vulgaris vulgaris (L.) Smooth Newt (Common Newt)

Both 99 and 86, **Au.** Recent records from oxbows and other ponds on both sides of Endrick Water between Mains and Finnich; and Skating Pond, Helensburgh Water Works. This species is probably common throughout both vice-counties, and Brown (1901) stated that it 'Abounds . . . everywhere'.

Triturus helveticus (Razoumoski) Palmate Newt

Both 99 and 86, **Au.** Common and widespread, even in the smallest ponds, and in hill lochans. Recent records include: Lochan Ghlas Laoigh, Roseneath Peninsula; pool on Tom na h'Airidhe, Helensburgh; and the reservoir at Bat a'Charchel, near Drymen.

Class Amphibia Subclass Anura (=Salientia)

Rana temporaria temporaria L. Common Frog

Both 99 and 86, **Au.** Very common and widespread.

Bufo bufo bufo L. Common Toad

Both 99 and 86, **Au.** Abundant and widespread.

Class Reptilia Order Squamata

Anguis fragilis L. Slow-worm (Blind-worm)

99, **Au.**, and 86. Brown (1901) lists the species as 'Very common . . . preferring dry situations'; though this is probably still true, the only record by the present authors is from a quarry near Mambeg, Dunbartonshire.

Lacerta vivipara Jacquin Viviparous Lizard (Common Lizard)

Both 99 and 86, **Au.** Recent records include: Auchengaich Glen, several localities in Glen Fruin, near Loch Ghlas Laoigh by Coulport (all in Dunbartonshire); Dalmary near Gartmore, Millarrochy near Balmaha (both in Stirlingshire).

Vipera berus berus (L.) Adder (Viper)

Both 99 and 86, **Au.** Throughout highland part of vice-counties; recent records include: Rhu water-works near Blairvadoch, Rhu, Dunbartonshire; Breac Leac near Balmaha.

The above list includes twenty-three species of cyclostomes and fishes, of which seventeen species occur in the waters of Loch Lomond itself. Within Loch Lomond, two distinct types of physical environment are found: the highland loch, a deep narrow trough most typical north of Inverbeg, and the lowland loch, wide and relatively shallow, lying south and east of Luss (see Slack, 1954, 1957; Hunter, 1958). Physical and chemical differences produce marked contrast in total faunal productivity between the two sections. Further, in certain groups of invertebrate animals the lowland loch

supports a greater diversity of species than the highland loch. This is also true of the fishes. Of these, Salmon, Sea and Brown Trout, Powan and Pike all occur in the highland section of the loch as well as being common in lowland Loch Lomond. Flounder, both species of Stickleback, Roach, Minnow and Loach are almost entirely restricted to the lowland section. Perch are definitely more abundant in lowland Loch Lomond, and may be largely restricted to it. Apart from the extremely doubtful case of Tench, discussed above, there is only one other fish species which may occur (or have occurred) in the loch. The possibility of Loch Lomond supporting its own endemic race of Charr (*Salvelinus alpinus* (L.)) was dismissed by Lamond (1931), although in the old *Statistical Account* for Luss Parish, Stuart (1796) had listed among the Loch Lomond fishes—' *Salmo Alpinus* Lin.', giving the English name 'Charr' and the Gaelic 'Tarragheal'. While it is reasonably certain that no specimen of *Salvelinus* has been taken from Loch Lomond during the last hundred years, no fishing method is prosecuted on the loch which would be certain to capture Charr. It is noteworthy that an endemic subspecies of Charr has very recently been rediscovered in Loch Eck (Friend, 1956); and in Loch Ness, recent echosounding shows the presence of deep-water fish shoals, which are most likely to be of Charr.

Five species of amphibians and three of reptiles are recorded above, out of the fourteen species on the British list. These eight species comprise all those characteristic of the Clyde Area as a whole. Only two other species have been recorded anywhere in the area, both almost certainly temporary introductions, the Grass or Ringed Snake, *Natrix natrix* (L.), and the Natterjack Toad, *Bufo calamita* Laurenti. Neither of these species has ever been reported in the Loch Lomond district.

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- (1) "The mammal fauna of the Clyde Area."
- (2) "New and newly-confirmed distribution records of non-marine molluscs in the West of Scotland (IVth paper)."
- (3) "A note on rainfall in the West of Scotland."

IDENTIFICATION OF AMMOCOETES OF BRITISH LAMPREYS

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(MS. received 4th September, 1958)

INTRODUCTION:

Three species of lampreys are found in British waters: the River Lamprey or Lampern (*Lampetra fluviatilis*), the Brook Lamprey (*Lampetra planeri*) and the Sea Lamprey (*Petromyzon marinus*). All of these lampreys spend the greater part of their life-cycle burrowed in muddy stream bottoms as filter-feeding larvae, or ammocoetes. Larval life terminates in a startling metamorphosis from which the adult free-swimming lamprey emerges. Both River Lampreys and Sea Lampreys then take up life in the sea, where they live by sucking blood from fish by means of a specially developed suctorial oral disc. The Brook Lamprey, in common with the other two species, develops a sucking disc, but does not feed and spends the rest of its very brief adult life in small streams. All species of lampreys spawn in early summer in rivers and streams.

Although the adult stages of these three species of lampreys can readily be recognised by great differences in size and colouration, no method has previously been devised by which the ammocoetes of different species, which all look superficially alike, can be selectively identified.

After examining over 11,000 ammocoetes from England, Scotland and Wales over the past year, the present author has developed an effective method by which the species, to which ammocoetes of British lampreys belong, can be ascertained.

In developing this key the author has not been without precedent. Several American investigators (Hubbs and Trautman, 1937; Raney, 1941; and others) devised systems (based mainly on myomere counts) for identifying ammocoetes of various species of lamprey found in America belonging to the genus *Ichthyomyzon*.

The greatest contributions in this field have been made by Vadim D. Vladykov, a Canadian biologist, who has, over the past decade, constructed keys for every species of ammocoete found in North America. Of particular value in the present paper was his key (1949) to ammocoetes of the Sea Lamprey (*P. marinus*), the American Brook Lamprey (*Entosphenus lammotteni*) and the Silver Lamprey (*Ichthyomyzon unicuspis*). This key was based on pigmentation,

myomere counts and general morphology, and these same characteristics have been exploited by the present author in working out a key to ammocoetes of British Lampreys.

MATERIALS AND METHODS :

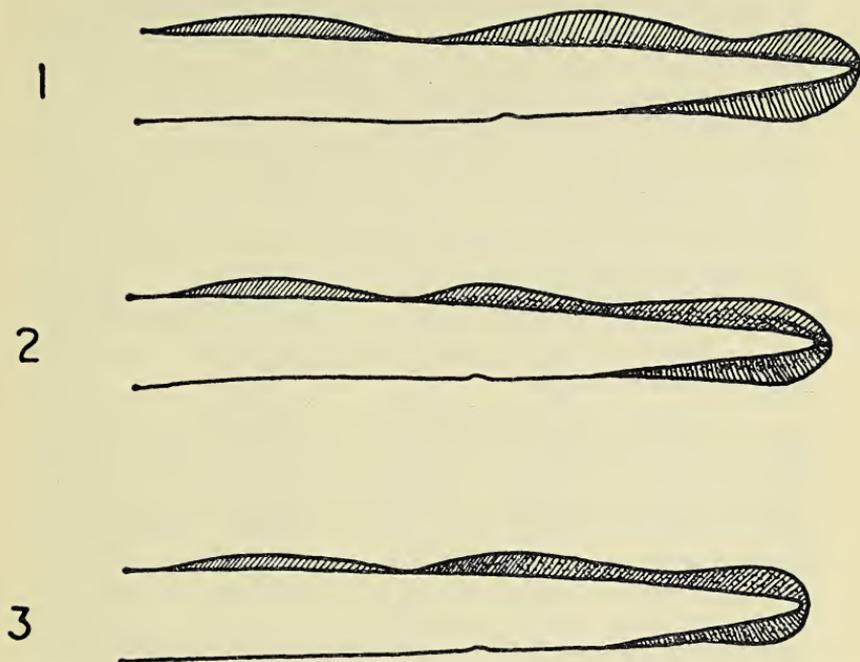
In order to acquire a representative sample, ammocoetes were collected widely throughout England, Wales and Scotland (Table 1). For the first few months all collecting was accomplished by means of hand nets. However, Dr. W. G. Hartley, of the Ministry of Agriculture, Fisheries and Food, lent a portable electric shocker to the author. This greatly simplified the collecting of ammocoetes.

All ammocoetes taken were preserved in 4% formalin and later transferred to 70% alcohol. Preliminary examinations of the first hundred specimens revealed three distinct "types" which were provisionally designated as "species." Ammocoetes taken from very small burns, where only Brook Lamprey were known to spawn, were all virtually identical. All ammocoetes sharing the same characteristics as these ammocoetes were therefore tentatively identified as Brook Lamprey larvae. Then another group of ammocoetes exactly fitted Vladykov's description of Sea Lamprey ammocoetes found in Canada (1949). It is therefore suggested that the third remaining group of ammocoetes must have been larvae of River Lamprey.

With this provisional separation as a basis, very intensive collecting was carried out over as wide an area as possible. Ammocoetes were also maintained under laboratory conditions through metamorphosis, after which they were easily identified. In this way the tentative identification of Brook Lamprey ammocoetes has been confirmed. Adult River Lamprey kept alive all winter in the laboratory spawned in April of this year. Examination of the ammocoetes thus produced has confirmed the tentative identification of *L. fluviatilis* larvae. Attempts to fertilise Sea Lamprey eggs in the laboratory failed, and no metamorphosing animals of this species have been obtained. However, the fact that after having examined many thousands of British ammocoetes only three definitive groups have emerged, two of which have been accounted for and the third of which closely resembles ammocoetes of Canadian Sea Lamprey ammocoetes is sufficient evidence for believing the "unproven" group of ammocoetes to be those of the Sea Lamprey.

RESULTS :

Four taxonomic characteristics differentiate the species of British ammocoetes.



Figs. 1, 2 and 3—Posterior ends of ammocoetes—(approx. $4.5 \times$ natural size). Fig. 1—*Lampetra planeri*, Brook Lamprey.
 Fig. 2—*L. fluviatilis*, River Lamprey.
 Fig. 3—*Petromyzon marinus*, Sea Lamprey

(1) *Shape of the Caudal Fin* : The caudal fin of the Brook Lamprey ammocoete is rather deeply notched dorsally at a point about two thirds of the distance between the anus and the posterior tip of the body (see fig. 1). The caudal fin of the River Lamprey ammocoete is very shallowly notched at a point about one third of this anal-caudal distance (see fig. 2). In Sea Lamprey ammocoetes this notch is again shallow and occurs slightly nearer to the posterior tip of the body than to the anus (see fig. 3). This characteristic is very effective in separating ammocoetes of Brook Lampreys from those of the River and Sea Lampreys, but it is not as dependable in segregating ammocoetes of the latter two species.

(2) *Pigmentation of the Branchial Region* : In ammocoetes of the Sea Lamprey the Branchial region is uniformly pigmented below and above the row of gill slits. In both Brook Lamprey and River Lamprey larvae there is no pigmentation ventral to the row of gill slits. This characteristic is very easily seen and is effective in separating ammocoetes of Sea Lamprey from those of River and Brook Lampreys.

(3) *Chromatophores on the Caudal Fin* : If the caudal fin of a Brook Lamprey ammocoete is examined under low power, it will be seen that the main area of the caudal fin is clear and that all of the chromatophores are concentrated in a narrow margin outlining the body tip (see fig. 1). In River Lamprey ammocoetes (fig. 2) the chromatophores are more widely scattered over the area of the caudal fin, but rarely extend all of the way out to the peripheral edges of the fin. In Sea Lamprey ammocoetes (fig. 3) these chromatophores are widely scattered, usually extending right to the outer edges of the caudal fin. This characteristic provides a certain way of identifying Brook Lamprey ammocoetes, but should not be relied on for selectively identifying River and Sea Lamprey ammocoetes.

(4) *Number of Trunk Myomeres* : Fortunately the myomeres or muscle bands are readily observed in ammocoetes, and they are valuable as a taxonomic characteristic. The trunk myomeres are those which lie between the seventh or posterior gill slit and the anus. River Lamprey ammocoetes have an average of 54.4 trunk myomeres, a range of 51 to 58 having been encountered in 4,102 specimens examined. Both Sea Lamprey ammocoetes and Brook Lamprey ammocoetes have over 61 trunk myomeres, and although the former has an average of 67.2 (1184 specimens examined) while the latter has an average of 65.2 (6,043 specimens examined), their ranges overlap almost completely (61 - 69 for the former, and 62 - 69 for the latter). Therefore, although the number of trunk myomeres is a valuable criterion in identifying ammocoetes of *L. fluviatilis*, it is virtually useless in separating Sea Lamprey larvae from those of Brook Lamprey.

SUMMARY :

It should be emphasised that in identifying any ammocoete, dependence should not be placed on any one of the four taxonomic characteristics described. Rather, every effort should be made to utilise all four criteria. This renders accurate identification in the field impossible, except in the case of Brook Lamprey larvae which have such characteristically shaped caudal fins. The method of identifying ammocoetes of British lampreys is summarised as follows :—

KEY TO AMMOCOETES OF BRITISH LAMPREYS :

- A1—Area of caudal fin clear, due to chromatophores being concentrated in a narrow dark margin closely adhering to and outlining the posterior tip of the body. *L. planeri*
 A2—Area of caudal fin not clear, due to chromatophores being widely scattered—

B1—Number of trunk myomeres never in excess of 58.
Branchial region unpigmented below gill-slits.

L. fluviatilis

B2—Number of trunk myomeres always in excess
of 60. Branchial region pigmented below and
above row of gill-slits.

P. marinus

TABLE I : Sources of Material.

River	Locality	Number of ammocoetes taken			Total
		<i>L. planeri</i>	<i>L. fluviatilis</i>	<i>P. marinus</i>	
Humber ...	England	166	74	45	285
Trent ...	England	22	7	0	29
Isis ...	England	40	50	0	90
Severn ...	England	2	125	866	993
Tad ...	England	857	405	0	1,262
Ysteth ...	Wales	11	0	0	11
Dee ...	Scotland	52	77	0	129
Forth ...	Scotland	759	135	12	906
Clyde ...	Scotland	746	2,019	206	2,971
Inler*	Scotland	2,281	722	6	3,009
Fruin ...	Scotland	328	200	0	528
Endrick ...	Scotland	779	288	49	1,116
		<u>6,043</u>	<u>4,102</u>	<u>1,184</u>	<u>11,329</u>

* A tributary burn to the River Leven, Dunbartonshire, about 1 km. from Loch Lomond.

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THE ISOPODS *ASELLUS AQUATICUS* AND
A. MERIDIANUS IN SCOTLAND

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(MS. received 19th October, 1958)

Collinge (1946) published localities for *Asellus meridianus* including one in 1920 from St. Andrews, Fife; and one in 1917 from Helensburgh, Dunbarton. Little reliance can, however, be placed on these records since Moon (1953) found many errors of identification in Collinge's collection. Moon did not find any Scottish material in this collection.

Between June, 1957 and September, 1958, *A. meridianus* has been found in 11 localities in vice-counties 82, 83, 84 and 86. In the same period *A. aquaticus* was found in 25 localities in vice-counties 82, 83, 84, 85, 86 and 87.

A. meridianus occurred as follows:—

Haddington, v.-c. 82. Eel Burn, North Berwick, near mouth, Edinburgh, v.-c. 83. Tranent Water Works Reservoir, Hope, Pathhead, water highly calcareous. In Edinburgh, at Blackford Pond, Duddingston Loch, Dunsapie Loch, St. Margaret's Loch, Lochend Loch.

Linlithgow, v.-c. 84. Dalmeny, the species occurs in one subsidence pond and two quarry ponds.

Stirling, v.-c. 86. Ditch, Stonehouse Farm, Grangemouth; this ditch may be brackish at times.

In the same period *A. aquaticus* occurred as follows:—

Haddington, v.-c. 82. River Tyne, East Linton; Balgone Loch, North Berwick; Peffer Burn, Tynninghame; pond, Spilmersford, Pencaitland.

Edinburgh, v.-c. 83. In Edinburgh in the Union Canal; Braid Burn; Alnwickhill Reservoir; Water of Leith at Canonmills; pond in Figgate Burn Park, Portobello; pond, Dalkeith Palace Grounds, Dalkeith; stream Turnhouse Airport; pond, Bush House, Milton Bridge; pond, Dalmahoy Golf Course; Keirshill pond, Ratho.

Linlithgow, v.-c. 84. Dundas Loch, Kirkliston; ponds, Newliston, Kirkliston; Carmelhill Reservoir, Winchburgh; Union Canal, Winchburgh; Linlithgow Loch; stream, Dalmeny.

Fife, v.-c. 85. Curling Pond, Raith, Kirkealdy.

Stirling, v.-c. 86. Reservoir, Polmont; Grange Burn, Polmont; Timber Ponds, Grangemouth.

Perth West, v.-c. 87. Lake of Menteith.

At the Bush Estate, Milton Bridge, v.-c. 83, is an artificial pond in a formal garden. This pond was constructed about 1932, and until recently its rooted vegetation was natural, being mostly *Potamogeton natans*. Since about 1955, water

lilies, bulrushes and other ornamental plants have been introduced. Probably as a result of these changes, the fauna of the pond has become noticeably richer. One of the animals which has appeared and which was not noticed before is *Asellus aquaticus*. This finding is in accord with the views of Moon (1957a, 1957b), who considers that *Asellus* is spread largely by human agencies.

Both species of *Asellus* were common where they occurred, but so far they have not been found together in Scotland. They both occur in natural and artificial bodies of water. *A. meridianus* was found associated in different localities with three different species of *Gammarus*. Sometimes, however, *Asellus* was found but not *Gammarus*. *Asellus* has not been found so far in Sutherland or in the Mallaig area.

It was noticed that *A. meridianus* was smaller and paler than *A. aquaticus*, as stated by Omer Cooper (1932). *A. meridianus* was reliably identified in the field using the character noticed by Scourfield (1940); *A. aquaticus* has two large clear lateral spaces on the posterior part of the head, while *A. meridianus* has one large clear space extending almost across the posterior part of the head. A further check was made by examining appendages.

Moon (1957) stated that *A. aquaticus* is the commoner species in Britain and this is certainly true of the Edinburgh area. Theinemann (1950) regarded *A. aquaticus* as a northern form, and *A. meridianus* as a southern species still colonising northerly habitats after the ice-age. However, judging from the distribution of *A. meridianus* in England, Wales and the Isle of Man, Moon (1957) suggested that it is the older of the two, *A. aquaticus* being a more recent arrival and a competitor with *A. meridianus*. The genus may still be increasing its range. Study of the status of *A. meridianus* and *A. aquaticus* in Scotland, especially near the limits of their ranges, would therefore be likely to determine which of the two above views is correct.

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THE PRESENT DISTRIBUTION OF
POTAMOPYRGUS JENKINSI (SMITH) IN BUCHAN
AND THE SOUTHERN MORAY FIRTH AREA

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(MS. received 22nd October, 1958)

Hunter and Warwick (1957) gave a summary of the then known distribution of the operculate snail *Potamopyrgus jenkinsi* (Smith) (*Hydrobia jenkinsi* and *Paludestrina jenkinsi* in earlier literature) in Scottish fresh waters, and a chronological analysis of the inland spread of this species in Scotland. From this it appears that there are large areas of Scotland from which neither positive nor negative reports have ever come in. In order to study the future history of colonization by this species, it is imperative to have a clear picture of its present status. I have therefore endeavoured to map its distribution in part of one of the largest "blanks" on the Scottish mainland, the Buchan peninsula and the area draining into the Moray Firth. The area investigated stretches from Aberdeen in the east to Inverness in the west, inland as far as Loch Garten and Loch Moy (see map). About seventy localities have been studied but it must be pointed out that many small waters, especially burns and streams, have been omitted. I am including all localities where a search has been made, whether the results were positive or negative. Only thus can a reasonably complete picture of the present distribution of the species be gained. A short description of the type of habitat is given, as well as the pH values of the water. The latter were, as far as possible, taken during the winter months as variations due to photosynthesis and other biotic causes are then at a minimum, making the results more comparable. For measurements at any other season, the date is given. BDH Universal Indicator was used throughout. No further analysis of the water was attempted.

The records for brackish waters of estuaries and salt marshes are only briefly summarised, except in those cases where the water-body is land-locked. The snail is universally distributed and abundant in such localities, no negative results being obtained anywhere.

The records are presented in detail below : positive records on pages 100 to 102, and negative records on page 103.



Fig. 1.—Map showing the distribution of *Potamopyrgus jenkinsi* (Smith) in the Southern Moray Firth area in 1957-58; black squares—positive records, black circles—negative records.

No. and locality	Map reference	Altitude ft.	pH	Date	Remarks
v.-c. 93. Positive records:					
3. Cotehill Loch ...	48/0229	110	7.0	15.12.57	Snails collected by Miss Betty Garden.
5. Loch of Strathbeg ...	48/0858	30	7.5	13.10.57	Large freshwater loch behind sand dunes. Reed and sedge fringe, much bottom vegetation. Unshaded shore. Small shaded loch by roadside. Muddy bottom, some sedge, <i>Myriophyllum</i> and <i>Callitriche</i> .
6. Cortes Loch ...	48/0059	100	6.75	13.10.57	
v.-c. 94. Positive record:					
71. Pool nr. Sandend ...	38/5466	5	8.0	29.7.58	Calcareous pool behind sand dunes.
v.-c. 95. Positive records:					
(a) Saline waters:					
Spey Estuary, Leen of Garmouth, Lossiemouth, Findhorn Bay, Culbin saltmarshes.					
(b) Freshwaters:					
20. Spey Bay ...	38/3565	10	7.0	9.5.58	Muddy stream with <i>Nasturtium</i> , etc. $\frac{1}{4}$ mile from sea. pH taken on 9.5.58.
21. Loch Na Bo ...	38/2860	175	7.0	27.7.57	Shaded by pines. Sandy bottom with <i>Littorella</i> .

<i>No. and locality</i>	<i>Map reference</i>	<i>Altitude ft.</i>	<i>pH</i>	<i>Date</i>	<i>Remarks</i>
22. Loch Oire	38/2860	150	7.5	1938 and 19.7.57	Open sandy and pebbly shore with <i>Littorella</i> and deep muddy sedge beds.
23. Speyslaw	38/2966	10	6.75	29.10.57	Depression in raised pebble beach. Thick vegetation.
24. Boar's Head	38/2867	10	8.0	9.5.58	Gravel pit on raised beach near sea. Little vegetation. pH taken 9.5.58.
33. Miltonduff Distillery reservoir.	38/1860	100	7.5	23.7.57	Muddy bottom, grassy edge.
36. Mosstowie	38/1761	100	7.0	26.10.57	Muddy burn with <i>Veronica</i> and <i>Nasturtium</i> .
38. Lochside, Elgin	38/2066	20	8.5	1938 and 16.6.57	Small pools on Spynie marshes. Thick vegetation and cattle contamination.
39. Loch Spynie	38/2366	20	7.8	1938 and 16.6.57	Reedy loch, clay bottom, much vegetation.
50. Loch Sanguhar, Forres	38/0255	100	7.5	6.10.57	Shaded loch with little vegetation. Clear water. Snails found on bare sand.
52. Netherton	38/0461	5	8.0	27.7.57	Landlocked pool on edge of Findhorn Bay. Very slightly saline.

No. and locality	Map reference	Altitude ft.	pH	Date	Remarks	
v.-c. 96. Positive Records:						
(a) Saline waters.						
Salt marshes near mouth of Nairn river and by edge of Culbin Forest.						
(b) Freshwaters.						
57.	Cran Loch	...	28/9459	30	22.9.57	Reed and sedge. <i>Littorella</i> on sand.
58.	Loch Loy	...	28/9358	30	22.9.57	Sedge beds and <i>Littorella</i> on sand.
64.	Loch Flemington	...	28/8152	130	1954 and	Open pebble beach and muddy sedge beds.
66.	Nairn Links I	...	28/8957	30	21.7.57	Deep quarry pool on Red Sandstone.
67.	Nairn Links II	...	28/8957	30	24.11.57	Shallow pool with fresh-water inflow and no salinity evident from flora and fauna.

v.-c. 92: Negative record:

1: Loch Skene (alt. 300 ft., pH 7.0 - 6.0).

v.-c. 93: Negative records:

2: Sand Loch (110 ft., pH 6.5). 4: Muckle Loch of Slains (135 ft., pH 7.0).

v.-c. 94: Negative records:

7: River Deveron above Banff (10 ft., pH 7.0). 8: River Fiddich at Dufftown (550 ft., pH 7.5). 9: Pond at Dufftown (550 ft., pH 7.5). 10: Loch Park (600 ft., pH 7.0). 17: Arndilly Pool (250 ft.).

v.-c. 95: Negative records:

14: River Spey at Blackboat (600 ft., pH 7.0). 15: Knockando pond (650 ft., pH 7.0). 16: Archistown Moor (650 ft., pH 6.0). 18: Gordon Castle, Fochabers, lily pond (100 ft., pH 8.0). 19: River Spey nr. mouth (10 ft., pH 7.0). 25: Mill-buies Loch (350 ft., pH 8.0). 26: Fogwatt Reservoir (250 ft., pH 7.0). 27: Longmorn Reservoir (200 ft., pH 7.5). 28-30: Buinach moorland pools (400 ft., pH 6.0 - 6.5). 31: River Lossie at Cloddach (100 ft., pH 7.0). 32: Gravel pit, Cloddach (100 ft., pH 7.5). 34: Miltonduff woodland pool (100 ft., pH 8.0). 35: Willow swamp, Lochinver, Elgin (100 ft., pH 6.25 - 8.0). 37: York Tower, Elgin, lilypond (130 ft., pH 6.0). 40: Loch Romach (500 ft., pH not taken). 41 - 42: East Grange Reservoir and stream (50 ft., pH 7.5). 43: Burghhead, stream (50 ft., pH 7.0). 44: Gordonstoun pond (20 ft., pH 7.25). 46: Lochindorb (969 ft., pH 7.0). 47: Loch Allen (850 ft., pH 4.0). 48: Glenernie Farm pond (600 ft., pH 6.0). 49: Loch of Blairs (150 ft., pH 6.75). 51: River Findhorn nr. Forres (50 ft., pH 6.75). 55: Brodie pond (50 ft., pH 8.0). 69: River Lossie at Calcots (30 ft., pH 7.0). 70: Dorback Burn (800 ft., pH 7.0).

v.-c. 96: Negative records:

11: Loch Garten (726 ft., pH 6.25). 12: Loch near Boat of Garten (700 ft., pH 7.0). 13: Loch Mor near Dulnain Bridge (750 ft., pH 6.25). 45: Lochan South of Lochindorb (1250 ft., pH 7.0). 53: Loch Moy (850 ft., pH 6.0). 54: Loch Belivat (570 ft., pH 6.5). 56: Mavieston peat pool (60 ft., pH 6.25). 59: Loch Ruthven (702 ft., pH 6.75). 60: Loch Ceo Ghlas (763 ft., pH 7.0). 61: Loch Duntelchaig (702 ft., pH 7.0). 62: Loch Ashie (716 ft., pH 6.75). 63: Loch Ness (70 ft., pH 7.0). 65: Loch of the Clans (130 ft., pH 6.5). 68: River Nairn above town (50 ft., pH 7.0).

Analysis of the above locality data reveals the following facts.

1. *Potamopyrgus jenkinsi* is widely distributed through the coastal strip of the area explored, up to six miles from the sea.

2. The species is absent from fast-flowing clear streams and rivers with a stony bottom.
3. It is not found in water with a pH of less than 7.0 (exceptionally 6.5).

Among the localities from which the snail was absent, there were some of markedly alkaline reaction, and quite close to waters in which the species occurred. I believe that such water is often non-calcareous, the alkalinity being due to contamination with ammoniacal matter. There is a swamp near Elgin, close to a stream in which *Potamopyrgus* was found. A fence divided the swamp into two portions, in one of which cattle were grazed. On this side, a pH value of 8.0 was obtained while beyond the fence, 50 yards away, it was 6.25. From both parts *Potamopyrgus* was absent. Moderate contamination is no barrier to successful colonisation but shortage of calcium may well be.

The absence of the snail from the more elevated inland localities may be due to ineffective dispersal. I consider it more likely to be due to climatic causes. The successful spread of the species through the low-lying Midland Valley of Scotland points in this direction.

As to means of dispersal, aerial transport must be postulated for the invasion of quarry pools, gravel pits, and other isolated waters but I would go further and assume that most inland localities were thus colonised. The apparent inability of this snail to establish itself in the fast-flowing rivers of the Moray Firth area seems to bar the subaquatic approach to the hinterland.

About the origin of the population of the Moray area, we can only speculate. We have no knowledge prior to 1938 when the species was well established in at least two Morayshire lochs. There are records from both Kincardine and North Caithness, antedating these records. If we assume the whole of the East Scottish population to stem from a single source, viz. the Tay Valley where the first records were made in 1906, a coastal spread through Kincardine, the Buchan peninsula, and thus to the Moray Firth, seems the most likely.

I wish to express my gratitude to Mr. Tom Warwick and Mr. A. R. Waterston for stimulating me to undertake this investigation, as well as for much subsequent help in the preparation of this paper. I am also indebted to Miss Betty Garden for material and water samples from the Sand Loch, Cotehill Loch, and the Meikle Loch of Slains in Aberdeenshire.

SUMMARY

1. The present distribution of *Potamopyrgus jenkinsi* (Smith) in Buchan and the southern half of the Moray Firth area was investigated.
2. The species was found widely dispersed through the coastal strip up to six miles inland.
3. The species was absent from markedly acid water.
4. It was also absent from fast-flowing stony rivers and streams, including nearly all the principal rivers of the area.
5. It is universally present in all brackish estuaries and salt marshes of the area.
6. Aerial dispersal is assumed for colonisation of most inland localities.

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A FURTHER NOTE ON THE LIMESTONE FLORA OF BEN SGULAIRD

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(MS. received 11th February, 1959)

In continuance of the search for Lightfoot's records on Ben Sgulaird, reported in the last part of this journal (1958, *Glasg. Nat.*, 16, 56-57), visits were made to that mountain in 1958 on April 27th, May 17th, and June 28th. The early expeditions were undertaken in an endeavour to trace the limestone outcrops and perhaps discover new areas of limestone. A few extra sink-holes etc. were encountered.

It was considered that June 28th should be in the flowering period of *Oxytropis halleri* and a visit was therefore planned to all the limestone outcrops. This involved a good deal of walking to and fro, but about the middle of the day *Juncus triglumis* was seen in a flush at 1,700 feet draining from a limestone boss, and two other similar areas in which it grew were later seen, one at the low altitude of 1,000 feet. Thus Lightfoot's record for this plant was confirmed.

Soon after encountering the *Juncus triglumis* the purple flowers of *Oxytropis halleri* were seen in a spot which had been visited at least twice in 1957. There were 2 groups of about 10 plants each separated by a few feet, but of these 20 plants only 2 were flowering and the leaves were so small and so hidden by other vegetation that the chance of discovery in the absence of flowers was remote. This then confirmed Lightfoot's record for *Oxytropis halleri*.

A considerable area around was searched without adding to the total number of plants in the colony. A careful check was made of the associates of *Oxytropis halleri* and the following were identified within two feet of the plants:—

<i>Selaginella selaginoides</i>	<i>Galium pumilum</i>
<i>Botrychium lunaria</i>	<i>Euphrasia</i> agg.
<i>Ranunculus acris</i>	<i>Thymus drucei</i>
<i>Alchemilla alpina</i>	<i>Prunella vulgaris</i>
<i>Alchemilla filicaulis</i>	<i>Carex pulicaris</i>
<i>Potentilla erecta</i>	<i>Festuca vivipara</i>
<i>Saxifraga oppositifolia</i>	
<i>Silene acaulis</i>	
<i>Arenaria norvegica</i>	<i>Cladonia gracilis</i>
<i>Viola riviniana</i>	<i>Solorina saccata</i>
<i>Polygonum viviparum</i>	<i>Cetraria aculeata</i>
<i>Campanula rotundifolia</i>	<i>Frullania tamarisci</i>
<i>Galium boreale</i>	<i>Hylocomium splendens</i>

<i>Rhytidiadelphus</i>	<i>Racomitrium</i>
<i>squarrossus</i>	<i>lanuginosum</i>
<i>Ctenidium molluscum</i>	<i>Racomitrium canescens</i>
<i>Hypnum cupressiforme</i>	<i>Tortella tortuosa</i>
(vars. <i>cupressiforme</i>	<i>Dicranum scoparium</i>
and <i>lacunosum</i>)	<i>Ditrichum flexicaule</i>
<i>Breutelia chrysocoma</i>	
<i>Mnium orthorrhynchum</i>	

The bryophytes were collected by J. H. Dickson, and confirmed by Mr. A. C. Crundwell. The lichens were also collected by J. H. Dickson and seen by Dr. G. D. Scott and Mr. P. James.

A small cairn was erected to facilitate return, photographs were taken, and a herbarium specimen was collected which will be deposited in the herbarium of Glasgow University.

The thin soil was well covered with a varied vegetation, but quite close at hand bare limestone rock outcropped in extensive sloping slabs. The aspect was south-westerly, and the slope about 30° at an altitude of approximately 2,000 feet. Lightfoot recorded in 1777 that the *Oxytropis* grew with "plenty of the *Dryas octopetala*" but to-day the small colony of *Oxytropis* discovered is separated by about 300 yards from the nearest known *Dryas* and the main *Dryas* area is still further away.

No soil analyses nor pH determinations have yet been made for the area, nor has the rock loosely referred to above as "limestone" been closely scrutinised. It is likely that it will prove to be extensively dolomitised, and perhaps otherwise altered by the adjacent granite.

The associated mosses clearly indicate the basic nature of the substratum. *Ctenidium molluscum*, *Ditrichum flexicaule* and *Tortella tortuosa* are marked basicoles. Elsewhere on the hill, *Rhytidium rugosum*, an uncommon moss, occurs in some quantity. It is another indicator of basic conditions.

A point of some interest is that two contrasted communities occur at close quarters in the region of the *Oxytropis* station on Ben Sgulaire. The *Oxytropis* itself grows in a dense closed community of short turf in which *Silene acaulis* and *Festuca vivipara* are prominent; but the *Arenaria norvegica*, though less than six inches away, is growing in an open community with very few other plants. These two communities alternate in this region because of variations of slope and possibly also of wind action. The *Silene* turf occurs on relatively flat ledges where soil accumulates. The sloping slabs are almost bare, with *Arenaria norvegica* in the cracks.

Though the *Oxytropis* and the *Arenaria* are thus not members of a single community they are in very close proximity on Ben Sgulaire and apparently in no other place in the world, for *Arenaria norvegica* is an arctic plant reaching its southernmost extension on Ben Sgulaire and *Oxytropis* is an alpine plant reaching its northernmost outpost in Scotland. The *Oxytropis* occurs more in the east of Scotland than in the west, whereas the 5 known British stations for *Arenaria norvegica* are all in the west and north of Scotland. The finding of these two together is therefore a singular feature.

The association of *Arenaria norvegica* and *Dryas octopetala* is more usual, occurring in Iceland, Norway, Sweden and at Inchnadamph in Scotland. On Ben Sgulaire these two plants occur together on "limestone" outcrops about 800 yards south of the *Oxytropis* station.

A historical problem is that the discoverer of the *Oxytropis*, *Dryas*, and *Juncus triglumis* on Ben Sgulaire did not apparently observe the *Arenaria*. Whether that discovery was made by James Robertson about 1768 or by the Rev. J. Stuart is not quite clear, but both gentlemen were excellent botanists and could hardly have failed to observe such a striking plant.

Indebtedness is acknowledged to Mr. G. Halliday who is working on *Arenaria* and communicated much interesting information.

**CRANGONYX PSEUDOGRACILIS BOUSFIELD, AN
INTRODUCED FRESHWATER AMPHIPOD, NEW
TO SCOTLAND**

By TOM WARWICK

Department of Zoology, University of Edinburgh

(MS. received 28th January, 1959)

As a result of a review by Bousfield (1958) the amphipod known in earlier British literature as *Crangonyx gracilis* Smith, or *Eucrangonyx gracilis* (Smith), is now named *Crangonyx pseudogracilis* Bousfield. This freshwater crustacean occurs in rivers, lakes and ponds over a large area of eastern North America.

It was first recorded in Britain by Crawford (1937) who found it in 1936 at the Lea Bridge Waterworks. Shortly afterwards Tattersall (1937) reported having found it in the water supply of the Metropolitan Water Board some years earlier. Further records of this species from England and Wales followed in subsequent years. Fryer (1952) gave details of its occurrence in Yorkshire. He found it in the Huddersfield-Ashton Canal between Huddersfield and Marsden. This is the most northerly record to date in England. Hynes (1955) published a map of England and Wales showing the vice-county distribution of *C. pseudogracilis*. From this map it seems that its distribution can be accounted for by spread along canals and navigable inland waterways; and by pleasure-boating activities.

This amphipod is now recorded from Scotland for the first time. It occurs in a timber-seasoning pond at Grangemouth, v. c. 86. There are five of these ponds, of which three are now in use by the timber firm of Muirhead & Sons. They were constructed about 1860 and have a total area of 22 acres, and a maximum depth of 15 feet. The ponds, marked as "timber basins," are shown on the 2nd edition of the 6 in. O.S. map of 1899; and on present-day 1 in. O.S. maps. The quantity of timber now stored in the ponds is considerably less than pre-war. A large proportion of the timber stored in the ponds comes from Canada, but occasionally a few logs are brought in from Puerto Cortes, Honduras. Wood is not brought to Grangemouth from England. Waterston (1934) noted that two of the ponds communicated with each other under a road; and one with the nearby Forth and Clyde Canal and with the River Forth at high tide.

It seems likely from the above details that *C. pseudogracilis* has been introduced directly from Canada to Grangemouth. Five specimens were obtained on 2nd November, 1958, and one on 4th January, 1959. The specimens were small and were collected in the pond to the right of the Grangemouth-

Falkirk road nearest to the sawmills. They were caught in a tangle of *Vaucheria* over a muddy bottom; *Elodea* and *Myriophyllum* were also present. Associated animals were *Asellus aquaticus*, *Glossiphonia complanata* and *Helobdella stagnalis*, planarians were abundant and the commonest molluscs were *Sphaerium corneum*, *Lymnaea peregra*, *Physa fontinalis* and *Planorbis contortus*. Eleven species of gastropod were found in these ponds in 1931 (Waterston, 1934). Of these, *Bithynia tentaculata* is of scattered distribution in Scotland and *Planorbis vortex* is rare, only occurring in five vice-counties. These ponds are the only locus in Scotland for the snails *Bithynia leachi* and *Bythinella scholtzi* (A. Schmidt) [formerly known as *Amnicola taylori* (E. A. Smith)]. *Bithynia leachi*, which occurs in England and Wales to as far north as Yorkshire, is considered by Waterston to have been introduced into the ponds. *Bythinella scholtzi*, which also occurs in canals near Manchester, has been introduced from its homeland of continental Europe (Ellis, 1951).

It seems likely therefore that other introduced species of animals may be present in these ponds. *C. pseudogracilis* itself may well have lived there undetected for many years. The nearby Forth and Clyde Canal has not yet been examined for this crustacean.

I am indebted to Dr. N. Hynes, Zoology Department, University of Liverpool, for verifying the identification and for a reference. Mr. J. M. Lindsay of Messrs. Muirhead & Sons kindly gave me details of the ponds and the timber trade.

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OBITUARY

JOHN R. LEE, M.A.

To those of us most closely in touch with Mr. Lee during 1958 it had become plain that his physical strength was undergoing a more rapid decline. His grasp of affairs was as firm as ever, but we realised with sadness that there would be few more occasions when we could hope to have his company on a Society evening, much less in the field. Nevertheless, his absence from our first meeting this year roused no misgivings, and the news of his death on 14th January, the day following the meeting, was quite unexpected.

John Ramsay Lee was born in Helensburgh on 26th May, 1868. Four years later the family moved to the north of England where the next ten years of his life were spent, first in Halifax then near Blackburn. It was during this period that his interest in Botany was aroused, due, he recalled, to lessons given by a country schoolmaster, Mr. Dawkins. Whoever has the credit of laying the foundation of what was to prove a life interest deserves the gratitude of us all. By 1885 the family had returned to Scotland; in the spring of that year the young John Lee, then nearing his seventeenth birthday, joined a Popular Botany class held in Anderson's College under the Rev. A. S. Wilson. That same autumn he was one of sixteen members of the class who came together in founding the Andersonian Naturalists' Society. This body, which survived a few difficult years in infancy, had by 1893 so far recovered that its membership numbered about 140, and the first number of its "*Annals*" was published. A year or two later John Lee joined the older Natural History Society of Glasgow. That he was becoming prominent among local naturalists is evidenced by his election to the presidency of the "Andersonian" for the term 1903-1904, and of the Natural History from 1911 to 1914. When, in 1931, these two Societies, and the Microscopical Society of Glasgow, became one, he was the obvious choice for first president of the combined body, and held that office till 1933. In that year came the publication of his "*Flora of the Clyde Area*," a work which established its author in the line of succession to Thomas Hopkirk and Roger Henedy. In 1938 he was appointed Honorary Curator of the Herbarium of Glasgow University, and seven years later he presented his own beautifully mounted collection to the University, where in the Department of Botany it forms an important part of the University Herbarium. In 1950, to the great joy of his many friends, the University recognised the value of his botanical work by conferring on him the honorary degree of Master of Arts—a distinction rarely given, and

worthily earned. To tell in a brief notice just what this one man has meant to our Society is not possible. The bibliography which follows records only the more formal of his contributions to botanical science; for notices of the steady succession of specimens (often new county records) exhibited at Society meetings, of excursions led and reported, one must refer to the Society's publications over a period of half a century. His happiest hours were those spent in the field; there every one could learn something from him. He told me once that in his youth he had been persuaded to act as tutor in Botany to an adult education class in Airdrie. At the end of the course he set an examination in which, he confessed cheerfully, "they all failed!" I can well believe that he would find classroom botany uninspiring, but in the open he was really at home. On excursions he made no concessions to the weather; the raincoat, the cap, the dark suit, the slender vasculum formed the uniform for all occasions, to be worn alike on a sharp spring day or on a torrid one in late summer. Heat affected him more than cold, but he tholed it with great fortitude when the hunt was up, and it was largely due to his persistence in the sultry days of July, 1945, that we were able to establish the existence of *Dryopteris cristata* as a Scottish plant. His method was exemplary—no plant, even the most obvious, was identified or discussed until it had been subjected to careful examination. To suffer fools patiently, if not gladly, was natural to him, and more than once we marvelled at the care he took in replying to some unworthy query. By nature he was the mildest of men; the nearest approach to ill-humour in him that I ever detected was a certain impatience with the authors of some of the baffling changes in botanical nomenclature, with which we have been bombarded in recent years—and over which the rest of us have been much more outspoken. In his more active years he was a "Lawers man"; when failing strength put an end to hill-climbing he was not content to sit at the base and become nostalgic about past triumphs. Instead, he began in earnest the study of some of the critical genera—the eyebrights, the hawkweeds, the roses and the brambles—which he could obtain at lower levels, and for which there had never before been time. I think that one of the greatest tragedies of his life came in his last ten years, when failing eyesight brought to an end even this activity.

It should, of course, be impossible for a man like this to pass from the scene without having put on record his reminiscences; they would have made wonderful reading. With Peter Ewing, D. A. Boyd and G. F. Scott Elliot, he had much to do with the compilation of the plant lists in the Handbook prepared for the 1901 visit of the British Association, and he

was as heavily involved in preparing the Card Catalogue for the 1927 meeting of the Association in Glasgow. His interest in mosses and liverworts led him into membership of the British Bryological Society; at its field meetings he made personal acquaintance with such men as J. B. Duncan, H. H. Knight and H. N. Dixon. To that Society's Census Catalogues of British mosses and hepatics he contributed records from nearly a dozen Scottish vice-counties, and in 1956 he was made an honorary member of the Society. His membership of the Botanical Exchange Club (now the Botanical Society of the British Isles) extended over 35 years, and brought him into personal contact with the man who for so long was its secretary and guiding spirit, G. C. Druce. In 1936, at the age of 68, he undertook a trip to Iceland, with all the enthusiasm of a keen student on his first excursion. And on a memorable day in August, 1956, he led his last excursion, to Stirling Castle; then, at 88, he could still be thrilled by the discovery of an unexpected plant.

This botanical activity, added to his daily occupation of cashier with Messrs. Arthur & Co. Ltd., a firm of city warehousemen, from whose employ he retired in 1930, would have been enough for most men. That in addition he yet contrived to give a lifetime of devoted service to the affairs of Greyfriars Church, including 56 years of eldership and 42 years as session clerk, speaks for itself. Professor Braid, who knew him better than most of us, writes: "I have never been able to decide whether I regarded Mr. Lee more highly as a man or as a botanist." A hard choice, indeed; luckily we do not have to make it. We need only congratulate ourselves on having had the good fortune to know him in both capacities, and on having been able on two of his birthdays to express our gratitude, and with it the assurance that he still held the first place in our esteem and affection.

Eighty-two years ago, Roger Hennedy lived just long enough to take part in the first British Association meeting ever held in Glasgow. Now, just after he had attended the fourth of these meetings in this city (and for himself the third) the name of John R. Lee must be taken from our roll of members. Custom dictates an obituary notice, but in fact we need neither that nor the inscription on a headstone to remind us of the greatness of this man. The healthy and vigorous functioning of this Society, for which he did so much, will be the best memorial of all to the one who will be remembered by us, as long as memory lasts, as "Mr. Lee."

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- 1896 "Plants of the Kenmuir district of the Clyde." *Ann. Anderson. Nat. Soc.*, 2, 8-15.
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- 1911 "Additions to the list of mosses of Dumbartonshire." *Glasg. Nat.*, **4**, 11-14.
- 1915 "A visit to the source of the Falloch." *Glasg. Nat.*, **7**, 65-77.
- 1916 "Excursions in Breadalbane (Killin District), July, 1915." *Glasg. Nat.*, **8**, 17-22.
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- 1933 "*The flora of the Clyde Area.*" Glasgow.
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- 1936 "Andersonian reminiscences, 1885-1930." *Ann. Anderson. Nat. Soc.*, **4**, 121-128.
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- 1946 (With Prasher, R.) "Appendix A. Botanical Section Report." in "The natural history features of the West of Scotland in relation to regional planning." *Glasg. Nat.*, **15**, 43-46.
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- 1952 "Obituary—Mrs. Ewing." *Glasg. Nat.*, **17**, 62-63.
- 1952 "Obituary—James Robertson Jack." *Glasg. Nat.*, **17**, 64.
- 1953 "Additions to the flora of the Clyde Area." *Glasg. Nat.*, **17**, 65-82.
- 1955 (With Patton, D.) "Ben Lawers—past and present." *Glasg. Nat.*, **17**, 184-188.

(Reference to the occasion of Mr. John R. Lee's eightieth birthday was made in *Glasg. Nat.*, **16**, 56-57, and a series of tributes on his ninetyeth birthday was printed, with a portrait, in *Glasg. Nat.*, **18**, 31-36.)

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NOTES FROM EXCURSION AND SECTIONAL REPORTS (1958)

(Full reports may be consulted at the Library)

Botanical Section.—In this section there was again special emphasis on the recording of vascular plants for the B.S.B.I. Maps Scheme, the first phase of which ended in 1958. Mr. R. Prasher recorded that the section held thirteen specifically botanical excursions, besides participating in the general excursions of the Society. At the time of going to press no special reports of interesting plants found on these excursions have been received, but on p. 82 of this issue are noted some recent records of flowering plants made by Miss E. R. T. Conacher.

Ornithological Section.—This section held successful excursions to the Bothwell-Hamilton district and to Lochwinnoch in March, 1958, and to the Barassie-Troon district in September, 1958. Perhaps the most interesting observation was made during the first of these excursions, when, under the leadership of Mr. C. M. Morrison, the party watched about six Great Crested Grebes, one pair of which was showing courtship display, with arched necks and extended head feathers. Miss E. R. T. Conacher, Convener of the Section, has provided the following account of a new recording scheme which was begun in May, 1958.

“ It was suggested that a record might be kept of the birds seen within the Glasgow City Boundary using postal districts as convenient units. The help of those who had declared Ornithology as their principal Andersonian interest was sought for recording. There is no time limit in which to complete the list, in fact we hope information will be added year by year so that we shall be able to note any large-scale changes of status that may occur to some species in certain districts. In the first instance we simply noted the occurrence of species but some recorders have given such illuminating additional information that it has been decided to qualify occurrence with the following remarks:—Rare, Breeding, Overhead, Common, Occasional, Summer, Winter, or All-year. We have purposely avoided the use of such terms as ‘ Resident ’ or ‘ Partial Migrant,’ as some residents are partial migrants and vice versa, and we want to record the actual presence or absence in our districts. The information is collected first in B.T.O. Field Lists and then transferred with notes to postal district folders; it is also entered on the master list which enables comparisons to be made. So far we have information for thirteen postal districts. House Sparrows and Starlings are the only birds to occur in all of them. Blackbirds occur in all but one and Black-headed Gulls occur in all but two. Swifts have been seen in ten out of thirteen and Cornerake, Merlin and Redstart in one. Glasgow N.W. has the most birds recorded up to date—fifty-four, with W.3. and S.3. coming next, both with over forty. Seventy-six species have been seen in all. The following members who have already sent in records must be thanked: Misses Black and Scott, and Messrs. Dickson, Mackechnie, Morrison and Robertson.”

Geological Section.—Four excursions and two winter meetings of this section were held in 1958. The excursions were to Paduff Glen, near Kilbirnie, to Auchenreoch Glen, to the Cardross district and to the Whangie.

Zoological Section.—Four excursions took place during the spring and summer of 1958. The dunes at Turnberry were visited on 26 April and animals obtained by digging in the roots of marram-grass included the large burrowing Carabid beetle *Broscus cephalotes*, the small sand-dwelling Scarabæid beetle *Aegialia arenaria*, a flea-beetle *Psylliodes*

marcida and the handsome burrowing wolf-spider *Arctosa perita*. On an excursion to the remnant of the Caledonian forest at Torlum Hill, near Muthill, on 31 May, the rare beetle *Cimberis attelaboïdes* and the Pearl-bordered Fritillary (*Argynnis euphrosyne*) were again collected. An excursion on 21 June to the High Parks, Hamilton, yielded the insects and spiders characteristic of the habitats which occur in old oak woodland, including the Dermestid beetle, *Ctesias serra*, only known in Scotland from this one locality. On 27 September, an excursion to the Monkland Canal, east of Easterhouse, showed that in spite of the increasing pollution such molluscs as the bivalve *Sphaerium lacustre* and the rarer freshwater limpet *Acroloxus lacustris* still survive along with a varied fauna at the Cuilhill end of the canal. Mosquitoes breed abundantly in the canal waters (including *Culex pipiens* and *Theobaldia annulata*) and specimens of the water-beetle *Colymbetes fuscus* were collected (a note on stridulation in this beetle appears on p. 83 of this issue).

DIGEST OF THE PROCEEDINGS OF THE SOCIETY

14TH JANUARY, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Minor constitutional changes were intimated. The ensuing meeting took the form of a Brains Trust, Mr. C. M. Morrison acting as question-master. Questions on Botany and Ornithology were answered by Professors John Walton and M. F. M. Meiklejohn, the President and Mr. C. E. Palmar.

11TH FEBRUARY, 1958.

Mr. Robert Mackechnie presided over the Annual General Meeting, which was held in the Department of Zoology, University of Glasgow.

Two new members were admitted to the Society: Mr. Edward Hill, 14 Arden Drive, Giffnock, and Mr. Donald R. Grant, c/o 145 Loanfoot Avenue, Glasgow, W.3.

Reports of the Society's activities were read, and it was noted that the membership of the Society on 31st December, 1957, was 229. The results of a questionnaire, which had been sent to all members, but answered by only one third, were presented by the General Secretary. New office-bearers were elected (see p. 115). Mr. Robert Mackechnie then delivered his Presidential Address entitled 'Plant recording in Clydesdale' (already printed in full in the June, 1958 issue, *Glasg. Nat.*, 18, 3-14).

1ST MARCH, 1958.

Mr. Robert Mackechnie presided over a special meeting held jointly with the Botanical Society of Edinburgh, in the Department of Botany, University of Glasgow.

Dr. George Bond gave a lecture entitled, 'The ecological importance of nitrogen-fixing plants.' After an interval for tea, Dr. H. R. Fletcher, F.R.S.E., took the Chair and introduced the second speaker, Dr. W. A. Clark, University of Durham, whose lecture was entitled 'Botanising in the Hebrides'.

25TH MARCH, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Three new members were admitted to the Society : Mr. David E. Allan, 237 Fenwick Road, Giffnock ; Mr. James Wells, c/o Cameron, 118 Kingsheath Avenue, Bankhead, Rutherglen, and Mr. John Lyth, St. Andrew's Rectory, Uddingston.

Mr. K. A. Pyefinch, F.R.S.E., of the Freshwater Fisheries Laboratory, Faskally, Pitlochry, gave a lecture on the biology of the salmon.

22ND APRIL, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Two new members were admitted to the Society : Mr. Eric Clifton, c/o Webster, 55 Ravelston Street, Glasgow, E.2, and Mr. John F. Dunn, 448 Edinburgh Road, Glasgow, E.3.

Dr. R. H. Cummings of the Department of Geology, University of Glasgow, lectured on microscopic fossils occurring in Scottish rocks, and on the advances which have been made in the recognition and interpretation of these during the last fifty years.

13TH MAY, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Miss Ann W. Deans, c/o Wilson, 576 Paisley Road West, Glasgow, S.W.1, was admitted as a new member of the Society.

Professor John Walton of the University of Glasgow gave a lecture entitled 'The history and development of the study of fossil plants in Scotland.'

3RD JUNE, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow, and gave a short account of the social evening held on 27th May to honour Mr. John R. Lee, M.A., on the occasion of his ninetieth birthday.

Mr. Gavin H. Bell, 126 Barshaw Road, Hillington, Glasgow, S.W.2, was admitted as a new member of the Society.

Mr. B. W. Ribbons then addressed the meeting on the subject of the vice-county system, discussing its history and the difficulties involved in its correct application to floristic recording.

11TH SEPTEMBER, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Two new members were admitted to the Society : Miss M. M. McLaurin, Corsewall, Blackburn Road, Ayr, and Mr. Thomas Callan, 58 Bradda Avenue, Rutherglen.

Dr. John Ramsbottom, O.B.E., formerly Keeper, Department of Botany, British Museum (Natural History), gave an illustrated lecture entitled 'Fungi of forest and field'.

14TH OCTOBER, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Department of Zoology, University of Glasgow.

A minor constitutional change concerning a new category of membership for school pupils was submitted to and approved by the meeting.

Two new members were admitted to the Society : Mr. D. I. Mackay, 7 Southern Avenue, Burnside, and Miss Kathleen M. H. Munro, 15 Woodend Drive, Glasgow, W.3.

Professor C. M. Yonge, C.B.E., F.R.S., of the University of Glasgow, then gave a lecture, illustrated by many lantern slides in colour, on colonial fisheries in Africa and Malaya.

11TH NOVEMBER, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow, and gave his personal report on the British Association meetings in Glasgow.

Mr. R. M. Stickney, c/o Heckie, 60 Grant Street, Glasgow, C.3, was admitted as a new member of the Society.

Professor K. W. Braid, O.B.E., a Past President of the Society, then delivered a lecture entitled 'Twenty-five years of detection work in Botany.'

9TH DECEMBER, 1958.

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Mr. William McConnachie, 8 Eaglesham Road, Clarkston, Glasgow, was admitted as a new member of the Society.

Mr. Peter S. Green of the Royal Botanic Garden, Edinburgh, gave a lecture, illustrated with coloured lantern slides, on the organisation and scientific work of that institution.

THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month, except during July and August, usually in the Royal College of Science and Technology, but from time to time in the University and the Glasgow Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are : for Ordinary Members, twenty shillings ; for Junior Members, ten shillings, and for Family Members, five shillings. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary* :—

CHARLES M. MORRISON, M.A.,
119 BALSHAGRAY AVENUE,
GLASGOW, W.1.

THE GLASGOW NATURALIST

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THE GLASGOW NATURALIST

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Vol. XVIII. Part 3

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RECENT SPREAD AND PRESENT DISTRIBUTION OF THE BARNACLE *ELMINIUS MODESTUS* DARWININ SOUTH-WEST SCOTLAND

By H. BARNES and MARGARET BARNES
The Marine Station, Millport, Scotland
(MS. received 19th November, 1959)

Elminius modestus is now well established in Great Britain (Crisp, 1958). In the north-west, following on independent colonization of Morecambe Bay, slow marginal dispersion took place along the Cumberland coast and was followed by more rapid progress in the Solway Firth. By the end of 1955 he records that *Elminius* was occasional at the Isle of Whithorn and he found a single specimen at Drummore near the Mull of Galloway. Crisp (1958) also records the presence at Stranraer in Loch Ryan of a separate population which has existed since 1950 but whose numbers have not increased; it is considered that the density has been inadequate to give rise to an expanding population. Apart from that for Stranraer Harbour the only other record of the occurrence of this species within the Clyde Sea Area is that of Connell (1955) who found a single specimen at Millport.

The entry and spread of *Elminius* into the Clyde Sea Area would have important consequences for several lines of work at present in progress in this laboratory and the discovery of an isolated specimen at Ayr in 1959 and of a vigorous population in Loch Ryan has led to a more detailed examination of the south-western coasts being included in the annual survey that is being made of the intertidal barnacles of this region; the results regarding *Elminius* in 1959 are given below (see also Fig. 1).

DETAILS OF THE SURVEY

POWFOOT

This is at the entrance to the estuary of the Eden. The beach is largely sand with some scattered stones at high water and a

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large concrete 'bathing' tank further down the shore; the tide recedes some 500 metres down the shore. On the more stable stones *Elminius* is common with adults at a density of

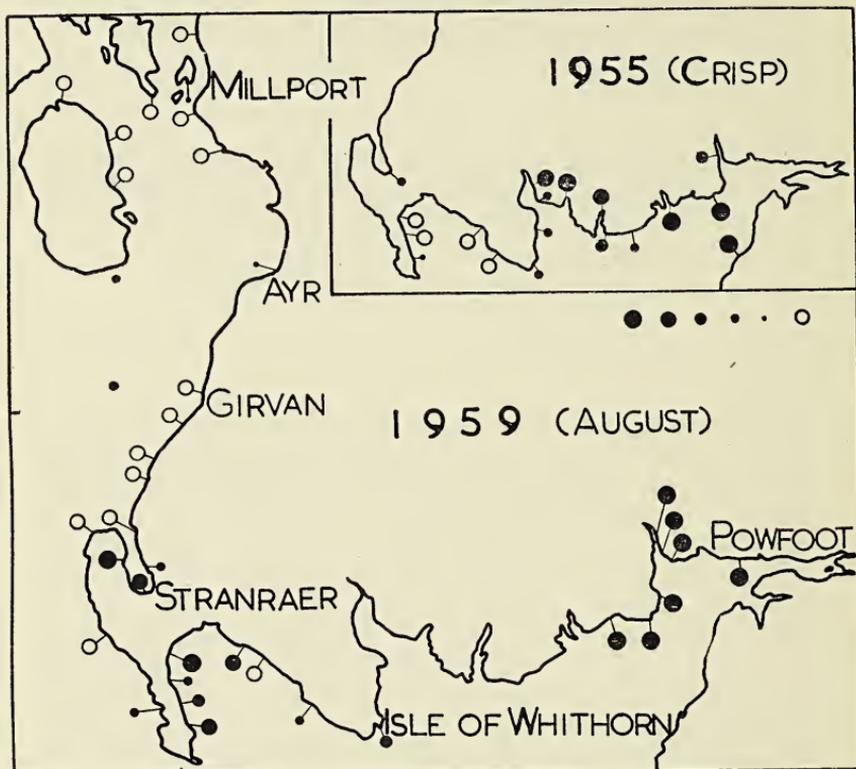


FIG. 1. Distribution of *Elminius modestus* in south-west Scotland. Inset figure shows the distribution on the basis of 1955 survey by Crisp (1958). Symbols under the inset figure read, from left to right: abundant, common, frequent, occasional, rare and absent.

1–2/cm² and spat (diameter < 2 mm) at 5/cm² in many places. *Balanus balanoides* is still abundant on these stones. At the lower edge of the twenty-metre-wide stony upper beach there were 15–20/cm² *Elminius* spat. On the sides of the concrete tank, which is some 150 m down the beach, *Elminius* (30/cm², all size groups) is rapidly replacing the indigenous species; not only are all the bare spaces occupied by the immigrant but both the adults and current year's settlement of *Balanus balanoides* are covered by young *Elminius*.

CAERLAVEROCK CASTLE

The banks of the Nith estuary—marshland intersected by a system of erosion channels—lead to wide expanses of mud exposed at low tide. The only surfaces suitable for settlement

are the semi-permanent net stakes driven into the mud at various places. *Elminius* is abundant on these stakes; old adults ($1/\text{cm}^2$) and spat ($16\text{--}20/\text{cm}^2$) were present even 5 ft above the mud surface. Just above the mud the *Elminius* formed a dense crust which was in some places breaking away leaving the bare wood. *Balanus balanoides* was absent.

GLENHOWAN

This is further up the Nith estuary and *Elminius*, old adults and a range of size groups, covered the wooden stakes; the spat density was $15\text{--}20/\text{cm}^2$. In places the dense settlement was again breaking away. *Balanus balanoides* was absent.

GLENCAPLE

At this point in the estuary a stone jetty fronts on the channel of the estuary, which is here narrowing. *Elminius* is abundant even though the stones carry a thick greasy layer of mud on their upper surfaces. Spat up to $10\text{--}15/\text{cm}^2$ was observed, being rather more abundant at the upper levels. There was a settlement of small *Elminius* adults on the *Fucus* fronds. *Balanus balanoides* was absent.

CARSETHORN

This is on the right bank of the Nith estuary at its entrance and a short bank of stones leads to extensive mud flats. *B. balanoides* is still present on these stones but it is being rapidly replaced by *Elminius*. Adults, two years old, of the latter species are common and spat density is $10\text{--}15/\text{cm}^2$. Bare places are being rapidly covered by *Elminius* which is also smothering the young *Balanus* and covering the adults, on one of which 30 small *Elminius* were counted. The situation is similar on the wooden remains of a ship's hull, where in many places dense *Balanus* had broken away and *Elminius* was well on the way to dominance.

SOUTHERNESS

This is in a relatively exposed position and a large rock reef stretches out for a considerable distance. *Elminius* is very abundant. Even in the zone above the main *Balanus balanoides* belt there are $2\text{--}4/\text{cm}^2$ *Elminius* spat and at this level it is competing with *Chthamalus stellatus*. In the mid-tide zone *Elminius* is somewhat commoner than the indigenous *Balanus balanoides* but towards the lower tidal levels the latter is still abundant, the current year's spat being abundant and showing good growth.

SANDY HILLS

There is a rock outcrop in the sandy shore and again *Elminius* is abundant particularly in the upper levels; both adults and spat are present. *Balanus balanoides* is still plentiful particularly at the lower levels but available space is rapidly being colonized by *Elminius*.

ISLE OF WHITHORN

Here there is a small bay and harbour flanked by rocky walls. *Balanus balanoides* is abundant on the shingle and under the weeds in the bay. *Elminius* both adults and a small amount of spat ($0.5/\text{cm}^2$) may be found in places but much of the area is still free from it; there is, however, heavy weed cover. On the outer side of the harbour wall *Elminius* is comparatively infrequent. On the exposed coast outside the bay there are scattered adult *Elminius* and a little spat somewhat locally distributed. *Balanus balanoides* is common.

MONREITH BAY

This is situated at the entrance to Luce Bay. The beach is sandy with some large stones and boulders and on these *Balanus balanoides* is dominant. Only scattered *Elminius*—adult and spat—were present. An occasional adult is often present amongst the *Chthamalus* which in this relatively exposed position forms a fairly well defined band above *Balanus balanoides*.

NEAR PORT WILLIAM (COCK INN)

The sides of Luce Bay, both east and west, show a curious development of beach shingle which is set along the coast in the form of a series of loops between which lie small sandy stretches. These boulder spits carry a heavy cover of *Fucus* and other weeds. The occurrence of *Elminius* was very variable. On some of these spits very few were found, on others it was fairly common. Everywhere, however, on the east side of Luce Bay *Balanus balanoides* was dominant. On this particular spit *Elminius* was absent.

COCK INN

On some spits near the inn, *Elminius* was quite common, being present on almost every boulder: this was in marked contrast to some of the spits nearer Port William. There were scattered old adults, one or two years old, with corroded shells and some spat ($8/\text{dm}^2$) on many of the stones.

SANDHEAD

Both *Balanus balanoides* and *Elminius modestus* are present on the lower stones of the narrow stretch of shingle above the

extensive sand-mud flats; this shingle is at high tide level. On a drainpipe running out across the beach, however, competition between the two species is severe. Adults ($1/\text{cm}^2$), young ($8-10/\text{cm}^2$), and spat ($5-10/\text{cm}^2$) of *Elminius*, are present although there is still a good growth of *Balanus balanoides*, the current year's settlement of which was abundant and showed good growth; in places it covered the previous summer's settlement of *Elminius*. The *Elminius* is more abundant on the west side of Luce Bay than on the east side and more abundant even than at Isle of Whithorn.

ARDWELL

On one of the larger spits, with dense algal cover, *Balanus balanoides* was common under the stones at all tidal levels. *Elminius* was, however, quite rare.

ARDWELL-DRUMMORE

On a spit further to the south, *Elminius* was more abundant, both adults and spat being quite easily found.

DRUMMORE

Here there is a small harbour, partly protected by a shingle spit, and into the harbour projects a large boat slip. *Elminius* is abundant and mixed with *Balanus balanoides*. On the slipway, old and corroded *Elminius* are present that are clearly several years old. The overall adult density in places was quite adequate for breeding (average in places $0.5/\text{cm}^2$), while small individuals ($1-2$ mm) reached a density of $2.0/\text{cm}^2$. In places—on, for example, individual stones—the density was much greater. *Elminius* was also present on the remains of a hull. *Balanus balanoides* is still, however, dominant even though *Elminius* is making rapid inroads into the indigenous population.

PORT LOGAN

This lies in a small rocky cove on the outer coast of Galloway and except for the local shelter the coast here is much more exposed than in the Solway Firth. On the stones near the jetty and on a pipe crossing the beach adult *Elminius* were present. The species was infrequent and no spat was seen. Even so, some of the small groups of adults were sufficiently dense to result in a breeding population.

PORT PATRICK

This is a small cove-like harbour on the outer exposed coast of Galloway and only a few miles to the north of Port Logan. Only a limited inspection was made. Nevertheless, the stones in the harbour, where there was considerable mud, the jetty

and nearby stoneworks were examined without finding *Elminius*. *Balanus balanoides* was present but the settlement in the spring had not been abundant and the year's growth appeared to be poor.

CORSEWALL POINT

This is the northern exposed point of Galloway. There is no harbour and the rocks go steeply down to the water. There was a very dense cover of *Balanus balanoides*, a good spatfall and excellent growth at all the levels examined. *Elminius* was absent.

LOCH RYAN, NEAR KIRKCOLM

This is a sheltered north-facing loch. At this particular point there is a large concrete slip on the western shore of the loch and much stony ground on the nearby shores, the stones being well covered with weeds. On the slip *Elminius modestus* is abundant, particularly in the open places, which are completely covered with young adults and spat. In places the adult density is 1/cm², size group 1–5 mm, 2/cm² and spat at 5/cm². The density was as great as that at many places in the Solway Firth. It was most noticeable that spaces cleared by the browsing of *Patella* were quickly colonized by *Elminius*; where the spring settlement of *Balanus balanoides* had been removed in this way *Elminius* had completely taken over the space. The stones on the shore, which were heavily covered by weed also had some *Elminius* on them—both young and old, but the density was far less than on the slip. In this area of the loch there is without doubt a thriving population of *Elminius* which is, in places, replacing *Balanus balanoides*.

LOCH RYAN—STRANRAER HARBOUR

Elminius modestus is common on the left harbour wall, all sizes from spat to 10–12 mm individuals being present; the species is commoner on the inner side. On the outer wall adults have a density of 8–10/dm² and spat 0.5/cm². A small concrete tank in the sandy shore at the upper tidal levels had abundant *Elminius* both young and adults. To the side of this wall there is stony beach; the stones are often heavily covered by mud and they carry a small quantity of both *Balanus balanoides* and *Elminius*. The situation here was, however, not favourable for settlement and in winter and spring the stones are probably subject to much abrasion.

LOCH RYAN—CAIRN RYAN

The now disused dock area was examined. No *Elminius* was found on the pier but on the groynes running out from the

concrete wall and under dense algal growth a few small isolated individuals were found.

PORT SALLY

This is on the exposed north-eastern entrance to the loch, and there is an outcrop of rock in a pebbly and steeply shelving beach. There was very considerable scour so that *Balanus balanoides* formed a conspicuous zone separated from the beach by bare scoured rock. At the higher levels on the rocks there was some, though not abundant, *Chthamalus stellatus*. *Elminius* was absent.

AYR

A single adult individual of *Elminius*—probably a year old at least—was found on the north wall of the harbour amongst abundant *Balanus balanoides*.

THE Ayrshire Coast and Clyde Sea Area

Apart from the single individual at Ayr, no *Elminius* has been found on the eastern shores of the Clyde Sea Area nor has the species been found elsewhere in the area during a series of annual shore surveys.

DISCUSSION

It is evident from the foregoing that *Elminius modestus* is now more abundant than when Crisp made his surveys in 1950–55. With the exception of a single specimen at Drummore (and the small dwindling population at Stranraer, see below) it was not found west of Isle of Whithorn, where it was only occasional, i.e. “very local and must be searched for.” It is now common throughout Luce Bay and in places abundant, and has rounded the Mull of Galloway to reach Port Logan. However, all along the north coast of the Solway, both in the bays and estuaries the species is irregularly distributed and there can hardly be said to be an advancing front. It would seem that settlement takes place from a larval population liberated into the Firth from places where it is abundant (and settlement is variable and dependent upon local conditions) rather than by frontal spread by coast-wise currents. The exposed Mull of Galloway and that part of the outer coast to Corsewall Point constitutes a distinct barrier to the entry into the Firth of Clyde but the population of the north Solway coast has now been built up to a sufficient density to pass the Mull. It may be anticipated that further spread and increase in density along this coast will still be slow. It is still infrequent on this coast as at Port Logan. A more potent potential source of infection for the Clyde Sea Area is the well developed population in Loch Ryan. This

loch is in many ways ideally suited to *Elminius*. The entrance is narrow, the waters are sheltered and in the inner parts muddy, and summer temperatures are high: it would be anticipated that the loch will come to sustain a dense population at all suitable places along the shore. The origin of this population is uncertain; Crisp (1958) describes a population in the harbour present in 1950 which had not increased by 1953, but the location was not given precisely. It is unlikely that the well established populations here recorded would not have been seen by Crisp, although his most recent observations at Kirkcolm were made in 1953. They may have reached the loch since 1955. The fact that the species is rare at Cairn Ryan suggests that these populations were not initiated there by war-time shipping. That *Elminius* is abundant on the slipway near Kirkcolm, that was used during that war as a sea-plane base, prompts the suggestion that infection may even have been directly from the south of England. The situation would then resemble the introduction of *Balanus amphitrite* into the saline but not marine Salton Sea in California. Under these conditions, however, the colonization of Loch Ryan would have been expected to be much more advanced than is the case. In any event this population might now be expected to expand and not only to link up with that proceeding northwards from the Solway but also, in view of the frequent strong northerly coastal drift along the eastern shores of the Clyde Sea Area (Barnes and Goodley, in press), to initiate colonization of the Clyde.

SUMMARY

1. An account is given of the further spread of *Elminius modestus* along the north coast of the Solway Firth and towards the Clyde Sea Area.
2. *Elminius modestus* is now common in Luce Bay and has rounded the exposed Mull of Galloway to reach Port Logan.
3. There are well established populations in Loch Ryan.

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NOTE ADDED IN PROOF

(MS. received 10th January, 1961)

Since submitting this paper for publication two further notes have been published on the presence of *Elminius modestus* in the Clyde Sea Area and a number of new observations have

been made. Powell (1960) has recorded two specimens at Keppel, Millport: relevant to this it should be stated that during 1959-60 occasional individuals were constantly being found on collected material, particularly mussels at about low tide level and a rare specimen on the shore here and also at Fairlie. During the summer of 1960 the species was quite common, with groups at breeding density, on a number of piles drawn from the pier at Largs; these included both spat and well grown adults, of which the latter may well have been one year old. Crisp (1960) has found small numbers of young individuals in the Gareloch, but since they only settled in late 1959 they could hardly be the source of the population at Largs. Crisp's (1960) chart of the distribution indicates that in 1959-60 *E. modestus* was absent from the Ayrshire and Renfrewshire coasts; this does not agree with the above observations. In view of the extensive pleasure steamer services in the Clyde, heaviest during the summer months when *E. modestus* is very actively breeding, it would seem that the area will be subject to constant although irregular infection; it is perhaps significant that the piers, where the ships often lie for periods, rather than the shore are first becoming infected.

CRISP, D. J., 1960. "Northern limits of *Elminius modestus* in Britain." *Nature, Lond.*, **188**, 681.

POWELL, H. T., 1960. "*Elminius modestus* Darwin on the Isle of Cumbrae (Firth of Clyde)." *Nature, Lond.*, **185**, 119-120.

**THE VICE-COUNTY DISTRIBUTION OF THE
SCOTTISH FRESHWATER LEECHES AND
NOTES ON THE ECOLOGY OF *TROCHETA
BYKOWSKII* (GEDROYĆ) AND *HIRUDO
MEDICINALIS* L. IN SCOTLAND**

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(MS. received 5th January, 1960)

The present known distribution of Scottish freshwater leeches is dealt with in a paper by Warwick and Mann (in press). This paper gives their distribution on a regional basis. Here the more precise vice-county distribution is given. New records (including those of Williams, 1961) obtained since the above paper went to press have been added, together with comments on the various species. Some details are given of the ecology of *Hirudo medicinalis* and *Trocheta bykowskii* in Scotland.

Much work remains to be done before a satisfactory map of the distribution of these animals in Scotland can be drawn. No records at all are available for 12 of the 41 Scottish vice-counties. In most of the 29 vice-counties from which leeches have been recorded the survey is far from complete. So far as is known leeches have been collected systematically only in the Edinburgh area, parts of Sutherland and the Isle of Barra, Forrest *et al.* (1936). The nomenclature of Mann (1954, 1959) is used in listing the leeches so far found in Scotland: *Theromyzon tessulatum* (O. F. Müller, 1774); *Hemiclepsis marginata* (O. F. Müller, 1774); *Glossiphonia heteroclita* (Linnaeus, 1761); *Glossiphonia complanata* (Linnaeus, 1758); *Batracobdella paludosa* (Carena, 1824); *Helobdella stagnalis* (Linnaeus, 1758); *Haemopsis sanguisuga* (Linnaeus, 1758); *Hirudo medicinalis* Linnaeus, 1758; *Erpobdella octoculata* (Linnaeus, 1758); *Dina lineata* (O. F. Müller, 1774); *Trocheta subviridis* Dutrochet, 1817; *Trocheta bykowskii* Gedroyć, 1913. Of the British leeches listed by Mann (1954), *Piscicola geometra* (Linnaeus, 1761) and *Erpobdella testacea* (Savigny, 1820) have not so far been recorded from Scotland. Table I gives the distribution of these leeches in the various vice-counties. The query after the record for *E. octoculata* for South Eubudes refers to the occurrence of "*Herpobdella*" in Loch Gillean and Loch Gorm in Islay reported by Reynoldson (1952).

TABLE I. The vice-county distribution of Scottish freshwater and amphibious leeches

V.C.	<i>Theromyzon tessulatum</i>	<i>Hemiclepsis marginata</i>	<i>Glossiphonia heteroclita</i>	<i>Glossiphonia complanata</i>	<i>Batrachobdella paludosa</i>	<i>Helobdella stagnalis</i>	<i>Haemopsis sanguisuga</i>	<i>Hirudo medicinalis</i>	<i>Erpobdella octoculata</i>	<i>Dina lineata</i>	<i>Trocheta subviridis</i>	<i>Trocheta bykowskii</i>	V.C.
72	Dumfries ..			x									72
74	Wigtown ..		x	x		x		x					74
75	Ayr ..					x	x						75
76	Renfrew ..	x		x	x	x		x	x				76
77	Lanark ..	x		x	x	x	x	x	x		x		77
78	Peebles ..	x			x	x		x	x				78
79	Selkirk ..	x		x		x		x					79
80	Roxburgh ..				x	x		x					80
81	Berwick ..	x		x	x	x	x	x					81
82	Haddington ..	x	x	x	x	x	x	x	x				82
83	Edinburgh ..	x	x	x	x	x	x	x	x			x	83
84	Linlithgow ..	x			x	x	x	x	x				84
85	Fife ..	x		x	x	x	x	x					85
86	Stirling ..	x		x	x	x	x	x	x				86
87	Perth West ..	x		x	x	x	x		x	x			87
88	Perth Mid. ..	x			x	x	x						88
89	Perth East ..	x											89
95	Elgin ..	x			x								95
96	Easterness ..									x			96
97	Westerness ..	x	x		x	x							97
98	Main Argyll ..	x							x				98
99	Dunbarton ..	x		x	x	x		x	x				99
102	South Ebudes ..	x			x	x			x?				102
104	North Ebudes ..	x				x							104
105	Ross West ..	x	x		x	x							105
106	Ross East ..					x							106
108	Sutherland W. ..	x	x		x	x		x					108
110	Outer Hebrides ..	x		x	x	x	x						110
112	Zetland ..				x		x						112

Theromyzon tessulatum is one of the commonest and most widespread Scottish leeches. It is rarely found in running water. No large specimens have been found in Sutherland.

Hemiclepsis marginata. This leech is not common but seems to occur more frequently in the west of the country.

Glossiphonia heteroclita. A small lethargic and unobtrusive species of leech which is probably much commoner than Table I suggests. It occurs in stagnant water often between the submerged sheathing leaves of water-plants.

Glossiphonia complanata and *Helobdella stagnalis* are perhaps the two commonest and most widespread species of leech.

Batrachobdella paludosa. This leech added recently to the British list (Mann, 1953a) has so far only been found in the Lake of Menteith and Loch Chon.

Haemopsis sanguisuga is widespread but does not seem to be really common in Scotland.

Hirudo medicinalis. Dalyell (1853) recorded this leech from some Scottish localities. The next record is that by Reynoldson (1952) who found one specimen under a stone at the edge of

Loch nan Diol, Islay. In 1956, large leeches and cocoons of this species were found at Balchrack, Kinlochbervie, Sutherland, Grid Ref. 29/190600. They occurred under stones in a roadside marsh traversed by a small ditch. Farm animals graze the area. The leeches were still there in 1957 and in that year they were also found in an unnamed loch a little over one mile north of the marsh, Grid Ref. 29/187617. This loch had a richer fauna than many in the district. Amongst submerged plants *Potamogeton crispus*, *Utricularia*, *Lobelia* and *Littorella* were seen. The water was brown with peat but *Lymnaea truncatula* and *L. peregra* occurred, as did *Spongilla*, *Hydra*, polyzoa, *Notonecta*, *Agrion* larvae and *Gammarus lacustris*. No other species of leech was found. No leeches were found in two other small lochs to the south. The loch where *Hirudo* occurs is near the sea and is surrounded by moorland grazed by sheep. Bennike (1943), working on Danish leeches, found it in few localities. He considered that opportunities for spreading rather than lack of suitable habitats limited its range. In one Danish area where it was easily transported by game it was found in at least three ponds. Something of this kind has probably happened in the Balchrack area. *Hirudo*, though it is sometimes found associated with several other species of leech (Bennike, 1943) can obviously live in localities which are poor for most leeches.

Erpobdella octoculata is very common in parts of Scotland but is not so widespread as the three common species already mentioned. It is apparently absent from Barra (Forrest *et al.*, 1936) and Sutherland West.

Dina lineata. This leech was added to the British fauna by Mann (1952). It has proved to be not uncommon and quite widespread in Scotland, occurring in at least 20 localities so far. Mann (1959) finds that drying ponds, particularly those with *Iris*, form the optimum habitat for this species. It is perhaps significant that of the two streams in which it has occurred, one was fringed with *Phragmites*, the other with *Iris*. (Collections made in August, 1960, details of which are not yet available, have extended the known range of this leech in northern Scotland.)

Trocheta subviridis has only been found once. It occurred in clay soil in a Glasgow garden.

Trocheta bykowskii has been added to the British fauna very recently (Mann, 1959). It was first found in February, 1957, near Belfast and in June, 1957, it was noticed in Lake Windermere. Since then it has been found in the Braid Burn, Edinburgh; the River Penk, Staffordshire; and the River Thames at Reading.

On 8th February, 1959, one moribund specimen was found in the Braid Burn at Redford House, Edinburgh. Later in that

month, five active leeches were found in the same stream at Peffermill, Edinburgh. The two localities are nearly five miles apart by stream. In December, 1959, no *Trocheta* could be found at Redford House. The only leech present was *Glossiphonia complanata*. There were a few *Asellus aquaticus* but *Gammarus pulex*, *Lymnaea peregra* and *Dendrocoelum lacteum* were abundant. The current was swift and the bed stony, *Ranunculus fluitans* being present. The stream was somewhat polluted from septic tanks upstream and from house drainage. On 10th November, 1959, "dissolved organic matter" absorbed 2.8 mg/l. oxygen (estimated by boiling 100 ml sample with N/80 potassium permanganate solution for $\frac{1}{2}$ hr). This compared with 1.6 mg/l. oxygen absorbed by the unpolluted stream a little higher up at its outlet from Torduff Reservoir. The calcium content here was 47.2 p.p.m.

In late November and early December, 1959, several visits were made to the Braid Burn at Peffermill. Here the stream is 8-9 feet wide and is usually less than a foot deep. There is a definite current but the bottom is muddy with occasional large stones, pieces of wood and rubbish. The stream from naked eye observation was somewhat polluted. A little below Peffermill oxygen absorbed was 5.2 mg/l. The calcium content of the water was 51 p.p.m. Small patches of *Fontinalis*, *Elodea*, *Glyceria* and *Nasturtium* occurred in the stretch examined.

The commonest animals under the stones were *Asellus aquaticus*, *Dendrocoelum lacteum* and *Lymnaea peregra*. In the mud of the stream, *Asellus* occurred with oligochaetes and larvae of *Chironomus*, *Eristalis* and *Tipulids*; *Gammarus pulex* was scarce. Leeches were collected and counted from under all the largest stones in a 60 yard stretch of stream. Collecting took 60 minutes on 25th November. As a result the following numbers of leeches were obtained: *Glossiphonia complanata*, 31; *Helobdella stagnalis*, 34; *Erpobdella octoculata*, 121; *Trocheta bykowskii*, 6. The majority of the specimens of the first three species were adults. The *Trocheta* were all juveniles. Three of them were found under one large stone. They were all of much the same size (two weighing 8.2 and 8.7 mg respectively). It is presumed that they had hatched fairly recently from a cocoon laid nearby.

Samples of debris were washed from mud and plants at the edge of the stream and leeches collected on 26th and 31st November and on 9th December. These three samples yielded altogether: *G. complanata*, 3; *H. stagnalis*, 5; *E. octoculata*, 10; *T. bykowskii*, 8. Only one of these *Erpobdella* was really small but five of the *Trocheta* were juveniles. The smallest *Trocheta* caught weighed 2.5 mg; other weights recorded were 6.2 and 10.5 mg. Two large leeches of this species weighed

142 mg and 247 mg respectively. (Nine *Erpobdella* obtained on 7th December ranged in weight from 91–225 mg.)

In all the collections very few recently hatched *Erpobdella* were found. Mann (1953b) finds that in *E. octoculata* cocoons are mainly laid in mid-June and mid-July and that the leeches hatch from these cocoons in August and September. From the details given above it seems as if *Trocheta bykowskii* has a much later breeding season than *Erpobdella octoculata*. Also although *Trocheta* is the rarest leech in this part of the Braid Burn it is commoner in the mud than under stones. Juvenile *Trocheta* can readily be distinguished from young *Erpobdella* by their colour. The former are reddish brown, the latter are brown.

Several large *Trocheta* which had been collected under stones were kept in water in the laboratory. Here they voided five *Chironomus* larvae and part of an aquatic oligochaete. One *Trocheta* when dissected contained fragments of *Asellus aquaticus*. Another which had been found under a piece of wood near the edge of the stream contained parts of a terrestrial oligochaete. Mann (1959) found that *Trocheta*, from under stones near the water's edge at Lake Windermere, had been feeding on oligochaetes.

Even at Peffermill, which is the only stretch of the Braid Burn where it seems to have established itself, *T. bykowskii* is uncommon. It is scarcer than it is in Troutbeck (Mann, 1959). Despite search it has not been found in the Braid Burn at Bonally Reservoir outlet; Braid Burn Park; Blackford Glen, Liberton; and Figgate Burn, Portobello. Nor has it been noticed in other Edinburgh streams. References quoted by Mann (1959) indicate that this species has a preference for well-aerated, cool, running water. During the warm summer of 1959 with a long period of drought, the flow of the Braid Burn at Peffermill was greatly reduced. Water temperature was probably higher than usual and the degree of pollution obviously increased. *Trocheta* was able to survive these adverse conditions and to breed in the autumn. When first discovered near Belfast in February, 1957, it already occurred in two areas. In April, 1958, Mann (1959) found it in one stream and at the mouths of three others, all on the east shore of Lake Windermere. He considers that *T. bykowskii* was brought to Windermere a number of years ago, is spreading along the lake shore and is beginning to colonize streams. In the Braid Burn it must have arrived at the latest in 1958. Its further spread in this stream and in other Scottish localities will be interesting.

I am indebted to Dr. K. H. Mann of the Zoology Department, Reading University, for aiding in identifications, Mr. Rodney G. F. Williams for providing records from the

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THE DISTRIBUTION OF FRESHWATER LEECHES IN THE GLASGOW REGION, WITH NOTES ON THEIR ECOLOGY

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INTRODUCTION

The first comprehensive study of the distribution of the freshwater leeches in Britain is that by Harding (1910). More recently, work on their ecology has been made possible by the revision of leech systematics by Mann (1952, 1954, 1955b), who has dealt with a list of thirteen British species as compared with fifteen species recorded for Danish fresh waters by Bennike (1943), and seventeen species recorded for Polish fresh waters by Pawlowski (1936).

Hardly any intensive collections of leeches, with a view to studying the ecological factors controlling their distribution, have been made in Scotland until recently. Work of this sort is at present being carried out in the Edinburgh area by Mr. T. Warwick, who has also summarized the vice-comital distribution (Warwick, 1961). The present paper records intensive collections in the Glasgow region, and is largely qualitative.

The area under survey extends southwards from Inverbeg on Loch Lomondside to East Kilbride, and westwards from Coatbridge to the Rosneath peninsula. The largest body of water is Loch Lomond, and the majority of the bodies of standing fresh water are ponds. With the exception of the Blane Water, all running waters included were relatively slow-flowing. The Blane Water was visited after a week-end of continuous rain, and was high and fast-flowing.

The results of standard collections for the twenty-eight stations at which any leeches were found are shown in Table I. The first observation here is that the numbers of individual species, as also the grand total catch, are strikingly low compared with the results published by previous workers. Of major importance is the higher productivity of the freshwater bodies in Denmark and in the Berkshire district of England, as compared with the low productivity of the freshwater bodies of the West of Scotland.

TABLE I. Standard collection of leeches for 30-45 minutes. Stations arranged in order of size. Running water listed separately.

STATIONS	Approximate pH value	Temperature at time of record °C	<i>Glossiphonia complinata</i>	<i>Glossiphonia heteroclitia</i>	<i>Theromyzon tessulatum</i>	<i>Helobdella stagnalis</i>	<i>Eryobdella octocollata</i>	<i>Dina lineata</i>	<i>Haemopsis songuisuga</i>	Totals	REMARKS
1 Loch Lomond ..	6.1	19.0	16	—	—	—	—	—	—	16	Less common
2 Hogganfield Loch ..	6.5	18.0	—	19	3	20	7	—	—	49	Common
3 Possil Loch ..	6.9	16.0	3	1	18	11	—	—	—	33	Common
4 Antermony Loch ..	6.4	19.0	—	—	—	6	—	—	3	9	Rare
5 Loch Ardning ..	6.1	17.0	2	—	1	2	—	—	—	5	Rare
6 Caldaran Loch ..	6.1	12.3	3	—	6	5	—	—	—	14	Less common
7 Johnston Loch ..	6.4	19.0	2	—	9	3	4	—	—	18	Less common
8 Cocksburn Reservoir	6.4	17.5	14	—	19	26	—	—	—	59	Common
9 Deil's Craig Dam ..	6.4	19.0	4	—	—	1	—	—	—	5	Rare
10 Dougalston Loch ..	6.65	16.1	—	1	2	—	—	—	—	3	Rare
11 Tannoeh Loch ..	6.4	19.0	—	—	14	7	—	—	—	21	Less common
12 Alloch Dam ..	6.7	22.0	6	—	2	—	—	—	—	8	Rare
13 Foxbar Dam ..	6.7	17.3	—	—	2	—	—	—	—	2	Rare
14 Wattie's Dam ..	6.4	20.0	27	6	6	6	—	—	—	45	Common
15 Calder Park Zoo pond	7.7	21.0	7	—	—	—	1	—	—	8	Rare
RUNNING WATER											
16 River Leven ..	5.7	14.5	12	—	—	—	—	—	—	12	Less common
17 Black Cart Water ..	6.2	17.0	7	—	—	2	5	1	—	15	Less common
18 Endrick Water (Drymen bridge) ..	6.3	19.0	6	—	—	1	6	—	—	13	Less common
19 Endrick Water (Killearn bridge) ..	6.3	20.0	11	—	1	11	2	—	—	25	Common
20 Blane Water ..	5.7	12.8	—	—	—	—	22	2	—	24	Less common
21 Allander Water ..	6.4	12.0	8	—	—	—	—	—	—	8	Rare
22 River Avon ..	—	—	—	3	—	—	—	—	—	3	Rare
23 Burn of Mar ..	6.0	12.2	—	—	—	8	—	5	—	13	Less common
24 Old Patrick Water ..	5.8	14.8	—	—	—	—	3	—	—	8	Rare
25 Dougalston outfall ..	6.4	16.1	6	23	6	11	—	—	—	46	Common
26 Rednock Burn ..	—	—	3	—	—	—	—	—	—	3	Rare
27 Forth and Clyde Canal ..	6.7	17.5	—	2	—	10	—	—	—	12	Less common
28 Rotten Calder ..	6.8	15.0	1	—	—	1	—	—	—	2	Rare
Totals ..			138	55	89	131	50	8	3	474	

The factors controlling productivity in fresh waters, including the nature of the substratum over which the body of water lies, depend on geology and topography. In considering the solid geology of the Glasgow region in relation to the fertility of the freshwater bodies (as was done by Hunter, 1957, 1958), the rocks can be grouped into four categories: (i) A north-western area along Loch Lomondside north of Luss, and including the Rosneath peninsula. This is an area of metamorphosed rocks of Dalradian age, consisting mainly of mica schist, other schists, grits and slates, overlain by a blanket of peat. The rocks break down to give acid soils which yield

little or no nutrient salts to the waters of the area. (ii) The area extending southwards and eastwards from Luss, and including the Drymen and Killearn areas and also the Blane valley. Sedimentary rocks in this area are of Carboniferous and Devonian age, consisting mainly of sandstone conglomerates. There is an extensive cover of drift deposits, mainly boulder clays along with some marine and fluvial deposits. The countryside in this area is arable farmland, the fresh waters thus receiving nutrient salts in field drainage in addition to those nutrients already present in the drift deposits. (iii) The area in the line of the Kilpatrick and Kilsyth hills, between Milngavie and Strathblane, and also in Renfrewshire, south and west from Paisley. The rocks in this area are igneous, mainly basalts, producing mostly basic soils on breakdown. (iv) The rest of the region around the city of Glasgow and extending east to Coatbridge, south-east to East Kilbride and north to Lennoxton and Kilsyth, lies on sedimentary rocks of Carboniferous age, consisting mainly of limestone and coal measures. These rocks also produce basic soils, and result in the hardest waters in this area. All collections were made between August and October, 1959.

METHOD

Leeches were collected by hand from stones, pieces of dead wood and other debris, and from leaf bases of plants, but only from depths accessible wearing thigh boots. The period of collecting was limited to 30–45 minutes in most cases, at the end of which the pH, estimated with B.D.H. papers, and temperature of the water were recorded.

The catch from each station was transported in Kilner jars back to the laboratory, where each catch was examined alive. The leeches were then narcotised in a solution of propylene phenoxytol ($< 1\%$), for 12–24 hours (Owen and Steedman, 1958), at the end of which period they were fully relaxed. This method was very convenient, since specimens can be left overnight and identified on the day after collection. Identification of species was done with the aid of the key by Mann (1954), published by the Freshwater Biological Association. Identified specimens were fixed in 10% neutral formalin to avoid affecting pigmentation, and finally preserved in a mixture of 10% glycerol and 1% propylene phenoxytol. The annuli of species of the family Erpobdellidae were often indistinct, and the female genital pore obscured, hence identification by the number of annuli separating the genital pores was not always reliable. Thus confirmation of the identification of the Erpobdellidae was by examination of atrial cornua dissected from preserved specimens.

RESULTS AND DISCUSSION

(a) *General*

A total of 39 stations were visited, of which 28 supported some leeches. The results for standard collections at these 28 stations are shown in Table I. In the "Remarks" column for

TABLE II. Standard collection of leeches. Stations arranged in descending order of pH value.

STATIONS	Approximate pH value	<i>Glossiphonia complanata</i>	<i>Glossiphonia heteroclitia</i>	<i>Theromyzon tessellatum</i>	<i>Helobdella stagnalis</i>	<i>Erpobdella octoculata</i>	<i>Dina lineata</i>	<i>Haemopsis sangulifuga</i>
15 Calder Park Zoo pond ..	7.7	7	—	—	—	1	—	—
3 Possil Loch	6.9	3	1	18	11	—	—	—
28 Rotten Calder	6.8	1	—	—	1	—	—	—
13 Foxbar Dam	6.7	—	—	2	—	—	—	—
27 Forth and Clyde Canal ..	6.7	—	2	—	10	—	—	—
12 Alloch Dam	6.7	6	—	2	—	—	—	—
10 Dougalston Loch	6.65	—	1	2	—	—	—	—
2 Hogganfield Loch	6.5	—	19	3	20	7	—	—
25 Dougalston outfall	6.4	6	23	6	11	—	—	—
11 Tannoch Loch	6.4	—	—	14	7	—	—	—
14 Wattie's Dam	6.4	27	6	6	6	—	—	—
9 Deil's Craig Dam	6.4	4	—	—	1	—	—	—
8 Cocksburn Reservoir	6.4	14	—	19	26	—	—	—
7 Johnston Loch	6.4	2	—	9	3	4	—	—
4 Antermomy Loch	6.4	—	—	—	6	—	—	3
21 Allander Water	6.4	8	—	—	—	—	—	—
18 Endrick Water (Drymen bridge)	6.3	6	—	—	1	6	—	—
19 Endrick Water (Killearn bridge)	6.3	11	—	1	11	2	—	—
17 Black Cart Water	6.2	7	—	—	2	5	1	—
1 Loch Lomond	6.1	16	—	—	—	—	—	—
5 Loch Ardning	6.1	2	—	1	2	—	—	—
6 Caldarvan Loch	6.1	3	—	6	5	—	—	—
23 Burn of Mar	6.0	—	—	—	8	—	5	—
24 Old Patrick Water	5.8	—	—	—	—	3	—	—
16 River Leven	5.7	12	—	—	—	—	—	—
20 Blane Water	5.7	—	—	—	—	22	2	—

each station, a comparison is made of the relative leech productivities; the basis of this will be explained below.

For comparison of productivities on a broader basis, all stations have been grouped in relation to the four geological categories of the Glasgow region as indicated in the introduction. The following stations lie on the area of metamorphosed rocks: (a) Douglas Water at Inverbeg, (b) Finlas Water, (c) Finlas Reservoir, (d) Luss Water at Luss, (e) Loch Lomond at Luss, (f) Auchengaich Dam near Garelochhead, (g) Lindowan Reservoir, (h) Lochan Ghlas Laoigh, the last two in the Rosneath peninsula. None of these stations had any leeches. The general observation was that animal life is

sparse in all these stations. There were the occasional amphipod, insect larvae and molluscs; there was a striking absence of planarians, which were common at stations which had leeches. The pH values recorded for these stations are within the range of pH for positive stations; but the waters in this area are unproductive. The calcium content for streams such as the Douglas Water and Finlas Water is from 3.5–5.4 mg/l. (Slack, 1957a). This is a reflection of the nature of the rocks which yield soils with little or no nutrient salts, i.e. nitrates, phosphates or indeed calcium, on break-down.

Stations within the area of sedimentary sandstone conglomerates include Nos. 1, 6, 16, 18, 19, 20, 23 and 26 (Table I) and two negative stations, (i) Loch Lomond at Balmaha and (j) Carnock Burn. The remarks for five of the eight positive stations, i.e. 'less common,' implies an area of intermediate productivity. Drift deposits of boulder clay covering the rocks produce soils with nutrient salts which enrich the fresh waters in the area. The rocks themselves may produce acid soils on breakdown; all stations in this area fall within the lowest pH range for waters which support any leeches in the district: 5.7–6.3 (Table II). The calcium content of the waters is naturally higher in this area, a value for the Endrick Water being 17–19 mg/l. (Maitland, 1960, unpublished). Although leeches in general are less common here, the numbers of the species of the family Erpobdellidae caught in stations in this area, represent 86.2% of the total catch for this family. It can thus be concluded that the stations in this area provide the best habitat for the Erpobdellidae in the Glasgow region, though the various species are rare in the region as a whole. All species recorded for the region, with the exception of *Glossiphonia heteroclita* and *Haemopsis sanguisuga*, were found in this area.

TABLE III. Frequency of occurrence of seven species of leech in 28 stations

Species	No. of stations found	Percentage occurrence
<i>G. complanata</i>	18	64.3
<i>G. heteroclita</i>	7	25.0
<i>Theromyzon tessulatum</i>	13	46.4
<i>Helobdella stagnalis</i>	17	60.7
<i>E. octoculata</i>	11	39.3
<i>Dina lineata</i>	3	10.7
<i>Haemopsis sanguisuga</i>	1	3.6

Stations lying in the area of igneous rocks include Nos. 5, 9, 13, 14, 17, 21, 22 and 24 (Table I), and one negative station, (k) Carbeth Loch. This is the area of 'low leech productivity' in the district; only the area of metamorphic rocks discussed first is 'less productive.' Leeches are rare in five of the seven

stations in which they are present in the area. *Glossiphonia complanata* was the only species present in appreciable numbers. However, excluding *H. sanguisuga*, all species recorded for the region were found in this area.

TABLE IV. Total catch, and percentage of grand total catch for each of seven species of leech

Species	Total	Percentage of grand total	Remarks
<i>G. complanata</i>	138	29.1	Common
<i>G. heteroclita</i>	55	11.6	Less common
<i>T. tessulatum</i>	89	18.8	Common
<i>H. stagnalis</i>	131	27.6	Common
<i>E. octoculata</i>	50	10.6	Less common
<i>Dina lineata</i>	8	1.7	Rare
<i>Haemopsis sanguisuga</i> ..	3	0.8	Rare

The area around and to the east of the city of Glasgow lies largely on limestones which produce harder waters in the water bodies of this area. Stations in the area include Nos. 2, 3, 4, 7, 8, 10, 11, 12, 15, 25, 27 and 28 (Table I). Water bodies in the area not visited personally but known to have leeches are Woodend Loch, Lochend Loch and Bishop Loch. As would be expected, the pH values for all stations in the area fall within the upper range of values for the region, i.e. 6.4–7.7 (Table II). The calcium content of these waters is very much higher than any other area in the region, a value for Bishop Loch being 39.6 mg/l. (Hunter, 1957). This area is the most productive in the Glasgow region, more than half the grand total number of leeches being caught in stations within the area. All species recorded for the region, with the exception of the Erpobdellidae, were encountered quite commonly in the area. This is self-explanatory, since the Erpobdellidae have been shown to prefer softer waters.

In the "Remarks" column of Table I is given an arbitrary comparison of the 'leech-productivity' of the various stations, based on the total number of leeches caught at each station, in approximately the same collecting time. Leeches are listed as 'common' if more than an arbitrary number of 25 were collected. If less than 10 were collected, leeches are regarded as 'rare' in such stations, while in those stations yielding 10 to 24 leeches per collection they are noted as being 'less common.'

Table VI gives a comparison of the relative productivities of the four geological areas into which the region has been divided, and also illustrates the relationship between total number of leeches and the pH values of the stations. The conclusion here is that leeches are more abundant in harder waters. The biological classification of standing waters is based

on the concept of eutrophy/oligotrophy, and the most productive fresh waters are eutrophic. Many of the Danish fresh-water bodies, and those of the Berkshire district of England surveyed by Mann (1955b), are classified as eutrophic; on the same scale none of the freshwater bodies of the West of Scotland are considered eutrophic, but are assessed toward oligotrophy. Hence the low catches for the Glasgow region, compared with records for Denmark and England by Bennike (1943) and Mann (1955b) respectively. On the other hand, all those stations at which leeches were found to be 'common' (see Table I), lie in the limestone area (iv) above; leeches were

TABLE V. Characteristic leeches of stations in which three or more species were found. Stations arranged in order of size; running waters listed separately.

Stations	pH	Most numerous	Second most numerous
Hogganfield Loch ..	6.5	<i>H. stagnalis</i>	<i>G. heteroclita</i>
Possil Loch ..	6.9	<i>T. tessulatum</i>	<i>H. stagnalis</i>
Cocksburn Reservoir ..	6.4	<i>H. stagnalis</i>	<i>T. tessulatum</i>
Wattie's Dam	6.4	<i>G. complanata</i>	{ <i>G. heteroclita</i> <i>T. tessulatum</i> <i>H. stagnalis</i>
Endrick Water	6.3	<i>G. complanata</i>	
Dougalston outflow stream	6.4	<i>G. heteroclita</i>		H. stagnalis

TABLE VI. Comparison of the relative leech productivities of the four geological areas, and the relationship between total number of leeches and the pH value of stations

	Area i	Area ii	Area iii	Area iv
pH range	5.7-6.3	5.7-6.3	6.1-6.4	6.4-7.7
Total number of leeches	0	120	86	268
Number of stations ..	8	8	8	12
Average number per station	0	15	10	22
Relative productivity ..	very low	inter-mediate	low	high

'less common' at stations in the sandstone-conglomerate area (ii) above. No leeches were collected during this survey in the area of metamorphic rocks (i) above, although *Glossiphonia complanata* and possibly other leeches do occur rather rarely.

(b) *The various leeches, with notes on their ecology*

Glossiphonia complanata (L.)

This was the commonest leech encountered as regards frequency of occurrence (Table III) and percentage of grand total catch (Table IV). It occurred over the whole range of pH, and was equally common in running and standing waters, the frequency of occurrence being 61.5% for running water and 66.7% for standing water. Mann observed a higher frequency for standing water (Mann, 1955b). In six stations

in which leeches were common *G. complanata* was the most numerous in one of standing water and one of running water (Table V). However, in all running water stations in which it was taken along with other species, it was the most numerous (Table I), the only exception being Dougalston outflow. All stations yielding this leech had a stony substratum or else loose stones scattered about the bottom. In the absence of stones, the leech was found attached to dead wood, as was the case in Calder Park Zoo pond. The leech thus shows a preference for stony bottoms. Associated fauna usually includes plenty of molluscs, but in a few cases leeches were collected off stones without molluscs, but with several trichopteran larval cases. This observation supports previous conclusions that the species feeds on insect larvae.

Glossiphonia heteroclita (L.)

This leech was more restricted in its distribution than *G. complanata*. Though found in "running" water, it was noted that they were found only in very slow running waters, for example the Forth and Clyde canal, or in pools in which the speed of the water is very much reduced. In relation to pH, it was observed that *G. heteroclita* is restricted to waters with higher pH values (Table II), and thus to waters with a high calcium content. The conclusion here is that it prefers hard waters. Bennike (1943) gave records of the species in waters with pH values as low as 4.8-6.4; he regards it as common in Danish fresh waters. Present observations as regards frequency of occurrence (Table III) and percentage of total catch (Table IV), indicate that it is less common in the Glasgow region. The leech is known to feed on molluscs; two stations, Dougalston outflow and Hogganfield Loch, were particularly rich in molluscs. At the former station, densities of *Sphaerium corneum* of up to 1420 per sq. metre in patches can occur (Hunter, 1960, unpublished). It is not surprising that *G. heteroclita* was the most numerous leech at this station, and the second most numerous leech in the latter station (Table V).

Theromyzon tessulatum (O. F. Müller)

Observations on the distribution of this species indicate that it rarely occurs in running water. Percentage occurrence in running water is 15.4, compared with 73.3% in standing water. It is a fairly common leech in the region, occurring in about half the stations during the survey (Table III), and representing 18.8% of the grand total catch (Table IV). It is distributed over almost the whole range of pH. It was also observed that it was not restricted to a particular type of habitat; specimens were collected off stones, off leaves and leaf bases and in muddy conditions. The species is recorded as the most numerous for

Possil Loch (Table V). In this case the majority of the specimens were obtained from one of the few stones scattered in the marsh, at the only point at which the loch was accessible. Many ducks and other water birds were observed in this corner. Since it is known that *T. tessulatum* is a parasite of a variety of water birds, it is reasonable to assume that the observed aggregation was not just accidental. Apart from the fact that the species is rare in running water, no optimum habitat conditions have been fixed for it, because it is apparently independent of other aquatic invertebrate organisms as a source of food.

Helobdella stagnalis (L.)

As will be seen from Tables III and IV, this is a common species of leech, being second only to *G. complanata* in frequency of occurrence and percentage of total catch. Previous records by Mann (1955b) and Bennike (1943) show that it is fairly widespread; the present record indicates a frequency of 53·8% in running water, and 66·7% in standing water. It extends over the whole range of pH values, and is capable of living in waters with pH values as low as 4·0–4·2 (Bennike, 1943). From Table V, it is seen that *H. stagnalis* is the most numerous leech in Hogganfield Loch and Cocksburn Reservoir; both stations, though with muddy bottoms, had numerous stones scattered about, and it was off these that the species was collected. It was the second most numerous leech for three other stations, all of which had a stony substratum or had plenty of stones about the bottom. In all, only at Caldaran Loch was the species collected on vegetation. Previous workers have concluded that the species prefers vegetation to stones; from these observations, it seems likely that in the absence of plants it can live equally abundantly on stones. The species has been recorded in the sub-littoral and profundal zones of Loch Lomond, and thus seems to be capable of existing on fine silts offering no firm support (Slack, 1957b). It is never the most numerous leech in running waters.

The Erpobdellidae

Two species of this family were found in the Glasgow region and these were relatively rare. They occurred mainly in the softest waters of the region which support any leeches, found in the area of sandstone-conglomerates and with a pH range of 5·7–6·3. Variations occurred in the position of the eye-spots; previous observations on the variation of eye-spots in *D. lineata* are recorded by Mann (1952).

Erpobdella octoculata (L.)

This species, the more widespread of the two, has a frequency occurrence of 39·3% (Table III), and represents 10·6% of the

total catch (Table IV). It was found more frequently in running waters, even in the fastest of these from which collections were made (Table I); it was invariably collected off stones. Specimens of this species can be graded into three categories, based on the degree and pattern of pigmentation: (a) 'dark' forms with a black reticulum dorsally, (b) 'intermediate' forms with scattered masses of black pigment, and (c) 'pale' forms with no black pigment, but only a yellow pattern around the sense receptors. The 'dark' and 'pale' forms were taken together at station 20, hence the variations are unlikely to be adaptations to local backgrounds.

Dina lineata (O. F. Müller)

This is the rarer Erpobdellid, and was found only in three stations, Nos. 17, 20 and 23, all running water stations. Pawlowski (1936) records the species for temporary ponds, while Bennike (1943) found it mainly in running waters. The present results support Bennike's observations. Mr. T. Warwick has found this species in a number of localities in eastern Scotland. *E. testacea* did not occur in either Warwick's or the present (Glasgow area) collections.

Haemopsis sanguisuga (L.)

This species was caught only in station 4. No conclusions can be drawn from the present observations about its habitat preferences, since station 4, lying on the fringe of the limestone area (area iv), is exceptional in supporting only very few leeches. It is known, however, that the species can be found under stones or buried in mud above the water line of ponds, or in very shallow water at the edge of ponds. Unless specially looked for, it is rarely encountered in the normal course of collection.

SUMMARY

(1) Seven species of leech were encountered during this survey. Leeches were caught at 28 out of 39 stations visited. Temperature and pH values were recorded for each of these stations.

(2) The region has been divided into four geological categories, and all stations have been grouped in relation to these four categories in order to compare their relative leech productivities. This is observed to be lowest in the softer waters of the north-west, and highest in the more calcareous waters of the south-east of the region.

(3) Three species, *G. complanata*, *H. stagnalis* and *T. tessulatum* are relatively common in the region; *G. heteroclita* is less common, and the remaining three species are rare.

(4) *G. complanata* and *H. stagnalis* occur over the whole

range of pH, and in standing and running waters, usually with stony bottoms. *G. heteroclita* is restricted to standing or very slow flowing waters, and to the harder waters. *T. tessulatum*, a parasite of water birds, is neither restricted by physical nor chemical conditions within the water bodies. The two species of the Erpobdellidae are restricted to running waters with stony substratum, and occurred mainly in the softest waters in the region which support any leeches.

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I am indebted to Dr. W. D. Russell Hunter who suggested this problem, and for advice on the presentation of this report; and to Mr. T. Warwick and Dr. K. H. Mann for help in the identification of the Erpobdellidae. Thanks are also due to Mr. P. Maitland and Dr. Russell Hunter for assistance with certain collections, and for furnishing some data.

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*Not seen in the original, quoted from Mann (1955b).

NOTEWORTHY PLANTS, 1959

by R. MACKECHNIE

(MS. received 13th April, 1960)

Amaranthus retroflexus L. A garden weed at Newlands, Glasgow, v.-c. 76, found by Miss F. Black, October, 1959. This casual from North America ("Pigweed") was last recorded from Glasgow (also from Newlands) by Robert Grierson in 1920 (*Glasg. Nat.*, 9, 41).

Alchemilla conjuncta Bab. Grassy roadside bank, Pollok, Glasgow, v.-c. 76, where established at least since 1952. Occasionally planted in rockeries; known definitely as a native plant only in Angus.

Galium mollugo L. Railway embankment near Shawlands station, Glasgow, v.-c. 76, July, 1959; first seen here in July, 1957. This bedstraw is always rare in the Glasgow area; last recorded in 1942, from the Monkland Canal (*Glasg. Nat.*, 14, 90).

Dipsacus fullonum L. On waste ground, Giffnock, Renfrewshire, v.-c. 76, first seen by me here about September, 1957. Records of Teasel in the Glasgow district are few; they extend over at least 150 years, and are mostly from the south of Glasgow. See *Glasg. Nat.*, 12, 110.

Senecio squalidus L. Near Lochan na Lairige, Killin, Perthshire, v.-c. 88, at 1700 ft, August, 1959. D. H. Kent, whose study of the distribution of Oxford Ragwort in Britain is appearing in the *Proceedings of the B.S.B.I.*, believes this to be the first Perthshire record, and writes "certainly an altitude record for Britain."

Potamogeton pectinatus L. In a quarry pool near Condorrat, Dunbartonshire, v.-c. 86, August, 1959, with *P. crispus*. Apparently a new station for this pondweed, which is very local in the West of Scotland.

Carex acutiformis Ehrh. and *C. lasiocarpa* Ehrh. Near Lake of Menteith, Perthshire, v.-c. 87, May, 1959, both in small quantity. These are local rather than rare plants in southern Scotland. They proved to be unrecorded from West Perth, suggesting that this part of the county may be underworked.

Poa trivialis L. At 2500 ft on Creag an Lochain, Killin, Perthshire, v.-c. 88, August, 1959. G. C. Druce (*Comital Flora*, p. 361) quotes 2500 ft as the altitudinal limit for this grass. It is usually a lowland plant in Scotland.

THE OAK WOODS OF SCOTLAND AND THEIR SPIDERS: WITH NOTES ON TWO RARE SPIDERS OF THE PINE WOODS

by ELIZABETH A. CROWSON

(*MS. revised to 10th November, 1960*)

INTRODUCTION

Although the first records of Scottish spiders were published in 1858 there is still much to be learned about their distribution and the habitats in which they are to be found. The most notable collector in Scotland was William Evans who published lists of spiders of the Clyde and Forth areas and of the neighbourhood of Aviemore. Since the death of Evans in 1922 attention has been concentrated on the distinctive northern fauna of the pine woods with the unfortunate result that the oak woods and the fertile midland valley have been neglected.

The present paper can be divided into four sections. The first deals in general terms with the oak woods, mainly those of the midland valley; the second gives lists of the spiders, other than Linyphiids, which are found in the oak woods (it is hoped to deal with Linyphiids in a later paper); the third consists of notes on spiders which are new to the Scottish list, have had few previous Scottish records, or about which some interesting fact has come to light; the fourth consists of notes on two species of spider from the pine woods, which have only twice before been collected in Britain.

Work in progress is designed to find out the seasonal distribution of the spiders in oak woods and to compare the fauna of this habitat with those of pine woods, moorland and sand dunes.

I. THE OAK WOODS

The popular image of Scotland is of a land of pine and heath but the pines must share the honour of dominance with the oaks. Both pine and oak woods are climax stages in vegetational succession. The oak woods may be regarded as part of the Deciduous Summer Forest of Europe while the pine woods belong to the Northern Coniferous Forest (Tansley, 1949); birch woods are frequently the successional stage which precedes the formation of either an oak or pine wood. Near Aberfoyle we find what is probably the most extensive area of natural oak woods and here the typical 'birch to oak' succession can be studied. At Ballater, on the hill of Craigen-darroch, there is evidence of competition between oak and

pine; on the lower levels of the southern slopes there is a coppiced successor of a natural oak wood while on the crown of the hill there is a mixed birch and pine wood. In 1958 the larger pines were being felled so it is possible that this interesting site may be spoiled for further study. Steven and Carlisle (1959) were of the opinion that the pines were sub-spontaneous (the present wood may have arisen from the seed of trees which were themselves planted) but, whatever the origin of the pines, the situation is similar to the natural one where the oaks tend to be most successful on the lower and more fertile ground while the pines are dominant on the higher and less fertile ground.

It is probable that at one time an oak forest covered the whole of the midland valley of Scotland, extending northwards on the coastal plain through Aberdeenshire to the Moray Firth, and farther inland on to land below 500 feet in the highland glens. With the development of agriculture, oaks were felled to free fertile ground for arable crops so that the oak woods of to-day represent remnants of the original forest. Many species of animals found in the isolated woods of to-day must be descendants of the fauna of the original forest since they would not be able to spread from one wood to another across large areas of meadows and arable ground. It is true that some species are capable of spreading rapidly, but these are a relatively small proportion of the total fauna.

The present oak woods have survived for a variety of reasons. In the Lothians, the woods of Dalkeith Palace were set aside as part of the royal hunting forest by David II, who was also responsible for the preservation of the oak woods at Cadzow Park, Hamilton, and the Tor Wood near Larbert. At Hamilton and Dalkeith we find the largest oaks, but because of the habit of grazing cattle in the woods there has been no regeneration for many years and the trees are widely spaced. While the animals which live on the trees themselves are well represented the ground fauna tends to be impoverished as many species live only in thick deposits of leaf litter. Some regeneration occurs in places protected from grazing animals; young trees are to be found at Dalkeith in an area which has been fenced to protect them and at Hamilton the steep sides of the Avon Gorge bear a covering of young oaks. At present the young trees in Cadzow Forest are being felled. It is to be hoped that natural regeneration will take place and that the character of this historic site will not be lost.

On other great estates the woodlands have been carefully managed to provide a steady crop of timber. Owners of these woodlands have followed the practice of selective felling, taking out a number of trees of one age group leaving young

trees to maintain the pleasant character of the wood and provide a future crop, while some mature trees are retained to provide the seed from which regeneration takes place. In this way a steady income was assured and the distinctive flora and fauna has been preserved. The oak wood at Rossdhu near Luss is an example of this type of management which results in a wood containing trees at various stages of development. In recent years little regeneration has taken place here probably because of grazing by rabbits, deer and sheep.

Possibly the most common form of economic exploitation of the oak woods was by coppicing. The woodlands were divided into blocks which were each clear felled once in about twenty years. Unlike the modern methods this did not result in the complete destruction of the wood as the roots were left and from them new shoots were produced. The typical flora and fauna has been preserved. The oak wood at Rossdhu to recolonise when the trees grew again. The trees in these woods did not have the thick trunks characteristic of those grown for timber but instead had several slender trunks rising from a common rootstock. The bark from the twenty-year-old shoots was used by tanners in curing leather while the wood was probably made into charcoal to be used in iron smelting. An account of this type of management is given by the Rev. Mr. Stuart of Luss in the *Statistical Account of Scotland* (1796). Examples of woods which have been managed in this way are Ross Wood, near Rowardennan, and Coilsholme Wood, near Failford (Ayr). The latter, which has a particularly sheltered situation in an area which is favoured climatically, has yielded both beetles and spiders of considerable interest and will repay further study.

Other woods seem to have survived because they grew in the steep gorges of the Clyde valley which were unsuitable for agriculture. The woods which grew on the gentler slopes must have given way at an early date to the orchards which now stretch from Kirkfieldbank to Garrion Bridge, but the gorges of the Fiddler, the Nethan and the Mouse were probably too steep for economic timber extraction. It is to be hoped that these woods, which still have a notably rich fauna and flora, will be spared in the future.

II. SPIDERS OF SCOTTISH OAK WOODS

- A. Spiders which occur in oak woods and seem to be confined to woodland sites. Species marked with an asterisk are found mainly in oak woods but some occasionally in birch woods; those marked with a question mark may not in fact be confined to woods although I have taken them only in this habitat.

1.	* <i>Clubiona compta</i> C. L. Koch	common
2.	* <i>Clubiona brevipes</i> Blackwall	rare
3.	* <i>Agroeca brunnea</i> (Blackwall)	very rare
4.	* <i>Anyphaena accentuata</i> (Walckenaer)	common
5.	? <i>Salticus cingulatus</i> (Panzer)	rare
6.	* <i>Lycosa lugubris</i> (Walckenaer)	common
7.	<i>Cryphoea sivicola</i> (C. L. Koch)	common
8.	<i>Theridion pallens</i> Blackwall	common
9.	<i>Theridion varians</i> Hahn	rare
10.	* <i>Robertus neglectus</i> (O. P. Cambridge)	rare
11.	? <i>Tetragnatha montana</i> Simon	probably common
12.	* <i>Pachygnatha listeri</i> Sundevall	frequent but not numerous
13.	<i>Araneus gibbosus</i> Clerck	very rare
14.	<i>Araneus umbraticus</i> Clerck	common
15.	<i>Araneus cucurbitinus</i> Clerck	common

B. Spiders which occur commonly in Scottish oak woods but are not confined to woodland sites.

1. *Ciniflo fenestralis* (Stroem)
2. *Oonops pulcher* Templeton
3. *Harpactea hombergi* (Scopoli)
4. *Segestria senoculata* (Linnaeus)
5. *Xysticus cristatus* (Clerck)
6. *Philodromus aureolus* (Clerck)
7. *Neon reticulatus* (Blackwall)
8. *Euophrys erratica* (Walckenaer)
9. *Lycosa pullata* (Clerck)
10. *Lycosa amentata* (Clerck)
11. *Lycosa nigriceps* Thorell
12. *Pirata hygrophilus* Thorell
13. *Trochosa terricola* Thorell
14. *Hahnia montana* (Blackwall)
15. *Theridion ovatum* (Clerck)
16. *Robertus lividus* (Blackwall)
17. *Pachygnatha clercki* Sundevall
18. *Meta segmentata* (Clerck)
19. *Meta merianae* (Scopoli)
20. *Araneus diadematus* Clerck
21. *Zygiella atrica* (C. L. Koch)

C. Spiders which occur occasionally in Scottish oak woods but are not confined to woodland sites.

1. *Drassodes lapidosus* (Walckenaer)
2. *Micaria pulicaria* (Sundevall)
3. *Clubiona reclusa* O. P. Cambridge
4. *Clubiona pallidula* (Clerck)
5. *Clubiona lutescens* Westring
6. *Clubiona trivialis* C. L. Koch
7. *Clubiona diversa* O. P. Cambridge
8. *Zora spinimana* (Sundevall)
9. *Oxyptila trux* (Blackwall)
10. *Oxyptila atomaria* (Panzer)
11. *Philodromus histrio* (Latreille)

12. *Heliophanus cupreus* (Walckenaer)
13. *Evarcha falcata* (Clerck) (Evans, 1901)
14. *Tarentula pulverulenta* (Clerck)
15. *Trochosa ruricola* (Degeer)
16. *Pirata piraticus* (Clerck)
17. *Pisaura mirabilis* (Clerck)
18. *Hahnina helveola* Simon
19. *Theridion* sp.—probably *T. neglectum* Wiehle
20. *Pholcomma gibbum* (Westring)
21. *Pachygnatha degeeri* Sundevall
22. *Meta menardi* (Latreille)

III. NOTES ON SPIDERS

Because of difficulty in tracing the exact localities of some of the earlier records of spiders the distribution of species is given by counties as in Bristowe's "The Comity of Spiders." By using larger units this system avoids the difficulty of trying to place early records in vice-counties but even at the county level some uncertainty remains. Several records by H. C. Young were given the locality 'near Glasgow' in the 1901 British Association Handbook (Evans, 1901) and Bristowe has treated these as records for Lanarkshire. Although the majority of the species concerned have been found by other collectors in the county it is by no means certain that Mr. Young did collect them there. In some cases, which have not been confirmed, the ecological requirements of the species suggest that, if they do occur in Lanarkshire, the locality would not be described as 'near Glasgow,' and that the specimens more probably came from another county. I prefer to place emphasis on the type of habitat in which spiders are found rather than upon the known geographical distribution and hope that this will give some indication to future workers as to whether the absence of a species from a county list is due to the lack of conditions suitable for its survival or merely to the absence of collectors at the season when it is adult.

Ciniflo fenestralis (Stroem)

This is one of the commonest species of spider and occurs in a variety of habitats, wherever it can find a convenient crevice in which to build its tube. It is not a species which we would expect to occur in pitfall traps and in several years of trapping at Rossthdu, where the species is common under the bark of trees, we have never taken it by this method. In October, 1959, some traps were set in the oak woods at Dalkeith Palace (Midlothian) and at Bothwell Castle (Lanark). In both sets of traps the most common species of spider was *Ciniflo fenestralis*. At Bothwell 46 males and 5 females were taken and at Dalkeith 48 males and 1 female; in both cases the majority of the spiders occurred in a single trap. The traps at Bothwell belonged to a series which were set from the middle

of June, 1959, and the only other specimen of the species which was taken during the period was a female which occurred in the same trap in the previous month. These trapping results seem to indicate a seasonal migration of mature males in search of a mate in the month of October.

Clubiona lutescens Westring

This species has been taken once before in Scotland by Maurice Young who gave the locality as 'near Paisley' (Evans, 1901). In England I have taken it outside from oak woods but both my Scottish records refer to such sites. When the Andersonian Naturalists held a field meeting at Rowardennan on 2nd May, 1959, I collected a mature female near the Dubh Lochan (Stirling). On 9th May, 1959, a student collected a mature male in the wood at Rossdhu, near Luss (Dunbarton). It is possible that further collecting in low vegetation in damp places in the oak woods will extend the range of this species.

Clubiona brevipes Blackwall

This species is occasionally beaten from oak trees. It is probable that, like the related species *C. compta* C. L. Koch, it does not spin a snare but builds a silk cell on the under side of leaves. When the spider emerges from the cell to hunt its prey on the surface of the leaves it can be shaken from the foliage on to a beating tray. Previous Scottish records are from the counties of Berwick, Midlothian, Fife, Dumfries and Lanark (Bristowe, 1939). The record for Lanark is taken from Evans' paper of 1901 where he records that H. C. Young took the species 'near Glasgow.' I have taken three males, two by beating oaks and one from a grassy roadside with overhanging oaks. The localities are: roadside near Bishopton (Renfrew), June, 1955; oaks at Cambusnethan Priory, near Wishaw (Lanark), May, 1959; and oaks at Coilsholme Wood, near Failford (Ayr), May, 1959. It seems probable that I have overlooked females of this species amongst material of *Clubiona compta* since it is possible to beat both species from the same tree.

Anyphaena accentuata (Walckenaer)

This spider, to which Bristowe gave the name "Buzzing Spider" in his book *The World of Spiders*, has previously been known from only three localities in Scotland. Carpenter and Evans (1897) record taking it from oaks near Aberfoyle (Perth) between the 23rd and 26th May, 1896, and refer to a previous record by Hardy from Pease Dene (Berwick) which is an oak wood. Evans (1901) records that H. C. Young took the species at Haugh Glen (Ayr) in September, 1879. I have not visited

this glen but there is probably an oak wood there, as in other glens in the neighbourhood. I have taken it at Coilsholme Wood, near Failford (Ayr), in May and June, 1959; at the Tor Wood, near Larbert (Stirling), June, 1959; and at Hamilton High Parks (Lanark), June, 1958. This spider is easily identified in the field from the figure in *British Spiders* or from the drawing by Arthur Smith in *The World of Spiders*.

Salticus cingulatus (Panzer) and *Salticus scenicus* (Clerck)

Salticus scenicus is recorded by Bristowe (1939) from all over Scotland; *S. cingulatus* has only five records from—Kirkcudbright, Inverness, Perth, Aberdeen and Lanark. It seems possible that some of the records of *S. scenicus* refer to *S. cingulatus*, especially since most of the identifications in the Clyde list seem to have been made from Blackwall (1861–64) in which the two species are confused under the name of *S. scenicus*. Locket and Millidge (1951) say that *scenicus* is found on sunny walls particularly around buildings, while *cingulatus* is normally found on tree trunks and palings around woods, away from human habitations. This suggests that a record by Evans for Cadder might in fact be of *cingulatus* and not *scenicus*. These are “jumping spiders” which have the anterior eyes very strongly developed so that they can judge distances very accurately. Both species have a well-marked abdominal pattern of white bars on a black ground which makes the genus readily recognisable in the field. Immature specimens were taken in the wood at Rossdhu, near Luss (Dunbarton), and on a cut stump at the side of Dundonald wood (Ayr). A mature male of *cingulatus* was taken on a paling post at Barochan Moss (Renfrew) in 1955. On 14th May, 1960, Master A. Maclaurin took another mature male of *cingulatus* on a birch tree in a small wood on the edge of Flanders Moss (Perth).

Lycosa lugubris (Walckenaer)

This species was recorded by Bristowe (1939) from the counties of Argyll, Inverness, Perth, Stirling and Dunbarton. The Dunbarton record is from Evans (1901) who records that it was common in oak coppices near Loch Lomond. Hull (1912), when recording a new species of spider for Moray, refers to a misidentification in a previous paper (Hull, 1911) and states that the spider was *Lycosa lugubris*. A search of the oak woods of Moray should settle the question of whether the species does in fact occur there. I have found it abundant in the wood at Rossdhu, near Luss (Dunbarton), May, 1954–59; at Coilsholme Wood, near Failford (Ayr), May, 1959; at Rowardennan (Stirling), May, 1959; Abbey Craig

(Stirling), September, 1958; Dinnet Oak Wood, near Ballater (Aberdeen), September, 1958; and Cambus o' May birch wood, near Ballater (Aberdeen), September, 1958.

Pirata hygrophilus Thorell

Bristowe (1939) records this species only from the counties of Dumfries and Perth. He seems to have overlooked a record by Evans (1901) from Peaton, Loch Long (Dunbarton). I have found that the species is by no means uncommon in the Clyde area and in fact have more records for this species than of *Pirata piraticus* (Clerck) which Evans considered more common. The localities in which I have taken it, in the Clyde area, are all in damp oak woods near either a loch or a river. They are Rossdhu, near Luss (Dunbarton), May, 1954-59; Dubh Lochan, near Rowardennan (Stirling), June, 1955; Ross Point, near Rowardennan (Stirling), June, 1958; Hamilton High Parks (Lanark), June, 1958; Bothwell Castle wood (Lanark), June, 1959; and Mugdock Wood (Dunbarton), June, 1959. Pitfall trapping at Rossdhu from mid-April to mid-July, 1960, shows that adults of this species have a very restricted season. From mid-April to mid-May only four immature specimens were taken in ten traps, from mid-May to mid-June fifty-five adults were taken in traps in the same situations, and from mid-June to mid-July only twelve adults were taken in the ten traps. This would suggest that the apparent scarcity of the species in the Clyde area was due to the seasonal fluctuations in numbers.

Pisaura mirabilis (Clerck)

This is one of the largest of the British wolf spiders, in England it is regarded as a common species but in Scotland it is very local or even rare. The first record from the Clyde area is that of H. C. Young who found it on the island of Inchtavanach near Luss (Dunbarton) (Evans, 1901). This island has a covering of oaks. Evans (1901) recorded it from Brodick on the island of Arran (Bute) but gave no indication of the habitat. The specimen from Brodick is in the Royal Scottish Museum in Edinburgh. Evans also records it from moorland and heather and he seems to have found that it was more common in upland districts than in the lowlands. One of the records made by Evans is of specimens taken near Aberfoyle (Carpenter and Evans, 1897) and by association with other records in the same paper, it might be deduced that these were taken in oak woods. Foreman (1951) draws attention to a record by Traill (1878) from Aberdeen and records that he has himself collected the species on the links near Aberdeen. Although I have collected on sand dunes in the Clyde and Forth areas and have set pitfall traps at the season when *Pisaura* is active, I have never met with it in this

habitat. Since 1901 the species seems to have escaped notice in the Clyde area until, on 2nd May, 1959, Mr. Maclaurin found an immature male on the lower slopes of Ben Lomond, near Rowardennan (Stirling). On 17th May, 1959, I found numerous mature males and females in a clearing in Coilsholme Wood, near Failford (Ayr). Males and females were taken alive and it was possible to watch mating behaviour by keeping them in a large glass tank. Bristowe, in *The World of Spiders* (1958) gives an interesting account of this species.

Hahnia helveola Simon

Bristowe (1939) gives three records for this species. The counties from which he records it are Lanark, Perth, and Ross. Locket and Millidge say that it is "local though often then abundant" and give as its habitat "undergrowth, often in woods." Donisthorpe (1927) regards this species as one which will "hunt and prey on ants." So far I have not observed *Hahnia helveola* preying on ants but the only place where I have found it any abundance was in the pine wood of Glentanner, near Ballater (Aberdeen), in September, 1959, when I took both males and females in nests of *Formica rufra* and among pine needles in company with ants, and with the spiders *Harpactea hombergi* (Scopoli), *Oonops pulcher* Templeton, and *Pholcomma gibbum* (Westring). Other new records for the species are: male from Mugdock Heath (Stirling), 1958; female from oak litter in Fiddler Glen, near Braidwood (Lanark), 21st June, 1959; female from Coilsholme Wood, near Failford (Ayr), May, 1959. The ant *Formica rufra* does not occur in these localities so the spider, if it is only to be found in the neighbourhood of ants, must also be associated with other ant species.

Robertus neglectus (O. P. Cambridge)

Evans (1901) records this species from the Clyde area, a specimen having been taken 'near Paisley' by Maurice Young. Carpenter and Evans (1894) record, from Evans' own collecting, a male at Temple (Midlothian) on 27th July, 1893, and another at Leven (Fife) in September, 1893. Evans later collected the species at Gifford (East Lothian) on 16th September, 1896, and a male at Polton Woods, near Edinburgh, in April, 1898 (Carpenter and Evans, 1894-1905). I have records of two males; one taken from pitfall traps in the oak wood at Bothwell Castle (Lanark), June, 1959; the other taken by hand in Dinnet Oak Wood, near Ballater (Aberdeen), September, 1958.

Pachygnatha listeri Sundevall

This species was taken by Evans at Temple (Midlothian); until now this was the only known Scottish locality for the

species. I have taken a male of this species at Dalkeith Palace (Midlothian) in 1955; it is fairly common in the leaf litter of the oak wood at Rossdhu, near Luss (Dunbarton), May, 1954-59; I have taken females in Coilsholme Wood, near Failford (Ayr), May, 1959, and a single female was found in a small birch wood at the edge of Flanders Moss (Perth), May, 1960.

Tetragnatha montana Simon

This species was recorded by Bristowe (1939) from the counties of Perth, Midlothian, Fife, and East Lothian. The species is probably much more widely distributed than these records indicate, partly because there was some confusion at the time Evans was working and some early records of *T. extensa* (Linnaeus) may in fact be records of *T. montana*, and partly because the later collectors have not worked in the habitats preferred by the species. I have taken the following specimens: a male from the oak wood at Rossdhu, near Luss (Dunbarton), May, 1959; and males and females from Coilsholme Wood, near Failford (Ayr), May, 1959.

Meta menardi (Scopoli)

This spider is known from England and France as a cave-dwelling species. In Scotland it has often been taken from dark places in damp houses and from the vaults of castles. Evans (1901) records it from the vaults of "Tillietudlem Castle" but this record was omitted by Bristowe (1939) who presumably was unable to trace the locality. I can confirm that, on the 13th August, 1955, the colony was thriving in the vaults of Craignethan Castle, between Crossford and Netherburn (Lanark). The latter is the name of the castle as it appears on the Ordnance Survey maps and should be used in preference to the local name in accounts of the flora and fauna of the locality. On 27th April, 1958, my husband discovered another colony of the spider in a hollow elm in Hamilton High Parks (Lanark), but when we returned with the zoological section of the Andersonian Naturalists on 21st June, 1958, it was discovered that the tree had been felled to make way for the workings of a sandpit. It seems probable that other colonies of the species occur in the inaccessible vaults of Cadzow Castle and in other hollow trees in the area.

It is probable that young spiders leave the shelter of hollow trees in order to colonize other trees but, as the immature forms of spiders cannot be determined with any certainty, records of the species from the open are not available.

Araneus gibbosus (Walckenaer)

Locket and Millidge (1953) say that this species does not extend north of Cheshire and Lincolnshire. It is one of three

species of orb-web spinners which have prominent tubercles on the anterior part of the abdomen. The other two species are even more restricted in their distribution. A mature female and an immature specimen were beaten from oak in Coilsholme Wood, near Failford (Ayr), in May, 1959; later in the year more immature specimens were taken in the locality.

IV. NOTES ON *Robertus scoticus* JACKSON AND *Dipoena torva* (THORELL) FROM SCOTTISH PINE WOODS

Robertus scoticus Jackson

This species was first described by Jackson (1914) from a single female taken in moss at the Black Wood of Rannoch in 1913. The male was described by Schenkel (1923) from a continental specimen but was not taken in Scotland until October, 1949, when La Touche was collecting in the Black Wood (Locket, Millidge and La Touche, 1958). In September, 1959, a female emerged from a sample of sphagnum moss which I had taken from the Old Wood of Meggernie (Perth) and placed in a Tullgarn funnel. The moss was collected in an area where the trees were fairly widely spaced so it is possible that the species may not be confined to woods but may also occur on open heaths.

Dipoena torva (Thorell)

The only recorded locality for this species is the Black Wood of Rannoch where it was taken by La Touche on pine trunks (Locket and Millidge, 1953). When collecting in Kinveachy Wood, between Boat of Garten and Aviemore (Inverness) in June, 1955, I took a mature female from pine foliage. This is the only species of the genus *Dipoena* which is recorded from Scotland so it is probable that a sub-mature male taken in Ballochbuie Forest (Aberdeen) may be *D. torva*, but no definite record can be made for this locality until mature specimens are obtained.

ACKNOWLEDGMENTS

I should like to take this opportunity to thank Mr. G. H. Locket for his help and encouragement over the last ten years, also for the confirmation of my determination of the following species: *Clubiona lutescens*, *Dipoena torva*, *Robertus scoticus*, *Robertus neglectus* and *Araneus gibbosus*. I am also indebted to Professor C. M. Yonge for facilities in the department of Zoology in the University of Glasgow, without which this work would have been impossible, also to the landowners who have given permission to collect in their woods and those on whose hospitality I have trespassed.

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THE BOUNDARIES OF THE VICE-COUNTIES IN SCOTLAND. Part 1.

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(*MS. revised to 28th November, 1960*)

INTRODUCTION

For about a hundred years the Watsonian Vice-county system has been used for recording the horizontal distribution of plants in Britain and more recently zoologists have begun to use it.

The system involves the division of the British Islands into areas (called vice-counties) which are more equal in area than are the counties. This is done by subdividing the large counties and by merging the small ones with neighbours. There are 112 vice-counties in Britain (41 of which are in Scotland) and 40 in Ireland. A list of these together with a map appears in Druce's *Comital Flora* (Arbroath, 1932) and in certain books of the "New Naturalist" series, e.g. Lousley (1950) and Turrill (1948).

It is, of course, very important that boundaries should remain fixed and that they should be ascertainable. Difficulties arise over both of these conditions: there is a lack of precision in some of Watson's definitions and many county boundaries which appear on current maps are not the same as those existing in Watson's time. These matters are discussed by Wilmott (1944) and by Dandy (1951).

A set of maps with definitive boundaries has been prepared and is kept at the British Museum (Natural History). Mr. J. E. Dandy, Keeper of the Department of Botany in the Museum has kindly marked these boundaries on a set of One Inch Ordnance Survey Maps of Scotland and this is deposited in the Department of Botany in the University of Glasgow where it may be consulted upon application to the Regius Professor of Botany.

It has been suggested to me that many local workers and others would find it useful to have more readily available the details of the correct vice-county boundaries. The need is even greater now that the Clyde Card Catalogue Committee has most properly decided that its future recording should be done on a vice-county basis and no longer on drainage areas, and accordingly the Publishing Committee of the *Andersonian Naturalists* has asked me to prepare an account of the Scottish vice-county boundaries.

I have based this upon the marked One Inch Maps referred to above and I wish to thank Mr. Dandy for his kindness in allowing me to use his unpublished material in this way.

The account will appear in several parts and will include maps to show the especially difficult boundaries. The descriptions generally commence in the northwest corner of the vice-county and proceed in an anti-clockwise direction. Only names which appear on Ordnance Survey Maps are given and free use is made of the co-ordinates of the National Grid—usually given to six figures (these appear in brackets). Deviations from the present county boundaries are distinguished by being printed in italic type.

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V.-C. 84 LINLITHGOW

The county of West Lothian, excluding the island of Inch Garvie. The vice-county adjoins V.-C. 83, V.-C. 77 and V.-C. 86; elsewhere it is bounded by the sea (the Firth of Forth).

This is one of the smallest vice-counties and the boundary is quite straightforward in following the present West Lothian county boundary for the most part. It begins in midstream in the River Forth (9983) and follows the present county boundary in midstream of the River Avon down to Hillend (918726) near Avonbridge. From Hillend the line runs in midstream along the Drumtassie Burn and then due west, passing to the south of Wester Whin to (862685) and turning north to join the North Calder Water. The vice-county boundary continues as the county boundary along the Barbauchlaw Burn and part of the How Burn, crossing the Glasgow-Edinburgh Road (A.8) at Harthill and continuing south to the junction of the Dormead Linn with the Breich Water, running in midstream to the meeting with the River Almond (016659). At (052669) the boundary leaves the Almond and runs slightly west of north, along the west side of a lane, so that Howden, Harry's Muir and Pumpherston are outside the vice-county (the Caw Burn and then the Bank Burn constitute the boundary). From (086688) the line follows the Almond again down to the centre of the Forth (195812), (Cramond Island is not included), from which point it runs westwards in the middle

of the river but it is important to note that it *passes to the south of Inch Garvie (the island supporting one of the piers of the Forth Bridge)* and of Beamer.

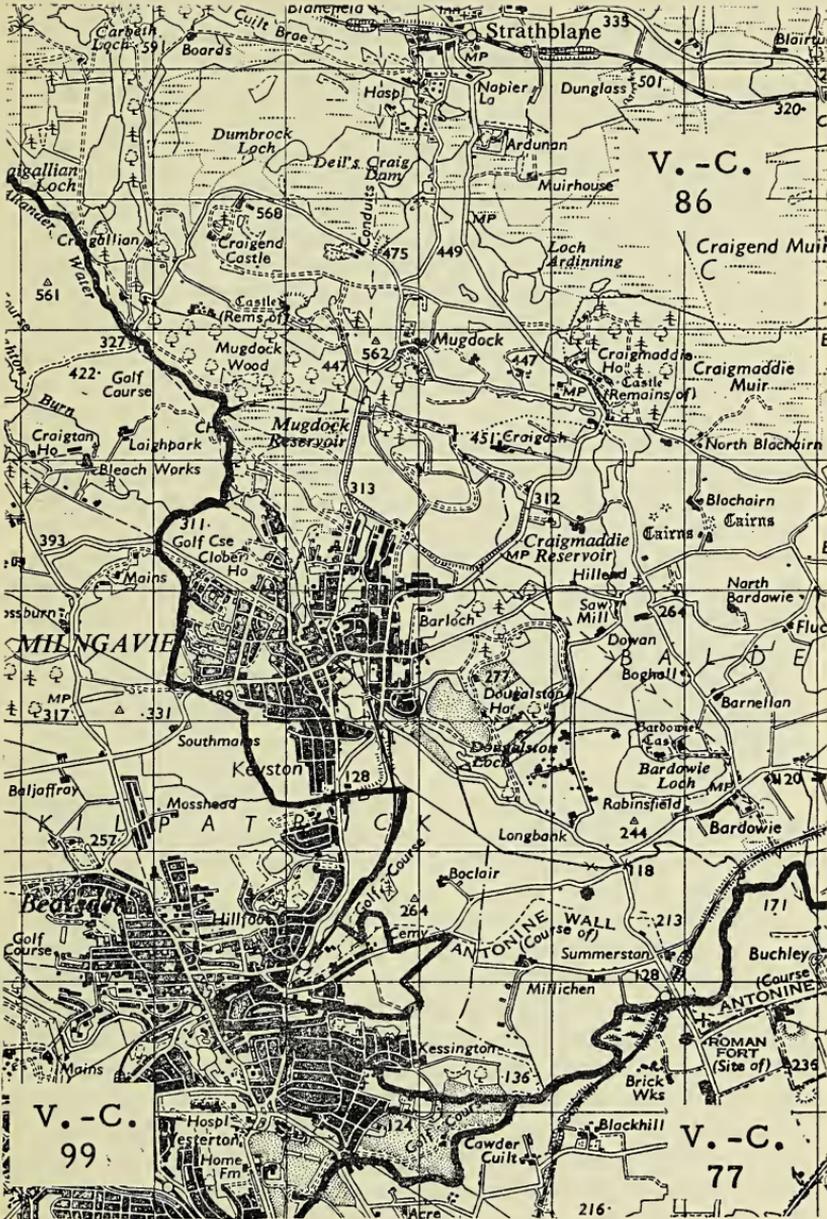
(Sheets 67, 68, 73 and 74, Popular Edition One Inch Maps)
(Sheets 61 and 62, Seventh Series One Inch Maps)

V.-C. 86 STIRLING

The county of Stirlingshire together with the detached part of Dunbartonshire; excluding two areas of Stirlingshire (part of Logie parish in the Bridge of Allan area and part of Kippen parish near Arnprior) but including an area of Perthshire (part of the Carse of Lecropt, near Bridge of Allan), an area of Lanarkshire (part of New Kilpatrick parish at Millichen) and an area of Dunbartonshire (part of New Kilpatrick parish including the town of Milngavie and the Dougalston Estate). The vice-county adjoins V.-C. 84, V.-C. 77, V.-C. 99 and V.-C. 87; elsewhere it is bounded by the sea (the Firth of Forth).

The vice-county boundary follows the county boundary as shown on the map from the summit of Ben Duतेach to that of Beinn a' Chroin by way of the middle of a wall, of the Pollocrow Burn and of Allt Rostan down to Loch Lomond. The line runs in the centre of the loch, excluding island I Vow but including Bucinch, Inchcruin, Ellanderroch and Inchfad, Inchcailloch and Clairinch. It then passes in midstream first up the Endrick Water and then up the Catter Burn, the Cameron Burn, the Bagory Burn and later along the Burn Crooks, the Auldmurroch Burn and the Allander Water.

At (546764) the county boundary turns eastwards but the vice-county boundary continues along the Allander for a short distance to (546759), follows the footpath to the Craigton Burn along which it more or less runs for about 0.3 miles westwards to (541756) and then goes southwestwards crossing the road at (540754). It skirts the policies of Mains on the northeast and east sides (Clober House is within the vice-county) and meets the Craigdow Burn at (541743). The line then follows down the Burn to the junction with the Manse Burn, which it enters between the Milngavie railway track and the Allander Water, and then runs up this burn (crossing the railway three times) to (553725). The vice-county boundary then pursues a very complicated course and reference should be made to a large-scale street



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FIG. 1. The boundaries between Vice-Counties 77 (Lanark), 86 (Stirling) and 99 (Dunbarton) in the Bearsden and Milngavie area.

map (see also Fig. 1). It excludes the Boclair Cemetery but runs along its eastern side to meet the B.8049, Boclair Road, at (558723). From this point it follows the south side of the road eastwards to the road junction at (563724), goes southwestwards to (558720) and southeastwards to (561718), thus enclosing what used to be Millichen Wood, and then almost due west, passing to the north of Whitehill Woods and along the southern boundaries of the houses on the south side of Boclair Crescent, crossing the main A.81 road and continuing along the dividing fences between the houses in West Chapelton Drive and Boclair Avenue. The line turns northwestwards along the backs of the houses on the east side of Greenhead Road to meet the railway track at (548720), follows the railway to (546719), leaves it to run first southwestwards along the rear fences of the houses on the northwest side of West Chapelton Crescent and then eastwards along the back fences of the houses on the south side of West Chapelton Avenue to meet the main A.81 road, Milngavie Road, at (550716). It goes southwards along the east side of this road and turns east along the north side of Kessington Road until it reaches the eastern boundary fence of Kessington School. It turns southwards along this fence and then runs eastwards to the north of Killermont Cottage (559712) and on to meet the county boundary (of Dunbartonshire and Lanarkshire) in the centre of the River Kelvin at (567711), i.e. about 0.2 miles west of a point where the present boundary of the County of the City of Glasgow meets the river.

This part of the vice-county boundary is shown in detail on the 1865 edition of the Six Inch Ordnance Survey Map as the county boundary and on the 1899 edition as the parliamentary county boundary.

After following the middle of the River Kelvin and then passing along the present county boundary also in the Kelvin, and then in the Bonnywater to (641742) the vice-county boundary runs south and east thus enclosing the detached portion of Dunbartonshire in vice-county 86. Near Woodneuk it follows the centre of Old Course of Stream, crosses the Forth and Clyde Canal, and continues by way of the Red Burn, Walton Burn, and later, Garbethill Burn, and various hedges and fences to bisect Black Loch from northwest to southeast. After some distance along the North Calder Water it shares the line which has already been described (p. 161) for vice-county 84 along the Drumtassie and Linn Mill Burns and the River Avon to the middle of the Forth (994836).

The vice-county boundary runs up the centre of the Forth and along the county boundary as shown from Airth upwards, passing under the centre of Kincardine road and Alloa railway

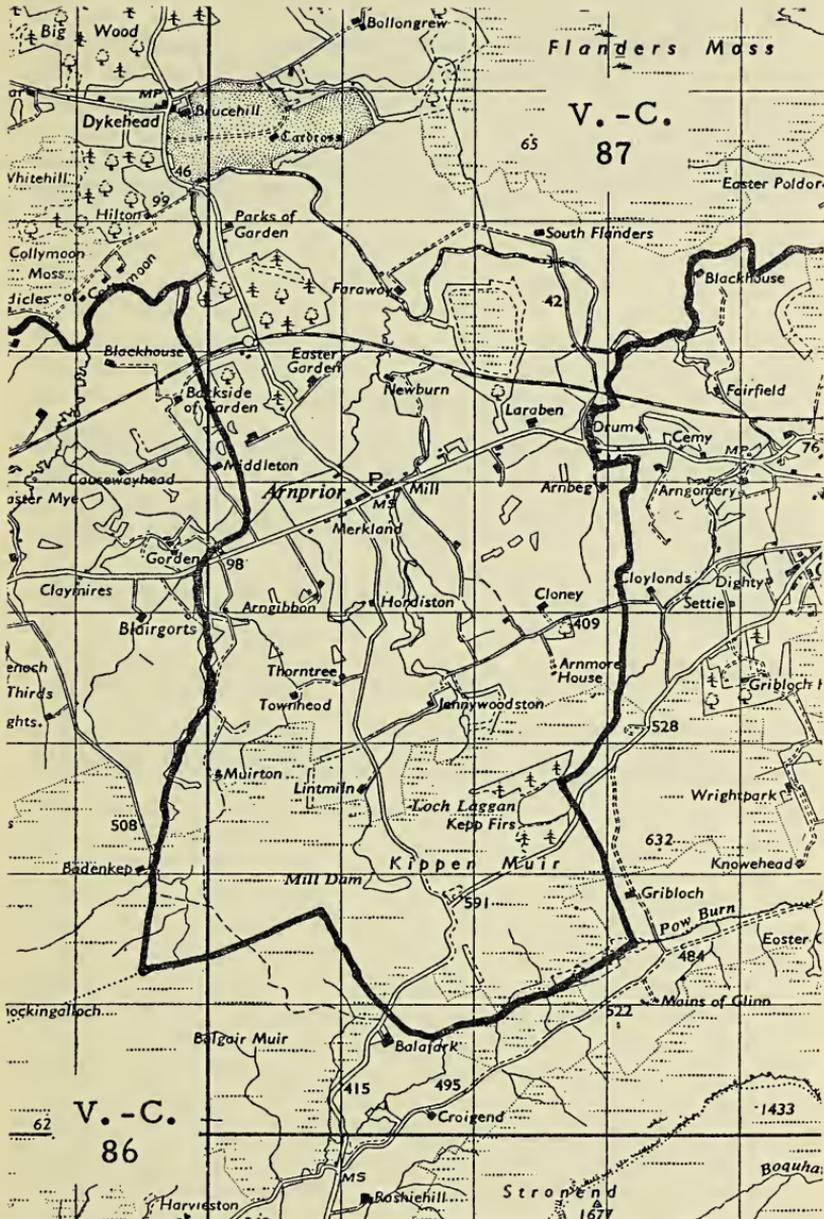
bridges (Alloa Inch and Tullibody Inch are excluded). The county boundary leaves the River Forth near Manor Powis Colliery (829947) *but the vice-county boundary continues in midstream (following the St. Ninians-Logie parish boundary for a while) to a point (803947) just southwest of Causewayhead Station. It there leaves the river at right angles, crosses the railway and passes northeastwards along the centre of the main A.9 road and across the policies of Airthrey Castle to the south-east corner of the lake (which is itself included). From this point it goes northwestwards up to the road junction at (815970) and along the burn which runs due north (the bend in the power line and the corner pylon shown on the Two and a Half Inch Ordnance Survey Map are just included) and into the burn which runs down to the Bridge of Allan Waterworks reservoir. It bisects this reservoir from southwest to northeast and continues along Cock's Burn to meet the county boundary again at the Allan Water (788986) (Fig. 2).*

This part of the vice-county boundary is shown in detail on the 1865 Six Inch Ordnance Survey Map as the county boundary.

The vice-county boundary again leaves the county boundary at (785980) just north of Bridge of Allan Station and crosses the Carse of Lecropt, just including Knockhill, passing midway between Mid Lecropt and Deafleys and then slightly west of south along a drain to meet the River Teith, just northwest of its meeting with the Forth, a little to the south of Greenocks (768964), i.e. Moss Farm and Deafleys are included, Mid Lecropt and Greenocks are not (Fig. 2).

The line follows the county boundary upstream in the Forth to (632961) where it turns southwestwards along a small burn for about a mile, passing through the now disused Ladylands railway siding and thence southwards, but to the east of the road, crossing the main Dumbarton-Stirling road, A.811, at Loaning-foot. It goes well to the east of Arnbeg, then south to the ruins of New Mill after which it follows up the Broich Burn almost to Loch Laggan (627927) from which point it takes a straight course to (632915) where it meets the Kippen-Balfron parish boundary. This boundary is followed to the Carlin Stone (B.S.) at (595913) whence the vice-county boundary goes almost due north keeping first to the east of the Arngibbon Burn, then to the centre of a fence as far as the waterfall at (597927) and afterwards to the centre of the burn to (603947). From there it runs north-northwestwards to the west side of Tipperdorroch, crosses the railway at (599959) and follows a small burn down to the Forth at (598965) (Fig. 3).

The boundary of this part of the vice-county, which includes part of Kippen parish, is shown in detail on the 1865 edition of the Six Inch Ordnance Survey Map, since it was then the



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FIG. 3. The boundary between Vice-Counties 86 (Stirling) and 87 (West Perth with Clackmannan) in the Kippen and Buchlyvie area,

county boundary, and also on the 1899 edition, since it was then the parliamentary county boundary.

From (598965) the vice-county boundary is the same as the county boundary, following the Forth to Barbadoes and then as on the map to Loch Katrine (Black Isle is excluded) and Ben Ducteach.

(Sheets 62, 66, 67, 72 and 73, Popular Edition One Inch Maps)

(Sheets 53, 54, 55, 60 and 61, Seventh Series One Inch Maps)

ACKNOWLEDGMENT

The Council of the Society wish once again to acknowledge their indebtedness to The Royal Society for a substantial grant towards the cost of publication of the following papers in a previous issue (Volume XVIII, Part 2) of *The Glasgow Naturalist*.

- (1) "Habitats of the Field Mouse on Fair Isle in spring, 1956."
- (2) "The lower vertebrates of the Loch Lomond district."
- (3) "The present distribution of *Potamopyrgus jenkinsi* (Smith) in Buchan and the southern Moray Firth area."

OBITUARY

Donald Patton, M.A., B.Sc., Ph.D. (1884–1959)
William Rennie (1879–1959)

DONALD PATTON was educated in Glasgow; he entered the University in 1903, graduating M.A. (1906) and B.Sc. (1911). He began his professional career as a schoolmaster in Bellahouston Academy, served during the war in the Black Watch (1917–19), and on demobilisation joined the staff of the University Botany Department as an Assistant. 1923 was a momentous year for him; he became Senior Lecturer in Botany, received his doctorate and left the University for the Science Department at Jordanhill Training College. During his early years there he produced a nature study textbook and took an active part in compiling the Clyde Card Catalogue in preparation for the visit of the British Association to Glasgow in 1928.

His connection with us dates from 1910, when he joined the Andersonian Naturalists' Society. He was President of that Society during 1925–26 and, immediately afterwards (1926–29) was President of the Glasgow Natural History Society. These societies amalgamated in 1931, and Patton was Librarian (1940–46) and President (1952–54) of the new body. He was Editor of *The Glasgow Naturalist* from 1940 to 1947.

In the earlier years his chief botanical interest was in the plants of upper Clydesdale, an interest summarised in his paper on the vegetation of the Tinto Hills (1922). Mountains and mountain plants attracted him; like J. R. Lee, he became a Lawers enthusiast and an authority on the plants of the Breadalbane Hills in general. Visits to Norway and Switzerland widened his experience of arctic and alpine plants, and his thesis for the degree of Ph.D., on the vegetation of Beinn Laoigh, reflected this enthusiasm. There were also shorter papers on the vegetation along the line of the Lawers–Caenlochan schist, on Norwegian plant-associations and on the Flora of Culbin Sands. Among his other interests, geology ranked high; he was an active member of Glasgow Geological Society, and was also interested in Gaelic place-names. He became a Fellow of the Royal Society of Edinburgh and a member of the Botanical Society of the British Isles; his published work is distributed through the transactions of these bodies.

Few professional botanists in Scotland can have become known to so wide a circle of people. For nearly fifty years he was constantly engaged in teaching in the classroom, the lecture room and the field—and to pupils of all ages, for he also conducted classes in Botany for the University Extra-

mural Department and the Workers' Educational Association. A kindly, tolerant man, he will be best remembered for his genial disposition and his great enthusiasm for natural history.

WILLIAM RENNIE was a pattern-maker to trade. He retired from this occupation in 1936, and thereafter devoted his time to various pursuits connected with natural science and archaeology.

He joined the Society in 1901, and served as Librarian from 1931 to 1936. For several years he acted as convener of our British Association Committee; during this period he also did much voluntary work for the Glasgow Museum at Kelvingrove, where he inaugurated the wild-flower display which has become an annual feature in the Natural History section.

Rennie's chief interests lay in birds, plants and rocks; he was also something of an antiquary. Most of his investigations were carried out within the city boundary; articles on the birds and the plants of Possil Marsh, on bird-life of Ruchill Park, on the early history of the Geological Society of Glasgow, appeared over his name from 1946 onwards. It was characteristic of this strongly independent man that much of what he wrote was printed privately, although the results of a rook census, made at Kenmure rookery, Bishopbriggs, appeared in *The Glasgow Naturalist*.

A few years ago an accident in a city tramcar resulted in a reluctant Rennie being removed to hospital; the after-effects of this mishap rendered him almost completely house-bound, and we saw no more of him at meetings. For some years prior to this his health had not been good, but he was a man of great determination, and continued to attend our meetings, and those of the British Association, when many of us thought such exertions beyond his powers. By nature, he was a most forthright person; I never knew him lukewarm on any of the issues raised at Society meetings during his active days. What he believed in, he fought for with conviction, and offered no quarter. Some described him as "thrawn," but there was always a twinkle in the eyes behind the glasses that belied the term; he was, in fact, one of our most popular members.

It is, I suppose, in a melancholy way appropriate that these two men, who worked so long in the Society's interests, should pass from its membership in the same year. Although so different in temperament, they were friends as well as contemporaries, and both were naturalists rather than specialists. It is fitting, too, that their last contributions to our pages should be made in a joint paper, and on a subject of life-long interest to them both—the plants of Possil Marsh.

R. MACKECHNIE

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY

13TH JANUARY, 1959

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Two new members were admitted to the Society: Mr. Alex. Pollock, M.A., L.R.A.M., 54 Earlsplug Road, Glasgow, S.3; and Mr. Michael D. Ash, 105 Bellwood Street, Glasgow, S.1.

Mr. Kenneth Williamson gave a lecture entitled "A Summer on St. Kilda," illustrated with colour transparencies.

28TH JANUARY, 1959

A joint meeting held in the Department of Botany, University of Glasgow, with the Royal Scottish Forestry Society, was presided over by Mr. John T. Lorimer, D.S.O. A lecture on the forests of Chile was given by Mr. C. W. Scott, O.B.E.

10TH FEBRUARY, 1959

The Annual General Meeting was held in the Art Gallery and Museum, Kelvingrove, and presided over by Mr. Robert Mackechnie.

Mr. Mackechnie first spoke of the death of Mr. John R. Lee (see the June, 1959, issue, *Glasg. Nat.* **18**, 111-114). Reports of the Society's activities were then read and it was noted that the membership of the Society on 31st December, 1958, was 213. New office-bearers were elected (see p. 171). Mr. C. E. Palmar then showed a colour film on water birds.

14TH MARCH, 1959

A joint meeting with the Botanical Society of Edinburgh was held in the Department of Botany, University of Glasgow, and presided over by Mr. Robert Mackechnie. A party had visited the Botanical Gardens of Glasgow earlier that day. Professor R. E. Holttum of Kew gave an illustrated lecture on the ferns of Malaya.

19TH MARCH, 1959

Mr. Robert H. Johnstone presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Mr. Athol J. Johnston, 16 Gower Street, Glasgow, S.W.1, was admitted as a new member of the Society.

Mr. Douglas Henderson of the Royal Botanic Garden, Edinburgh, gave an illustrated lecture on a wide variety of fungi, and noted several aspects of the study of fungi which would repay attention from amateur naturalists.

14TH APRIL, 1959

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Four new members were admitted to the Society: Miss Margaret S. Provan, B.Sc., West Muckcroft Cottage, Lennoxton; Mr. John White, 64 Viewfield Road, Coatbridge; Mr. Alfred A. Percy, 5 Buckingham Drive, Carmyle, Glasgow, E.2, and Mr. David C. Wylie, Lochlea, Stirling Road, Denny.

Mr. Timothy B. Bagenal of the Marine Station, Millport, gave a lecture, illustrated with coloured lantern slides, on a biological survey of North Rona and Sula Sgeir.

12TH MAY, 1959

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Miss Amelia R. Millar, M.A., B.Sc., 81 Viewpark Street, Rutherglen, was admitted as a new member of the Society.

Dr. C. H. Gimingham, of the University of Aberdeen, gave an illustrated lecture entitled 'Through north-west Europe in search of heathlands.'

9TH JUNE, 1959

Mr. Robert Mackechnie presided over a meeting held in the Department of Zoology, University of Glasgow.

Miss Mary E. Byers, M.A., 18 Stuart Avenue, Burnside, was admitted as a new member of the Society.

Dr. H. F. Steedman of the Department of Zoology, University of Glasgow, gave a lecture entitled 'The use of plastics in biology,' and conducted members round a demonstration of specimens in plastics.

8TH SEPTEMBER, 1959

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow. Mr. Mackechnie referred to the recent death of Dr. D. Patton (see p. 169).

Mr. Robert A. Clark, B.Sc., Ennerdale, Barrmill Road, Beith, was admitted as a new member of the Society.

Dr. G. D. Scott gave an illustrated lecture entitled 'The singularity of lichens.'

13TH OCTOBER, 1959

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Dr. Fish of the Department of Pharmacognosy, Royal College of Science and Technology, gave an illustrated lecture on British poisonous plants.

10TH NOVEMBER, 1959

Mr. Robert Mackechnie presided over a meeting in the Royal College of Science and Technology, Glasgow.

Three new members were admitted to the Society: Dr. W. M. Hutchison, B.Sc., Ph.D., M.I.Biol., 18 Merryvale Avenue, Giffnock; Mr. Harry Kinnaird, 97 Cumbernauld Road, Stepps, Glasgow, E.3, and Mr. J. M. Lennie, 104 Alderman Road, Glasgow, W.3.

Mr. George Waterston, F.R.S.E., gave an illustrated lecture on bird migration.

8TH DECEMBER, 1959

Mr. Robert Mackechnie presided over a meeting of the Royal College of Science and Technology, Glasgow, and referred to the recent death of Mr. William Rennie (see p. 169).

Mr. Mackechnie then paid tribute to the work of Mr. C. M. Morrison who was resigning the office of General Secretary on his translation to Dundee. Mrs. A. Cross had agreed to act as General Secretary.

Mr. G. Flett, Department of Mining, Royal College of Science and Technology, then gave a lecture on the work of the wartime South Polar expeditions, in which he had participated.

THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month, except during July and August, usually in the Royal College of Science and Technology, but from time to time in the University and the Glasgow Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are: for Ordinary Members, twenty shillings; for Junior Members, ten shillings, and for Family Members, five shillings. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary*—

Mrs. A. CROSS, B.Sc.,
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THE GLASGOW NATURALIST

Copies of many back numbers of the journal and of its predecessors, including the *Proceedings and Transactions of the Natural History Society of Glasgow*, are available for purchase by members of the Society and others. Enquiries regarding these should be addressed to the *Librarian*—

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THE GLASGOW NATURALIST

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ANDERSONIAN NATURALISTS OF GLASGOW

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BATHYNELLA NATANS, NEW TO SCOTLAND

By PETER S. MAITLAND, B.Sc.

Department of Zoology, University of Glasgow.

(Revised MS. received 14th September, 1961)

Most of the older text-books on zoology and zoogeographical distribution, e.g. Borradaile *et al.* (1958), and Hesse *et al.* (1937), speak of the primitive crustacean order Syncarida as being represented by the Anaspidacea, found in fresh waters in Southern Australia and Tasmania; and the Bathynellacea, found in subterranean waters in Europe. Whilst the Anaspidacea are still known only from Australia, in recent years the Bathynellacea have been shown to have a much wider distribution, and members of the group are now known from Europe, Asia, Africa, and South America. In Europe, Chappuis (in a series of papers from 1914 onwards), and later Jakobi (1954), Husmann (1956), and others, have shown that many subterranean waters hold a varied and interesting fauna—among which the Bathynellacea, usually *Bathynella natans* Vejdowski, are prominent.

The recent discoveries of *Bathynella natans* in England by Efford (1959), and Spooner (1961), have shown that in Britain, too, this species is much commoner than was formerly supposed. In December, 1960, a collection of bottom fauna from the River Endrick, in Scotland, was found to contain a single specimen of *Bathynella*, and Dr. I. Gordon, of the British Museum, is satisfied that it is *Bathynella natans*. This record, the first from Scotland, constitutes a further addition to the known distribution of this species in Great Britain.

The specimen was collected among small stones and gravel in the Altquhur Burn (Stirlingshire), a small tributary on the right bank of the River Endrick. The stretch of the stream where the collection was made occupies a narrow valley which it has cut through a series of sand, gravel, and clay beds (Jack, 1877). These sands and gravels give the stream an appearance unusual in a valley where the beds of most other tributary streams are rocky. Here, the substrate varies from fine sand to coarse gravel, and only occasionally do larger stones appear. Though the discovery was a chance one, it is significant that it was from an area such as this that *Bathynella* was taken.

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In January, 1961, further collections were taken at the Altquhur Burn, with the specific intention of finding more *Bathynella*. Nicholls (1946) gives a description of Chappuis' method of collecting, and several collections were made, in apparently suitable places, by this method. Collections were also taken from a sand bed in mid-stream, and from a spring issuing some fifty feet above the stream. No *Bathynella* were found in any of these samples. However, in a routine bottom fauna sample, also taken in January, from the same substrate as the December collection, another specimen of *Bathynella natans* was discovered. Eighteen more specimens were found in a similar collection taken in February, and 21 in a collection taken in March. The April collection contained a further 2, and 6 more were obtained in this month from a sandbank at the side of the stream, by filtering 90 litres of water collected by Chappuis' technique. Of the 49 specimens collected so far, only 1 has been adult, all the others being juvenile—mostly first stage larvae.

It is probable that this species, unknown in Britain until Lowndes (1932) discovered it in Wiltshire, but now recorded from five other counties, occurs in many areas, where it has been overlooked on account of its small size and subterranean habit. Further collections from suitable habitats in such areas will no doubt extend the known area of occurrence of this, and other, interstitial species.

ACKNOWLEDGMENTS

I would like to express my thanks to Dr. W. D. Russell Hunter for help in the preparation of this paper; to Dr. I. Gordon for verifying the identification of *Bathynella natans*; and to the Carnegie Trust for the Universities of Scotland for receipt of a Scholarship.

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OBSERVATIONS ON COLEOPTERA IN SCOTTISH OAK WOODS

By R. A. CROWSON

Department of Zoology, University of Glasgow

(Revised MS. received 14th September, 1961)

The oak woods of central and western Europe, like the conifer woods further north, represent major "climax formations"—stable vegetational types which have persisted for a considerable period of geological time (doubtless slowly shifting their positions in relation to climatic changes), long enough to permit the evolution of a whole series of characteristic animals for each. Scotland is fortunate for a small country in possessing (or having possessed) a good representation of both types—we have even in a few places, e.g. Glen Falloch, traces of a natural transition from one to the other. Among the characteristic animals of the oak woods, Coleoptera occupy an important place, showing very varied ecological relations with the trees and with other organisms. In Scotland a number of species of the group are practically confined to those old oak woods which are as much remnants of the original "Caledonian Forest" as any of our pine woods are. During the 18th and 19th centuries, most of our oak woods suffered frequent and severe cutting; several species of Coleoptera (particularly among those attached to old and dead trees and associated fungi) are almost confined to those few woods which escaped this fate, notably those of Hamilton High Parks (Lanarkshire) and Dalkeith Palace (Midlothian). Both these woods were declared as royal hunting forests by David I in 1163 and have been in effect nature reserves for 800 years, though neither is effectively protected today. Within the oak-wood belt, the southern uplands probably form an important distributional barrier; among the insects, a fair number of species seem not to extend north of them, but information on this question is still very inadequate. A few of the oak-wood beetles are wingless and flightless, e.g. *Sphaerosoma piliferum*, *Mniophila muscorum*, *Acalles pinoides*, *A. turbatus*, *Brachysomus echinatus*. The first mentioned of these seems to have no regular means of distribution other than its own very limited walking powers, and its Scottish distribution appears to be very restricted. The other four may be spread down river valleys in flood drift, and the *Acalles* may also be spread by the human transport of timber and firewood (the larvae probably develop in dead branches of trees).

The large majority of oak-wood beetles possess functional wings, and thus should be capable of comparatively long-

range dispersal. The fact that so few of the listed species have actually colonised apparently favourable sites in the numerous deciduous plantations dating from the 19th century is probably to be explained in terms of the limiting conditions for flight in these insects. Most of them will fly only in warm, humid and practically still air, and only at certain seasons of the year—mostly in the late spring or early summer. In favoured parts of southern England such conditions are not infrequently realised, with temperatures around 70°F, at about sunset in late May or early June—mass flights of Coleoptera are then observed. Many species may then be caught in the air some way from possible breeding sites, and colonisation over ranges even of miles may not be rare. At such times in Scotland, when other conditions are favourable, temperatures are likely to be 60°F or even lower, and mass evening flights of Coleoptera are very rarely seen. Most woodland species in Scotland probably fly mainly during the heat of the day rather than at dusk, and their flights are then restricted to the area under the shelter of the trees. The survival of these species as members of the Scottish fauna will thus depend on the persistence of suitable woodlands on or immediately adjacent to their existing habitats. This survival is today gravely jeopardised by the activities of the Forestry Commission and of landowners influenced by its example—all over the country the remaining old oak woods are being destroyed outright to make way for conifer plantations.

If an adequate representation of the oak-wood fauna is to be preserved in Scotland, it will probably be necessary that the Nature Conservancy should gain possession of suitable oak woods here. Hitherto, despite the fact that these woods are both the richest of our types of natural habitat in nearly all groups of terrestrial animals, and the most gravely threatened today, none of our important oak woods has been made a Nature reserve. The oak woods contribute much to the scenic beauty of Loch Lomond and many of the highland glens, so that their preservation should be a matter of concern for the tourist industry as well as naturalists.

Perhaps the most characteristic of the beetles of old oak woods are to be found among those living under bark and in wood of dead trees, in bracket fungi, and in the litter layer (characteristically deep in old forest sites); others occur on the foliage of the oaks, on various other plants of the shrub and herb layers, and in nests of vertebrates. Two characteristic bracket fungi of old oaks are the "beefsteak" *Fistulina hepatica*, and the "sulphur bracket" *Polyporus sulphureus*, both well represented at Hamilton and Dalkeith (though in few other Scottish localities), and both with interesting associated beetles.

To save space, some of the principal oak-wood localities will be cited by numbers, as follows: 1—Dalkeith Old Oak Wood (Midlothian); 2—Hamilton High Parks (Lanarkshire); 3—Rossdhu, Luss (Dunbartonshire); 4—Fiddler Glen, Braidwood (Lanarkshire); 5—Coilsholme Wood, Failford (Ayrshire); 6—Ross Peninsula, Rowardennan (Stirlingshire); 7—Mugdock Wood, near Milngavie (Stirlingshire). Species marked with an asterisk seem not to have been recorded hitherto from Scotland; those marked with a + sign extend beyond the oak-wood belt in Sweden (Palm 1959), though unless otherwise stated they have not been found in our pine-wood areas. A few of the listed species, marked with the sign †, are perhaps not strictly woodland types, in that they sometimes occur well away from woods.

1. *Feronia (Lyperosomus) oblongopunctata* F.
(CARABIDAE) +

This is probably widespread in our damper western woods; I have it from 3, also Loch Goil (Argyll), Inversnaid (Stirling) and the vicinity of New Galloway (Kirkcudbright).

2. *Agonum (Anchomenus) obscurum* Hbst. (CARABIDAE) + †

Adults of this have been caught in mossy bark of old oaks, and in pitfall traps under them, at 3; there are specimens in the King collection (Glasgow University) from 7, and a published record by Lennon (1883) from Durisdeer, Dumfries—all woodland sites.

3. *Ptenidium (Gressnerium) gressneri* Erichs. (PTILIIDAE) *

I found adults, and probable larvae, of this on a cut sappy Sycamore stump in the Avon gorge at 2 on April 12, 1960. The few other British records are mostly from old oak-wood sites (Sherwood Forest, New Forest etc.) and it seems similarly restricted on the continent.

4. *Anisotoma orbicularis* Hbst. (ANISOTOMIDAE) +

I have collected adults of this at 3, 5, 7, in the Avon Gorge near Bo'ness (West Lothian), and at Broxburn (East Lothian), all of them in the months May, June and July. Like other species of *Anisotoma*, this probably eats some species of Mycetozoa.

5. *Liodes cinnamomea* Panz. (ANISOTOMIDAE)

Reported to breed in true truffles (Tuberaceae), which are themselves restricted to deciduous woodlands. I found an adult at Craignethan Castle, Crossford (Lanark) in October 1954, and there is one in the Fergusson collection collected near Irvine (Ayr) by A. A. Dunsmore on August 14, 1920.

Lennon (1878) recorded it from flood drift of the river Nith near Dumfries, and Murray (1853) from Vicar's Bridge, near Dollar (Clackmannan).

6. *Colon latum* Kr. (ANISOTOMIDAE, SILPHIDAE, CHOLEVIDAE)

The larva is unknown for this species (and genus), but the mode of life is suspected to be similar to that of *Liodes*. I found adults at Waygateshaw, Crossford (Lanark), apparently hibernating under moss, on March 2, 1958, and others were caught in pitfall traps in a wood at Dalsersf (Lanark) in August, 1958. The species seems not to have been found in Scotland outside the Clyde Valley.

7. *Euthia schaumii* Kies. (SCYDMAENIDAE) †

A single adult was found on a decayed fallen oak branch at 3, on 12 August, 1961. Little is known of the habits of the species, but it is probably a predator on mites like other Scydmaenids. Apart from Fowler's record "has been taken near Glasgow" I have seen no other Scottish records of it.

8. *Euconnus nanus* Schaum. (SCYDMAENIDAE) *

Probably fairly widespread in moss, sticks and leaf-litter of the oak woods of SW Scotland: I have it from 4, 5, 6, and Bemersyde, Melrose (Roxburghshire).

9. *Neuraphes rubicundus* Schaum (SCYDMAENIDAE) *

My records are: in a hollow tree, Garscube Estate, Glasgow, May 2, 1955; in débris among beech roots, Comlongon Castle, Ruthwell (Dumfries), June 22, 1958.

10. *Xylodrepa quadripunctata* L. (SILPHIDAE)

As an adult, this handsome insect is known as a devourer of caterpillars, principally "loopers" (Geometridae) on oak foliage. The beetle is usually collected by beating oak foliage at the season of maximum abundance of such caterpillars, in late May and early June. I have found it in this way at 3, and Mr. A. MacLaurin did so in the Tor Wood, Larbert (Stirling) on the Andersonian zoological excursion of June 26, 1959; the species is probably widespread in our major oak woods. The larvae live on the ground, specimens have been caught in pitfall traps at 3 during July, and W. Murdoch similarly caught them at 7.

11. *Scaphidium quadrimaculatum* L. (SCAPHIDIIDAE) †

Of this insect I found a larva on a decayed oak stump at 3 on 3 July, 1953, and an adult was caught flying in sunshine at the same place on 25 May, 1957. Mr. I. Pendleton found

another in a decayed birch log at Flanders Moss, Perthshire during the Andersonian zoological excursion of 14 May, 1960. In the King collection (Glasgow University) there is a specimen labelled "Aviemore, June-July 1877."

12. *Scaphisoma boleti* Panz. (SCAPHIDIIDAE) * +

I found this among decayed sticks in the strip of old woodland on Ardnail Bank, Portencross (Ayr) on 29 Sept., 1959; there is a specimen in the Fergusson collection with the label "Knoweside, Ayr, 20.5.1910." *S. agaricinum* L. seems to go much further north, with us as on the continent. I have collected it at Darnaway Forest, Forres (Moray), Cambus O'May, Ballater (Aberdeen), and at many points further south.

13. *Coryphium angusticolle* Steph. (STAPHYLINIDAE) +

I found one under bark of a dead willow at Bothwell Castle (Lanark) on 29 Oct., 1955, and there are others in the Fergusson collection labelled "under fir bark, Shewalton, Ayr, 21.4.1910".

14. *Hapalarea pygmaea* Payk. (STAPHYLINIDAE)

Though recorded from Rannoch (Perth), the species hardly seems to extend into the conifer forest belt on the continent. My own records are: **5**, beaten from oak, 16 June, 1959, and in rotten beech trunk, 12 Aug., 1959; in dead oak, Midhope (W. Lothian), 22 July, 1956; in hollow lime trunk, Crosslee, Houston (Renfrew) 19 Feb., 1961; in decayed tree, Bothwell Castle (Lanark) 30 July, 1961.

15. *Phloeostiba plana* Payk. (STAPHYLINIDAE) +

This has an old record from Rannoch, at the sap of birch, but does not extend far into the conifer forests of Europe; it is said to be specially attached to sap-flows from trees attacked by Cossid larvae. I found it under sappy bark of a log at New Abbey, Kirkcudbright, on 3 May, 1958.

16. *Ilyobates nigricollis* Payk. (STAPHYLINIDAE) †

Though sometimes found in damp places outside woods, oak leaf-litter seems to be its main habitat. I have found it in litter at **5** and at Garroch, New Galloway (Kirkcudbright), and W. Murdoch found it at Bothwell Castle.

17. *Thectura cuspidata* Er. (STAPHYLINIDAE) +

My Scottish record for this is from **1**, under oak bark on 23rd Sept., 1959; Fergusson (1913) recorded it from "Lanark."

18. *Oligota apicata* Erichs. (STAPHYLINIDAE) * + †

Found by me at 4, in débris under a log pile on 5th March, 1961, also on a decayed beech at Nun Mill, Kirkcudbright on 29th May, 1961. Apparently not hitherto recorded further north than Yorkshire.

19. *Quedius cruentus* Ol. (STAPHYLINIDAE)

My specimens were found with the fungus *Polyporus sulphureus*, at 1 on 23rd Sept., 1959, and 2 on 1st Sept, 1957. According to Fergusson (1913) it has been found at Rannoch, Perth.

20. *Quedius scitus* Grav. (STAPHYLINIDAE) *

Two specimens were found at Bothwell Castle (Lanark) in a fungus-attacked oak trunk, on 16th Aug., 1958.

21. *Philonthus subuliformis* Grav. (*fuscus* Grav.)
(STAPHYLINIDAE) * +

One specimen of this emerged from a sample of decayed wood etc. from around an abandoned woodpecker's nest (*Dryobates major*) at 5 on 21st June, 1961. The sample was collected by Mr. J. Begg, to whom I am also indebted for the identification of the nest. The beetle seems not to have been hitherto recorded from further north than the English midlands in Britain.

22. *Clambus nigriclavis* Steph. (CLAMBIDAE)

This I have previously reported as *C. minutus* (Crowson and Crowson 1955); the new determination has been confirmed by S. Endrody-Younga who has recently revised the family (1960). The other *Clambus* occurring in Scotland are *C. armadillo* DeG. and *C. punctulum* Beck., both of which seem to be more widespread than *nigriclavis*.

23. *Sinodendron cylindricum* L. (LUCANIDAE) +

This occurs in some of our pine-wood areas, e.g. Rannoch, Perth (Murray 1853), Aviemore, Inverness (specimens in the King collection) and Nethybridge, Inverness (collected by me in July, 1961), but is more characteristic of deciduous woods. It is abundant at 2, but I have never found it in apparently favourable habitats at 1, 3, 4, 5, 6 and 7. I have it from two other Lanarkshire sites, Bothwell Castle and Cambusnethan Priory, and from Kenmure Castle, Kirkcudbright. Dr. A. F. G. Dixon found it in Glen Lyon (Perth) and it has been recorded from near Peebles. The distribution is oddly localised.

24. *Trox scaber* L. (TROGIDAE or SCARABAEIDAE) +

Its usual breeding site is in débris under owls' nests in hollow trees. Scottish records are: Jardine Hall, near Lockerbie, Dumfries (Murray 1853); near Gretna, Dumfries,

(Murray 1934); and one specimen found crawling up the trunk of a large damaged beech at Crosslee, Houston, Renfrew by myself on 18th June, 1955.

25. *Melolontha melolontha* L. (SCARABAEIDAE) †

The common cockchafer of the south has few Scottish records; I have specimens from near Kirkcudbright and from 5, the latter beaten from an oak on 21st June, 1961. There are old records from Perth, Lanark and from near Paisley (Renfrew). *M. hippocastani* F., which extends further north on the continent, is much more widespread with us; adults are fairly common at 3, flying rather high round the trees at about dusk in late May and early June.

26. *Ctesias serra* F. (DERMESTIDAE) * +

Many "stored product" species of Dermestidae have been recorded from Scotland, but this seems to be the first species recorded as breeding here in the wild. The larva occurs under and in crevices of loose bark of old part-dead oaks, in company with spiders (*Ciniflo fenestralis*, *Segestria senoculata*, *Harpactea hombergi* etc.) and apparently lives mainly on insect remains in their webs. The species occurs in both the places in Scotland where its habitat is best developed, at 1 and 2. Adults have been found at 2 in June and July, one of them on the Andersonian zoological excursion of 21st June, 1958. Observations in captivity suggest that the life cycle takes at least two years.

27. *Lyctus brunneus* Steph. (BOSTRYCHIDAE or LYCTIDAE) *

The species listed so far have been almost certainly survivors of our primeval oak-wood fauna, but it may be doubted whether this one belongs in that category. Dead adults were first found by my colleague Dr. A. F. G. Dixon, under dead oak bark at 1 on 23rd Sept., 1959; on 22nd Oct., 1959 I was able to find the larvae burrowing in sound sapwood of large wind-blown oak branches at the same place. On the continent, *L. brunneus* is a species of the southern rather than northern oak woods, and its outdoor records from England are few and scattered—on the other hand it is well known as a pest of imperfectly seasoned hardwoods, e.g. in wartime "utility furniture". The Dalkeith site is not, however, adjacent to any factories or depots at which foreign hardwoods are likely to be stored.

28. *Ptinus subpilosus* Sturm. (PTINIDAE) * +

Ptinids, like Dermestids, seem hitherto to have been recorded only as "domestic" insects in Scotland, but the present species is undoubtedly native here. It occurs chiefly

on old mossy part-dead oaks. Localities are 1; Craignethan Castle (Lanark); Waygateshaw, Crossford (Lanark); Dalserf (Lanark); the lower oak woods on Craigendarroch, Ballater (Aberdeen); Darnaway Forest, Forres (Moray). Ptinid larvae, presumably of this species, have been found in decaying oak wood at several places. The only other Ptinid I have collected out of doors in Scotland is *Tipnus unicolor* Pill. & Mitt., adults of which were found in vegetable litter round the ruined walls of Cadzow Castle at 2, also in decaying oak débris at Bemersyde, Melrose (Roxburgh).

29. *Hedobia imperialis* L. (ANOBIIDAE)

There is an old record by Lennon (1895) from near Dumfries; I have found the distinctive larva (not yet the adult) of the species at 4 and at Craignethan Castle (Lanark), in dead hawthorn branches.

30. *Ochina ptinoides* Marsh. (ANOBIIDAE)

Mr. N. W. Hussey sent me larvae of this species from dead ivy stems off a house in Dunblane (Perth), collected in May, 1952; similar larvae were found by me in dead ivy at Waygateshaw, Crossford (Lanark) and a dead adult in a similar habitat at Bemersyde, Melrose (Roxburgh) on 27th Aug., 1960. It is probably widespread.

31. *Ptilinus pectinicornis* L. (ANOBIIDAE)

Larvae and pupae were numerous in a dead standing beech at Broxmouth, East Lothian on 11th May, 1958, and on 3rd July, 1958, adults were in some numbers on the same tree. In Lanarkshire, it has occurred at Bothwell Castle (larvae in a dead wind-broken wild cherry) and at 4 (in the more usual habitat of dead beech); there is an indoor record from a house at Broomhill near Glasgow (Murphy & Gordon 1921). Efforts to find it at apparently favourable sites in Ayrshire (5, and Dundonald) have failed, and I have not seen it in such old oak-wood sites as 1, 2, 3, 5, 6, the Tor Wood (Stirling), and Garroch or Kenmure Castle (Kirkcudbright). It may be a comparatively recent incomer to Scotland, like the beech trees in which it lives.

32. *Haplocnemus nigricornis* F. F. (MELYRIDAE or DASYTIDAE)

Recorded by Murray (1853) from 1. On 6th Sept., 1957 I found a Melyrid larva in débris from an old hollow oak trunk in the same locality; this larva agreed with one attributed by Saalas (1917) to *Dolichosoma*, while he described a quite different larva as that of *Haplocnemus*—both identifications

being conjectural, not based on rearing. I have found larvae similar to the Dalkeith one in Windsor Forest (Berkshire) and in litter under old oaks at Brookman's Park (Hertford); *Haplocnemus* has been recorded many times, *Dolichosoma* apparently never, from Windsor Forest. Murray (1853) recorded another Melyrid, *Dasytes aerosus* Kies., from 1. Larvae of *Dasytes* are known, and quite unlike the Dalkeith one.

33. *Phloiophilus edwardsi* Steph. (PHLOIOPHILIDAE)

Though recorded from Nethy Bridge (Inverness) on the edge of the pine-forest belt, in Europe this is very much a species of the western deciduous woods. It seems to be specifically attached to the fungus *Phlebia merismoides*, growing chiefly on dead branches of oak, but also at times on hazel and beech and probably other trees. I have found the adult or its distinctive larva (which will be described elsewhere) under the fungus at 3, 4, 5 and 6; there are published records from E. and W. Lothian and from Carnsalloch Wood, Dumfries—the species probably occurs in most old oak-wood areas of Scotland. The adults appear in autumn, from late September on; the larvae over-winter and pupate in spring; the life-cycle resembles those of *Tetratoma fungorum* and *T. desmaresti* (*v. infra*).

34. *Micrurula melanocephala* Marsh. (NITIDULIDAE) +

I have this from 4, beaten from oak on 17th May, 1961, and in leaf-litter on 5th March, 1961; also from flood drift near Annbank (Ayr) on 12th Dec., 1960. Its larval habits are apparently unknown.

35. *Cychramus luteus* F. (NITIDULIDAE) +

The adults are usually collected by beating young oaks or flowering hawthorns, in May or early June; I have collected them in this way at Inversnaid, Stirling, and in the vicinity of New Galloway, Kirkcudbright. There are specimens in the Fergusson collection from Cleghorn, Lanark. I found larvae probably of this species in a fungus on the ground at Falls of Clyde, New Lanark, Lanark on 10th Sept., 1952.

36. *Silvanus unidentatus* Oliv. (SILVANIDAE or CUCUJIDAE)*

One specimen of this, found under bark of a dead oak at Garroch, New Galloway, Kirkcudbright, was an unexpected addition to the Scottish fauna. Though locally common in southern England it becomes scarce in the midlands and has not to my knowledge been found north of Yorkshire.

37. *Caenoscelis ferruginea* Sahlb. (CRYPTOPHAGIDAE) +
Day (1927) recorded it from Penton, Liddesdale, Dumfries; I have it from leaf-litter at 2 and from Craignethan Castle, Lanark, also from flood-drift at Annbank (Ayrshire).

38. *Atomaria fimetarii* Herbst. (CRYPTOPHAGIDAE) * †
Adults of this were found in old *Pleurotus* on dead beeches at Dundonald, Ayrshire on 30th March, 1959.

39. *Atomaria umbrina* Er. (CRYPTOPHAGIDAE) * +
Apparently fairly widespread in southern Scotland. It is said to be attached to the tree-fungus *Pholiota squarrosa*; my specimens have been found in leaf-litter or bark samples from dead trees. Localities are Old Melrose, Roxburgh; Houston Wood, Renfrew; Dundonald, Ayr; and Garroch, New Galloway, Kirkcudbright. There is a specimen in the Fergusson collection from Cleghorn Glen (Lanark).

40. *Dacne biputulata* Thumb. (EROTYLIDAE) * +
In Scotland, this seems to feed mainly on the bracket fungus *Pleurotus*, in which I have found it in the Nethan Gorge and also at Dalserf (Lanark), at Dundonald (Ayr), and near Nun Mill (Kirkcudbright). The larvae occur during the summer.

41. *Triplax aenea* Schall. (EROTYLIDAE) +
I have found adults of this associated with *Pleurotus* at Bothwell Castle (Lanark), at Comlongon Castle, Ruthwell (Dumfries) and at 5. Buck (1954) recorded it from near Inverness. Larvae occur in early summer, in *Pleurotus* fruit-bodies.

42. *Sphaerosoma piliferum* Mull. (ENDOMYCHIDAE) *
This wingless species, found in leaf-litter in the Avon gorge near Bo'ness (W. Lothian) was an interesting addition to the Scottish fauna. Adults were first found in April, 1961; a visit to the same place in July produced larvae and further adults, from encrusting fungi growing on the ground and on damp decayed logs. Its British distribution seems predominantly eastern.

43. *Mycetaea hirta* Marsh. (ENDOMYCHIDAE)
This occurs indoors, in damp cellars, stables etc. and may have been spread by human agency, but as an outdoor insect does not seem to extend beyond the deciduous forest belt in Europe. I have found it in many of the old woods of the Clyde Valley, breeding most frequently in the damp fungusy interiors of hollow trees, but also in well aerated leaf- and stick-litter.

44. *Endomychus coccineus* L. (ENDOMYCHIDAE) +

This is recorded from near Aviemore (Inverness) and I have found it on fungusy birch stumps in a pine-birch wood at Cambus O'May, Ballater (Aberdeen), but in Europe it is more characteristic of the deciduous woods. I have never found it in apparently favourable habitats in western Scotland; [it seems to be another "eastern" species.

45. *Cerylon fagi* Bris. (CERYLONIDAE or COLYDIIDAE)*

I found adults under bark of a fungusy oak stump in the Nathan Gorge, Crossford (Lanark), on a decayed oak at Cartland Crags near Lanark, and at 4. The other two British species of *Cerylon* extend further north, well into the conifer forest of Europe.

46. *Anommatus duodecemstriatus* Mull. (MEROPHYSIIDAE or LATHRIDIIDAE)

Adults, and presumed larvae, of this occurred in leaf- and stick-litter at 5, though it seems to be more usually associated with human settlements.

47. *Enicmus testaceus* Steph. (LATHRIDIIDAE)

Reported by Kevan (1945) from near Edinburgh, I have found this in Mycetozoan fruit-bodies (*Reticularia*) at 2 and 4, also Bothwell Castle (Lanark). *E. fungicola* Thoms. also occurs with us, but goes much further north in Europe. *E. rugosus* Hbst. is more characteristic of the pine woods.

48. *Cartodere elongata* Curt. (LATHRIDIIDAE)*

In England, this usually occurs in the litter layer of old oak woods; my only Scottish record is from a sample of old *Polyporus* fruit-bodies off the oaks at 1.

49. *Metopthalmus serripennis* Broun (LATHRIDIIDAE)

This is probably native to New Zealand, where I have myself found it in the litter layer of *Nothofagus* forests near Nelson. In Britain it has hitherto been reported mainly indoors; its previous Scottish records are Kevan (1945) from a house in Edinburgh, and my own from an old wasps' nest in a house at Eaglesham, Renfrew. I can now record its outdoor occurrence, in an old hollow lime trunk at Crosslee, Houston, Renfrew on 19th Feb., 1961. It will be interesting to see whether this becomes widely established with us as did the Australian *Coninomus nodifer* in the last century, and as *C. bifasciatus* Reitt. seems to be doing now (I have recently found it near Duddingston, Edinburgh).

50. *Cis festivus* Panz. (CISIDAE, CIIDAE, CIOIDAE) +

Associated with the encrusting fungus *Stereum* on dead oak, birch, alder etc., in our oak-wood areas and extending to some extent into the pine woods, is a small species of *Cis* which appears to be *C. festivus*, though the distinction between it and *C. vestitus* Mellie is by no means satisfactory.

51. *Cis castaneus* Mellie. (CISIDAE)

Adults occurred in a dead fungus-encrusted beech trunk at 2, on 5th Nov., 1959. There is a record from Brodick (Arran) by W. Evans.

52. *Ennearthron cornutum* Gyll. (CISIDAE) *

An adult, emerging from a mixed sample of fungusy bark from 6 on 2nd Feb., 1961, was an unexpected addition to the Scottish fauna.

FAMILY MYCETOPHAGIDAE—I have published elsewhere an account of the Scottish representation of this group (Crowson 1961); since writing it I have found *Mycetophagus multipunctatus* F. on *Polyporus radiatus* and other fungi in the vicinity of Nethybridge (Inverness).

53. *Tetratoma desmaresti* Latr. (TETRATOMIDAE or MELANDRYIDAE) *

My first Scottish examples were found at Kenmure Castle, New Galloway (Kirkcudbright) in the bark of a dead *Stereum*-encrusted oak; another adult was found in similar circumstances at 4 on Oct. 9th, 1960. A larva which proved to belong to this species had been collected in the same circumstances at 4 on 4th Oct., 1959. An account of the larvae and habits of British Tetratomidae will be published elsewhere. *T. desmaresti* apparently over-winters as a larva and pupates in the spring; there is probably a summer diapause of the adult, as in *T. fungorum*.

54. *Orchesia (Clinocara) undulata* Kr. (MELANDRYIDAE) +

Although previous Scottish records are few, this seems to be widespread and often common in our oak woods. I have it from as far north as Inveraray (Argyll) and Darnaway Forest, Forres (Moray). *O. minor* Walk. is far scarcer with us (I have only found it at 4 and 5 and in the pine woods at Abernethy Forest, Inverness) but goes further north in Europe.

55. *Melandrya caraboides* L. (MELANDRYIDAE)

Murray's (1853) old record of this from near Edinburgh has been ignored by Fowler and later writers. My colleague Dr. A. F. G. Dixon found adults on a decayed fallen tree-trunk at Inversnaid, Stirling on 29th May, 1960, with probable larvae in the soft decayed wood. I found another adult at 6 on 26th June, 1961.

56. *Abdera flexuosa* Payk. (MELANDRYIDAE) +

I have found this in most Scottish localities where old alders bearing *Polyporus radiatus* are plentiful, as far north as Nethybridge (Inverness); its natural range is probably almost co-extensive with that of *Alnus*. Two characteristic Melandryids of the pine forests have recently been found in the lowlands—Mr. J. W. McHardy of Edinburgh University sent me a larva of *Xylita buprestoides* F. from a decayed pine at Borthwick Castle (Midlothian), and I found adults of *Zilora ferruginea* Payk. on a dead pine with the fungus *Hansenia abietina* at 4 on 27th March, 1960.

57. *Oncomera femorata* F. (OEDEMERIDAE)

Apart from Waterston's record (1935) from the Abbey Craig, Stirling, this seems not to have been found further north than the Silverdale area of Lancashire. In Europe, it is a species of the western deciduous woods.

58. *Eledona agricola* Hbst. (TENEBRIONIDAE)

Lennon and Douglas collected this at Carnsalloch Wood, near Dumfries, according to Fergusson (1913). The species seems to be specific to *Polyporus sulphureus*, which is a common fungus at 1 and 2, but so far I have not found *Eledona* at either site.

59. *Grammoptera ruficornis* F. (CERAMBYCIDAE)

I have found this at 2 and 4, also Bothwell Castle (Lanark) but never at 3 or 7; it seems not to occur north of the main Forth and Clyde valleys.

60. *Alosterna tabacicolor* DeG. (CERAMBYCIDAE) +

This usually occurs on flowers, together with the last, but extends further north than it (Kauffmann records it from Perth) in Europe as with us.

61. *Pachytodes cerambyciformis* Schrk. (CERAMBYCIDAE)

Specimens in the Fergusson collection are labelled "on meadow-sweet and umbelliferous flowers" from Cleghorn Glen, Lanark; Kauffmann (1947) records it from Berwick, Midlothian and E. Inverness. The species breeds mainly in exposed dead roots of deciduous trees, a habitat which the steep gorges of the tributaries of the middle Clyde are likely to offer in unusual amount.

62. *Phymatodes variabilis* L. (*testaceus* L.) (CERAMBYCIDAE)

An old record of this from near Edinburgh has been generally ignored, as probably derived from imported timber (Kauffmann, 1947). The species occurs at 1, where I have collected

the larvae under bark of dead oaks on several occasions and where Dr. A. F. G. Dixon found dead adults; it may well be native there.

63. *Pyrrhidium sanguineum* L. (CERAMBYCIDAE)

Recorded from a wood-yard near Edinburgh by Fowler and Donisthorpe (1913), it might well have been of native origin. The most likely habitat for it in the area is 1, which much resembles some of its English localities.

64. *Clytus arietis* L. (CERAMBYCIDAE)

Previous Scottish records are few (Kauffmann 1947). There is a specimen in the Fergusson collection from 6, where I found a larva on 2nd Feb., 1961. Pupae were abundant in a dead wind-broken oak at 4 on 4th Sept., 1959, and the same tree yielded larvae and a dead adult on 7th July, 1960. Old burrows almost certainly of this species were observed in a dead oak at Kenmure Castle, New Galloway, Kirkcudbright in 1961, and Mr. F. A. Hunter found a larva in a dead oak at Darnaway Forest, Forres, Moray on 11th July, 1961.

65. *Leiopus nebulosus* L. (CERAMBYCIDAE)

This occurs in most oak-wood sites I have studied in Scotland, as far north as Darnaway Forest (Moray). The larvae occur under bark of dead oak branches, often on living trees.

66. *Saperda scalaris* L. (CERAMBYCIDAE) +

Recorded from a number of scattered localities in Scotland (Kauffmann 1947), I found its larva at Garroch, New Galloway, Kirkcudbright under bark of a dead oak branch on 10th Sept., 1960. Others were found at 6, by A. F. G. Dixon on 2nd Feb., 1961, and by myself on 26th June, 1961.

67. *Phyllobrotica quadrimaculata* L. (CHRYSOMELIDAE) +

There is an old record from "near Glasgow" (Murray 1853); this might well relate to 7, where I have found the beetle on many occasions on *Scutellaria galericulata*—larvae were found on roots of this plant at the same place on 8th March, 1959. There are specimens in the King collection from the same area, apparently the only Scottish habitat for the species.

68. *Apteropeda orbiculata* Marsh. (CHRYSOMELIDAE) †

A wingless species breeding mainly on species of Labiatae, in woodland glades, sometimes occurring in scrub areas and hedgerows; its larva is a leaf-miner. Apparently widespread in south-west Scotland.

69. *Mniophita muscorum* Koch. (CHRYSOMELIDAE)

The adult is believed to feed on mosses, chiefly on mossy stumps or trunks in woods; its larva is still unknown. Chitty (1893) recorded it from flood-drift at Forres (Moray), down stream from Darnaway Forest; I have it from several places in the Clyde Valley (Lanark), and from flood-drift at Annbank (Ayr). The Fergusson collection contains a specimen from Barr (Ayr).

70. *Apoderus coryli* L. (ATTELABIDAE or CURCULIONIDAE)

This leaf-rolling species occurs mainly on hazel, and is recorded from a number of Scottish woods, but I have never found it here.

71. *Attelabus nitens* Scop. (ATTELABIDAE or CURCULIONIDAE)

The leaf-rolling habits of this handsome insect have often been described. I have beaten it from oaks at 7, and it was similarly found on an Andersonian zoological excursion to the Tor Wood (Stirling) on 6th June, 1959. It has also been recorded from the Forth and Tweed valleys, and there is a specimen in the Fergusson collection labelled "Nethybridge: E. C. Bedwell 1907."

72. *Rhynchites aeneovirens* Marsh. (ATTELABIDAE or CURCULIONIDAE)

Though not rolling leaves like the last, it is similarly attached to oak. I have it from 5 on 17th May, 1959, and from Garroch, New Galloway, Kirkcudbright on 27th May, 1961. There are specimens in the Fergusson collection from 6 and from Auchendrane (Ayr); it is reported also from Orchardton (Kirkcudbright) and Argyll.

73. *Apion pallipes* Kirby. (APIONIDAE or CURCULIONIDAE)

I have this, from its food-plant *Mercurialis perennis*, from 4, 5, Bothwell Castle (Lanark) and the Avon Gorge, Bo'ness (W. Lothian); there are specimens in the Fergusson collection from Cleghorn Glen, Lanark.

74. *Mesites tardyi* Curt. (CURCULIONIDAE)

Abundant at points on the Ayrshire coast (Culzean Castle, Portencross, etc.) and occurs also in Argyll, but I have not met it elsewhere in Scotland. It is largely restricted to Atlantic coastal areas of Europe, and breeds in dead wood of almost any kind.

75. *Rhyncolus lignarius* Marsh. (CURCULIONIDAE)

Its only previous Scottish record seems to be an old one from the Solway area; I found adults in burrows in dead oak branches at Ardneil bank, Portencross, Ayr on 29th Sept., 1959.

76. *Pentarthrum huttoni* Woll. (CURCULIONIDAE) *

Probably native to New Zealand, where I have found it plentifully in native forests. I found it breeding in numbers in dead elder and sycamore at Broxmouth, East Lothian on 11th May, 1958; one was found on a drift-wood log on the shore at Heads of Ayr (Ayr) during the Andersonian zoological excursion there.

77. *Magdalis armigera* Geoff. (CURCULIONIDAE)

This breeds mainly, if not exclusively, in dead elm. In Scotland, the wych elm seems most likely to be truly native on the unstable sides of gorges in the south; the two places whence I have specimens of this species are of this character—the Avon gorge at 2, and the Mouse Water gorge near Lanark.

78. *Acalles ptinoides* Marsh. (CURCULIONIDAE)

This seems to be widespread in the litter layer of lowland oak woods, but has not yet been recorded further north than the main Forth and Clyde valleys. I failed to find it in litter samples from Darnaway Forest (Moray) or Dinnet Oak Wood (Aberdeen).

79. *Acalles turbatus* Bohem. (CURCULIONIDAE) †

This species, apparently more "oceanic" than the last, may be specially associated with ivy; I found it under a thick growth of that plant on Dumbarton Rock (Dumbarton), and at Culzean Castle (Ayr). Fergusson (1913) records it from old ivy at Girrick, Nenthorn (Berwick), and Lennon (1878) from Carnsalloch Wood near Dumfries.

80. *Balaninus villosus* F. (CURCULIONIDAE)

Fergusson (1913) records this from the Holy Loch (Argyll) and there is a specimen in the Fergusson collection from 6 dated 28.6.19. The larva is known to develop in acorns.

81. *Balanobius pyrrhoceras* Marsh. (CURCULIONIDAE)

This occurs on oak, but its breeding habits are not certainly known—the larva may develop in some type of Cynipid gall. It occurs in most oak woods in which I have collected in Scotland, as far north as Darnaway Forest (Moray).

82. *Coeliodes dryados* Gmel. (CURCULIONIDAE)

Similarly distributed to the last; a Ceuthorrhynchine larva probably of this species was found by beating oaks at Barochan House, Renfrew, and probably had developed in a young oak shoot.

83. *Coeliodes ruber* Marsh. (CURCULIONIDAE)

Apparently similar in habits to the last, but much less common with us; I have it from 3 and 5, also Milton Lockhart and Bothwell Castle in the Clyde valley (Lanark).

84. *Rhynchaenus quercus* L. (CURCULIONIDAE)

The larva of this typical oak-wood insect mines young oak-leaves in the early summer, and the adults hibernate. I have it from many Scottish oak woods, as far north as Darnaway Forest, Moray.

85. *Rhynchaenus avellanae* (CURCULIONIDAE)

Probably similar to the last in habits, but far less common. I have it from Kenmure Castle, New Galloway, Kirkcudbright and Darnaway Forest, Moray; Joy (1932) records it from Garve, Ross-shire and it has been recorded from the Tweed area.

86. *Anthonomus ulmi* DeG. (CURCULIONIDAE) +

In France, this has been reported to develop in flower-buds of *Prunus* and *Crataegus* much like the next species; I have found it apparently hibernating under bark of a dead elder at Bothwell Castle (Lanark) on 17th Sept., 1958, and there are specimens in the Fergusson collection from Cleghorn Glen (Lanark).

87. *Anthonomus pedicularius* L. (CURCULIONIDAE) + †

This oviposits in the flower-buds of hawthorn much as *A. pomorum* does for apples, and I have larvae from such "capped" blossom. It occurs at Cambuslang, near Glasgow, at Barr and Ayr (Ayr) and at 3; in the last locality the form *conspersus* Desbr. also occurs, on flowering rowans (*Sorbus aucuparia*).

88. *Brachysomus echinatus* Bonsd. (CURCULIONIDAE) + †

Adults were found in litter samples from Crossford, Lanark, on 1st July, 1957, and Old Melrose, Roxburgh on 28th May, 1958; also by sweeping river-side herbage (well away from trees) at Dalserf, Lanark on 4th June, 1961. Specimens in the Fergusson collection are from Cleghorn Glen, Lanarkshire.

89. *Polydrosus mollis* Str. (CURCULIONIDAE) +

I have beaten this from oak foliage at 4 in May, and there are specimens similarly collected at Cleghorn Glen (Lanark) in the Fergusson collection.

90. *Scolytus intricatus* Ratz. (SCOLYTIDAE) *

This occurs in abundance at 1, breeding under the bark of wind-blown oak branches, but I have not found it elsewhere in Scotland.

91. *Scolytus destructor* Oliv. (SCOLYTIDAE) *

This has occurred in elm bark at 1, and also at Old Melrose, Roxburgh, but I have not so far found it in the Clyde gorges region where it might be expected if it is truly native in Scotland.

92. *Dryocoetes villosus* F. (SCOLYTIDAE)

Breeding almost exclusively in the bark of dead or part-dead oaks, this occurs in most of the Scottish oak woods in which I have collected, including Darnaway Forest (Moray), and its native status is hardly to be doubted.

93. *Trypodendron domesticum* L. (SCOLYTIDAE) +

This species, *T. lineatum* Oliv. of the pine forests, and *Hylecoetus dermestoides* L. of both oak and pine forests, seem to be the only "ambrosia beetles" permanently established in Scotland. The characteristic cylindrical borings of *T. domesticum* go some distance straight into the sound dead wood of various hardwoods (beech, birch, oak etc.); the species is at least as widespread as the last.

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KALMIA POLIFOLIA IN SCOTLAND

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(MS. received 24th October, 1961)

On a recent visit to the site of *Ledum groenlandicum* on Flanders Moss, Perthshire, I discovered a well-established specimen of *Kalmia polifolia* Wangenh. (American Bog Laurel). The plant is low, semi-prostrate and about 2-3 feet in diameter. Inflorescences would seem to be of sporadic occurrence since only three had been produced during the past season.

That part of the Moss on which the bush was found has ceased regeneration and is now dominated by *Betula pubescens* displaying a wide age spectrum. The lower vegetational strata are dominated by *Calluna vulgaris* and by *Polytrichum commune* in tussock form. Other species present are those typical of raised bogs, notable among them being *Andromeda polifolia*.

The close resemblance of the *Kalmia* leaves to those of *Andromeda*, together with the scarcity of flowers, perhaps accounts for the fact that this plant has not been previously discovered, despite its proximity to the *Ledum*.

The only other known instance of naturalisation of *Kalmia polifolia* was reported by Britton (1910) whose description of locality was limited to "a very wet bog in mid Surrey." In Salmon's "Flora of Surrey" (1931), however, the locality is given as "a dangerous bog on Chobham Common." E. C. Wallace, in a recent private communication, confirms that the *Kalmia* still grows "in a wet boggy area" "on a remote, unspoilt part of Chobham Common."

Britton mentions that he was unable to find any record of planting and states that there are no gardens in the vicinity. Efforts to trace the origin of the Flanders Moss plant have likewise proved fruitless. Sir Ronald Orr-Ewing, owner of the Moss, has given willing co-operation in the search for possible parent plants in the gardens of Cardross. The only species to be found there, however, is *K. latifolia*.

The two British stations are closely similar in character to the native habitat of the species in North America. It thus seems likely that these plants have originated from naturally disseminated seed, either from plants already established in British gardens or from North American plants via the agency of migratory birds.

I wish to express my thanks to Sir Ronald Orr-Ewing, Bt., of Cardross, for his co-operation and interest, and to Mr. E. C. Wallace for his note on the Surrey site.

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- (1) "Recent spread and present distribution of the barnacle *Elminius modestus* Darwin in south-west Scotland."
- (2) "The distribution of freshwater leeches in the Glasgow region, with notes on their ecology."
- (3) "The boundaries of the vice-counties in Scotland. Part 1."

ON A POPULATION OF *HYDROBIA ULVAE* IN THE CLYDE ESTUARY

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(MS. received 22nd May, 1961)

This note presents density data from a few quantitative samples taken in an extensive population of *Hydrobia ulvae** near Cardross. Using qualitative comparisons, an estimate of the total number of snails is made, and the biological significance of such large populations briefly discussed.

A general feature of estuarine faunas is the occurrence in each habitat of relatively few species (in contrast to the faunas of open sea-shores), but these species numerically abundant as individuals. Detailed surveys of estuaries have included many habitats which proved to have a macrofauna of only four or five species (Bassindale, 1938; Rees, 1940; Spooner and Moore, 1940). However, estuarine animals, including several species of molluscs, often occur at very high densities. Among the marine animals occurring in estuaries the cockle, *Cardium edule*, has been recorded at densities up to 383 per square metre in the Tamar, England (Spooner and Moore, 1940), and 1360-4675 per sq. m. at Skalling, Denmark (Thamdrup, 1935). These are densities as high or higher than are found under fully marine conditions, where cockles are harvested commercially. Some years ago in this journal, the late Mr. Richard Elmhirst noted that in a good year cockles occurred at densities of 172 and 240 per sq. m. on Fairlie Sands—then among the best Clyde cockle beds (Elmhirst, 1932).

Other marine species can be abundant in estuaries, including the periwinkle, *Littorina littorea*, which the present writers have counted at 320 per sq.m. in patches in the Clyde Estuary near Cardross. Other molluscs are specifically estuarine. These include such bivalves as *Scrobicularia plana* (up to 1094 per sq.m. in the Tamar, Spooner and Moore, 1940; and 1025 in the Gwendraeth, Green, 1957), and *Macoma balthica* (5900 per sq.m. in the Mersey, Fraser, 1932; Bassindale, 1938).

But perhaps the most characteristic estuarine mollusc is the prosobranch snail *Hydrobia ulvae* which can be found in almost "pure culture" over extensive areas of the shores of estuaries. It reaches densities of 10-18,000 per sq.m. near Cardiff (Rees, 1940); 10-28,000 in the Tamar (Spooner and

* *Peringia ulvae* and *Sabanea ulvae* of some authors

Moore, 1940); 27–32,500 in the Forth (Nicol, 1935); and 46–60,000 per sq.m. at Skalling, Denmark (Thamdrup, 1935). In the Clyde, near Cardross, densities of *H. ulvae* from 5,400–20,500 (and exceptionally 42,000), per sq.m. have been found (see below). None of the earlier authors quoted give any assessment of the total extent of the populations from which they had collected their samples, although this is clearly of some biological significance. An attempt is made here to produce an approximate census of this Clyde population.

The part of the estuary involved appears in the map (fig. 1),

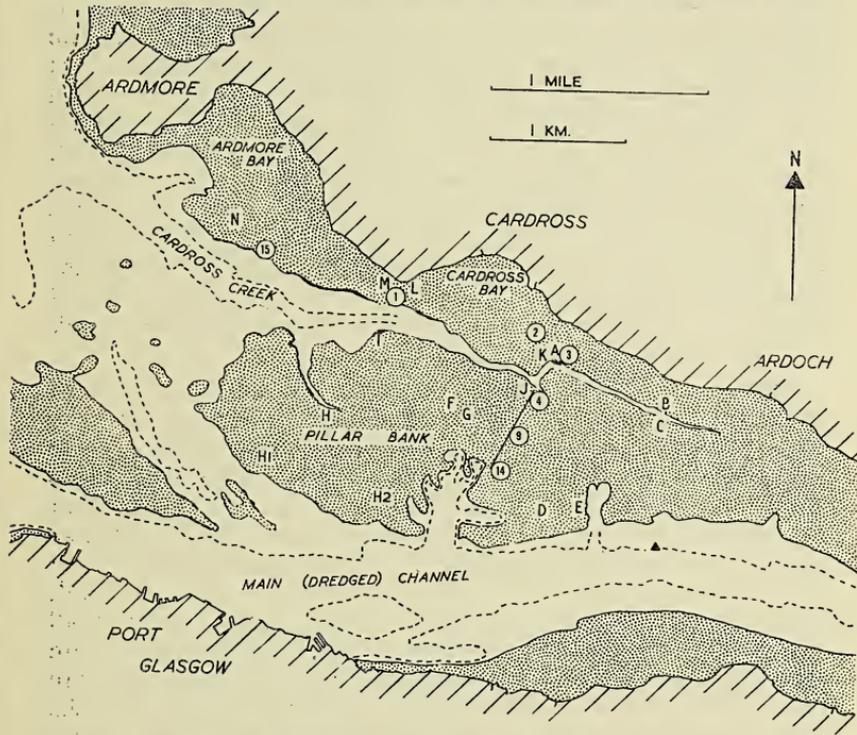


Figure 1—The Clyde Estuary near Cardross: the areas shown stippled lie between Low Water Mark, M.S.T. and H.W.M., M.S.T. (both indicated by full lines) and the depth contour one fathom below L.W.M. is marked by a broken line. The circled numbers mark the sites of quantitative sampling (including the main transect of eleven stations 4–9–14), and the letters are used to indicate the lines and areas of qualitative surveys (for further explanation, see text).

on which the areas shown stippled lie between Low Water Mark, M.S.T. and H.W.M., M.S.T. (both indicated by full lines). The broken line is the depth contour one fathom below L.W.M., that is with depths of at least 16 feet at the time of high water of ordinary spring tides. The areas visited, over all of which *H. ulvae* occurs, include the Cardross shores from

Ardmore to near Ardoch, and the nearly detached offshore bank, Pillar Bank. The southern shore of the estuary (from Port Glasgow eastwards) was not examined, and the detached bank to the west of Pillar Bank was not visited during this survey. Unnamed on fig. 1, the latter bank is called the "Cockle Bank" on Admiralty charts, but the "Mussel Bank" on Ordnance Survey maps. Biologically the latter is more correct.

On the map (fig. 1) the circled numbers mark the sites of quantitative sampling (the main transect of eleven stations being indicated by the line 4-9-14) and letters are used to designate the lines and areas of only qualitative survey. The quantitative samples were all collected during the spring tides of 20-23rd June, 1958, the main qualitative survey done then and during 15-17th August, 1958, and repeated during 3-5th September, 1959, when other fauna were collected. Other visits have been paid to Pillar Bank in early summer, 1959, and in the spring and summer of 1960, and to the shores of Ardmore and Cardross bays more frequently. The area would be classified as mixo-mesohaline (Caspers, 1959; see also Segerstråle, 1959), and a single water sample taken about one hour before the time of low water in Cardross Creek (near J) gave a salinity of 22.34‰.

Each quantitative sample consisted of a square foot of sandy mud dug out to a depth of at least 1.5 inches. *H. ulvae* rarely penetrates to an inch below the mud surface. The inshore samples were sieved immediately on collection, those from the offshore bank were placed intact in cotton bags and carried inshore; but were sieved within a few hours of collection (sieve mesh size = 0.9 mm). Sieved material was fixed in 10% formalin, stored in 70% alcohol and sorted by hand. Each entire sample was examined by being spread out, a small amount at a time, in flat white dishes. All *Hydrobia* were removed and counted; damaged and obviously dead shells are **not** included in the totals, though a few unbroken dead shells were undoubtedly counted. In four subsamples, where this was checked, the proportion of such dead shells made up less than 3% of the count of "living" *Hydrobia*. The shells of dead snails must be carried away on water currents and/or be mechanically damaged soon after death. The counts are set out in Table I, in which the actual numbers counted appear in the third column and the number per square metre in the fourth.

It can be seen that all of the Pillar Bank samples (4-14), along with inshore sample 15, group into two "density levels": B, 4-7 and 11-15 (7,449 to 8,654 per sq.m., mean 7,954); and A, 8, 10, 9 (5,393 to 5,511 per sq.m., mean 5,443). The inshore samples were specially selected as representative

Table I—Quantitative samples of *Hydrobia ulvae*

Map No.	Sample reference	No. counted (per sq. foot)	Density (per sq. metre)	Density level (class)
1	T155/1	970	10,441	C
2	T158/1	1905	20,505	D
3	T158/2	3903	42,012	X
15	T155/2	706	7,599	B
4	T157/1	804	8,654	B
5	T157/2	692	7,449	B
6	T/1573	714	7,685	B
7	T157/4	770	8,288	B
8	T157/5	501	5,393	A
9	T157/6	512	5,511	A
10	T157/7	504	5,425	A
11	T157/8	748	8,051	B
12	T157/9	740	7,965	B
13	T157/10	721	7,761	B
14	T157/11	756	8,138	B

Means of density level classes $\left\{ \begin{array}{l} A = 5,443 (3) \\ B = 7,954 (9) \end{array} \right.$

of different "density levels" encountered. The lowest inshore density falls in the higher bank range (15—level B), and the only others generally encountered are those of 1 (10,441 per sq.m.—level C) and 2 (20,505 per sq.m.—level D.). The sample from locality number 3 reflects exceptional conditions, being taken from one of the shallow drainage channels in the sand, in which *Hydrobia* seems to be accumulated. Such densities (42,012 per sq.m.—level X) are only rarely encountered; less than 0.1% of the ground where *Hydrobia* occurs is occupied at this density.

In an admittedly crude attempt to assess the total numbers in the population, a qualitative survey was carried out by a series of walks at low water initially over the lines AB, BC, CD, etc. to MN, and then subsequently in some additional directions, e.g. JE, the triangle, H.H1.H2, and northwards inshore from B. A and N. Stops were made at intervals of 50

or 100 metres, or where the substratum obviously changed, and the "*Hydrobia*-density" related visually and by touch to those few "density levels" known on the bank transect or inshore. Each area could be assessed "between B and C," "about $\frac{1}{2}$ A", "none," etc. Notes were taken there and then, and differences of substratum (such as mussel beds) roughly plotted. Positions were mostly determined by prismatic compass and pacing—though a tape was used on the 4-14 transect. Two other features limit the accuracy of the survey. Extensive areas of mussel beds occur on Pillar Bank and smaller patches in Cardross Bay and elsewhere inshore. *Hydrobia ulvae* is certainly present among the mussels though at low density. Careful examination suggests that less than 100 *Hydrobia* per sq.m. occur within the beds. Therefore, during the qualitative assessment all areas of mussel bed were rated as "none." Further, in the area H2.G.D. (see fig. 1) and to a lesser extent near E, small steam lighters (the Clyde "puffers") are continually removing sand and gravel. Around these artificial embayments, the contours of the bank, and thus the densities of *Hydrobia*, alter from month to month.

A few examples will show how population totals for different parts of the area were assessed. The triangle of the bank enclosed by lines from H through H1 and H2 to L.W.M. is about 0.48 sq.km. in extent. Of this, about 30,000 sq.m. lie at too low a level or on the scoured edge and are rated as without *Hydrobia*. The rest falls into two zones: first, about 170,000 sq.m. towards the centre of the bank (H) with 20% loose *Mytilus* beds (none), and the rest cleaner sand at A-level (i.e. 734,400,000 individuals), and secondly an outer zone (H1 to H2) of about 280,000 sq.m. with 60% thick *Mytilus* beds running in ridges (none), with valleys of muddy sand between with *Hydrobia* at C-level (i.e. 1,164,800,000 ind.). Thus this triangle is assessed as contributing 1.9 milliard* individuals to the total for the population. Similarly the strip of shore from A east to Ardoch inshore of the creek is about 0.46 sq.km. in extent. Of this about 90,000 sq.m. lies at too high a tidal level or is scoured (i.e. "none"), a small part, 2,000 sq.m., consists of drainage channels between D and X-levels (i.e. 62,600,000 ind.), and the rest (368,000 sq.m.) consists of 30% mussel beds and seaweed-covered boulders (none), 25% sand at D-level (i.e. 1,886,000,000 ind.), and 45% sand at B/C-level (i.e. 1,523,500,000 ind.). Thus the snails in this strip are assessed as totalling 3.47 milliard. Details of the other

*In this note and others, the term "milliard" is used, since it has only been employed to denote a thousand million (10^9). The term "billion" is best avoided as it is used to signify both a thousand million (10^9 , in the United States and France), and a million million (10^{12} , in Great Britain).

nine divisions (over 30 subdivisions) of the area will not be given here, but all were assessed in this way giving a grand total of 30,174,500,000 ind. (say 30.2 milliard ind.). The probable maximum and minimum limits for the population size were also estimated, e.g. the latter assessment from a minimal density value and the lowest reckoning of the area occupied by *Hydrobia*. It is extremely unlikely that the actual population number is more than 125 milliard, and unlikely that it is less than 8 milliard.

Thus the estimate of the total population of *Hydrobia ulvae* in this area of less than 2.5 square miles (6.08 sq.km.) of tidal sands is 30 milliard individuals. From an evolutionary point of view such an enormous population is in complete contrast to the classic cases of isolated populations of small mammals or poorly flying birds on oceanic islands (where there may be no more than a few hundreds of interbreeding individuals of the species). It should be noted that in spite of the small size and slow rate of crawling of *Hydrobia ulvae*, the whole of the Cardross population is probably potentially interbreeding (i.e. potentially panmictic genetically). As recently pointed out by Newell (1960, 1961) the changes in activity of *H. ulvae* during the tidal cycle can involve floating for a period on a mucous raft. Apart from its importance for feeding as described by Newell, this behaviour will serve to distribute and mix the individuals of the population, so that the establishment of partially discontinuous breeding groups is unlikely. The effectiveness of natural selection in bringing about evolutionary change differs from large to small interbreeding populations at any given intensity of selection. Further, the dynamic balance between selection, mutation, and chance recombination at any time differs markedly with population size. In a very large population quite a low intensity of selection can be effective in modifying the relative frequencies of adaptive characters. In the contrasting extreme case, only within a small isolated population can an accidental non-adaptive character become generally established, or a deleterious change appearing through chance recombination become established and perhaps lead to population extinction. Huxley (1942) has even stated that "repeated mutation together with a considerable-sized population, are necessary for new mutations to have an evolutionary chance." Genetically, an evolutionary change may imply that a population has become homozygous for a new advantageous allelomorph. This is ensured in a small population only if selection is very intense, but at more usual selection intensities in a small population, chance is important. (That is, the "genetic drift" of Sewall Wright (1934, 1940, 1948) is more likely to occur, though Fisher and Ford (1947, 1950) regard this effect as

unimportant). Within a large interbreeding population even a low intensity of selection will narrowly determine change in gene-frequency, and the population will certainly become homozygous for the advantageous gene. A clear summary of the genetic effects of drift and selection in relation to population size has recently been given by Sheppard (1958).

It is significant that several species of molluscs now established as members of the freshwater fauna are almost certainly derived from estuarine forms living in similar enormous populations. In recent history (from 1893 to date) the hydrobiid *Potamopyrgus jenkinsi* has invaded European fresh waters (see Roebuck, 1921; Ellis, 1926; Hubendick, 1950; Hunter and Warwick, 1957), and relatively recently in a geological time-scale (during a Günz/Mindel interglacial) the neritid *Theodoxus fluviatilis* had done likewise.

We are most grateful to Professor C. M. Yonge, C.B.E., F.R.S., for his continued encouragement. We also wish to thank Dr. J. D. Robertson, F.R.S.E., for the salinity determination, and Miss Jane C. L. Gorlach for help in sorting and counting the samples.

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CAMOUFLAGE IN *AMOEBEA*

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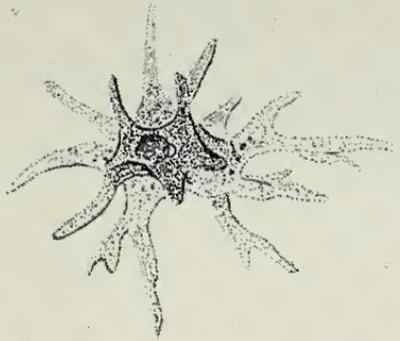
(MS. received 2nd June, 1961)

This note results from collections of protozoans made at a lake in the grounds of Gartmore House, near Aberfoyle, in Spring, 1960. Detritus from the top layer of the bottom mud was sampled with a collecting spoon and, from deeper water, with a diatom bulb sucker. Tow nettings were also made from the water, and water plants collected for maceration. I am indebted to Dr. and Mrs. Inglis Cameron for making the collections possible, and to the game-keeper, Mr. Saunders for help with collecting.

In the laboratory, the collecting tubes were left uncorked and examined subsequently, a suitable pabulum (hay-water) being added to "hungry" catches. A rich micro-flora and fauna turned up. In addition to *Amoeba*, of special interest were the rich populations of *Chilomonas* and of *Euglena*, both being useful food organisms for *Amoeba* species. Incidentally I have succeeded in establishing from the material collected a micro-aquarium with a luxuriant *Hydra viridis* culture. So often catches of this *Hydra* refuse to establish themselves in artificial habitats. One remarkable (at least in my experience) characteristic of the catches was the complete absence of *Paramecium*. Even in the macerated weed this usually ubiquitous ciliate failed to appear.

The great discovery, however, was the fact that the lake resembles a pure culture of *Amoeba radiosa*. A year's search has failed to reveal any other species. It must be remembered that a "radiate" form occurs in the life-cycle of many *Amoebae* and that the *limax* form may be converted into the "radiate" type by chemical action. However, *A. radiosa* is a valid species, and has a diameter averaging 135 μ . It was well known to early naturalists. A full description of it is given in Leidy's *Fresh Water Rhizopods of North America* (1879). So arresting is Leidy's account of it that Penard quoted it in his *Faune Rhizopodique du Basin du Lemman* (1902).

I make no apology for following Penard's example and I quote Leidy: "*A. radiosa* is a comparatively small inactive species, and ordinarily is observed suspended in the water almost motionless and with its ray-like pseudopods apparently



M. M. Pierce.

Figures 1-3—*Amoeba radiosa*—drawings by Miss Marie Pierce, partly after Leidy.
(The cost of this block is provided from a legacy of the late William Rennie, Esq.)

fixed, as though they were rigid. It possesses comparatively little irritability, and at times when it comes into the vicinity of a *Stentor*, a *Vorticella*, or a rotifer, it may be seen whirling about in the currents produced by these animals, with its form unchanged, and its pseudopods extended, as if it had no inherent power of motion. On closely watching the *Amoeba* as it remains quietly suspended in water, it is observed very slowly to undergo more or less change of shape, and the pseudopods are noticed gradually to contract or elongate, to bend from side to side in a gently oscillating manner or to become twisted or bent in an angular direction. Sometimes more quickly than usual, a pseudopod will be withdrawn in a tortuous course. While one or two pseudopods are almost imperceptibly shortened or lengthened or entirely withdrawn, new ones will as slowly appear and elongate."

I have cultivated *A. radiosa* in four-inch petri-dishes, and with the help of a water-immersion objective I have verified each statement made by Leidy. But I would emphasise strongly the contrast between the "floating" condition and what obtains when the *Amoeba* attaches itself to a substratum. It then becomes orientated, moves with an anterior direction, and looks superficially like a stage in the life cycle of any *proteus*-type of *Amoeba*. In this phase its passage across the field of view is so rapid that it is difficult to measure the length. Why the *Amoeba* should adopt this position is mysterious for it can feed easily on the floating diatoms and other algae.

As one focuses down from the surface of the petri-dish culture, which itself contains *Amoebae*, one encounters the floating *Amoebae* which are almost indistinguishable from the surrounding fluid—the perfect concealing colouration reminds one of what can obtain in salps, ctenophores, medusae and other marine animals. Whether the *Amoebae* are well stuffed with food, or hungry and freer from food vacuoles, the camouflage persists.

I was particularly impressed with the following observation. One morning I had done the routine examination of a petri-dish and found the *Amoebae* completely starved and perfectly concealed. The next day, they had all fed voraciously on *Euglena*—they were again perfectly concealed—it was difficult to distinguish the *Euglenae* in the food vacuoles from those in the culture fluid.

Besides the radiate shape another characteristic appearance is where the denser part of the endoplasm is hunched up over a spreading ectoplasm giving the impression of two distinct structures. Often, a single finger-shaped pseudopodium, longer than the rest of the creature, gives a very bizarre effect. This lobopod may form a hook to help the creeping *Amoeba* back to its floating habitat. As is usual in *Amoeba*, the cytoplasmic

contents of the endoplasm vary with its age, and the character of its food. Sometimes there are many vacuoles. The contractile vacuole works very slowly and the nucleus is large in comparison with the cytoplasm.

One great deterrant from *Amoeba* research is the amount of time required for the life-cycle. In the large *proteus* type mitosis is completed in about twenty minutes, but occurs only once in every twenty-four hours! I have not yet observed mitosis or sporulation in *A. radiosa*, although it is evident that the latter process must occur, because all developmental stages of size have been found in the culture.

Beautiful preparations may be obtained by fixing well stretched *Amoebae* in acetic alcohol, leaving them overnight in this fluid, staining in aceto-carmin, clearing and preserving in 10% glycerine with 45% acetic alcohol. The nucleus is seen to consist of a karyosome with a collar midway between it and the nuclear membrane. The chromatin stands out clearly.

Scant attention to this *Amoeba* has been given in texts on protozoology. It would seem that the growth of urban populations, and the consequent draining of suitable collecting grounds, have prevented study of this camouflaged *Amoeba*, and thus it runs the risk of becoming neglected and forgotten.

JOHN SCOULER, M.D., LI.D., F.L.S. (1804-1871)

By BLODWEN LLOYD, M.Sc., Ph.D.

Department of Applied Microbiology and Biology, Royal
College of Science and Technology, Glasgow.

(Revised MS. received 12th October, 1961)

Darwin himself noted that, before a great mind came on any particular scene, many lesser minds made their contribution to set the stage. We find many pre-Darwinian minds which conditioned the world of biology in which Darwinism finally emerged. Such was the mind of Professor John Scouler, the first Honorary President of the Glasgow Natural History Society, formed in 1851 and now embodied in the Andersonian Naturalists of Glasgow.

When, after a lapse of half a century or so, his herbarium was discovered in a forgotten corner of the Department of Applied Microbiology and Biology of the Royal College of Science and Technology, Glasgow, there was an impetus to seek to know more about him and to assess his contribution to the natural sciences.

Scouler was a Glasgow-born lad of better circumstances, the son of a cotton printer at Kilbarchan, where he was educated privately by a clergyman; proceeding at 16 years to the University of Glasgow to study medicine, he was acclaimed by that famous Professor of Botany, Hooker, as one of his most brilliant pupils. At the age of 19 years Scouler went to Paris to extend his studies.

On his return in 1824 Scouler was nominated by Professor Hooker to sign on as surgeon and naturalist on the brig *William and Anne*, which had been chartered by the Hudson Bay Company to explore the Pacific Northwest coast of America, beyond the Stony (now the Rocky) Mountains. He took with him as a plant collector David Douglas, then assistant Curator of the Glasgow Botanic Gardens—that same Douglas who thereafter introduced many of our garden and cultivated trees. Scouler was accordingly the first botanist to explore what is now the State of Oregon. Two years later he brought back his plant collections to Hooker. The log of his travels was published in the *Edinburgh Journal of Science* (1826-27), and republished by the Oregon Historical Society (1905). His zoological material, his geological and ethnological collections and his herbarium still survive in varying degrees of completeness, chiefly in Glasgow.

Quite soon after, Scouler again shipped as surgeon, this time

aboard the *Clyde*, chartered for the East India Company. It has not been possible to trace any log of his travels, but his herbarium, and such of his correspondence as survives, indicate his activities in the Cape of Good Hope, Mauritius, Ceylon, India and Macao. He graduated in medicine on his return, practised a little, and established the *Glasgow Medical Journal*. However, his interest in Natural History gained an ascendancy in his mind, and in 1829 he was appointed to Anderson's University (now the Royal College of Science and Technology, Glasgow) as Professor of Natural History and Curator of its Museum. He built up this museum very rapidly for five years, and included preparations from his own collections.

In 1834 he went to a similar post with the Royal Irish Society, Dublin, where he also arranged and developed their Museum. He stayed there for almost twenty years, teaching, administering and collecting, but during that time he visited Scotland frequently, addressing the many learned societies of that time; in particular, he arranged the splendid geological exhibits, praised highly by Agassiz the elder, for the visit of the British Association for the Advancement of Science to Glasgow in 1840. Despite his extensive activity and increasing fame centred on Glasgow, this period cannot have been a particularly happy one. His wife and only child died, and as he was politically a zealous Liberal, the unsettled times of the Reform Bill may have contributed to his unhappiness. He received the honour of the Degree of LL.D. of the University of Glasgow in 1850.

In 1853 he retired for health reasons from his Dublin appointment, on a pension of two thirds of his salary; he returned to Glasgow, and spent his time in travelling to Uppsala, Portugal and the Low Countries; studying his biological materials and collecting more; amassing a splendid library, and working informally once again at his old museum.

The foregoing are the bare facts of his life, but even after this lapse of time it is possible to clothe them with his personality and make some move to assess his significance to his particular field of Natural History, to the scientific thought of his time and to evaluate his legacy of collected specimens.

Scouler's contribution to the scientific thought of his time is not easy to assess; his obituarist Keddie* regretted that he had not published anything adequate to his mental stature, despite the breadth of his field of interests in natural history—botany, zoology, geology and ethnology. Scouler's extreme modesty forbade even a painting to be made of him, and there is only one bust extant, done when he was comparatively young. This same unassuming nature caused him to forbid the publication of his translation of Aristotle's *De Rerum*

Animalium. Neither of these traits, however, could reduce or conceal the affectionate esteem in which he was held by his co-evals, the high admiration accorded him by such leaders as Agassiz, Hooker and Wallich, and the value placed on his knowledge by such of his correspondents as Ralfs and Torrey.

Scouler's specific contribution to Natural Science is more readily assessed, and if any one item were to be singled out in this necessarily brief review, it would be that he was the first botanist to visit Oregon. This is reflected in the fact that altogether some twenty plants from Oregon and the North-west Pacific coastal regions were named in his honour by Hooker, Douglas, and as late as 1907 by Rydbergh. They include a moss, a fern, and a *Phyllospadix* (Zosteraceae). Apart from these, a mineral, a fish and at least four fossils were also named after Scouler.

In estimating Scouler's achievements, regard must be given to his physical relicts—his fine library which he bequeathed to Stirling's Library, and which now, appropriately enough, is housed in the Mitchell Library, under the same roof as that of the Natural History Society of Glasgow. Scouler's collections, although dispersed, are traceable, and the location of his zoological and ethnological material is now to be further investigated. Of his botanical collections, apart from the specimens taken by Hooker to Kew and some few known to be at the Royal Irish Society, nothing was known until a chance re-organisation at the Royal College of Science and Technology, Glasgow, revealed them. These herbarium specimens have now been rehabilitated and catalogued. A perusal of the catalogue alone reveals much of the way of work of our predecessors in this society; many evidence of collections made on Society excursions throw an engaging light on their activities at a time when transport was more difficult and leisure very much less.

Scouler's obituarist, Keddie*, draws a kindly picture of him in his later years, living alone among his books, his specimens and his tobacco smoke in his lodgings, ambling daily to the Andersonian Institution, until his death in 1871, predicted by him almost to a day. When next the Society makes an excursion in the vicinity of Kilbarchan, they might well deflect their course to visit the grave of Scouler, buried in his father's lair on the immediate left as one enters the churchyard.

*Keddie, W., 1872. *Trans. geol. Soc. Glasg.*, 4, 194; see also *Glasgow Daily Herald*, 15th November, 1871.

SHORTER NOTES

New records of *Amoeba* spp.

Amoeba lescherae was obtained by macerating water weed from the River Leven, Dunbartonshire, collected by Mr. Alexander Young. The same species was found in October, 1961 by Miss Veronica Scollan, associated with *Pelmatohydra* on weed collected in a small stream running into Hogganfield Loch. *Amoeba dubia* was obtained by macerating weed and organic debris from "The Cut," near Kelly Reservoir, Renfrewshire, collected by Sr. Julie Magdalen, S.N.D. Two earlier records of *A. dubia* from ponds at Drumchapel and Garscube are no longer valid, since the collecting grounds have been built over.

Sr. Monica Taylor

Raft Spider in Easternness

On 27th October, 1959, I took two specimens, one of each sex, of the Raft Spider, *Dolomedes fimbriatus* (Clerck) in a marsh at Tulloch, Boat of Garten, Easternness. Both were immature. Apart from one record from Perthshire, this spider does not appear to have been found in Scotland before.

Roland Richter

Raft Spider in Scotland

On 10th July, 1961, Mr. Peter Skidmore took an adult female *Dolomedes fimbriatus* (Clerck) in a sphagnum bog near the Duack Burn in Abernethy Forest (Inverness). The national grid reference for the site is 998/186 on sheets 38 and 43 of the "Popular Edition" Ordnance Survey maps. This is the first adult of the species recorded from a Scottish locality.

The Perthshire record seems to be based on a tentative determination by Dr. A. R. Jackson, of immature specimens which he took in the Black Wood of Rannoch in June, 1913. (Jackson, A. R., 1913. "A Contribution to the Spider Fauna of Scotland." *Proc. roy. phys. Soc. Edinb.*, **19**, 108-128.). It seems likely that his specimens were of *Dolomedes fimbriatus* but, until adults are collected in the locality, the possibility that another species might occur there must be borne in mind.

Elizabeth A. Crowson

Miller's Thumb Bullhead in Renfrewshire

While on a visit to the Black Loch about four miles south-west of Newton Mearns, Renfrewshire, on 6th June, 1961, I collected, along with minnows, two specimens of the Miller's Thumb Bullhead (*Cottus gobio* L.) from the small burn draining the northern end of the loch (National grid reference:

- NS 502517). On 12th June I returned to the burn and collected three more specimens. Two standard books on fishes, "*The Fresh Water Fishes of the British Isles*" (C. Tate Regan, 1911) and "*The Fishes of the British Isles*" (J. Travis Jenkins, 1936 edition), give no record of this species being found in Scotland, but Dr. Russell Hunter referred me to the following records: 1901—Upper Kelvin and tributaries, T. Scott and A. Brown; Carmel Water, Ayrshire, H. A. Woodburn; Dobbs Burn, near Paisley, J. M. B. Taylor. (All in "*Fauna, Flora and Geology of the Clyde Area.*" Glasgow.) 1951—Earn Water, a tributary of the River Cart, in stream above bridge at Muirshields Farm House, Loganswell. (Patton, D., 1951. *Glasg. Nat.*, 17, 48.)

Taken in conjunction with the late Dr. Patton's record, the present captures seem to confirm that *Cottis gobio* is well established in the tributaries of the Earn Water. His locality and mine are approximately a mile and a half apart, following the course of the burns.

H. Gemmell

Potamopyrgus jenkinsi in North Ayrshire

Specimens of the small operculate snail, *Potamopyrgus jenkinsi*, were first collected at Lincluden, Skelmorlie, Ayrshire and brought to us for identification by Sister Julie Magdalen of Notre Dame Convent, Glasgow. They had been collected from a small drainage stream where it descends the sandstone cliffs of the "thirty-foot" raised beach behind the house. Further sampling by one of us (WRH) in November, 1961 showed *P. jenkinsi* to be abundant in this locality at Skelmorlie and also present in smaller numbers in two other small streams, three and a half miles to the south, at about three hundred yards north of the burgh boundary of Largs. The snails in these are living in a similar habitat at the steepest slope of the raised beach.

The new records are likely to mark a real extension of the distribution of *P. jenkinsi*, as north-western Ayrshire was among the areas presumed to be "not yet colonized" in the survey of Scottish records at 1956 (Hunter and Warwick, 1957, *Proc. roy. Soc. Edinb. B*, 66, 360-373; see also additional records for southern Scotland in Kevan, 1960, *J. Conch.*, 24, 399-401).

S^r. Monica Taylor and W. Russell Hunter

Old Lady Moth in Moray

On 24th July, 1958, and again on 25th July, 1959, I captured single specimens of the Old Lady Moth, *Mormo maura* (L.) (formerly *Mania maura* L.), at Gordonstoun, Moray. There seems to be no previous record for the county.

Roland Richter

Aulacomnium androgynum in Ayrshire

On 30th September, 1961, on the Andersonian excursion to the Blair estate, Dalry, the moss *Aulacomnium androgynum* (Hedw.) Schwaegr. was found in some quantity on the branches and trunks of several old elders. This is an unusual habitat, for it most often grows on sandy banks and rotting tree stumps. This is a new record for Ayrshire and a westward extension to its range in this part of Scotland. The only previous records in the Clyde Area are from Cadder Wilderness and the Falls of Clyde, in Lanarkshire, and from an old wood near Croy, in the detached part of Dunbartonshire, where it was found by the late J. R. Lee (1937, *Glasg. Nat.*, **13**, 39). The species is common in many of the eastern and central districts of the British Isles, but becomes rare or absent in the west.

A. C. Crundwell

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY

12TH JANUARY, 1960

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Mr. Mackechnie then introduced a programme of films arranged by Mr. C. Eric Palmer. These covered ornithology, the process of photosynthesis, and palaeontology.

9TH FEBRUARY, 1960

The Annual General Meeting was held in the Royal College of Science and Technology, Glasgow, and presided over by Mr. Robert Mackechnie.

Two new members were admitted to the Society: Thomas Tait, 98 Waverley Drive, Wishaw; and B. Naish, 151 Craigpark Drive, Glasgow, E.1.

Reports of the Society's activities were read and it was noted that the membership of the Society at 31st December, 1959 was 178. New office-bearers were elected (see. p 216). An exhibition of colour slides was then presented by members of the Society, including A. Slack, Mrs. A. Cross, Mrs. F. M. Elder and I. McLaurin.

8TH MARCH, 1960

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Hamish Cumming, c/o Laurence, 59 Bank Street, Glasgow, W.2., was admitted as a new member of the Society.

Lectures on different aspects of parasitism were then given by Dr. William O. Hutchison and Mr. Donald McLeod, both of the staff of the Biology Department, Royal College of Science and Technology. The meeting then adjourned to the lecturers' laboratories where a demonstration of some of their work was displayed.

12TH APRIL, 1960

Mr. Robert Mackechnie presided over a meeting held in the Art Gallery and Museum, Kelvingrove.

Four new members were admitted to the Society: Doris Anton, 18 West Chapelton Crescent, Bearsden; M. Buchanan, Glenosmond, Ardoch, Cardross; C. I. McFadzean, 17 Barrington Drive, Glasgow, C.4; and Gerald Rodway, East Lodge, Botanic Gardens, Glasgow, W.2.

Mr. Mackechnie then introduced the "Exhibit night": more than 15 members had provided specimens.

9TH MAY, 1960

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Five new members were admitted to the Society: M. Flockhart, 150 Bardowie Street, Glasgow, N.2; Greer Hart, 1413 Paisley Road West, Glasgow, S.W.2; Ian Pendleton, 2 Carseview Drive, Glasgow, S.1.; Ian Dance, 59 Glenburn Avenue, Cambuslang; and Ralph C. Wylie, 26 County Avenue, Eastfield, Cambuslang.

A lecture was given by Dr. A. J. Brook of the Department of Botany, University of Edinburgh, entitled "Algae and the fisherman."

14TH JUNE, 1960

Mr. Robert Mackechnie presided over a meeting held in the Department of Geography, University of Glasgow.

Two new members were admitted to the Society: Patricia M. Ellis, 15 St. Ninians Road, Paisley, and Fiona McKechnie, 3 Balvaird Crescent, Rutherglen.

Dr. J. Tivy then gave a lecture illustrated with coloured lantern slides on the origins of landscape in Scotland.

13TH SEPTEMBER, 1960

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Five new members were admitted to the Society: A. Finlay, 158 Sunnyside Drive, Glasgow, W.5; T. McLennan, 100 Alexander Street, Airdrie; W. B. McGarva, 447 Sauchiehall Street, Glasgow, C.3; A. D. Chisholm, 43 Caird Drive, Glasgow, W.1; and A. C. MacRaild, 2 Glenlui Avenue, Rutherglen.

Mr. David Stephen gave a lecture, illustrated with coloured lantern slides, entitled "Predatory birds and mammals."

11TH OCTOBER, 1960

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Hamish K. Spence, 36 Kelburne Oval, Paisley, was admitted as a new member of the Society. Mr. David K. Paton agreed to accept the office of Minute Secretary, on the resignation of Miss A. H. McCallum.

Mr. C. Eric Palmar then introduced a programme of films, which included one of his own on various terns.

8TH NOVEMBER, 1960

Mr. Robert Mackechnie presided over a meeting held in the Department of Botany, University of Glasgow.

Four new members were admitted to the Society: D. M. Clephane, 92 Eastwoodmains Road, Giffnock; C. Lindsay, 13 Walker street, Paisley; Norman M. Bickett, 46 Whitecrook Street, Clydebank; and Peter H. MacLachlan, 45 Buchanan Road, Killearn.

Professor J. Walton of the Department of Botany, University of Glasgow, then gave a talk entitled "A visit to parts of South California and Arizona", and exhibited specimens of flora collected on this trip.

6TH DECEMBER, 1960

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Dr. C. H. Mortimer, Director of the Marine Biological Station at Millport, delivered a lecture, illustrated with lantern slides and films, entitled "The influence of water movements on biological productivity in closed basins."

THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month, except during July and August, usually in the Royal College of Science and Technology, but from time to time in the University and the Glasgow Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

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THE GLASGOW NATURALIST

The Journal of the
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HEMICLEPSIS MARGINATA AND *BATRACOBDELLA PALUDOSA* IN STIRLINGSHIRE, WITH NOTES ON THE ECOLOGY AND MORPHOLOGY OF THE LATTER SPECIES

By PETER S. MAITLAND, B.Sc.

Department of Zoology, University of Glasgow

(MS. received 1st November, 1962)

Recent accounts of the distribution of freshwater leeches in Scotland have been given by Warwick and Mann (1960) and Warwick (1961). Williams (1961) gave an account of their distribution in the Glasgow area. The main purpose of the present paper is to record the presence in Stirlingshire of two species new to this vice-county, though some observations on the ecology and morphology of one of them are also included.

Hemiclepsis marginata (Müller)

This species has been recorded from five vice-counties in Scotland (Warwick, 1961), but was not found by Williams (1961) in his survey of thirty-nine waters in the Glasgow area. It is considered by Warwick and Mann (1960) to be one of the rarest of Scottish leeches. A fish parasite, this species is never found in large numbers and its distribution must in large part depend on the incidence and abundance of its host species. Recent collecting has shown this leech to be present at several places in Stirlingshire (vice-county 86), and all the specimens were taken from a similar habitat—underneath large stones in shallow water at the edges of streams. It was found at three stations in the River Endrick—Drymen (6th June, 1961), Dalnair (6th June, and 17th September, 1961) and Blane (4th September, 1961)—and one station in Dougalston Burn (18th May, 1962). On only one occasion (when two individuals were found together) was more than one specimen of *H. marginata* recorded. In the lower reaches of the River Endrick where this leech was found, at least twelve species of fish are known to occur, and several of these species are also found in Dougalston Burn. At no time, however, has *H. marginata* been found attached to fish in these waters.

Batracobdella paludosa (Carena)

This leech was recorded for the first time in Great Britain by Mann (1953), who discovered it in a pond in Berkshire, and subsequently also in Lake Windermere. In Scotland the species has been recorded by Warwick and Mann (1960) from the Lake of Menteith and Loch Chon. The first specimens of *B. paludosa* from Stirlingshire were found by the author in the River Endrick at Dalnair (2nd September, 1961), and others were found later in Dougalston Burn (18th May, 1962). Like *H. marginata* this is a rather uncommon species, and in view of this rarity—both in Great Britain and in other parts of Europe—it was thought worthwhile to deal with these records in some detail.

OCCURRENCE

All the previous records of this species in Great Britain have been from standing water, and at three of these localities it appears to be uncommon—Lake Windermere, the Lake of Menteith and Loch Chon. These are all relatively unproductive lakes and the few specimens found in them were all taken from under stones at the edge of the water. *B. paludosa* appears to be commoner in the Berkshire habitat from where it was first recorded in Great Britain by Mann (1953)—a small woodland pond near Aldermaston which was overgrown by aquatic plants of various kinds. All the leeches were found among *Sparganium* at the edge of this pond. In contrast to these habitats, both the present records are from running water. In the River Endrick at Dalnair five specimens were found under stones in shallow water near the edge. Subsequent collecting at this station, and at many others in the Endrick system, failed to find any further specimens of this species and it cannot be considered common in this river. Some time later, a collection of leeches from Dougalston Burn (a tributary of the River Allander) was found to contain several specimens of *B. paludosa*, and recent collecting here has shown this species to be a common element of the fauna.

HABITAT

Dougalston Burn has its origin in Dougalston Loch, a small, rather eutrophic body of water which is surrounded by woodland. As it leaves the loch the burn cascades swiftly over a series of artificial steps and then flows more slowly through a short stretch of woodland. It then passes under a road bridge and thereafter flows through open fields before joining the River Allander about one kilometre from the loch. The first specimens of *B. paludosa* were collected just below the bridge and others were found subsequently both here and in the woodland section of the burn above the bridge.

On the 29th September, 1962, a series of five collections was taken in order to determine the abundance of *B. paludosa* and other species of leech at different stations in this area. Each collection was made for a standard period of twenty minutes, during which time the substrate at each station was examined for leeches all of which were collected and later identified. The results of this survey are given in Table 1. The five stations collected at are as follows: (1) Loch. Here, just above the outflow, the water is shallow and the bottom consists mainly of mud with some stones and many dead twigs and leaves. Beech trees overhang the water and there are several large clumps of *Callitriche* at the edge of the loch. (2) Outflow. This station is at the foot of the cascade mentioned above, and the water flow here is very fast and the substrate stony. Most of the stones have a growth of *Fontinalis* and other mosses and this stretch is heavily shaded by beech trees. (3) Wood. The current here is slower and the substrate consists for the most part of small stones and gravel with a few larger stones. *Fontinalis* and *Callitriche* are present and again there is heavy shading by beech trees. (4) Bridge. Conditions here are similar to those at station 3, though large stones are more numerous and the water is shaded by the road bridge and a series of water pipes instead of trees. As well as *Fontinalis* and *Callitriche* there is a large clump of *Sparganium* growing in mid-stream. (5) Field. The burn is canalised here with high banks on either side opening out to fields. The current is fast, but in spite of this the bottom is soft, and there is a dense emergent vegetation consisting mostly of *Typha*, *Nuphar* and *Hippurus*. *Callitriche* and *Elodea* are also common here.

Station	<i>Batracobdella paludosa</i>	<i>Helobdella stagnalis</i>	<i>Glossiphonia heteroclita</i>	<i>Glossiphonia complanata</i>	<i>Theromyzon tessulatum</i>
1. Loch	2	1	—	—	—
2. Outfall	2	3	8	—	—
3. Wood	19	47	40	20	—
4. Bridge	17	55	27	10	1
5. Field	—	—	—	—	—

TABLE 1—Numbers of leeches collected in twenty minutes at each of five stations in the Dougalston area on 29th September, 1962.

It can be seen from Table 1 that at stations 3 and 4 *B. paludosa* was common whilst at the other stations it was uncommon or absent. The stretch of Dougalston Burn including both of these stations would thus appear to represent a very suitable habitat for this species. The burn here is less than 10 metres across and its banks are steep. Water depth varies from a few centimetres at the edge to

about 40 centimetres in mid-stream. As mentioned above, clumps of *Fontinalis* and *Callitriche* are present and the stream is heavily shaded in all places. The substrate consists of sand, gravel and stones and it is underneath the latter that most leeches are found. Dead twigs and leaves are common here too and leeches are also found attached to these. The speed of the current is variable but in mid-stream at the surface speeds of about 15 centimetres per second have been recorded at normal water level.

Table 1 shows also that the other species of leech common in the area—*Glossiphonia complanata* (L.), *Glossiphonia heteroclita* (L.) and *Helobdella stagnalis* (L.)—have a similar distribution to that of *Batracobdella paludosa*. All these leeches are known to be predatory on various species of invertebrates, and the reason for their abundance in this short stretch of stream is almost certainly connected with the large numbers of such invertebrates which occur here. The fauna of Dougalston Burn is rich, and in addition to the four species of leech mentioned above, *Ephydatia*, *Polycelis*, *Dendrocoelum*, *Asellus*, *Hydropsyche*, *Simulium*, *Physa*, *Planorbis* and *Sphaerium* are all abundant. It can be seen that several of the non-carnivorous members of this community are filter-feeders of one kind or another, dependent for their food on the amount of organic material carried in suspension by the water. Müller (1955) has shown that large numbers of such "passive feeders" are typical of the invertebrate communities found below lake outflows, where the presence of large amounts of plankton which continually drift out of these lakes affords them a constant source of food. Dougalston Loch, then, has an important bearing on the richness of the invertebrate fauna below its outflow.

Under such conditions *B. paludosa* appears to be able to thrive at densities much higher than previously found in Great Britain. Its absence further downstream at station 5 is probably due not only to a diminished food supply but also to the absence of an adequate stable substrate in this stretch. The distribution of other species of leech appears to be similarly affected. This is of particular interest in the case of *Glossiphonia heteroclita*, which Mann (1953) found to be absent from running water and of commonest occurrence at the base of plant stems (e.g. *Typha*) in still water. In Dougalston Burn, this species is apparently uncommon at the base of *Typha* but very common under stones in flowing water. The species occurs under stones even at station 2 in conditions which are almost torrential. The extremely rich source of food from the loch is presumably responsible for this unusual distribution.

MORPHOLOGY

The recent diagnosis of *Batracobdella paludosa* given by Mann (1953) agrees essentially with that of previous workers such as Johansson (1909). Basically *B. paludosa* is described as a soft-bodied, smooth, greenish brown leech which is 7 to 13 mm. long by 4 to 5 mm. broad when at rest. There are two pairs of eyes which are often fused, and the crop has seven pairs of lateral diverticula. The specimens of this species collected in Stirlingshire agreed with the above description in some respects but not in others, and moreover differed in several points of finer detail from the accounts given by previous workers.

The body colour of all the living specimens examined was greenish brown with six longitudinal rows of irregular yellowish spots. There were never any longitudinal brown lines of the type described by Mann (1953) as characteristic, and it is evident that there must be considerably more colour variation within this species than was originally suggested.

All previous workers on *B. paludosa*—except Bennike (1943)—mention two pairs of eyes (often fused in various ways) as being diagnostic of this species, and this character is used in the keys given by Johansson (1909), Bennike (1943), and Mann (1953, 1954 and 1962). Bennike (1943) does mention that three pairs can occur, but considers two pairs to be normal. A characteristic feature of the specimens collected from Dougalston Burn was the possession of three pairs of eyes. These were typically as shown in fig. 1C, the first pair being further apart and smaller than the others, of which the anterior pair is usually the larger. Generally the three eyes on each side were fused to a greater or lesser degree, and occasionally specimens were found which had one or more eyes missing on either side. The few specimens collected from the River Endrick appeared to possess only two pairs of eyes, fused on either side in the manner figured by Bennike (1943).

The essential distinction between *Glossiphonia* and *Batracobdella* lies in the number of crop diverticula—the former having six of these and the latter seven. Bennike (1943) and Mann (1954) both give comparative figures of the crops of these two leeches showing this distinction. The Stirlingshire specimens of *Batracobdella* naturally possessed the diagnostic seven pairs of crop diverticula, but their position differed from the figures given by the above two workers. These figures indicate that the arrangement of the crop diverticula is similar in both *G. complanata* and *B. paludosa*, i.e. the paired diverticula being given off laterally from the main crop in a symmetrical manner with a portion of the main crop between each pair. The last pair is always the largest and deflected

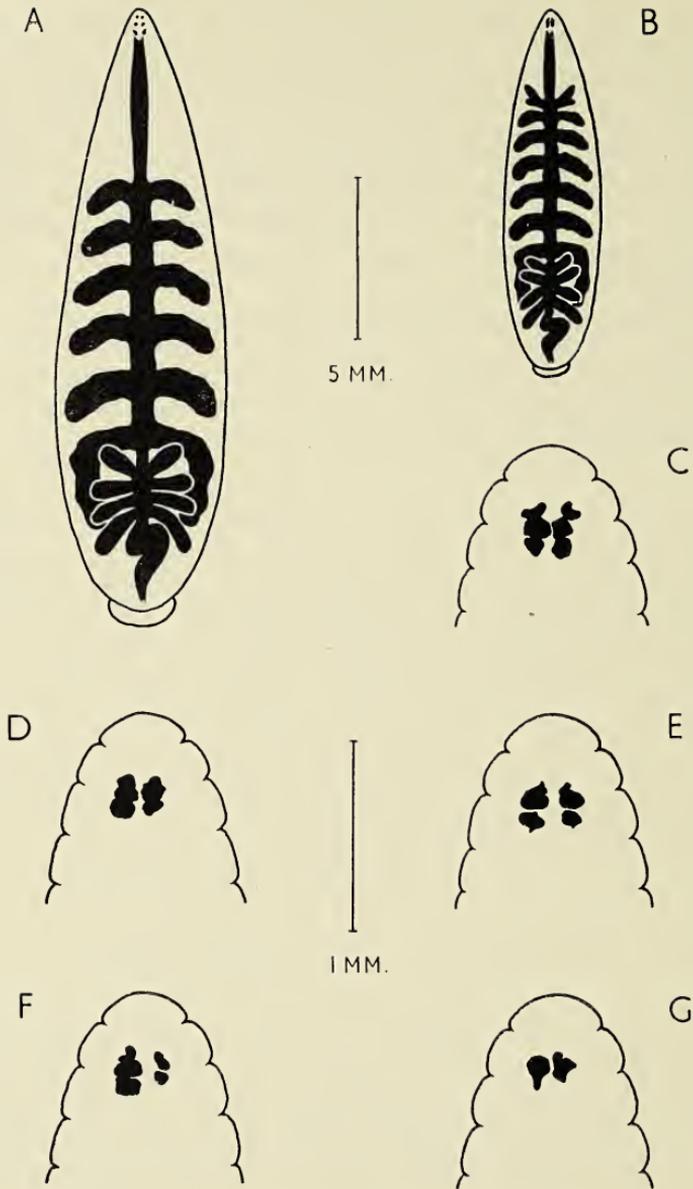


FIGURE 1. A—*Glossiphonia complanata*, gut; B—*Batracobdella paludosa*, gut; C—*B. paludosa*, eye arrangement in a typical specimen from Dougals-ton Burn; D, E, F—*B. paludosa*, variations of eye arrangement in specimens from Dougals-ton Burn; G—*B. paludosa*, eye arrangement in a specimen from River Endrick.

posteriorly, whilst all the others run laterally with slight posterior flexion. In all the specimens of *B. paludosa* from Stirlingshire, however, the first pair of diverticula was rather distinct from the remaining six, there being no distinct portion of the main crop between it and the second pair (fig. 1B). Moreover this first pair of diverticula was found always to run laterally and anteriorly, this anterior flexion being very marked in well relaxed specimens. Another characteristic feature about this pair of diverticula is that each appears to be always bi-lobed. Autrum (1936) has pointed out that the crop diverticula of *Glossiphonia* are undivided, whilst those of *Batracobdella* are secondarily lobed, but Bennike (1943) maintained that this was not always the case—the diverticula of *Glossiphonia* being sometimes distinctly lobed and those of *Batracobdella* entire. It would seem probable that the amount of food in the crop must have an important bearing on whether or not the diverticula appear to be lobed and this must be taken into account when considering this character. Of the many *Glossiphonia* and *Batracobdella* examined recently which possessed full crops only the first pair of diverticula in *Batracobdella* showed regular lobation (fig. 1B). None of the other six pairs of diverticula in *Batracobdella* or any of the six pairs in *Glossiphonia* were ever distinctly lobed. The figure of *B. paludosa* given by Autrum (1936) shows the first pair of crop diverticula to be directed anteriorly and to be bi-lobed, but the other diverticula are also indicated as being lobed.

Figures 1A and 1B, showing the distinction between the first pair of crop diverticula in *Glossiphonia complanata* and *Batracobdella paludosa*, were drawn from relaxed specimens with full crops which were cleared and mounted whole. Some contracted specimens of *B. paludosa* prepared in this way failed to show clearly the forward position of the first pair of diverticula. The drawings given by both Bennike (1943) and Mann (1954) appear to have been made from dissected specimens which were in a contracted condition, and it is probable that the differences between their figures and those in the present account are due to these different methods used in the preparation of specimens.

BEHAVIOUR

During the present study it was noted that there are certain characteristic differences between the behaviour of *Glossiphonia complanata* and that of *Batracobdella paludosa*. These may prove useful to distinguish between the two species in the field.

The change in body shape of the two species as they move is notably different and this may well be connected with the differences in the consistency of the bodies noted by Mann

(1954)—that of *G. complanata* having a firm consistency whereas that of *B. paludosa* is soft. When moving forward *B. paludosa* extends its body far more in proportion to its size than does *G. complanata*. On average it was found that specimens of *B. paludosa* extended their bodies about 2.5 times their length at rest, whilst *G. complanata* extended only about 1.5 times in making the same movement. The general shape of the body is similar in the two species when they are at rest (figs. 1A and 1B), but when fully extended *B. paludosa* becomes almost parallel-sided and much more elongate than *G. complanata*, the sides of which are always distinctly convex.

When alarmed, both species contract sharply and remain in this contracted state for some time. The position of their bodies relative to the substrate at this time is different in the two species. *B. paludosa* remains attached by its posterior sucker with its anterior sucker well off the substrate and with its ventral surface convex, whilst *G. complanata* lies close to the substrate with which both anterior and posterior suckers remain in contact. Its ventral surface is normally flat, or even slightly concave. Of the two, *B. paludosa* appears to be the more active leech.

It is clear, therefore, that the essential distinguishing feature between *Glossiphonia* and *Batracobdella* lies in the number of crop diverticula. Most of the other characters—including the number of eyes and their position—overlap in the two animals, and are thus less satisfactory in making a reliable distinction. The differences in behaviour noted above are obviously of use only where live specimens are available, and even then may be subjective.

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OBSERVATIONS ON INSECTS AND ARACHNIDS FROM THE SCOTTISH SOUTH COAST

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(MS. received 20th December, 1962)

The southern coasts of England have long been favoured as collecting grounds by British botanists and entomologists, as many species occur there which are rare or absent in other parts of England. Most of these species are more characteristic of lands lying further to the south, such as France. Very few Scottish naturalists seem to have realized that the southern coast-line of Scotland—from the Mull of Galloway to the Nith estuary or beyond—shows considerable analogies with the English south coast. In both cases a narrow coastal strip enjoys a sunnier and drier climate than the hinterland, south-facing “suntraps” are frequent, and winters are particularly mild. No doubt as a result of these conditions, various species of plants and invertebrate animals occur along the Scottish south coast which are rare or absent in other parts of the country. For most such species, the main British occurrences are in central and southern England; the Galloway coastal fauna stands to that of southern England in much the same relation as the English coast fauna stands to that of France.

It may be worth recording here that we have observed the Great Mullein (*Verbascum thapsus*) growing as an evidently established member of plant communities at Rascarrel Bay and Castle Hill Point—at the latter of which localities it was recorded nearly a century ago by the Dumfries and Galloway Naturalists. The two mallows, *Malva moschata* and *M. sylvestris*, also occur fairly commonly along this coast. Both the *Verbascum* and the *Malva* support specific insects in England; though we have not yet found any of these in Galloway, further searches are planned.

Most of our records are from Castle Hill Point, Rockcliffe, Kirkcudbrightshire, which we visited twice; others are from single visits to Rascarrel Bay, south of Auchencairn, Kirkcudbrightshire; Torrs peninsula, Auchencairn; Mull of Galloway; Brighthouse Bay, south of Borgue, Kirkcudbrightshire; and Luce Bay, Wigtownshire. Species marked with an asterisk are apparently new to the Scottish fauna.

**Armadillidium pictum* Brandt (Crustacea-Isopoda)

Many specimens emerged from a turf sample from Castle Hill Point, collected on 19th September, 1962. The northern-

most previous British record of the species, according to Edney (1953), is from Westmorland.

Leptophyes punctatissima Bosc. (Orthoptera-Tettigoniidae)

We collected nymphs of this from Castle Hill Point on 4th July, 1962, and an adult male and female from the same locality on 19th September, the habitat in both instances was tallish rough vegetation with some brambles. An old record of this species from Luce Bay (Gordon, 1906) is ignored in the work of Hincks (1949), who gives no records further north than Lincolnshire for it. It is the only long-horned grasshopper known to occur in Scotland.

**Himacerus mirmicoides* Costa (Hemiptera-Nabidae)

An adult, and several of the ant-like nymphs, of this emerged from a turf sample from Castle Hill Point, collected on 19th September, 1962. Southwood and Leston (1959) record the species as rare in the north of England and absent from Scotland.

Berytinus signoreti Fieb. (Hemiptera-Berytinidae)

Adults of this were obtained from a turf sample from Castle Hill Point, collected on 19th September, 1962. It appears to be a mainly southern species particularly associated with calcareous downlands, though there are one or two previous records from eastern Scotland.

**Phytocoris varipes* Bohem. (Hemiptera-Miridae)

Several adults were obtained by sweeping rough vegetation at Castle Hill Point on 19th September, 1962. The species is not recorded from Scotland by Southwood and Leston (1959).

Ochlodes venata Brem. & Grey (Lepidoptera-Hesperiidae)

We observed the Large Skipper butterfly at Castle Hill Point on 4th July, 1962. There are previous records of it from the Scottish lowlands, but we have never seen it in Scotland before.

Lebia chlorocephala Hoffm. (Coleoptera-Carabidae)

An adult of this was swept from herbage at Castle Hill Point on 19th September, 1962. The species had previously been found by one of us (E.A.C.) at Kinraig Head, Elie, Fife (15th May, 1955). There is an old record by Lennon from near Dumfries, and a specimen in the Fergusson collection with the label "Ayr: about the roots of broom". Morris Young appears to have collected the species from the Paisley area long ago, and Murray (1853) also cites records from Lairig (Sutherland) and Berwickshire.

Olibrus aeneus F. (Coleoptera-Phalacridae)

Adults of this were abundant on *Matricaria* flowers at Torrs peninsula (2nd July, 1962) and Castle Hill Point (4th July, 1962); larvae were collected in *Matricaria capitata* at the latter locality on 19th September, 1962. We have not seen the species in Ayrshire (despite abundance of the *Matricaria* at points on the coast) or elsewhere in Scotland, though Thompson (1958) cites records from Dumfriesshire, Berwickshire and Perthshire.

**Scymnus frontalis* F. (Coleoptera-Coccinellidae)

A specimen, apparently belonging to the form of this species with unspotted elytra, was beaten from willow scrub at Rascarrel Bay on 3rd July, 1962. The species appears not to have been recorded from further north than the Birkdale sandhills of Lancashire hitherto.

Subcoccinella 24-punctata L. (Coleoptera-Coccinellidae)

This was found breeding on white campion (*Silene* sp.) at Mull of Galloway on 19th August, 1960, and on this and other plants at Torrs peninsula (2nd July, 1962) and Castle Hill Point (4th July, 1962). There is a specimen in the Fergusson collection from Ailsa Craig, but we have never found it in apparently suitable localities on the Ayrshire coast. There are published records from Berwickshire and the Solway region.

**Phylan gibbus* F. (Coleoptera-Tenebrionidae)

Adults and larvae were collected under decaying drift above high water mark at Luce Bay on 19th August, 1960. We have also found the species on several occasions at Turnberry, Ayrshire, in similar conditions. We have seen no other Scottish records of it.

Lagria hirta L. (Coleoptera-Lagriidae)

Adults and larvae of this were collected in more or less abundance at Torrs peninsula, Rascarrel Bay, and Castle Hill Point, but we have never found it in Ayrshire or elsewhere in western Scotland. There are published records for a few points on the East coast.

Crepidodera transversa Marsh. (Coleoptera-Chrysomelidae)

One example of this was swept from a marshy area at Rascarrel Bay on 3rd July, 1962. We have not found this species in Scotland, though there are records from Ayrshire and Argyll.

Aphthona herbigrada Curtis (Coleoptera-Chrysomelidae)

Specimens of this were obtained at Castle Hill Point, on Rock Rose (*Helianthemum*) on 19th September, 1962.

According to Norman Joy (1932) it has previously been recorded from south-west Scotland, but we have been unable to trace the locality.

Anthonomus rubi Hbst. (Coleoptera-Curculionidae)

Specimens of this were swept from mixed herbage at Rascarrel Bay on 3rd July, 1962. The food-plant was not established but could be some species of Rosaceae. We have not found the species elsewhere in western Scotland, though there are published records from both the south-east and the south-west.

**Atypus affinis* (Araneae-Atypidae)

An immature *Atypus affinis* emerged from a turf sample collected at Castle Hill Point on 4th July, 1962, when it was warmed in a Tullgren funnel. In September, 1962, the site was revisited but no further specimens of this species were obtained although there must surely be a breeding colony there. Until 1955 the only published locality for this species north of Cambridge was "near Carlisle" (Blackwall, 1861) and this record has been omitted from more modern works. On 23rd May, 1955, turf samples were taken (by R.A.C.) from a field near Silverdale station in Lancashire. From this sample five immature *Atypus affinis* emerged when it was warmed in a funnel. A subsequent visit to the site revealed the presence of a strong breeding colony. More recently Mr. I. L. Crombie has found *A. affinis* at Whitbarrow in Westmorland (private communication). It is probable that the distribution of this species is much wider than has been supposed but that its presence has been undetected in many places because of its habit of living in burrows.

**Dictyna latens* (Araneae-Dictynidae)

Two females were taken from marshy ground at Rascarrel Bay (3rd July, 1962). This species has not to our knowledge been previously recorded from Scotland but it is widespread in England and occurs in Ireland.

**Scotina celans* (Araneae-Clubionidae)

A sample of herbage was taken from Castle Hill Point on 19th September, 1962. When this was warmed a male *Scotina celans* emerged. This species has not previously been recorded from Scotland although it is fairly widespread in England and there have been some records from Ireland. On 24th October, 1962, two females were taken (by R.A.C.) at Dumbarton Rock. It was thought at first that these were *S. palliardi* but Mr. G. H. Locket has examined the specimens and says that they,

too, are *S. celans*. It is probable that this species will be discovered in coastal sites between Castle Hill Point and Dumbarton if a search is made in the autumn months.

**Entelecara acuminata* (Araneae-Linyphidae)

Two females were beaten from oak at Torrs peninsula on 2nd July, 1962, and a male and a female were taken from trees at Rascarrel Bay on 3rd July, 1962. This species has not previously been recorded from Scotland but it is widespread in England.

Bathyphantes setiger (Araneae-Linyphidae)

A female of the species was swept from herbage at the edge of the sand at Red Haven Bay, Old Torrs peninsula, on 2nd July, 1962. Records of this species in England are few but fairly widespread; the only Scottish record which we have seen is from Lochinver in Sutherland (Parker, 1959).

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THE FRESHWATER FAUNA OF HIRTA, ST. KILDA

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(MS. received 24th January, 1963)

Many naturalists have visited St. Kilda in the past and several records of the invertebrate fauna of the island have been published. (See Stewart, 1937, for a bibliography up to 1936.) These accounts contain few references to freshwater species and in those papers dealing with insect groups having aquatic immature stages, only imagines appear to have been collected. Accordingly, during the Glasgow University expedition to the island from 20th June, to 3rd July, 1956, the opportunity was taken to make a collection of the freshwater fauna.

It had been assumed that all the tarns, wells and streams marked on the Ordnance Survey map (Mathieson, 1928) represented the permanent bodies of fresh water on the island but it was found that of the streams two, Amhuinn Gleshgil and Amhuinn Ruaival (see map page 234), were completely dry while sections of other streams consisted of pools connected by trickles of water running below the surface. In contrast to this a number of pools and streams not marked on Mathieson's map were found and although none of these was large, some at least were thought to be permanent. For instance, a series of small peat pools was present along the northern part of Leacan an t'Sluic Mhoir. Some of these were overgrown with *Potamogeton* sp. and *Callitriche* sp. and most were drained by tiny streams. Peat pools were also found on The Cambir and on Mullach Sgar and there was some standing water on the marshy ground behind the storm beach in Village Bay.

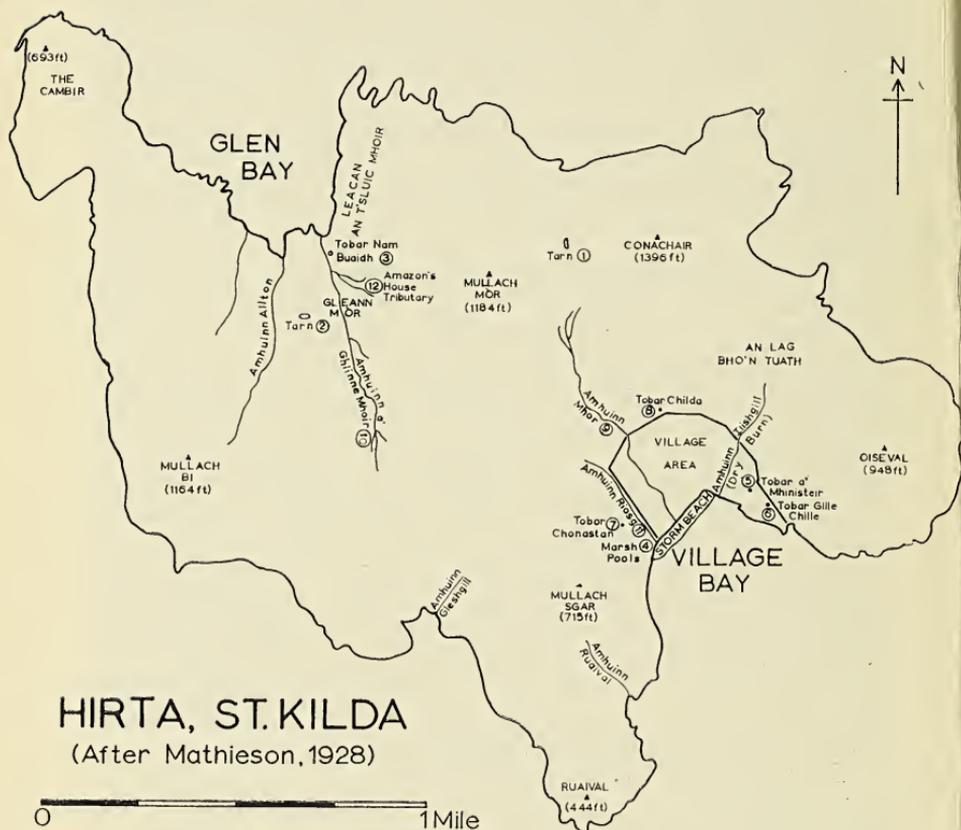
The presence of water at places other than those marked on the Ordnance map suggested that recent rainfall had been near average and that the two dried-up streams referred to above were in their normal mid-summer condition. These two streams must therefore be considered temporary.

After a heavy rainstorm on 29th June some pools appeared in the Dry Burn (Amhuinn Ilishgil) and on 1st July water was running in the bed of this stream from some gravelly pools beside the sheep fanks on An Lag Bho'n Tuath to just inside the Village Area wall. This indicates that the so-called "Dry Burn" is dry only in certain seasons and that other temporary bodies of water may be formed after heavy rain.

Taking the above differences into account an attempt was made to examine and sample all freshwater habitats on the

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main island of Hirta. Although collections were made at more than thirty different localities, all the species found occurred in one or more of the twelve habitats described below. These habitats can be grouped into four distinct categories: (a) tarns, (b) marsh pools, (c) wells and springs, and (d) streams.



Tarns

1. Tarn between Conachair and Mullach Mòr. This peat pool lies at 1000 feet above sea level and is 15 yards long by 2 yards wide. It has an even depth of just over a foot and the bottom is formed of granitic sand overlying solid strata. A thin layer of organic detritus covers the bottom and *Potamogeton* sp. is present over half the area of the tarn, along the edges of which grow various mosses. It is surrounded by several smaller pools.

2. Tarn in Gleann Mòr. This peat pool is only 250 feet above sea level. It is 18 yards long by 11 yards wide and has a maximum depth of 18 inches. The bottom has a deep

layer of organic silt and although reeds grow at either end there is a fair proportion of open water. There are some smaller pools alongside.

3. Tobar Nam Buaidh. Although named as a well (= *tobar*) this pool is similar to those found on Leacan an t'Sluic Mhoir. It lies at 200 feet above sea level and is about 5 yards in diameter. It is 10 inches deep and almost entirely filled with *Potamogeton* sp. and *Callitriche* sp.

Marsh Pools

4. Several marsh pools lie behind the storm beach in Village Bay formed by water from Amhuinn Riasg and a stream from Tobar Chonastan. The substrate is gravel and sand in many places and, although there is much emergent vegetation, the water is not peaty. At the time of the visit there appeared to be a slow flow of water through the pools and out under the storm beach.

Wells and Springs

5. Tobar a'Mhinisteir. This well, which is just less than a yard square, holds water to a depth of 6 inches. The bottom is sandy with a little filamentous algae and there is a good flow of clear, potable water. The well is lined with blocks of stone and protected by a dry-stone cover.

6. Tobar Gille Chille. This well is a little larger than Tobar a'Mhinisteir but only 4 inches deep. There is no apparent outflow and the well is almost completely choked with filamentous algae. It is again lined and covered.

7. Tobar Chonastan. These two natural springs issue from steeply-sloping ground, and had very poor flow when visited.

8. Tobar Childa. These form a group of natural springs arising in marshy ground.

Tobar na Gille and what was taken to be Tobar a'Chleirich were no more than damp patches at the time of the visit and were not sampled. The difficulties involved in landing on the adjacent island of Soay prevented inspection of the area marked on the Ordnance Survey map as Tobar Ruadh.

Streams

9. Amhuinn Mhor. The largest stream on the island, it drains the boggy ground at 800-900 feet between Conachair and Mullach Mòr. The first part of its course is very steep with numerous rock slopes while the major portion of the stream (almost three quarters of a mile) is narrow, fast-flowing and cut down to bed-rock in many places. Over the last one hundred yards it widens out into a slower stream with pools of up to two yards wide and gently sloping banks. It finally reaches the sea after wandering under and among

TABLE 1—Freshwater fauna found on Hirta, St. Kilda, June/July, 1956.

	Tarns			Marsh Pools 4	Wells and Springs			Streams				
	1	2	3		5	6	7	8	9	10	11	12
TURBELLARIA												
<i>Crenobia alpina</i> (Dana)												+
? <i>Planaria torva</i> Mull.								+				++
OLIGOCHAETA												
<i>Nais communis</i> Piguet	+	+										+
<i>N. elinguis</i> O. F. Müller								+	+			++
<i>Pristina</i> spp.												++
<i>Marionina</i> sp.												+
<i>Lumbricillus</i> sp.												+
<i>Fridericia</i> sp.			+									+
<i>Stylodrilus</i> sp.	+											+
<i>Lumbriculus variegatus</i> Grube	+	++										+
<i>Eiseniella tetraedra</i> (Savigny)												+
ROTIFERA												
<i>Asplanchna</i> sp.	+											
<i>Anurea</i> sp.	+		+									
CLADOCERA												
<i>Alona quadrangularis</i> (O. F. Müller)	+		+									
<i>Alonella excisa</i> (Fischer)	+	+	++									
<i>Chydorus sphaericus</i> (O. F. Müller)	+	+	+++									
OSTRACODA												
<i>Cypria ophthalmica</i> Jurine	+	++	++									
COPEPODA												
<i>Canthocamptus zschokkei</i> Schmeil												+
<i>Cyclops agilis</i> Koch		+++	+									+
<i>C. bisetosus</i> Rehberg			+									+
AMPHIPODA												
<i>Gammarus duebeni</i> Lilljeborg				+++				++	+			+
HEMIPTERA												
<i>Velia caprai</i> Tamanini <i>n., a.</i>				+								+
<i>Corixa wollastoni</i> (Douglas & Scott) <i>n., a.</i>	+	+	+									
TRICHOPTERA												
<i>Limnephilus griseus</i> (L.) <i>a.</i>												+
<i>L. sparsus</i> Curtis <i>a.</i>												+
<i>Plectrocnemia geniculata</i> McLachlan <i>l., p.</i>	+			+		++	+++	+				++
<i>Philopotamus montanus</i> (Donovan) <i>l., a.</i>								+				+
COLEOPTERA												
<i>Hydroporus pubescens</i> (Gyllenhal) <i>l., a.</i>	++	+	++									
<i>Agabus bipustulatus</i> (L.) <i>l., a.</i>	+	+	+									
<i>Helophorus flavipes</i> F. <i>a.</i>								+				
<i>Anacaena globulus</i> (Paykull) <i>a.</i>	+							+				
<i>Helodes minuta</i> (L.) <i>l.</i>				+				+				+
DIPTERA												
Tipulidae												
<i>Tipula rufina</i> Meigen <i>l.</i>								+				+
<i>Dicranota</i> sp. <i>l.</i>												+
Chironomidae												
<i>Anatopynia</i> (<i>Macropelopia</i>) sp. <i>l.</i>	+			+++								++
<i>Diamasa</i> spp. <i>l., p.</i>								++				+
<i>Orthocladus</i> spp. <i>l., p.</i>				+				++				+++
<i>Corynoneura</i> sp. <i>l.</i>								+++				+
<i>Tanytarsus</i> sp. <i>l.</i>	+							+				++
Ceratopogonidae												
<i>Palpomyia</i> sp. <i>l., p.</i>				+				+				+
Thaumaleidae												
<i>Thaumalea</i> sp. <i>l.</i>								+				+
HYDRACARINA												
<i>Sperchonsquamosus</i> Kramer												++
<i>S. glandulosus</i> Koenike												++
MOLLUSCA												
<i>Pisidium casertanum</i> (Poli)		+	++		++							
<i>P. hibernicum</i> Westerlund		+										+
PISCES												
<i>Anguilla anguilla</i> (L.) elvers												++

n. = nymph, *l.* = larva, *p.* = pupa, *a.* = adult

the large boulders of the storm beach and down the gently-sloping sandy beach of Village Bay.

10. Amhuinn a'Ghlinne Mhoir. The second largest stream, it arises on the slopes between Mullach Mòr and Mullach Bi at a level of about 500 feet and runs down the length of the "glen" in a series of rock-strewn riffles and small pools. There is no beach in Glen Bay and this stream reaches the sea by way of an almost vertical drop of 20-30 feet over exposed rock.

11. Amhuinn Riasg. A small stream draining the hillside at the west end of the village, it has most of its course running along the outside of the western boundary wall of the Village Area. It joins with the stream from Tobar Chonastan to form the marsh pools behind the storm beach.

12. A tributary to Amhuinn a'Ghlinne Mhoir runs from the region of the Amazon's House. It was only a trickle at the time of sampling.

Amhuinn Alltan and the unnamed stream to the west of it are very similar in character to Amhuinn a'Ghlinne Mhoir (see 10 above) and as their faunas were also found to be similar, they have not been included in the faunal lists.

The Fauna

A list of the animals found is given in Table 1 and the relative abundance of each species is indicated by the number of plus signs.

TURBELLARIA. As there is no previous record of Turbellaria from St. Kilda it is unfortunate that the difficulty of preserving these flatworms in good condition leaves the identification of some of the specimens open to doubt. Those thought to be *Planaria torva* may be a pale, atypical form of *Dugesia lugubris*.

Crenobia alpina was taken within the first few feet of a stream running from the spring, Tobar Childa, a typical habitat of this species.

OLIGOCHAETA. Only two of the present list of oligochaete worms have been recorded previously. *Eiseniella tetraedra* was found in soil by Boyd (1956) and a species of *Marionina* (*M. sphagnetorum*) was recorded from moss by Evans (1912).

Of the new records, the genus *Fridericia* is mostly terrestrial and some species of *Lumbricillus* are found in saline conditions. The rest are typical freshwater forms, although both species of *Nais* are sometimes found in brackish water.

ROTIFERA. Murray (1905) found two species of rotifers, *Anurea cochlearis* and *Polyarthra platyptera*, in the open

water of the tarns, but not *Asplanchna*. All three genera are cosmopolitan.

CLADOCERA and OSTRACODA. No previous records could be traced for these groups. The four species found are among the most widely distributed of all the freshwater "entomostraca".

COPEPODA. Again no earlier records could be found. *Canthocamptus schokkei* is a widely distributed stream harpacticid, *Cyclops agilis* is found typically in weedy tarns and *C. bisetosus* is eurythermous and euryhaline.

AMPHIPODA. The identification of *Gammarus duebeni* has been kindly confirmed by Dr. H. B. N. Hynes and its occurrence on St. Kilda fits in well with the known pattern of distribution (Hynes, 1954). *G. duebeni* was noted by Evans (1906) but Hewitt's record of *G. pulex* in 1907 is almost certainly incorrect.

HEMIPTERA. Earlier collectors of aquatic Hemiptera (Waterston, 1906 and Lack, 1932) recorded only *Velia currens* which is now thought to be absent from Britain. The pond-skaters taken during this visit were determined from the key by Macan (1956) and found to be *V. caprai*, the more widely spread of the two British species.

Dr. Macan has kindly confirmed the identification of *Corixa wollastoni*, which appears to have been overlooked by the previous collectors.

TRICHOPTERA. All the species of caddis flies listed in Table 1 have been recorded as adults (Morton, 1906, and Lack, 1932) and Lack also took adults of *Stenophylax permistus*, *Micropterna sequax* and *Tinodes aureola*. The present collections included some unidentified larvae and pupae belonging to the family Sericostomatidae and some empty larval and pupal cases, possibly Limnephilidae and Leptoceridae. No Sericostomatidae or Leptoceridae have been recorded for St. Kilda.

COLEOPTERA. Lack (1931) collected adults of all the species of water beetles found in 1956, but he used the synonym *Helophorus aeneipennis* for *H. flavipes*. All five species recorded here are widespread in Britain.

DIPTERA. With the exceptions of *Corynoneura* sp. and *Dicranota* sp., all the dipterous larvae found in 1956 are mentioned as adults in the composite list of 153 species taken on St. Kilda up to 1931 (Edwards and Collin, 1932).

The lack of suitable keys to the immature stages of Diptera prevented the identification being taken beyond genus in most cases but five different types of *Orthocladius* larvae and two distinct *Diamesa* larvae were noted. However, even if

these are taken into account the present list falls far short of the 40 species in the composite list which could have aquatic larvae and pupae. This disparity, and the fact that two new records were added to a list which was already long, underlines the difficulties of making comprehensive collections of insects during short summer visits.

HYDRACARINA. No previous records could be found. Both species listed here are widely distributed in Britain.

MOLLUSCA. In the only previous account of molluscs from St. Kilda, Waterston and Taylor (1906) recorded one species of *Pisidium* using nomenclature now obsolete. The two species now found were identified by Dr. W. D. Russell Hunter and a fuller account has been published elsewhere (Hunter and Hamilton, 1958).

PISCES. There appears to be no mention of eels in any of the previous accounts of the natural history of St. Kilda. Elvers were found only in Amhuinn Mhor, the one stream on the island running out across a shelving beach. The steep rock slopes at the outlets of the streams in Glen Bay may form impassable barriers to the ascent of the elvers.

DISCUSSION

Although collections of freshwater invertebrates taken at one time of the year are not likely to include all the species present, the freshwater fauna of St. Kilda does seem to be poor in species. With the exception of *Chydorus sphaericus*, *Cyclops agilis*, *Gammarus duebeni*, *Plectrocnemia geniculata* and some chironomid larvae, the fauna is low also in total numbers.

While little is known of the physical and chemical conditions in the freshwater habitats of the island, this limited type of fauna is to be expected from the geology and the latitude of St. Kilda. However, the degree of isolation also contributes to the lack of variety in the freshwater fauna, since in similar ecological situations on the mainland and on other Hebridean islands, representatives of the Ephemeroptera, Plecoptera and Gastropoda are usually present. These three orders were not represented in the 1956 collections on St. Kilda. Elsewhere, the distribution maps of Macan (1961) show five species of Ephemeroptera for Lewis and Harris and eleven species for the western mainland of Scotland and Heslop Harrison (1938) lists five mayfly species for Raasay, three species for Scalpay and one species for South Rona.

Collections of Plecoptera by Corbet (1959 and 1962) include eleven different species from various Hebridean islands and sixteen species from the mainland. With regard to the freshwater Gastropoda, McMurtrie (1893) found three

species on Eigg and Roebuck's summary (1918) of molluscan distribution in the Outer Hebrides lists three species from Lewis, three from North Uist, three from Barra and one from South Uist. This paper gives *Lymnaea peregra* for St. Kilda and attributes the record to J. Waterston although Waterston's own paper (1906) on the collections he made in 1905 does not mention it. G. Heslop Harrison's records of Mollusca (1937) mention three species from South Rona, five from Raasay, three from Scalpay, four from Coll and one from Fladday.

Various species of Megaloptera and Neuroptera have been taken on Raasay and adjacent islands (Harrison, 1938).

Some representatives of the orders mentioned above may yet be found on St. Kilda but the records to date suggest that isolation is partly responsible for the absence of some freshwater animals from the island.

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**RECORDS OF *Gobius paganellus* FROM
WESTERN SCOTLAND**

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(MS. received 7th January, 1963)

The Rock Goby, *Gobius paganellus* L., is a marine gobiid (Teleostei-Percomorphi) with an extensive geographical range stretching from the Black Sea, through the Mediterranean, and along the Atlantic shores of continental Europe north to Wimereux in the Pas de Calais, but appears to be absent from the North Sea (Ninni, 1938; Vivien, 1939; Iljin, 1957). The southern limit of distribution in the Atlantic appears to be at Madeira (Maul, 1949). In their important work on the British gobies, Holt and Byrne (1903) stated that *G. paganellus* does not extend north of the Firth of Clyde or the Firth of Forth.

In the British fauna, *G. paganellus* has probably been confused with a related species, *G. niger* L., the so-called Black Goby, which is widely distributed around the British Isles and which occurs to the north along the Norwegian coast as well as in the Baltic. The diagnostic characters of the two species are given in a key by Holt and Byrne (1905) (reproduced by Jenkins, 1925, 1936) and have recently been summarised by Wheeler (1960). There are also marked differences in habitat, *G. niger* being sublittoral and estuareni on sandy or mud grounds, while *G. paganellus* occurs in intertidal pools on rocky shores and among sublittoral rocks. Although the occurrence of the latter in the North Sea requires confirmation, there are many authenticated records from the western coasts of England and Wales, the Isle of Man, and Ireland, including the North (Day, 1880-84; Holt and Byrne, 1903; Williams, 1954; Bassindale and Barrett, 1957; Marine Biological Association, 1957; Wheeler, 1960; Miller, 1961a, 1961b; Ellison and Chubb, 1962; M. Golden, personal communication).

For Scottish waters, this goby was again recorded in the Clyde Sea Area by Elmhirst (1926) at Millport, Isle of Cumbrae. However, an old reference and present findings show that this species extends farther north along the west coast of Scotland than was originally believed by Holt and Byrne. Over seventy years ago, Harvie-Brown and Buckley (1888) noted that *G. paganellus* was found at low tide on rocky ground at Loch Creran, Argyllshire. There seems no reason to doubt this identification, especially since *G. niger* was distinguished at the same locality in a characteristic brackish habitat.

During the spring and summer of 1962, several collections of littoral fishes have been made by the authors on the west coast of Scotland. Although not very numerous, they have yielded some interesting records of *G. paganellus*. Lengths cited with these are "standard" i.e. exclude that of the caudal fin which is added separately when not damaged (*d*). Within the known limits of distribution, an immature specimen ($22.5 + d$ mm) was obtained at Millport in April, and seven ($9.5 + 2.5$ to $14.0 + 3.5$ mm) at Rockcliffe, Kirkcudbrightshire, on the Solway Firth (6th August). Collecting again at Millport (29th April), and at Turnberry (26th May) and Dunure (10th August), Ayrshire, failed to reveal *G. paganellus* in shore pools at these places, and a visit to Loch Creran (13th May) was equally unsuccessful. However, over 22nd and 24th July, fifteen *G. paganellus* were taken from pools below M.T.L. at Sgeir Dremisdale (Nat. Grid Ref. 23/747 374) on the west side of South Uist by one of us (R.G.H.) and, on 15th and 17th August, two (male of $40.0 + 10.0$ mm and female of $46.0 + d$ mm) in pools on the southern shores of Canna, in the Inner Hebrides, by Mr. I. M. Evans, of Leicester Museums and Art Gallery.

The sex and age of the gobies from South Uist have been determined by dissection and examination of the otoliths, as described by Miller (1961*b*). The series comprised three male and one female 1-group (age about 14 months) representing the 1961 year-class, of $40.5 + d$ mm to $45.0 + 11.0$ mm, and four male and seven female 2-group fishes (age about 26 months) belonging to the 1960 year-class. The size

Locality	Year-Class	Date of Capture	No. of Fishes	Mean Length (mm)	Length Range (mm)
South Uist (Sgeir Dremisdale)	1960	22nd and 24th July, 1962	11	58.59	53.0-64.0
Isle of Man (Poyllbrein)	1957	16th July-7th Aug., 1959	17	59.79	53.0-67.0
Isle of Man (Poyllbrein)	1958	18th July-1st Aug., 1960	13	60.85	52.5-66.5

TABLE 1—Mean standard length and length range for 2-group *G. paganellus* from South Uist and the Isle of Man.

range and mean length of these older individuals are compared in the table with those for 2-group fishes from two year-classes taken at about the same time of year at Poyllbrein, Isle of Man, where the biology of *G. paganellus* has been studied (Miller, 1961*b*). Although the numbers available are probably too small for proper comparison, the values given do not show any great difference between the two localities in size reached by *G. paganellus* at this age. In the Isle of Man, the breeding season is relatively short, lasting from April to June, and

sexual maturity is reached in 2- or 3-group fishes. With specimens of the former age-group examined after the breeding season, it is usually difficult to tell whether a fish has spawned or not that season. Nearly all those from South Uist were apparently still immature, the one exception being a female of 59.0 + 12.5 mm with ovaries in stage II (developing virgin or recovering spent). Breeding of *G. paganellus* may thus occur at South Uist, but spring or early summer collections of older fishes would be needed to settle this question.

With the finding of *G. paganellus* at South Uist and Canna, and the marked north-south trend of isotherms for minimum sea-surface and air temperatures across the British Isles, this southern form may well be expected to occur along the entire western seaboard of Scotland. Distribution in this area may however be restricted by the absence in many parts of suitably sheltered rocky shores with numerous pools, where the species can be commonest. At Craig, Outer Loch Torridon, Ross-shire, only about 25 miles north of the South Uist locality, one of us (P.J.M.) was unable to find *G. paganellus* when collecting from 6th to 8th July on an exposed boulder beach with few pools which contained other shore fishes. The old record from Loch Creran suggests that *G. paganellus* has been long established on the west coast, not a more recent immigrant following slight climatic changes.

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OBSERVATIONS ON THE OCCURRENCE OF KEELED SLUGS (*MILAX* GRAY) IN THE GLASGOW AREA

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Following the discovery that *Milax budapestensis* (Hazay), a keeled slug apparently unrecorded from the Scottish mainland, was abundant in a garden at Netherlee, five miles south of Glasgow, an extensive survey was carried out between May, 1961, and October, 1962, to investigate the occurrence and relative abundance of *Milax* spp. in the Glasgow area.

Many sites, including well tended and derelict private gardens, parks, waste spaces, road verges, refuse tips, woodlands and grassland, were visited and slugs were sought during daylight under stones, amongst rubbish and in loose soil. *Milax* spp., distinguishable from other British slugs by having a well developed median dorsal ridge or keel extending from the hind-margin of the mantle to the tip of the tail, were found at 36 localities. They were commoner in built-up areas than in the country and were particularly abundant in or near well established private gardens and amongst garden rubbish on refuse tips. None was found in woods except amongst refuse nor were any found on agricultural land or at other sites remote from human habitation.

Of the three species encountered, *Milax budapestensis* (Hazay) was by far the commonest and most widely distributed. This slug, which can be identified readily by its slender form and dark-striped foot, was found at 30 sites. Eight of these sites were within the City of Glasgow, namely at Carntyne, Cathcart, Gilmorehill (2 sites), Lambhill, Pollokshaws, Thornliebank and Yoker; 11 were just outside the city boundary, at Bearsden, Burnside, Cambuslang (2 sites), Carmunnock, Clarkston (Renfrewshire), Milngavie, Netherlee, Robroyston Mains, Stamperland and Whitecraigs, and 11 were further afield, at Dumbarton, Eaglesham, East Kilbride, Helensburgh (2 sites), Johnstone, Neilston (2 sites), Paisley (2 sites) and near Uddingston. In the garden at Netherlee where it was first found, *M. budapestensis* was causing extensive damage to bulbs and corms by attacking them underground.

M. budapestensis was first recorded in Britain by Phillips and Watson (1930) and has since been recorded from about 33 of the vice-counties of England and Wales and from 6 in Ireland (Quick, 1960). In Scotland it has been recorded from the Isle of Arran (v.-c. 100) by Waterston (1953) and it may also have been recorded (Ellis, 1951) from the Outer Hebrides

(v.-c. 110) but I have not been able to confirm this. There are no previous published records of *M. budapestensis* from the Scottish mainland but Mr. A. R. Waterston of the Royal Scottish Museum, Edinburgh, informs me (*in litt.*) that he obtained somewhat atypical specimens in a garden at Corstorphine, Edinburgh (v.-c. 83) in 1953, and Mrs. Jane Bett, lately of Glasgow University, found specimens in a garden at Pollokshields, south Glasgow (v.-c. 76) several years ago (private communication). It seems likely that the species has been introduced fairly recently: Mr. Waterston states that it was not present in the Edinburgh garden during the period 1930–39 and that he failed to find it at Paisley where he lived from 1939–42.

The present observations establish new vice-county records for *M. budapestensis* thus: Renfrew (v.-c. 76), 13 sites; Lanark (v.-c. 77), 11 sites; Dunbarton (v.-c. 99), 5 sites and Stirling (v.-c. 86), 1 site. Representative specimens have been deposited in the Royal Scottish Museum.

Milax sowerbyi (Férussac) was found at 11 sites and although abundant locally was generally much less common than *M. budapestensis*. The two species are similar in many respects but *M. sowerbyi* can be distinguished by its greater bulk, its uniformly pale foot and by its possessing a short but bulky conical stimulator in the genital atrium. In *M. budapestensis* the stimulator is lacking. *M. sowerbyi* was found at Pollokshaws, Paisley, Lambhill, Netherlee, Carntyne and Yoker, together with *M. budapestensis*. *M. sowerbyi* occurred with *M. gagates* Draparnaud at Dunbarton and at a second site in Yoker but was the only *Milax* present on sites at Bellahouston, Springboig and Springburn.

M. sowerbyi is well-known in Britain and has already been recorded from 10 vice-counties in Scotland. The present observations establish first records for Lanark (v.-c. 77), 5 sites, and Dunbarton (v.-c. 99), 2 sites.

Milax gagates Draparnaud was found in small numbers at 5 sites and was by far the least common of the three species. It resembles *M. sowerbyi* in having a uniformly pale foot but differs by having colourless rather than yellow slime, by having the grooves between the body tubercles unpigmented and by having an elongate and often curved tongue-like stimulator. It occurred with *M. budapestensis* at Cambuslang and Dunbarton and with *M. sowerbyi* at Yoker and Dunbarton (site 2). As the drab, slightly fuscous var. *rava* Williams it was the only *Milax* species present on a site in Renfrew town.

M. gagates has previously been recorded from 15 vice-counties in Scotland and the present observations establish new records for Renfrew (v.-c. 76), 2 sites, and Lanark (v.-c. 77), 1 site.

ACKNOWLEDGMENTS

I am grateful to Mr. A. R. Waterston for substantial help with identifications and for allowing me to use material from his private correspondence. Dr. H. E. Quick kindly checked the identity of a specimen taken at Helensburgh.

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SHORTER NOTES

Umbilicus rupestris in Dunbartonshire

On 8th September, 1962, on the Andersonian excursion to the Rosneath area, Dunbartonshire, I came upon a few plants of *Umbilicus rupestris* (Salisb.) Dandy, the Wall Pennywort, to the east of Kilcreggan Pier. This is a new record for vice-county 99.

The plants were growing about the base of the crags backing the flat coastal strip, under a thick tangle of tall bracken and well-armed bramble stems, which we had to tread down.

A. Cross

Buccinum undatum L. in the Clyde Estuary

During an extra-mural class excursion on 19th May, 1962, attended by several members of the Zoological Section of the Andersonians, small living specimens of the White Whelk or Buckie (*Buccinum undatum* L.) were found to be not uncommon on the western and southern shores of Ardmore Point, near Craigendoran, Dunbartonshire. On other occasions in the early summers of 1961 and 1962, we found *B. undatum* along the northern shore of the Clyde estuary, and living specimens occurred as far east as the old fish yair at Murray's Farm, Cardross (point M on the map in our paper on *Hydrobia ulvae*: 1962, *Glasg. Nat.*, **18**, 198-205).

Thus *B. undatum* penetrates the estuary only to a point where animals characteristic of brackish waters begin to appear. Although the Buckie is known to be able to survive in water of relatively low salinity, its distribution in this part of the Clyde estuary corresponds exactly to that of the starfish *Asterias rubens*, a marine form completely intolerant of brackish conditions.

Of course, *B. undatum* is more typically a sub-littoral animal, occurring off all coasts of Britain, from shallow inshore waters to depths of 100 fathoms. Living specimens collected (just above L.W.M., M.S.T.) round Ardmore Point and on the Cardross shore average 4.9 cm shell-length, though larger empty shells are often encountered. Offshore, *B. undatum* normally grows much larger and can reach 11.2 cm shell-length in the Clyde. In June, 1958, Dr. John A. Allen found small living Buckies about mid-tide level north of Largs (1962, *Fauna Clyde Sea Area*, **3** (*Mollusca*), 1-88), and describes them as "young specimens about one inch long". Although small, the animals collected on the Ardmore and Cardross shores were certainly *not* young, but dwarfed, and the older whorls of some shells show worm-borings and other erosion. As a result of observations on *B. undatum* on the Canadian Atlantic coast, Gowanloch (1927, *Contrib. Canad. Biol. Fish.*, N.S., **3**, 167-177) suggested that intertidal

populations of *Buccinum* are small temporary colonies drawn from the reserves of the main deep sea populations. As several naturalists have observed, the Buckie does *not* possess the protective behaviour patterns and reactions characteristic of truly intertidal molluscs, such as the *Littorina* spp., and thus, when it does colonize the littoral zone, it is much more liable to death from desiccation or mechanical displacement.

W. Russell Hunter and Myra Russell Hunter

ACKNOWLEDGMENT

The Council of the Society again wish to acknowledge their indebtedness to The Royal Society for a grant of part of the cost of publication of the following papers in the last issue (Volume XVIII, part 4) of *The Glasgow Naturalist*:

- (1) Observations on Coleoptera in Scottish oak woods.
- (2) On a population of *Hydrobia ulvae* in the Clyde estuary.

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY

10TH JANUARY, 1961

Mr. Robert Mackechnie presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Seven new members were admitted to the Society: S. S. Gunn, 13 Winton Circus, Saltcoats; A. B. Mitchell, 103 Crofton Avenue, Glasgow, S.4.; C. Macfarlane, 10 Stirling Drive, Burnside; E. M. E. Oakley, 4 Hyndland Avenue, Glasgow, W.1.; E. C. D. Todd, 24 Buchanan Drive, Bearsden; R. D. Watson, 35 Upper Glenburn Road, Bearsden; and Ronald Brown, 52 Alderman Road, Glasgow, W.3.

A lecture was given by Mr. Len Fullarton entitled, "A nature artist at work", and illustrated with lantern slides of his drawings of birds and other animals.

14TH FEBRUARY, 1961

The Annual General Meeting was held in the Royal College of Science and Technology, Glasgow, and presided over by Mr. Robert Mackechnie.

Three new members were admitted to the Society: Sister Mary Julie and Sister Julie Magdalen, both of the Convent of Notre Dame, Downhill, Glasgow, W.2.; and A. M. Stirling, 17 Austen Road, Glasgow, W.1.

Reports of the Society's activities were read and it was noted that the membership at 31st December, 1960 was 177. New office-bearers were then elected (see p.251). Mr. Mackechnie briefly reviewed the changes which had occurred during his period as President, and then called on the new President, Mr. Basil W. Ribbons, to occupy the chair. Mr. A. Slack then introduced a short exhibition of colour slides by members of the Society.

14TH MARCH, 1961

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Two new members were admitted to the Society: Robert Pirrie, 3 Wellmeadow Road, Glasgow, S.3.; and J. R. Clark, 10 Alloway Road, Newlands.

Dr. N. R. Grist of the Department of Virology in the University of Glasgow then gave a lecture entitled, "Some virus diseases of Man and animals".

4TH APRIL, 1961

Dr. E. Conway presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Two new members were admitted to the Society: W. S. Duncan, 44 Curling Crescent, Glasgow, S.4.; and K. R. Dronamrajn, Department of Genetics, University of Glasgow.

A lecture was given by Dr. J. C. Smyth of Paisley Technical College on the marine life of the foreshore of the City of Edinburgh.

3RD MAY, 1961

Mr. Basil W. Ribbons presided over a meeting held in the Department of Botany, University of Glasgow.

Brian Simpson, 12 Hurlaw-Crook Road, East Kilbride, was admitted as a new member of the Society.

Professor A. R. Gemmell of the University College of North Staffordshire, Keele, gave a lecture entitled "Biology and crime".

13TH JUNE, 1961

Mrs. I. J. Paton presided over a meeting held in the Department of Zoology, University of Glasgow.

Three new members were admitted to the Society: Mary Bormond, M.A., 7 Whittinghame Gardens, Glasgow, W.2.; Helen McCollm, 20 Broompark Drive, Newton Mearns; and Eric Dunsmore, 1010 Aikenhead Road, Glasgow, S.4.

A lecture was given by Mr. E. J. M. Davies of the Forestry Commission on the use of exotic trees in British forestry.

12TH SEPTEMBER, 1961

Mr. Basil W. Ribbons presided over a meeting held in the Art Gallery and Museum, Kelvingrove.

Four new members were admitted to the Society: E. Curtis, Curator's House, Botanic Gardens, Glasgow, W.2.; W. Craigie, 730 Gt. Western Road, Glasgow, W.2.; W. K. Stove, 37 Stamperland Avenue, Clarkston; and M. White, B.Sc., 29 Rothesay Crescent, Coatbridge.

This meeting was an exhibition of specimens collected and displayed by more than twenty-two members.

17TH OCTOBER, 1961

Mr. Basil W. Ribbons presided over a meeting held in the Department of Botany, University of Glasgow.

Five new members were admitted to the Society: M. Little, 9 Mitchell Drive, Rutherglen; M. G. Donald, B.Sc., 34 Rennie Street, Falkirk; William Todd, M.B., Ch.B., 154 Carmunnock Road, Cathcart; A. Murray, 1 Greenhill Street, Rutherglen; and Paul D. Burns, 67a Burnbank Road, Hamilton.

An illustrated lecture on insect migration was given by Dr. C. B. Williams, F.R.S.

14TH NOVEMBER, 1961

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow.

N. Gardner, 28 Hamilton Park Avenue, Glasgow, W.2., was admitted as a new member of the Society.

Dr. Blodwen Lloyd gave a lecture entitled "Scouler and Hennedy, two notable Glasgow naturalists".

12TH DECEMBER, 1961

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Peter J. Miller, B.Sc., Department of Zoology, University of Glasgow, was admitted as a new member of the Society.

Professor M. F. M. Meiklejohn gave a lecture, illustrated with lantern slides, entitled "A naturalist in Sardinia".

THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month, except during July and August, usually in the Royal College of Science and Technology, but from time to time in the University and the Glasgow Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are: for Ordinary Members, twenty shillings; for Junior Members, ten shillings, and for Family Members, five shillings. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary*—

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THE GLASGOW NATURALIST

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Vol. XVIII. Part 6

Published August, 1963

AN ANNOTATED LIST OF THE LESS COMMON SCOTTISH BASIDIOMYCETES (EXCLUSIVE OF RUSTS AND SMUTS)

By DEREK A. REID and PETER K. C. AUSTWICK

(*MS. received 15th May, 1963*)

INTRODUCTION

Initially the aim of this publication was to produce a short account of a few characteristic Scottish fungi for the benefit of visitors attending the Third European Mycological Congress in the autumn of 1963 and the Tenth International Botanical Congress in the following year. However, since there is no complete work readily obtainable which relates to the larger British Basidiomycetes, it was decided to enlarge the scope of our project to provide a publication of wider use. As a result we have included accounts of the less common Basidiomycetes recorded from Scotland, exclusive of the rusts and smuts. In order to limit the size of this work we have had to omit all reference to common species since descriptions of these are available elsewhere. Although conscious of the shortcomings of this list we venture to suggest that if it is used in conjunction with the "New Check List of British Agarics and Boleti" by Dennis, Orton and Hora and "Common British Fungi" by Wakefield and Dennis it may help to fill the gap in the literature until a new fungus flora is forthcoming.

We wish to make it clear that the descriptions of the agarics appearing in this list are largely based on information published elsewhere by various authors. We have consulted "Flora Agaricina Danica" by J. E. Lange, "Flore analytique des champignons supérieurs" by R. Kühner and H. Romagnesi, "New Check List of British Agarics and Boleti" Parts II and III by P. D. Orton and F. B. Hora, the Monographs of *Russula*, *Lactarius*, *Boletus*, *Mycena* and *Inocybe* by A. A. Pearson published in *The Naturalist* and finally of *Cortinarius* I and II by P. D. Orton published in the same journal. In genera where the recognition of species is particularly difficult, and based largely on microscopic data, as for example in

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Inocybe, *Cortinarius*, *Psathyrella*, *Corticium* etc., we have sometimes listed the less common species without giving a description. Furthermore, in the genus *Cortinarius* we have excluded from consideration most of the species belonging to the Friesian subgenera *Telamonia* and *Hydrocybe* since no attempt has been made to deal with these in the "New Check List".

The descriptions of the Aphylophorales are largely original, although we have derived assistance from "Hyménomycètes de France" by H. Bourdot and A. Galzin.

In preparing this list we have inevitably met with difficulties, the chief of which has been to ascertain whether published records are reliable. Ideally the identity of all available collections forming the basis of published records should have been checked, but this was not practicable. As it is, we have indicated where records appear to need confirmation. Another problem was that early accounts of Scottish fungi include unfamiliar specific names which for various reasons have ceased to be in common use. For the agarics, reference to the "New Check List" will usually give an indication as to their status and probable application. Since there is no corresponding list of British Aphylophorales we have attempted to give some idea of the fungi to which such names probably refer.

There are a number of species belonging to the Aphylophorales which were originally described by Berkeley and Broome from Scottish material, and for which there are no modern diagnoses. Type material of many of these is preserved in the Kew Herbarium, and we have taken the opportunity of examining it and reporting our findings in some detail. We have also checked and redetermined a large number of specimens forming the basis of published records in this group of fungi.

Throughout this work we have tried to adopt modern concepts of classification and nomenclature. For the Agaricales we have followed the "New Check list of British Agarics and Boleti" but for other groups we have had to rely extensively on our personal opinions. Occasionally this has necessitated new combinations, but since we have no wish to propose formal name changes in this publication we have deliberately refrained from validating them as required by the International Code of Botanical Nomenclature. In such instances we have omitted any reference to the author responsible for the transfer e.g. "*Flagelloscypha* (*Cyphella*) *mairei* (*Pilát*)".

In compiling this list we have relied largely on published records but we have also included accounts of species which we ourselves have collected in recent years. In addition we have had access to the Scottish collections preserved in the

Herbarium of the Royal Botanic Gardens, Kew, many of which have been made by Dr. R. W. G. Dennis. We are also grateful to Mr. P. D. Orton who has advised us on the inclusion of a number of agarics, some of which are new to, or have been restored to, the list of species known to occur in Britain since the publication of the Check List in 1960.

In conclusion we have much pleasure in acknowledging the very great help given to us by Dr. R. W. G. Dennis in making available to us the records of Scottish fungi that he had abstracted from the literature up to 1940, thereby greatly facilitating our task.

AGARICALES

Agaricus bernardii Quél. apud Cooke & Quél. forms large "fairy rings" in maritime pastures and is recognized by its robust, areolately cracked pileus.

Agaricus excellens (F. H. Möller) F. H. Möller

'**Agaricus**' **hookeri** Klotzsch. The type at Kew is *Melanophyllum echinatum*.

'**Agaricus**' **mariae** Klotzsch was based on material collected by Miss Maria Hooker in a conservatory of the Botanic Garden at Sandyford, Glasgow. The type specimen, preserved at Kew, is *Lepiota friesii* (Lasch) Quél. [= *L. acutesquamosa* sensu auct.]

Agaricus porphyrocephalus F. H. Möller

Agaricus semotus Fr. has a small cap up to 5 cm in diam., covered with adpressed dingy purple or vinaceous fibrils on a whitish ground, and becomes yellow on bruising.

'**Agaricus**' **spinipes** Sow. ex Pers.—The specimen recorded under this name from Blackadder plantations, Berwickshire, by Johnston (1829) is preserved at Kew. This determination was subsequently changed to *Agaricus esculentus* by Klotzsch. See under *Pseudohiatula esculenta*.

Agrocybe arvalis (Fr.) Sing. resembles a *Conocybe*, but springs from a sclerotium about the size of a walnut. It has large facial cystidia crowned with coarse finger like processes.

Agrocybe paludosa (J. Lange) Kühn. & Romagn. grows in marshy places and has a small cream-coloured cap, flushed with tan especially toward the centre. It has a mealy smell and spores measuring $8-11 \times 5-7\mu$.

Agrocybe temulenta (Fr.) Orton. According to the check list this species is retained "sensu Fries, Cooke (based on material of Cooke and Stevenson now in Herb. Kew - -)". In fact the Stevenson material from Glamis is *Agrocybe arvalis* and has spores $9-11 \times 5-6.5\mu$, as stated by Orton, and pleurocystidia crowned with sterigma-like appendages. The Cooke collection mentioned by Orton, and annotated by him as having brown spores $9-10 \times 5-6\mu$, with a small germ-pore would appear to consist of numerous fruitbodies bearing small hyaline spores.

Amanita crocea Quél. appears to be widespread in the British Isles and is associated with *Betula*. It resembles *A. fulva* [Schaeff.] Secr. but is more robust, has a scaly stem and a brighter overall colour.

Amanita gemmata (Fr.) Gillet is recognized by its lemon-yellow or pale amber-coloured cap bearing thick white patches of the veil. The stem has a bulbous base but lacks a prominent free volva, and may or may not possess a well developed annulus.

Amanita nivalis Grev. is confined to certain of the higher mountains where it is associated with dwarf willow (*Salix herbacea*). Continental mycologists have tended to use this

name for a white variety of *A. vaginata* (Bull. ex Fr.) Vitt., but *A. nivalis* differs in its subglobose spores and habitat.

Amanita solitaria (Bull. ex Fr.) Secr. is a robust species with a whitish or pale grey cap up to 16 cm in diam. bearing very large and very thick flat-topped grey scales. The thick stem, which has a swollen-fusiform rooting base, is densely covered up to the ring with a white floccose snow-like coating. This fungus is found chiefly in calcareous grassland. There are no recent Scottish records.

Amanita verna (Bull. ex Fr.) Vitt. This is an entirely white species with a free volva, and short elliptical spores measuring $8-11 \times 7-9\mu$.

Amanita virosa Secr. closely resembles the preceding species but tends to have a more conical-campanulate cap and round spores $9.5-13 \times 8.5-12\mu$. It can be distinguished readily from *A. verna* by the cap at once turning golden yellow with KOH.

Armillaria haematites (Berk. & Br.) Sacc. The systematic position of this fungus is uncertain as it is known only from the original gathering by Stevenson at Glamis, Angus. It has a hemispherical liver-coloured cap up to 2.5 cm in diam. and an annulate solid stipe which is concolorous and swollen below. The ring is cottony and scaly on the underside; the gills are white and shortly decurrent. According to Orton the type material has broadly elliptical non-amyloid spores, $7.5-8.5 \times 5-6\mu$, and a cuticle formed of filamentous hyphae $5-20\mu$ wide.

Boletus aeruginascens Secr. [= *B. viscidus* Fr. & Hök] has a slimy whitish, yellowish or pale brownish cap, whitish or grey pores and an annulate stipe. It occurs under *Larix*.

Boletus appendiculatus Schaeff. ex Fr. has an ochraceous-bay or reddish brown, subtomentose cap, sulphur-yellow pores becoming blue-green when bruised, a yellow stem with a yellow net, and flesh which turns slowly blue in air.

Boletus calopus Fr. [= *B. pachypus* Fr., *B. olivaceus* Schaeff. ex Fr.]. This widespread fungus is uncommon in Scotland. It has a pallid cap, yellow pores and a stem which is yellow toward the apex but scarlet below and commonly ornamented with a white or pinkish network. The pores become blue on bruising, as does the flesh on exposure.

Boletus carpini (R. Schulz) Pearson resembles *B. scaber* Bull. ex Fr. [= *B. leucophaeus* Pers.] but may be distinguished by its pseudoparenchymatous cuticle and its occurrence under *Carpinus* and *Corylus* as opposed to *Betula*.

Boletus duriusculus Schulzer apud Fr. resembles *B. scaber* but is always associated with *Populus* and has flesh which becomes coppery pink then greyish. This species has not been reported from Scotland in recent years.

Boletus flavidus Fr. usually occurs in *Sphagnum* in the vicinity of *Pinus sylvestris*. It resembles *B. elegans* Schum. ex Fr. but has a paler and less brightly coloured cap.

Boletus holopus Rostk. apud Sturm [= *B. niveus* [Fr.]] is an uncommon bolete found in *Sphagnum* bogs under *Betula* and belonging to the section *Leccinum*. It is recognized by its white cap which is often tinted with green, and by its white floccose-scaly stem.

Boletus impolitus Fr. There are no recent Scottish records of this fungus.

Boletus luridus Schaeff. ex Fr. has an olive-brown cap, often becoming yellowish or reddish especially toward the margin, vermilion or red pores and a stem which is yellowish above, reddish towards the base and covered with a red network. The flesh becomes strongly blue on bruising. There are many old Scottish records of this fungus but very few recent collections. However, *B. luridus* seems less common in southern England than formerly.

Boletus percardidus Vassilkov was only known from Russia until 1957 when it was collected in a *Pinus-Betula* stand at Tomich, Inverness-shire. It belongs in the Section *Leccinum* and may be recognized by its whitish, rose-tinted cap, white scaly stem, and flesh which turns immediately rosy lilac when cut, becoming finally purple-black. See Watling (1960).

Boletus purpureus Pers. is a rare species of the section *Tubiporus* which has a whitish or yellowish pileus, becoming blue and finally pinkish red, pores which are yellow then vivid carmine, a golden-yellow stem with a blood-red net and a fruity alcoholic smell. All parts turn blue then red on bruising.

Boletus rubinus W. G. Smith is found chiefly in oakwoods (*Quercus*). It has a tan-coloured cuticle which often cracks and exposes the pallid flesh; carmine pores fading to a pale pink and a short stipe, which is rich carmine above and sulphur below. Microscopically it is well characterized by its short, broadly elliptical spores, $5.5-6.2 \times 4.2-4.75\mu$.

Boletus satanas Lenz, a species of calcareous beechwoods (*Fagus*), is recognized by its pale convex cap, blood-red pores, and short bulbous stem with a blood-red net. There are no recent records from Scotland.

Boletus sulphureus Fr. is rare but easily recognized by its sulphur-yellow colour and its occurrence on pine sawdust. It was reported in great abundance on sawdust at Forres, Morayshire (Berkeley & Broome, 1875).

Boletus varicolor Berk. & Br. is not accounted for in the Check List. Originally described from Deeside, Aberdeenshire, it was said to have a subtomentose, olivaceous cap, with blackish purple flesh under the cuticle. The rather elongated stipe was stated to be yellow bulbous below and attenuated, reddish and reticulated above. The tubes were said to be

minute, free and yellow, while the flesh was noted as pale, inclining to yellow in places.

Boletus vulpinus (Watling) described from Rothiemurchus, Inverness-shire, is closely related to *B. testaceoscaber* Secr. but may be distinguished by its dark dull sienna-brown to fox-red pileus and the colour change of the cut flesh, together with its occurrence under *Pinus*. See Watling (1961).

Cantharellula expallens (Pers. ex Fr.) Orton

Cantharellula graveolens (Petersen) Moser apud Gams is a pasture-loving species, characterized by its reddish brown colour, strong mealy smell and amyloid spores $6.5-8.5 \times 4-5\mu$. It was recently collected in West Perthshire.

Cantharellula umbonata ([Gmelin] Fr.) Sing.

Cantharellus cibarius var. **neglectus** (Souché) Bigeard & Guillemin is an entirely pale lemon-yellow colour variant.

Cantharellus friesii Quél. This is a little known species which resembles *C. cibarius* Fr. but is less robust, and has a pinkish orange colour. It was recently collected in Glen Lyon, Perthshire.

Cantharellus lutescens [Pers.] Fr. is not uncommon in native pinewoods, such as Rothiemurchus Forest, Inverness-shire. It is recognized by its thin dark brown cap, often marked with radiating crests or ridges through which the bright orange colour of the under surface is visible; its smooth or radially folded hymenium; its bright orange-coloured stipe and a smell of apricots.

Claudopus byssisedus (Pers. ex Fr.) Gillet. For an account of the differences between this species and the next see Orton (1960).

Claudopus depluens (Batsch ex Fr.) Gillet

Clitocybe asterospora (J. Lange) Moser apud Gams is an uncommon heathland species with a small, flattened, dirty brown, pellucid striate, hygrophanous cap and well characterized by its echinulate globular spores, $4-8\mu$ in diam., and faint mealy odour.

Clitocybe clusiliformis Kühn. & Romagn. has a yellow-brown or dark ochraceous, convex-umbilicate cap with a rugulose to almost minutely squamulose surface. Furthermore the gills are very broad, distant, pale brownish, and abruptly emarginate. The spores are large, measuring $9.5-11.5 (-12.5) \times 5.5-6.2 (-7)\mu$.

Clitocybe concava (Scop. ex Fr.) Gillet has been recorded from Scotland but it is a little known species in Britain and needs further investigation in this country.

Clitocybe diatreta (Fr. ex Fr.) Kummer

Clitocybe fritilliformis (Lasch apud Fr.) Gillet

Clitocybe fuscusquamula J. Lange is distinctive in the small pale cap, densely beset with very minute fuscous squamules.

especially towards the centre, and by its elongated tear-drop-shaped spores $6.5-9 \times 2-3\mu$. Its only known locality in Scotland is near Aviemore, Inverness-shire.

Clitocybe gilva (Pers. ex Fr.) Kummer

Clitocybe incomis (Karst.) Orton. See Orton (1960).

Clitocybe inornata (Sow. ex Fr.) Gillet. This is a fairly robust species with pale cap and fusiform spores, $6-10 \times 3-4\mu$.

Clitocybe sinopicoides Peck sensu Kühn. & Romagn. has a flattened or shallowly infundibuliform, pale pinkish brown cap $1.5-5$ cm in diam., densely covered, at least toward the centre, with minute granular-floccose scales; a similarly coloured but darker stem; cream, decurrent gills; a strong smell of meal and spores measuring $6-8 \times 4-5\mu$. This fungus, which has been found at Loch-an-Eilean, near Aviemore, Inverness-shire, grows under conifers.

Clitocybe tornata (Fr.) Kummer

Clitocybe umbilicata (Schaeff. ex Fr.) Kummer

Clitocybula (Collybia) lacerata (Lasch apud Fr.) Sing., a rare species with a very thin hygrophanous convexo-umbilicate, greyish, grey-brown or horn-coloured pileus up to 6 cm in diam., which is innately radiately striate almost to the disc—a feature which becomes even more pronounced during drying. The margin of the pileus is dentate or lacerate, and the spores subglobose $5-7 \times 4.2-5.5\mu$. There are no recent Scottish records.

Clitopilus passeckerianus (Pilát) Sing. is best recognized by its occurrence as a weed fungus of mushroom beds. It smells of meal and has a poorly developed stipe which expands into a whitish flabelliform or spatulate pileus, up to 4 cm in diam.

Collybia acervata (Fr.) Kummer closely resembles *Collybia (Marasmius) erythropus* (Pers. ex Fr.) Kummer, but may be distinguished by its subcylindric-elliptical spores, $5-5.7 \times 2.8\mu$, and its occurrence on rotting conifer stumps.

Collybia distorta (Fr.) Quél. is not uncommon in Scottish pine woods where it often occurs in small clusters. It has a red-brown umbonate cap up to 8 cm in diam., a long pallid stem, and globose spores, $3-4\mu$ in diam., which are white in the mass.

Collybia fuscopurpurea (Pers. ex Fr.) Kummer resembles *C. peronata* (Bolt. ex Fr.) Kummer, but has a dark brown cap with a purplish red flush, and a dark purplish brown stem. The spores measure $6-8 \times 2.7-3.7\mu$.

Collybia inolens (Fr.) Quél.

Collybia mephitica (Fr.) Karst.

Collybia ocellata (Fr. ex Fr.) Kummer resembles *C. cirrhata* (Schum. ex Fr.) Kummer, but has a bright yellowish or brownish spot in the centre of the cap and larger spores.

Collybia oreadoides (Pass.) Orton was first collected in Britain in Balloch Park, Dunbartonshire. It grew in clusters

on a heap of old leaves and had a whitish or pinkish buff cap with brick-coloured patches, free, distant, white or cream-coloured gills, a tough elastic texture, bitter taste and subfusiform spores, $6-6.5 \times 2.5-3\mu$.

Collybia palustris (Peck) A. H. Smith is a not uncommon fungus in *Sphagnum* bogs, recognized by its pale brownish grey, hygrophanous, striate cap and mycenoid habit.

Collybia prolixa (Hornemann ex Fr.) Gillet closely resembles *C. distorta* but may be distinguished by its larger subglobose or broadly ovoid spores, measuring $5-6 \times 4-5\mu$, which are pink in the mass.

Collybia putidella Orton

Collybia putilla (Fr.) Sing. grows on pine needles. It has a reddish-tawny or chestnut-coloured, striate cap, up to 4 cm in diam., a concolorous stipe with a white strigose base, crowded gills tinted with the colour of the cap and spores measuring $7-9 \times 3-4\mu$.

Collybia rancida (Fr.) Quél.

Collybia striaepilea (Fr.) Orton

Collybia succinea (Fr.) Quél.

Collybia tesquorum (Fr.) Gillet [= *C. plexipes* (Fr.) Kühn. & Romagn.]

Conocybe coprophila (Kühn.) Kühn. See Dennis (1955).

Conocybe neoantipus (Atk.) Sing. See Dennis (1955).

Conocybe ochracea (Kühn.) Sing.

Conocybe rickeniana Orton

Conocybe vexans Orton is a species closely related to *C. blattaria* (Fr.) Kühn. but having smaller spores, $10-12 \times 6-6.5\mu$, borne on 4-spored basidia.

Coprinus cineratus Quél.

Coprinus ephemeroideus (Bull. ex Fr.) Fr. is a small dung-inhabiting species with persistent ring and a mealy coating of globular cells on the cap.

Coprinus extinctorius (Bull. ex St. Amans) Fr. is a small lignicolous species with fibrous covering to the cap.

Coprinus lagopides Karst. closely resembles *C. lagopus* (Fr.) Fr. but differs in growing on burnt ground, charred wood or plaster, and in having subglobose, lenticular spores, $6-8 \times 5-7 \times 4.5-6\mu$.

Coprinus macrocephalus (Berk.) Berk.

Coprinus martinii Orton is recognized in the young state by its elongated cylindrical mealy cap up to 22 mm in height, its ashy grey colour and its occurrence on *Carex*, *Scirpus* and *Juncus* debris.

Coprinus miser (Karst.) Karst.

Coprinus pellucidus Karst.

Coprinus saccharomyces Orton belongs in the "*narcoticus*" group. See Orton (1960).

Coprinus urticicola (Berk. & Br.) Buller

Coprinus vermiculifer Joss.

Cortinarius (Telamonia) adalbertii Favre

Cortinarius (Dermocybe) anthracinus (Fr.) Fr.

Cortinarius (Sericeocybe) argentatus (Pers. ex Fr.) Fr.

Cortinarius (Seric.) argutus Fr.

Cortinarius (Seric.) azureovelatus Orton [= *C. azureus* sensu Henry]. This species is similar to *C. anomalus* (Fr. ex Fr.) Fr. and *C. caninus*. It is distinguished from the former by its "more robust habit, more ochraceous-buff cap and stronger smell", and from the latter by its different colours.

Cortinarius (Phlegmacium) balteatocumatilis Orton. According to Orton (1960) this species "differs from *C. cumatilis* in restriction of violet colour in cap to margin, in smell and spores, and from *C. balteatus* in more viscid shiny-smooth cap and the violaceous veil". This is *C. balteatus* (Fr. ex Secr.) Fr. sensu Cooke and J. Lange and *C. cumatilis* Fr. of Kühner and Romagnesi, which was renamed *C. balteatocumatilis* by Henry (1939) but without a latin diagnosis.

Cortinarius (Phleg.) caerulescens (Schaeff. ex Secr.) Fr.

Cortinarius (Cortinarius) callisteus (Fr. ex Fr.) Fr.

Cortinarius (Phleg.) calochrous (Pers. ex Fr.) Fr. There are no recent Scottish collections of this large chrome-yellow species, in which the young gills are bright violet. The fungus has a marginate bulb to the white or yellowish stem and amygdaliform spores $9-12 \times 5-6\mu$.

Cortinarius (Seric.) caninus (Fr.) Fr.

Cortinarius (Derm.) cinnamomeo-badius R. Henry

Cortinarius (Derm.) cinnamomeo-luteus Orton

Cortinarius (Myxacium) collinitus (Sow. ex Fr.) Fr. This fungus is not uncommon in Scottish pinewoods although rare elsewhere. It is recognized by its bright tawny orange viscid cap and stem, the latter ornamented with whitish or bluish remnants of the veil which form conspicuous bands of scales below the cortina, and its large limoniform spores $13-18 \times 7-9\mu$.

Cortinarius (Phleg.) crassus Fr.

Cortinarius (Derm.) croceofolius Peck

Cortinarius (Phleg.) cyanites Fr. occurs locally in certain Scottish birch-pine woods especially in heathy places. It is recognized by its bright purple-blue cap, often marked with darker and/or brown innate streaks especially toward the centre, its concolorous stipe and gills, and its purplish blue flesh, which changes to wine-red on exposure.

Cortinarius (Phleg.) cyanopus (Secr.) Fr.

Cortinarius (Phleg.) durus Orton, described from the Rothiemurchus pinewoods, is recognized by its hard flesh, date-brown or dirty ochraceous buff colour, whitish veil and whitish or very pale clay-coloured gills. It is *C. claricolor* [Fr.] Fr. sensu Konrad & Maubl. nec Fries. See Orton (1960).

Cortinarius (Myx.) emollitus Fr. is a small ivory-yellow species.

Cortinarius (Myx.) favrei Henderson [= *C. alpinus* sensu Favre] described from Beinn Eighe, Wester Ross, is an alpine species with a very glutinous conical-obtuse cap which is at first ochraceous-tawny, paling to ochraceous. The glutinous stem is white flushed with violet at the base, and the gills also have a violaceous tint. This species has been much confused with *C. alpinus* Boud. but is separable from it on account of its smaller spores which measure $11-15 \times 7-8\mu$. The epithet *favrei* was first proposed by Moser (1955) for *C. alpinus* sensu Favre but was not validly published.

Cortinarius (Phleg.) fulgens (Alb. & Schw. ex Secr.) Fr.

Cortinarius (Phleg.) glaucopus (Schaeff. ex Fr.) Fr.

Cortinarius (Myx.) livido-ochraceus (Berk.) Berk.

Cortinarius (Seric.) malachioides Orton [= *C. malachus* (Fr. ex Fr.) Fr. sensu Lange, Ricken non Fries]. This rare fungus was described from specimens found under conifers in the Rothiemurchus Forest, Inverness-shire. It belongs in the section *Albocyanei*, has a pale lilaceous or silvery-violaceous cap which soon discolours to pallid or clay-buff, and is distinguished from other members of this section by its larger spores, (9-) $9.5-12 \times 5.5-6.5\mu$.

Cortinarius (Seric.) malachus (Fr. ex Fr.) Fr. is distinguished from the preceding species by its smaller spores, (7-) $7.5-9 (-10) \times 4.5-5.5\mu$, and the more pronounced blue-violaceous colours of the young cap. This fungus is not uncommon.

Cortinarius (Phleg.) melliolens Orton. This robust species, which occurs in deciduous and coniferous woods, was based on material collected in the Rothiemurchus Forest. It has a bright, yellowish ochre cap which is often innately streaked, a concolorous bulbous stipe, white flesh except towards the base of the stipe where it is yellowish brown, gills which are at first whitish clay colour, a strong smell of honey and spores measuring $8-9 \times 4.5-5\mu$.

Cortinarius (Phleg.) microspermus J. Lange grows in coniferous woods. It has a bright yellowish cap with a tawny-coloured disc, broadly emarginate gills which are at first pallid then café au lait and finally ochraceous, a white stem and very small spores, $5 \times 3\mu$. This fungus resembles *C. (Myx.) vibratilis* but is distinguished from that species by its dry cap and stem.

Cortinarius (Myx.) mucosus (Bull. ex Fr.) Kickx is a characteristic species of native Scottish pinewoods. It has a rich chestnut-coloured cap, a smooth cylindrical white stem without scales, gills which are at first whitish and sublimoniform spores $13-16 \times 6-7 (-7.5)\mu$. It is very similar to *C. collinitus* but this latter species has a stipe which is concolorous with the cap, and bears whitish or bluish bands of scales below the cortinal zone.

Cortinarius (Phleg.) multiformis (Fr. ex Secr.) Fr.

Cortinarius (Seric.) muricinus Fr.

Cortinarius (Seric.) myrtilinus Fr.

Cortinarius (Phleg.) napus Fr.

Cortinarius (Myx.) ochroleucus (Schaeff. ex Fr.) Fr.

Cortinarius (Cort.) orellanus Fr. is a beautiful tawny-orange-coloured species which is known to be highly toxic. See Skirgiello & Nespiak (1958).

Cortinarius (Tel.) pertristis Favre has been found at 3,800 ft. on Ben Lawers, Perthshire, in association with *Salix herbacea*. It has a hygrophane, dull chocolate-brown cap with a slightly squamulose surface, a dull ochraceous brown, fibrillose stem, chocolate-brown gills, and spores measuring $8-9 \times 5-5.5\mu$.

Cortinarius (Derm.) phoenicius [Bull.] Maire

Cortinarius (Myx.) pinicola Orton. This species has only been found in the native pinewoods of Scotland. It resembles *C. pseudosalor* J. Lange but is distinguished by the white, floccose-scaly veil-zone on the stem. This zone is almost completely lacking in blue-violaceous tints. The conspicuously sterile gill edge separates it from *C. collinitus* which is also slightly brighter and more coarsely scaly on the stem.

Cortinarius (Myx.) pluvius (Fr.) Fr.

Cortinarius (Phleg.) porphyropus [Alb. & Schw.] Fr.

Cortinarius (Phleg.) prasinus (Schaeff. ex Pers.) Fr.

Cortinarius (Cort.) psammocephalus (Bull. ex Mérat) Fr.

Cortinarius (Seric.) pseudo-crassus Orton. This rare species resembles a *Hebeloma* with a pale brown cap ornamented with short radiating innate fibrils. The stipe is pallid and may have a more or less rooting base, the gills are at first whitish, and the whole fungus has a firm texture. Its spores measure $8-10.5 \times 4.5-5\mu$.

Cortinarius (Tel.) purpureobadius (Karst.) Karst.

Cortinarius (Derm.) raphanoides (Pers. ex Fr.) Fr.

Cortinarius (Cort.) rubicundula (Rea) Pearson

Cortinarius (Phleg.) scaurus (Fr. ex Fr.) Fr. has been found only once in recent years, in a damp Scottish pinewood. It has an olive to date-brown cap often tinged greenish with darker smoky brown or chocolate spots especially toward the margin, a blue stem apex, olive gills and spores measuring $10-13 \times 6-8\mu$.

Cortinarius (Phleg.) sebaceus Fr.

Cortinarius (Phleg.) serarius Fr. has a tawny orange-cap with a red-brown umbo, a stem which lacks a distinct bulb, and narrowly fusiform spores, $7-8 \times 3\mu$.

Cortinarius (Seric.) simulatus Orton is probably not uncommon in Scotland, and is found under pine and birch, sometimes in *Sphagnum*. It resembles species of the section *Anomali* but

differs from these in having elliptic spores $7-8.5 (-9) \times 5-6\mu$. It has a strong smell of radish especially when cut.

Cortinarius (Cort.) speciosissimus Kühn. & Romagn. This is a brightly coloured species with a large umbonate, tawny reddish cap, bright ochre gills becoming tawny ochre or deep tawny red-rusty, and large subglobose or broadly elliptic-ovate spores, $9-12 (-12.5) \times 6.5-8\mu$.

Cortinarius (Derm.) sphagneti Orton is not uncommon in Scotland. It belongs in the section *Cinnamomei* where it is recognized by the persistent olive tints of its gills, stem and flesh, and also by its habitat and elliptic-amygdaliform spores $7.5-9.5 \times (4.25-) 4.5-5\mu$.

Cortinarius (Derm.) subanthracinus Henry.

Cortinarius (Seric.) subargentatus Orton [= *C. argentatus* sensu Kauffmann = *C. kauffmannianus* Henry nec A. H. Smith]. This species was renamed *subargentatus* by Orton (1960) but this epithet is invalid. The fungus resembles *C. alboviolaceus* but is less robust and is silvery white when young. It also lacks a distinct second veil.

Cortinarius (Phleg.) subpurpurascens ([Batsch] Fr.) Kickx is similar to *C. purpurascens* [Fr.] Fr. but differs in having a paler cap and pallid-buff gills which are never violaceous unless bruised.

Cortinarius (Phleg.) subtortus (Fr.) Fr. This fungus occurs amongst *Sphagnum* and *Myrica* near *Betula* in wet deciduous woods especially on high ground. It has a pale straw-yellow cap becoming bright yellow with a tawny tinge and finally tawny buff, gills which are at first pale olive, subglobose spores $7-9 \times 5-6.5\mu$, numerous facial and marginal cystidia and an aromatic smell.

Cortinarius (Phleg.) subtriumphans Orton is a very rare species described from specimens collected in Glen Affric, Inverness-shire. It is similar to *C. triumphans* Fr. sensu Henry but differs in having smaller spores, $9-11 \times 5-6\mu$, and an ochraceous to orange-yellow cap with innate brown fibrils. *C. crocolitus* Quél. is paler and yellower and lacks innate fibrils on the cap. See Orton (1960).

Cortinarius (Seric.) tabularis (Bull. ex Fr.) Fr.

Cortinarius (Cort.) tofaceus Fr.

Cortinarius (Seric.) traganus (Fr. ex Fr.) Fr. is not uncommon in native Scottish pinewoods. It has a pale violaceous cap, up to 12 cm in diam., which becomes whitish then pale yellowish or ochraceous and finely rusty ochre, pale ochraceous buff gills, a strong, sickly-sweet smell, and spores measuring $8-10 \times 5-6\mu$.

Cortinarius (Phleg.) turbinatus (Bull. ex Fr.) Fr.

Cortinarius (Phleg.) turmalis [Fr.] Fr.

Cortinarius (Derm.) uliginosus Berk.

Cortinarius (Phleg.) validus Favre

Cortinarius (Phleg.) variicolor (Pers. ex Fr.) Fr.

Cortinarius (Cort.) venetus (Fr. ex Fr.) Fr.

Cortinarius (Myx.) vibratilis (Fr.) Fr. is easily recognized by its bright orange-yellow, viscid cap, white viscid stipe, bitter taste and small spores $6.5-8 \times 4.5-5.5\mu$. It closely resembles *C. microspermus* but can be distinguished by its viscid cap and stipe.

Cortinarius (Phleg.) violaceo-cinctus Orton is similar to *C. balteatocumatilis*. See Orton (1960).

Cortinarius (Cort.) violaceus (L. ex Fr.) Fr. occurs locally in birch-pine woods on acid soils and is easily recognized since it has an entirely dark blue-violet velvety-scaly cap, amygdali-form spores $11-15 \times 7-9\mu$, and both cheilo- and pleuro-cystidia.

Cortinarius (Phleg.) xanthocephalus Orton [= *C. decolorans* (Pers. ex Secr.) Fr. sensu Orton 1955, Moser 1952]. This fungus resembles small specimens of *C. delibutus* Fr., but has a dry stem with a blue apex.

Cortinarius (Phleg.) xanthophyllus (Cooke) R. Henry

Craterellus cornucopioides (Linn. ex Fr.) Pers. has been recorded from a number of Scottish localities.

Crepidotus applanatus (Pers. ex Pers.) Kummer

Crepidotus calolepis (Fr.) Karst. is similar to scaly forms of *C. mollis* (Schaeff. ex Fr.) Kummer, but smaller, with more densely crowded minute scales, and a much thinner gelatinous layer to the cap.

Crepidotus phillipsii (Berk. & Br.) Sacc. A small species with cap up to 8 mm wide, having a short lateral stipe, and growing on *Carex* or grass debris in damp places. Its spores measure $5-7 \times 3-4\mu$.

Crinipellis stipitarius (Fr.) Pat. [= *Agaricus arundicola* Johnston] is a tiny marasmioid fungus which grows on dead grass. It has a flattened cap with a small, brown, acute papilla; the surface disrupts into brown repent fibrils, formed of pseudoamyloid hyphae, on a whitish ground. The dark brown stem is shaggy-tomentose with similar hyphae; the spores measure $6.5-9 (-11) \times 4-6.5\mu$.

Cystoderma carcharias (Pers. ex Secr.) Fayod is not uncommon in Scotland, although rare in other parts of the British Isles. It is recognized by its white or flesh-coloured cap which has a mealy-granular surface, and by its small amyloid spores ($3.5-5$) $4-5.5 \times 3.2-4\mu$.

Cystoderma cinnabarinum (Alb. & Schw. ex Secr.) Fayod is similar to *C. amianthinum* ([Scop.] Fr.) Fayod but more robust, with the cap up to 8 cm in diam., and of a bright red or orange-brown colour. The spores are non-amyloid and measure $3.5-5 \times 2.2-3 (-3.5)\mu$.

Cystoderma granulosum (Batsch ex Fr.) Fayod is similar to the preceding species but is dark brick-red and lacks cystidia.

Dermoloma atrocinerum (Pers. ex Pers.) Orton has a dark blackish brown cap fading to grey-brown at the margin, pale grey stipe, similarly coloured emarginate gills, and a strong smell of meal. Like *D. cuneifolium* (Fr. ex Fr.) Sing. it has a cellular cuticle but is easily distinguished by its non-amyloid spores.

Eccilia cancrina (Fr.) Ricken

Eccilia nigrella (Pers. ex Weinm.) Gillet

Entoloma ameides (Berk. & Br.) Sacc. This species is well characterized by its smell of boiled sweets ("bonbons anglais").

Entoloma costatum (Fr.) Kummer

Entoloma eriophilum (Fr.) Karst.

Entoloma fuscomarginatum Orton. This species, described from Tomich, Inverness-shire, is very close to *E. jubatum* but is distinguished by its mealy smell, larger spores and dark gill edge. The latter feature also separates it from *E. helodes*. See Orton (1960).

Entoloma helodes (Fr.) Kummer

Entoloma jubatum (Fr.) Karst.

Entoloma madidum (Fr.) Gillet [= *E. bloxamii* (Berk. & Br.) Sacc.] occurs in meadows. It is well characterized by the blue-grey colour of its conical-campanulate cap and stem, but the latter may have a yellow base.

Entoloma majaloides Orton is similar to *E. rhodopolium* (Fr.) Kummer, but differs from it in the very striking and persistent yellowish colour of the cap. See Orton (1960).

Entoloma nitidum Quél.

Entoloma porphyrophaeum (Fr.) Karst.

Entoloma prunuloides (Fr.) Quél.

Entoloma sericatum (Britz.) Sacc.

Entoloma sinuatum (Bull. ex Fr.) Kummer

Entoloma speculum (Fr.) Quél.

Entoloma turbidum (Fr.) Quél.

Fayodia bisphaerigera (J. Lange) Sing. has been found on several occasions in Scotland. It has a rather mycenoid appearance but is easily recognized by its peculiar, globose spores, 8–12 μ in diam., which have a characteristic cog-wheel-like appearance and are surrounded by a very thin outer amyloid membrane.

Flocculina (Naucoria) carpophila (Fr. ex Fr.) Orton

Flocculina (Naucoria) limulata (Fr. ex Weinm.) Orton is a lignicolous species found only in Scotland. It has a dark orange-brown cap 3–6 cm in diam., with a felty-scaly surface, a rather short stalk, and reniform spores 6.5–10 (–11) \times 3.7–5 μ .

Flocculina (Naucoria) siparia (Fr.) Orton

Galerina ampullaceocystis Orton, described from Tomich, Inverness-shire, is distinguished from all other veiled species of

Galerina by its bright colours, ellipsoid-amygdaliform spores, measuring $9-11.5 \times 5-6\mu$, peculiar cystidia and possibly by growing on rotten wood. See Orton (1960).

Galerina badipes (Fr.) Kühn.

Galerina calyptrata Orton, differs from *G. calyptrospora* Kühn. [i.e. *G. hypnorum* (Schrank ex Fr.) Kühn.] "in its bright colours and usually more conical cap, possibly also mealy taste." (Orton, 1960).

Galerina cinctula Orton has been collected in Glen Einich, Inverness-shire. It is characterized by a copious white veil, 2-spored basidia bearing minutely punctate, amygdaliform spores, $10-13 \times 5-6\mu$, capitate-lageniform cystidia and its small size.

Galerina mycenoides (Fr.) Kühn. is a rare species, usually found in *Sphagnum* at the edges of lakes. It has a distinct annular zone on the stipe, a rather dark, strongly striate cap and large, rugulose, fusiform spores $12.5-15.5 \times 5.5-7.5\mu$, borne on 2-spored basidia.

Galerina praticola (F. H. Möller) Orton. See Orton (1960).

Galerina pseudopumila Orton [= *Agaricus* (*Pholiota*) *pumilus* Fr. (1838) non *A. (Naucoria) pumilus* Pers. ex Fr. (1821)].

Galerina sphagnorum (Pers. ex Fr.) Kühn. A species found in *Sphagnum* bogs which is decidedly rare in Britain. It is distinguished from the common *G. tibiicystis* (Atk.) Kühn. by its mealy taste and differently shaped cystidia.

Galerina stagnina (Fr.) Kühn. is another rare annulate species of *Sphagnum* bogs with a dark red-brown cap, which often becomes depressed at the centre. It has large smooth spores, $11.5-18 \times 6.5-10\mu$.

Gloiocephala caricis (Karst.) Bas. This tiny marasmioid fungus occurs on debris of *Carex*. It has a white cap up to 5 mm in diam., very distant, thick, fold-like gills and a white ascending stipe. Microscopically it is characterized by a cellular cuticle with scattered, cylindrical, clavate or fusiform pileocystidia having slightly thickened walls; fusiform or ventricose-fusiform pleuro- and cheilocystidia with thin walls and large tear-shaped spores $(14.5-17.7-21.5 (-24.4) \times (4.5-5.3-6.3 (-7.2))\mu$. The only British record of this fungus is from Loch-an-Eilean, Inverness-shire. See Bas (1961).

Gomphidius maculatus [Scop.] Fr. occurs under *Larix* and is distinguished by its very pale pinkish buff cap shading into red-brown or dark brown toward the margin, and by its white stem which bears scattered black granules and finally becomes entirely black at the base.

Gomphidius roseus (Fr.) Karst. This species is easily recognized by its rose-red cap.

Gymnopilus flavus (Bres.) Sing. This rare species is best recognized from its habit of growing in clumps of *Dactylis glomerata*.

Gymnopilus fulgens (Favre & Maire) Sing. Another rare fungus found amongst *Sphagnum*.

Gymnopilus hybridus (Fr. ex Fr.) Sing.

Gymnopilus stabilis (Weinm.) Kühn. & Romagn.

Gyroporus castaneus (Bull. ex Fr.) Quéf.

Gyroporus cyanescens (Bull. ex Fr.) Quéf. is a robust species with pallid cap and strongly blueing flesh.

Hebeloma fastibile (Pers. ex Fr.) Kummer

Hebeloma leucosarx Orton occurs on damp ground under *Salix* and *Betula*. It has a pinkish buff cap, which in young specimens shows a tomentose margin, weeping gills, white flesh, and a stem lacking all trace of a veil. It has clavate cheilocystidia and limoniform spores, 9-12 (-14) \times 5.5-6.5 μ . This fungus was described from specimens collected at Loch Loy, Morayshire. See Orton (1960).

Hebeloma longicaudum (Pers. ex Fr.) Kummer [= *H. nudipes* (Fr.) Gillet sensu Kühn. & Romagn.] resembles *H. crustuliniforme* (Bull. ex St. Amans) Quéf., but has a more elongated stem in which only the extreme apex is minutely floccose-farinose, gills which do not weep in wet weather and very little smell. This fungus has elongated clavate cheilocystidia and is not uncommon.

Hebeloma radicosum (Bull. ex Fr.) Ricken

Hebeloma sinuosum (Fr.) Quéf. For a description see J. Lange (1938) as *H. sinapizans* (Paulet ex Fr.) Gillet.

Hebeloma testaceum (Batsch ex Fr.) Quéf.

Hebeloma versipelle (Fr.) Gillet

Hohenbuehelia atrocaerulea (Fr. ex Fr.) Sing.

Hohenbuehelia longipes (Boud.) Moser apud Gams

Hohenbuehelia reniformis (Meyer ex Fr.) Sing.

Hygrophoropsis albida (Fr.) Maire [= *Cantharellus stevensonii* Berk. & Br.] occurs in moss under conifers or amongst moss on very rotten wood. It forms small white pilei 5-13 mm in diam., which may become tinted with cream or ochre; the gills are white, decurrent and forked. Microscopically this species is characterized by non-amyloid spores measuring 5-6.5 \times 2.7-4.5 μ and hyphae which lack clamp connexions at the septa. The type material of *C. stevensonii* has rather larger spores, 5.75-9.75 \times 4-4.75 μ .

Hygrophorus (Hygrophorus) agathosmus (Fr. ex Secr.) Fr. [= *H. cerasinus* (Berk.) Berk.] is a rare species which occurs locally in the native pinewoods of Scotland, and is most easily recognized by its strong smell of bitter almonds or cherry-laurel. It has a greyish buff cap which is sometimes faintly tinged with pink and may disrupt into small scales; a white stem dotted above with white flocci and white arcuate gills.

Hygrophorus (Camarophyllus) berkeleyi Orton. This fungus resembles a very pale *H. pratensis* (Pers. ex Fr.) Fr. and occurs in similar habitats. It needs to be closely compared with "*H. virgineus* ss. Bataille" of French authors.

Hygrophorus (Hygroph.) camarophyllus (Alb. & Schw. ex Fr.) Dumée, Grandjean & Maire [= *H. caprinus* [Scop.] Fr.] has a dark bistre cap ornamented with radiating blackish fibrils (seen under a lens); whitish or pallid gills; a whitish, grey-brown or bistre stem and spores measuring $7-9 \times 5-6\mu$.

Hygrophorus (Hygrocybe) cantharellus (Schw.) Fr. occurs in mossy grass or in *Sphagnum*. It is very similar to *H. coccineocrenatus* but has a scarlet, vermilion or orange cap, often with a yellower margin, and the entire surface covered with concolorous scurfy scales which do not darken. It also has smaller spores, $8-10 \times 5-6\mu$.

Hygrophorus (Cam.) cinereus (Pers. ex Pers.) Quél. occurs in meadows, and is distinguished from related species by its non-striate grey or grey-brown cap, its grey arcuate-decurrent gills and its white stipe which lacks a yellow base.

Hygrophorus (Hygroc.) coccineocrenatus Orton [= *H. turundus* (Fr. ex Fr.) Fr. sensu Kühn. & Romagn.] grows in wet places especially in *Sphagnum*. It has a small cap up to 30 mm in diam. with a depressed centre, which is at first scarlet or vermilion, fading to orange or yellowish except near the margin. The cap is covered with erect, pointed, brown scales which soon darken or blacken. The gills are deeply decurrent and either whitish or yellowish, while the spores measure $10-13 (-14) \times 6-8\mu$.

Hygrophorus (Hygroc.) conicoides Orton. This is a characteristic fungus of coastal dunes, which blackens on bruising. It has the aspect of *H. conicus* (Scop. ex Fr.) Fr. but may be distinguished by its more persistently reddish cap, chrome-yellow gills which soon become reddish, reddish flesh in the pileus, and narrower spores, $(9.5-) 10-13 \times 4-5\mu$. See Orton (1960).

Hygrophorus (Hygroc.) flavescens (Kauffm.) A. H. Smith & Hesler resembles *H. chlorophanus* (Fr.) Fr., from which it may be separated by its chrome-yellow or sometimes orange-tinted (never lemon-yellow) gills, drier stem and narrower spores, $6.5-9 \times 4-5 (-5.5)\mu$.

Hygrophorus (Hygroc.) fornicatus Fr. is a fairly robust species which is not uncommon in Highland meadows. It has a conico-campanulate cap which is at first white but later becomes streaked with grey-brown from the disc outward; a white stipe with grey-brown fibrillose streaks especially toward the base which may also be dotted with blackish flocci.

Hygrophorus (Hygroph.) fuscoalbus (Lasch.) Fr.

Hygrophorus (Hygroc.) glutinipes (J. Lange) Orton is a lemon-yellow species with persistently viscid cap and stem.

The horizontal gills are whitish yellow then pale lemon; spores $6.5-8 \times 3.5-4\mu$.

Hygrophorus (Hygroph.) hedrychii (Vel.) Kult has a viscid, alutaceous cap, up to 4 cm in diam., with a fleshy hue, a concolorous elongated stipe and similarly coloured sub-decurrent gills. It grows in woods and has ovate spores, $6.5-7.5 \times 4.5\mu$.

Hygrophorus (Cam.) hymenocephalus A. H. Smith & Hesler is recognized by its dark blackish brown cap with an hymeniform cuticle, concolorous stipe and globose or sub-globose spores $4-5.5 \times 4-4.5\mu$.

Hygrophorus (Hygroc.) intermedius Pass. has a conical reddish orange cap with a distinctly fibrillose-scaly surface, the scales sometimes becoming brownish, a concolorous fibrillose stem, and whitish or pale yellowish gills bearing numerous cheilocystidia. There is a tendency for this species to blacken with age or on handling.

Hygrophorus (Hygroc.) langei (Kühn.) Pearson [= *H. croceus* (Bull. ex St. Amans) Bres. sensu Kühn. & Romagn.] resembles *H. conicus* (Scop. ex Fr.) Fr. but does not blacken.

Hygrophorus (Hygroc.) lilacinus (Laestadius) M. Lange is an alpine species which grows on peat above 2000 ft. It has a very small cap, 10-20 mm in diam., which is yellowish brown or ochraceous with a violet tinge at the centre, a violaceous stem, deeply decurrent pale ochraceous gills and spores measuring $7.5-9.5 \times 5-6\mu$. This fungus has been collected on Cairngorm Mt., Inverness-shire.

Hygrophorus (Hygroc.) marchii Bres. is a fairly common species with a dry, deep scarlet-red cap fading to orange-scarlet, and becoming pale tawny buff or dirty ochraceous yellow with a golden yellow silky sheen. The spores are ellipsoid-ovoid or ellipsoid, $6.5-8.5 \times (3.5-) -4-5\mu$.

Hygrophorus (Hygroc.) metapodius [Fr.] Fr. A large coarse grassland species with a greyish, grey-brown or red-brown cap up to 15 cm in diam., it has a very stout greyish stipe and thick, broad, adnate, distant, grey gills. Furthermore all parts turn slowly red then black when handled or with age. The fungus has a strong mealy smell.

Hygrophorus (Cam.) micaceus Berk. & Br. is a small woodland species in which both cap and stipe are yellowish brown and often tinged with olive; the gills are darker sepia-brown. This rare fungus has a cellular cuticle.

Hygrophorus (Hygroc.) mollis (Berk. & Br.) Kauffm. occurs in grass or woodlands. It is similar to *H. coccineocrenatus* but has an orange-yellow cap bearing small pointed concolorous scales, which do not darken, and smaller spores $8-9 \times 4-5\mu$.

Hygrophorus (Hygroc.) nemoreus (Pers. ex Fr.) Fr. resembles *H. pratensis* (Pers. ex Fr.) Fr. but is distinguished by its mealy

smell, innate radiately fibrillose cap, smaller spores $5.5-6.5 \times 3.5-4\mu$) and by its occurrence in woodland.

Hygrophorus (Hygroc.) nitiosus Blytt is a grassland species with grey-brown or sepia cap darkening to vandyke or dark sepia-olive. It has a white stipe with a brownish base and rather broad distant sinuate-adnate gills which are at first white but at length pale olive-sepia. The gills, and sometimes also the cap and stem, redden then turn slowly dark brown or black when bruised. This fungus has a strong nitrous smell.

Hygrophorus (Hygroc.) nitratus (Pers. ex Pers.) Fr. is very close to the preceding species, differing only in the absence of any reddening on bruising.

Hygrophorus (Hygroc.) obrusseus (Fr.) Fr. is a species of grasslands and heaths having a lemon-yellow or golden cap which soon becomes dry and radiately fibrillose. Microscopically it is well characterized in having conspicuously projecting, acutely conical cheilocystidia.

Hygrophorus (Hygroph.) olivaceo-albus (Fr. ex Fr.) Fr. has a dark brown glutinous cap, and a stipe which is viscid and brownish in colour beneath the veil.

Hygrophorus (Hygroc.) ovinus (Bull. ex Fr.) Fr. is similar to *H. nitiosus* but larger and darker with very broad, thick distant gills of a dark sepia or vandyke-brown which bruise bright red especially along the margin. This fungus usually has a nitrous smell, and its spores measure $7-9 (-10) \times 5-6.5 (-7)\mu$.

Hygrophorus (Hygroph.) pustulatus (Pers. ex Fr.) Fr. has a grey-brown cap covered with minute fuscous squamules. The stem, although paler, is also covered with similar dark granular squamules, and the gills are white and decurrent. It is a northern species found in coniferous forests.

Hygrophorus (Hygroc.) reai Maire was named after the British mycologist Carleton Rea by René Maire in 1910. It has a scarlet or orange-red cap which is convex to acutely conical then expanded and somewhat viscid at first, adnate gills varying from pale to deep chrome-yellow but sometimes flushed with orange or red from the base, and a bitter taste. The spores, often strongly constricted in some views, measure $6.5-9 \times 4-5\mu$.

Hygrophorus (Cam.) russocoriaceus Berk. & Miller resembles small sporophores of *H. niveus* [Scop.] Fr. but has an ivory colour. It is most easily recognized by its strong smell of Russian leather or cardamom.

Hygrophorus (Hygroc.) schulzeri Bres. resembles *H. nitiosus* and *H. nitratus* in having a vandyke or blackish brown cap which appears minutely adpressedly silky-tomentose under a lens, but it is readily separated from these fungi by its small rugulose, subglobose spores, $3-4.5 \times 2.5-3.5\mu$, and lack of nitrous smell. This fungus was originally stated to grow under

Larix but it has been found in grassland in this country. See Orton (1960).

Hygrophorus (Hygroc.) sciophanus (Fr.) Fr. A grassland species with tawny-brick or blood-red cap and stem, rose-brick or orange-blood-red gills, and spores $7-9 \times 5-6.5\mu$.

Hygrophorus (Hygroc.) splendidissimus Orton occurs in grasslands. It resembles *H. coccineus* (Schaeff. ex Fr.) Fr. and *H. puniceus* (Fr.) Fr. but differs from the former in having more narrowly adnate to free gills, a more robust habit and differently shaped spores, (7-) $7.5-10 \times (4-)$ $4.5-5.5\mu$, and from the latter in its lack of a conspicuously fibrillose-striate stipe. Furthermore *H. puniceus* has white flesh at the base of the stem and its cap colours fade more slowly. See Orton (1960).

Hygrophorus (Hygroc.) strangulatus Orton closely resembles *H. marchii*. It has a very hygrophanous cap which is at first scarlet or vermilion but dries out yellowish ochre or orange and then appears minutely golden-scurfy or even reflexed-scaly at the disc. Microscopically it is well characterized by its strongly constricted spores which are ellipsoid-oblong, $7-9 \times 4-5\mu$. This fungus occurs on heaths under *Pteridium* and *Calluna*.

Hygrophorus (Cam.) subradiatus (Schum. ex Secr.) Fr. has a pale date-brown cap with a darker umbo; old specimens becoming grey-brown and radiato-striate. The gills are adnato-decurrent and often tinged with the colour of the cap, while the spores measure $7-9 \times 4.5-6\mu$. This fungus tends to occur gregariously in grassy places.

Hygrophorus (Cam.) subviolaceus Peck has been collected at Loch Rannoch, Perthshire. It may be recognized by its violaceous-grey cap with darker, brownish disc, slate or blue-grey arcuate decurrent gills, and similarly coloured but paler stipe. This fungus resembles *H. lacmus* ([Schum.] Fr.) Kalchbr. without the yellow stem base.

Hygrophorus (Hygroc.) turundus (Fr. ex Fr.) Fr. is very similar to *H. coccineocrenatus* but differs in the chrome-yellow or orange colour of the cap, which is also ornamented with dark-brown or sepia scales, at least toward the centre. *H. turundus* also has smaller spores, $8-11 (-12) \times 4.5-5.5\mu$.

Hygrophorus (Hygroc.) unguinosus (Fr.) Fr. has a persistently glutinous cap and stipe, varying in colour from smoky grey or greyish brown to sepia, while the broadly adnate gills are at first white but soon become greyish and often rather darker at the base; the ellipsoid spores measure $6.5-8 \times 4.5\mu$. This is a fairly common grassland species.

Hygrophorus (Hygroc.) vitellinus Fr. [= *H. citrinus* Rea non sensu J. Lange] occurs in damp mossy grass or on heathy places under *Pteridium*. It has a fairly small, viscid umbilicate cap of a lemon-yellow colour, fading to whitish in old specimens, persistently deep lemon- or egg-yellow gills which are

strongly arcuate-decurrent, and spores measuring $6-8 \times 4.5-5\mu$.

Hygrophorus (Hygroc.) xanthochrous Orton was first described from the Rothiemurchus Nature Reserve, Inverness-shire. It is a small delicate fungus, resembling *Mycena fibula* (Bull. ex Fr.) Kühn. in habit, with a viscid convex-umbilicate, chrome-yellow cap, which is usually tinged with lilac especially at the centre. The gills are arcuate-decurrent and pale lilac in colour; the rather tall, narrow, viscid stipe is pale lilac above but yellowish below, and the spores have a characteristic ellipsoid-amygdaliform shape and measure $6-8 \times 3.5-4.5\mu$.

Hypholoma epixanthum (Fr.) Quél. See Orton (1960).

Hypholoma polytricha (Fr. ex Fr.) Ricken

Hypholoma radicosum J. Lange

Inocybe auricoma (Batsch ex Fr.) J. Lange

Inocybe bongardii (Weinm.) Quél. is a robust species, reaching 17.5 cm in total height, with a brown, adpressedly squamulose cap up to 8.5 cm in diam., and a tall similarly coloured stipe up to 1.7 cm in thickness. It has a red-staining flesh, and a strong floral smell similar to, but distinct from, that of *I. pyriodora* (Pers. ex Fr.) Kummer.

Inocybe calamistrata (Fr.) Gillet has a dark brown cap with erect scales, a similarly coloured squarrose-scaly stipe with a blue-green basal tomentum, and flesh which reddens except in the base of the stem where it is blue-green in colour.

Inocybe calospora Quél. apud Bres. is best recognized by its round spiny spores.

Inocybe cervicolor (Pers. ex Pers.) Quél.

Inocybe dulcamara (Alb. & Schw. ex Pers.) Kummer

Inocybe dunensis Orton [= *I. decipiens* sensu Heim] is a not uncommon fungus in dune slacks, usually found in association with *Salix* spp. It may resemble *I. serotina* Peck, with which it often grows, but its stem is usually tinged pinkish inside and out at least at the apex. See Orton (1960).

Inocybe eutheles (Berk. & Br.) Quél. has a whitish or very pale ochraceous cap with a rimose surface; the margin is often appendiculate with the veil. The stipe is white, or tinted with pink at the apex, and is pruinose throughout. The spores are smooth, amygdaliform, $8.5-10 \times 4-5\mu$; the cystidia thick-walled, fusiform and often yellowish. This species, found in coniferous woods, was originally described from Aboyne, Aberdeenshire.

Inocybe fibrosa (Sow. ex Berk.) Gillet has a large smooth, conical, shining white cap which stains sulphur-yellow then ochraceous. The stipe, either equal or enlarged downwards to a napiform marginate base, is white then pale ochre with a sulphur edge to the bulb; it has a floccose apex but is fibrillose elsewhere. This fungus occurs in coniferous woods, and has a smell of new meal.

Inocybe flocculosa (Berk.) Sacc.

Inocybe grammata Quél. has a whitish or pallid cap densely covered with silky fibrils, but it becomes dark straw-yellow with age as the fibrillose covering disappears.

Inocybe haemacta (Berk. & Cooke) Sacc. In this species the cap, which has a very dark disc, is covered with olive squamules. The stipe has a white fibrillose apex and a white, tomentose, marginate bulb, but is elsewhere covered with dense olive squamules. Further the flesh has a green tint in the cap whilst in the stem it is darker green blotched with red.

Inocybe halophila Heim is an uncommon species of coastal sand dunes with cylindrical spores $12-16 \times 5-7\mu$.

Inocybe hirsuta (Lasch) Quél. occurs in coniferous woods and has a reddish or dark brown cap with pointed recurved scales and a similarly scaly brown stipe with a white floccose apex. It has smooth ellipsoid spores, $11-13 \times 5-7\mu$, and thin-walled, clavate cystidia.

Inocybe hystrix (Fr.) Karst. is not uncommon in certain deciduous Scottish woodlands. It is easily recognized by its cap which is densely covered with dark brown erect, pointed scales, set against a pale background. The stem is concolorous and likewise covered with recurved scales. It has smooth spores, $9-11.5 \times 4.5-6\mu$, and long, fusoid, thick-walled cystidia, capped with crystals.

Inocybe longicystis Atk.

Inocybe lucifuga (Fr. ex Fr.) Kummer

Inocybe mixtilis (Britz.) Sacc.

Inocybe obscura (Pers. ex Pers.) Gillet is one of a group of closely allied species with a violet tint to the top of the stem, which is elsewhere covered with brown cottony fibrils.

Inocybe phaeoleuca Kühn. has a dark brownish fawn or chestnut-coloured cap with an almost black centre. The stipe is white and pruinose throughout owing to a covering of cystidia; at the base of the stipe the cystidia are very thick-walled and are capped by crystalline material. The spores are smooth and measure $8.5-12 \times 5-7\mu$.

Inocybe pudica Kühn. resembles *I. geophylla* (Sow. ex Fr.) Kummer, but is distinguished by both cap and stem becoming stained with pink or orange.

Inocybe putilla Bres.

Inocybe sambucina (Fr.) Quél. This species is very similar to *I. geophylla* (Sow. ex Fr.) Kummer, but more robust. It is poorly known in the British Isles and needs further investigation.

Inocybe terrigena (Fr.) Kühn.

Inocybe trechispora (Berk.) Karst. is a rare species of damp woods with a slightly viscid, white cap becoming pale ochre with age. It has nodulose spores $6.5-7.5 \times 4-5\mu$ and thick-walled fusoid cystidia.

Inocybe umbrina Bres.

Inocybe virgatula Kühn.

Inocybe whitei (Berk. & Br.) Sacc. has a convex tawny, slightly viscid cap with a white fibrillose veil, but at length expands and becomes entirely tawny. The stem is at first white then tawny. The type material bears smooth, ellipsoid-amygdaliform spores, $8-10.5 (-12) \times 4-5 (-6)\mu$, very like those figured by Heim (1931) for *I. eutheles* (fig. 142); it also bears short, thick-walled facial cystidia varying in shape from ovoid to obpyriform, with swollen bases up to 26μ in diam. The cheilocystidia are more variable. This fungus was named after Dr. F. Buchanan White, who collected it at Loch Rannoch, Perthshire, in 1875.

Inocybe xanthomelas Boursier & Kühn.

Laccaria bicolor (Maire) Orton is distinguished by its pale lilac or violaceous gills, and by the presence of a bluish or lilac tomentum at the base of the stipe. In other respects it is similar to *L. proxima* (Boud.) Pat. and is sometimes regarded as a variety of this species.

Laccaria striatula (Peck) Peck resembles *L. tortilis* ([Bolt] S. F. Gray) Cooke in having 2-spored basidia but the spores are smaller than in that species, measuring $8-11 (-12) \times 8-10 (-10.5)\mu$ as against $11-14 (-16)\mu$. For a detailed comparison of these two species see Orton (1960).

Laccaria trullisata (Ellis) Peck occurs on sand dunes and is characterized by its orange-brown cap and long, oval very minutely warted spores $12-18.5 \times 7.5-8.5\mu$. It has been found repeatedly at Culbin Sands, Inverness-shire.

Lactarius acris (Bolt. ex Fr.) S. F. Gray occurs in deciduous woodland especially on calcareous soil. It has a somewhat viscid cap which varies from tan to blackish brown and is often radiately wrinkled. The very acrid milk, like the flesh, rapidly becomes bright rose-red on exposure to air.

Lactarius circellatus Fr. is usually associated with *Carpinus*. It resembles *L. pyrogalus* (Bull. ex Fr.) Fr., but has a vinaceous buff cap ornamented with darker zones and dries with a rather leaden appearance.

Lactarius controversus (Fr. ex Fr.) Fr. is very like *L. piperatus* (Scop. ex Fr.) S. F. Gray, except that both cap and stem are mottled with pink or blood-red patches. It is usually found under *Populus*.

Lactarius flexuosus (Pers. ex Fr.) S. F. Gray has a leaden- or violaceous-grey cap with darker zones, and white acrid milk. It occurs in coniferous woodland.

Lactarius fulvissimus Romagn. This species is similar to *L. mitissimus* (Fr.) Fr., but is much larger, reaching 7 cm in diam., and has a matt surface.

Lactarius glaucescens Crossland is very like *L. piperatus* (Scop. ex Fr.) S. F. Gray, but both the flesh and milk turn a greenish blue on exposure to air.

Lactarius helvus (Fr.) Fr. has a minutely floccose scaly cinnamon or tan-coloured cap which develops a strong smell of fenugreek when dried. This fungus is not uncommon in coniferous woods.

Lactarius hyginus (Fr. ex Fr.) Fr. occurs in coniferous woods. It has a glutinous, reddish brown cap, often flushed with pink, and frequently ornamented with rather indistinct, darker zones. In dry weather the cap, which may be up to 13 cm in diam., has a shiny appearance. This fungus has copious, white, acrid milk.

Lactarius insulsus (Fr.) Fr.

Lactarius lacunarum Hora is a species found in damp places, especially under *Alnus*, with a plano-depressed, indistinctly papillate, rugulose cap of a fulvous or rufous orange colour. The milk is at first mild, but slowly becomes bitter to subacid, and changes to yellow on a handkerchief.

Lactarius lilacinus (Lasch) Fr. This species, which occurs in alder bogs, has a minutely pubescent, dingy lilaceous grey cap and mild watery milk.

Lactarius mairei Malençon var. **zonatus** Pearson belongs in the same section as *L. torminosus* (Schaeff. ex Fr.) S. F. Gray, but differs in having an orange-buff cap with darker zones and darker adpressed or recurved scales, while the margin is shaggy with brown hairs.

Lactarius musteus Fr. is a very rare species occurring amongst *Sphagnum* in pinewoods. It has a viscid, uniformly pale chamois-coloured cap.

Lactarius obscuratus (Lasch) Fr. grows in *Sphagnum* under *Alnus*. It has a small cap 1-3.5 cm in diam., which is conspicuously striate when water-soaked, of a reddish brown colour, sometimes olivaceous at the centre and commonly papillate.

Lactarius picinus Fr. resembles *L. fuliginosus* (Fr.) Fr., but has an almost black, velvety cap, and flesh which scarcely changes colour.

Lactarius representanaeus Britz. is a characteristic fungus which is virtually restricted to the native Scottish pinewoods. It has a large viscid cap up to 16 cm in diam., which is bright straw-coloured but becomes violaceous on bruising. The surface is covered with adpressed fibrillose scales and the margin is shaggy with matted hairs. The stipe is concolorous but pitted, the gills are pale cream but bruise violet, and the white milk becomes violet on exposure to the air.

Lactarius scrobiculatus (Scop. ex Fr.) Fr. This species is very similar to the preceding fungus, but it does not develop violet tints on bruising and the milk soon becomes sulphur-yellow.

Like *L. representaneus* it appears to be restricted to native Scottish pinewoods.

Lactarius sphagneti (Fr.) Moser apud Gams occurs in coniferous woods. It has a red-brown cap with a darker, pointed umbo and resembles *L. hepaticus* Plowright apud Boud. except that the milk rarely becomes yellow.

Lactarius spinosulus Quél. closely resembles *L. lilacinus* but occurs fairly freely in deciduous woods. It has a flesh-pink to brick-red cap covered with small pointed scales, and white milk which is mild at first then acrid.

Lactarius trivialis (Fr. ex Fr.) Fr. has a glutinous, violaceous slate-grey or lead-coloured cap with indistinct zones, a stem, which is pinkish buff above but straw-yellow below and sometimes pitted with darker spots, and milk which turns slightly greenish yellow.

Lactarius zonarius (Bull. ex St. Amans) Fr.

Lentinellus flabelliformis (Bolt. ex Fr.) Orton [= *Lentinus scoticus* Berk. & Br.].

Lentinellus tridentinus (Sacc. & Syd.) Sing.

Lentinellus vulpinus (Sow. ex Fr.) Kühn. & Maire

Lentinus adhaerens (Alb. & Schw. ex Fr.) Fr. The old Scottish records of this species are dubious, see Reid (1958).

Lepiota alba (Bres.) Sacc. is an entirely white fungus with a cap up to 4 cm in diam., which may become finely scaly with age. It has large elliptic-fusiform spores, $10-15 \times 5.5-6.7\mu$, and is found particularly on dunes and coastal grassland.

Lepiota badhamii (Berk. & Br.) Quél. [= *L. meleagroides* Huijs.] has been much confused with *L. bresadolae* by continental mycologists. It is a very characteristic species with a dark brown cottony-tomentose or minutely hirsute-scaly cap, and a similarly coloured stem bearing a distinct ring. The fungus reddens on bruising and turns blue-green with NH_3 fumes. Its spores measure $6-8 \times 3.5-4-5\mu$.

Lepiota bresadolae Schulzer is often confused with the previous species but has larger spores, $8-12 \times 6-8\mu$, a cap which is at first white becoming saffron, at least on handling, then quickly red-brown, and which breaks up into small reddish brown scales toward the margin. Furthermore the flesh becomes saffron-yellow when exposed and the fungus does not change colour with NH_3 .

Lepiota erminea (Fr.) Gillet resembles *L. alba* but is altogether smaller, apart from having a distinctly papillate, silky-fibrillose cap and larger spores, $14-19 (-21) \times 5-6 (-6.7)\mu$.

Lepiota excoriata (Schaeff. ex Fr.) Kummer

Lepiota georginae (W. G. Smith) Sacc. has a white cap, up to 3 cm in diam., stippled with reddish brown, and a rather tall, thin, annulate stem which appears densely hairy under a

lens. All parts of this fungus become bright crimson when bruised, and blue-green when in contact with NH_3 .

Lepiota leucothites (Vitt.) Orton [= *L. naucina* (Fr.) Kummer]

Lepiota pseudohelveola Hora has a dirty brownish grey cap, up to 5 cm in diam., which is often tinged with pink. It is hispid at the disc but breaks up into fine squamules on a white background nearer the margin. The stipe is pinkish brown and may be subsquamulose or floccose below the membranous ring. This fungus bears ventricose-fusiform hairs on the gill edge and ellipsoid spores measuring $7-10 (-11.5) \times 4-4.7\mu$.

Lepiota serena (Fr.) Sacc. This is another rather tall delicate white species which can only be recognized by its microscopic characters.

Lepiota ventriospora Reid belongs in the same group as *L. clypeolaria* (Bull. ex Fr.) Kummer. It is a fairly robust species in which the cuticle disrupts into small adpressed fibrillose brown or yellowish brown scales on a brownish fawn base flushed with pink or pinkish orange, and in which the cap margin is appendiculate with the remnants of the thick, felty yellowish or pinkish brown veil. The stipe is concolorous with the pileus and densely covered with thick felty remnants of the veil beneath the cottony, evanescent ring, and may also bear dark brown spiral bands of scales toward the base. This fungus, which occurs under conifers and broad-leaved trees, has mummy-shaped spores $13-20.8 \times 4-5\mu$.

Lepista luscina (Fr. ex Fr.) Sing. [= *L. panaeola* (Fr.) Karst.] occurs in pastures, sometimes forming rings. It has a smoky-brown cap, becoming paler with age, which is typically marked with a ring of darker spots toward the margin. The gills are at first white then reddish with a greyish violet tinge, and the spores are pink in the mass and minutely roughened.

Leptoglossum lobatum ([Pers.] Fr.) Ricken

Leptoglossum retiruge ([Bull.] Fr.) Kühn. & Romagn. is similar to the above species, but has a central point of attachment and more reticulately-connected gills.

Leptonia anatina (Lasch.) Kummer. See Orton (1960).

Leptonia babingtonii (Blox.) Orton

Leptonia caerulea Orton. See Orton (1960).

Leptonia chalybaea (Pers. ex Fr.) Kummer

Leptonia corvina (Kühn.) Orton

Leptonia cyaneoviridescens Orton comes closest to *L. lazulina* (Fr.) Quél., but is easily distinguished by the sulphur-yellow mycelium and by the gills which are at first pale ultramarine then sulphur-greenish.

Leptonia euchroa (Pers. ex Fr.) Kummer

Leptonia exilis (Fr. ex Fr.) Orton

Leptonia formosa (Fr.) Gillet

Leptonia fulva Orton has a striate cap which is similar in colour to that of *Amanita fulva* [Schaeff.] Secr. See Orton (1960).

Leptonia griseocyanea (Fr. ex Fr.) Orton

Leptonia griseorubella (Lasch.) Orton

Leptonia incana (Fr.) Gillet

Leptonia intermedia F. H. Möller

Leptonia lampropus (Fr. ex Fr.) Quél.

Leptonia lappula (Fr.) Quél.

Leptonia linkii sensu Möll.

Leptonia lividocyanula (Kühn.) Orton

Leptonia nigroviolacea Orton. See Orton (1960).

Leptonia placida (Fr. ex Fr.) Kummer

Leptonia poliopus Romagn.

Leptonia pyropisila Orton is readily recognized by the carrot-coloured or vermilion base to the stem.

Leptonia sarcitula Orton was described from material collected at Plodda Falls, Guisachan, Inverness-shire. See Orton (1960).

Leptonia turci Bres.

Leucocoprinus cepaestipes (Sow. ex Fr.) Pat. usually occurs in clusters on rotting sawdust, and is recognized by its whitish egg-shaped cap with a pale brown disc and a striate margin; the surface is cracked into minute granular, often concentric scales. The whitish stipe, which bears a distinct membranous ring, is rather tall and slender although distinctly enlarged toward the base.

Leucocortinarius bulbiger (Alb. & Schw. ex Fr.) Sing. is a very rare fungus resembling species of *Cortinarius* subgenus *Phlegmacium* section *Scauri*, and is restricted to native Scottish pinewoods. It has a pale clay-brown cap, whitish or very pale brown gills, and a whitish stem with a conspicuous marginate bulb and bearing toward the apex the remnants of a distinct cortina. The spore print is white and the hyaline spores measure $7-9 \times 4-5\mu$.

Leucopaxillus giganteus (Sow. ex Fr.) Sing. commonly forms large fairy rings in meadows. It is a very robust white fungus with funnel-shaped cap and decurrent gills. It is readily distinguished from all similar *Clitocybe* spp. by its smooth amyloid spores.

Leucopaxillus paradoxus (Constantin & Dufour) Boursier is similar to the preceding species but has a smaller, cream-coloured or pale ochraceous cap, and spores ornamented with amyloid warts.

Limacella glioderma (Fr.) Maire. In wet weather this fungus has a glutinous cap which is red-brown in colour but sometimes chestnut-brown at the disc. The stipe is pallid and floccose below the fugacious cottony ring, while the small, globose spores measure $4-5\mu$. This species has a very strong smell of meal.

Limacella guttata (Pers. ex Fr.) Konrad & Maubl. is a white or very pale tan-coloured fungus with a large viscid cap up to 11 cm in diam. The stipe gradually enlarges toward the base and bears a spreading membranous ring. This fungus is usually found in coniferous woods.

Lyophyllum connatum (Schum. ex Fr.) Sing. resembles *L. decastes* (Fr. ex Fr.) Sing. [= *L. aggregatum* (Schaeff. ex Fr.) Kühn.] in habit and growth form, but has a white cap.

Lyophyllum fumatofoetens (Secr.) J. Schaeff. [= *Lyophyllum leucophaeatum* (Karst.) Karst.] has a dirty grey, innately fibrillose cap up to 7 cm in diam., concolorous stipe, similarly coloured gills, and more or less verrucose spores measuring $6-9 \times 2.5-4\mu$. The fruitbody blackens on bruising.

Lyophyllum immundum (Berk.) Kühn. resembles *L. decastes* (Fr. ex Fr.) Sing. [= *L. aggregatum* (Schaeff. ex Fr.) Kühn.] and its allies but does not form large clusters, and its greyish gills quickly turn grey-blue then blackish on bruising. It has spherical spores $6-7.5 \times 5-7\mu$.

Lyophyllum semitale (Fr.) Kühn is similar to the preceding fungus but differs in having oblong spores $6.5-9.5 \times 4-5\mu$. It occurs in coniferous woods.

Marasmius alliaceus (Jacq. ex Fr.) Fr. is a medium-sized species with whitish radiately sulcate cap, tall blackish pruinose stipe and a strong smell of onion (*Allium cepa*).

Marasmius amadelphus (Bull. ex Fr.) Fr.

Marasmius calopus (Pers. ex Fr.) Fr. See Orton (1960).

Marasmius epiphylloides (Rea) Sacc. & Trotter is a very tiny white species which is restricted to ivy (*Hedera helix*) leaves, and has spores $14-17.2 \times 3-3.2\mu$.

Marasmius hudsonii (Pers. ex Fr.) Fr. is a small species with a pale fawn or creamy-flesh-coloured cap covered with very long, dark brown, scattered erect hairs. This fungus is only found on fallen holly (*Ilex*) leaves.

Marasmius porreus (Pers. ex Fr.) Fr. is a little known species with a small pallid cap, elongated reddish brown tomentose stipe, and a strong smell of garlic. It has been figured as having subglobose spores by various authors.

Marasmius undatus (Berk.) Fr. [= *M. chordalis* Fr.] usually occurs on old rhizomes of *Pteridium*. It has a small pale brown cap, up to 1 cm in diam., covered with a whitish pruina, a tall, thin, whitish pruinose stipe becoming dark brown from below, and characteristic amygdaliform spores, $8-11 (-12.5) \times 4.2-6.5\mu$.

Melanoleuca reai Sing. [= *Tricholoma subpulverulentum* (Pers.) Karst. sensu Rea]

Melanophyllum echinatum (Roth. ex Fr.) Sing. [= *Lepiota haematosperma* (Bull. ex Fr.) Quél.; *Agaricus hookeri* Klotzsch] is recognized by its dark brown, granular-mealy

conico-campanulate cap up to 4 cm in diam. It has a similarly coloured, mealy stem, blood-red or purplish gills which soon become dark reddish brown, and purplish flesh. The granules on the cap and stem are formed of brown sphaerocysts. The spores of this fungus, $5-6 \times 2.5-3.5\mu$, are also slightly tinted with brown.

Mycena atrocyanea (Batsch ex Fr.) Gillet.

Mycena atromarginata (Lasch) Kummer grows on wood, has a grey-brown cap and stem and a blackish-coloured edge to the gill. It is a characteristically Scottish fungus.

Mycena aurantimarginata (Fr.) Quél. occurs under conifers. It has a grey-brown or brownish olive cap, a greyish stem which may be slightly tinted with yellow or brown, and grey-brown gills with a bright orange margin.

Mycena belliae (Johnston) Orton grows in fascicles on the stems of *Phragmites*, just above the water level. Its cap, which is sepia fading to pale horn-colour or whitish, has a viscid cuticle and is striate to the disc. The stem is whitish discolouring red-brown from the base up, and the whitish gills are deeply arcuate-decurrent. See Orton (1960).

Mycena bulbosa (Cejp) Kühn. resembles *M. stylobates* (Pers. ex Fr.) Kummer in having a basal disc to the stipe, but differs from this species in having a gelatinous gill edge, non-amyloid spores, and lack of warts or spines on the cap.

Mycena capillaripes (Schum. ex Fr.) Kummer grows in vast swarms under pines. It resembles *M. rubromarginata* but unlike that species it has a nitrous smell.

Mycena carnicolor Orton grows amongst grass and has an omphalinoid habit. The entire fungus is pinkish in colour, and its spores are $7.5-9 \times 4-4.5\mu$.

Mycena cinerella Karst. is a species with a strongly striate, hemispherical, ashy-grey or grey-brown cap, strongly arcuate-decurrent whitish gills, a mealy smell, and spores measuring $6.5-10 \times 4-5.7\mu$.

Mycena citrinomarginata Gillet has a yellowish cap with dirty brown striae, a whitish to pale sulphur-coloured stem and white gills with a pale yellow margin.

Mycena clavicularis (Fr.) Gillet belongs in the section *Glutinipedes*. It has a conico-campanulate umbilicate cap which is dingy white with brown striae, a viscid stem, greyish decurrent gills, and spores measuring $7-12 \times 4-6\mu$. This fungus is found in coniferous woods.

Mycena crispula (Quél.) Kühn. is a very small pure white fungus with a few decurrent fold-like gills which peter out before reaching the margin of the cap. Both cap and stem are covered by long pointed hairs with a somewhat swollen base; the spores are non-amyloid.

Mycena crocata (Schrad. ex Fr.) Kummer is easily recognized by the saffron or blood-red juice in the stem and by all parts

becoming stained with this colour on bruising. There are no recent Scottish records but the fungus is so distinctive that it is unlikely to have been misdetermined.

Mycena fagetorum (Fr.) Gillet grows on dead fallen leaves of *Fagus*.

Mycena floridula (Fr.) Quél resembles *M. flavo-alba* (Fr.) Quél. but may be distinguished by its cap which is at first bright coral-pink, then salmon and finally pale citron-yellow.

Mycena integrella (Pers. ex Fr.) S. F. Gray is a small, pure white species, growing on rotting trunks. It has horizontal, irregularly forked, vein-like gills; and spores, $7-9 \times 3.5-5\mu$, which are more or less amygdaliform but contracted into a beak at the apex.

Mycena longiseta Höhnelt has a basal disc to the whitish stipe, and a thin conical or convex, pale grey cap, up to 7 mm in diam., which is striate almost to the disc, and covered with long (-200μ) thick-walled hairs. The non-amyloid spores measure $6-8 (-10) \times 3-4 (-5)\mu$.

Mycena mucor (Batsch ex Fr.) Gillet is similar to *M. stylobates* (Pers. ex Fr.) Kummer but with a very rudimentary basal disc to the stipe.

Mycena pearsoniana Dennis ex Sing. [= *M. pseudopura* (Cooke) Sacc. sensu auct. non Cooke] is very similar to *M. pura* (Pers. ex Fr.) Kummer but readily distinguished by its non-amyloid spores.

Mycena pelliculosa (Fr.) Quél. has a viscid, smoky-grey, campanulate cap which is striate to the disc, whitish arcuate, adnate or decurrent gills united in a collar near the stem and with a separable gelatinous gill edge, and a light grey viscid stem. It occurs gregariously on heaths and in coniferous woods. See Dennis (1955).

Mycena polyadelpha (Lasch) Kühn.

Mycena pseudocorticola Kühn. is very close to *M. corticola* (Pers. ex Fr.) S. F. Gray and difficult to separate from it.

Mycena pterigena (Fr. ex Fr.) Kummer grows on dead fern fronds and is recognized by its small cap, 2-6 mm in diam. which, like the stem, varies in colour from orange to pale pink, and by the flesh-pink gills with a red edge.

Mycena pullata (Berk. & Cooke) Sacc. This fungus has a dark brown cap, striate to the centre, with an almost black disc, a concolorous stem and a slight nitrous smell. It is said to resemble *M. leucogala* (Cooke) Sacc. but differs from this species in the absence of milk in the stem.

Mycena purpureo-fusca Peck is similar to *M. rubromarginata*, and also occurs on wood. The sporophores are distinctly purple, the cap having a violet or lilac tint, while the gills have a dark violet margin.

Mycena renatii Quél. (= *M. flavipes* Quél.) grows on pieces of wood and has a nitrous smell. The stem is golden-yellow,

the gills white, the cap dirty pinkish brown especially at the disc, and the elliptic-cylindric spores measure $7.5-10.5 \times 4.5-6.5\mu$.

Mycena rosella (Fr.) Kummer is a gregarious species which occurs in large numbers on pine needles. It is entirely pink and has a deeper pink edge to the pale pink gills.

Mycena rubromarginata (Fr. ex Fr.) Kummer. This northern species, which is virtually restricted to Scotland, grows gregariously amongst pine needles, and also either singly or in small clusters on rotting trunks or branches. It has a grey-brown, striate cap, pallid gills edged with pinkish or purplish brown, and elliptic-ovoid spores measuring $10-12 \times 5-7\mu$. This fungus has been much confused with the nitrous-smelling *M. capillaripes* by British authors, and many of the older records probably refer to the latter species.

Mycena smithiana Kühn. is a very small species, up to 2.5 mm in diam., growing on leaves and twigs of *Quercus*. It has a whitish cap which is often tinged with pale pinkish brown, and 2-spored basidia bearing spores measuring $9-13 \times 3.7-6.5\mu$.

Mycena tintinnabulum (Fr.) Quél. forms dense clusters of sporophores on stumps late in the year. These resemble the clustered fruitbodies of *M. inclinata* (Fr.) Quél., although the individual pilei are smaller, the stems do not become bright bay-brown from below, and there is no pronounced smell. The spores are also entirely different and very distinctive since they measure only $3-6 \times 2-3\mu$.

Mycena uracea Pearson is said to be restricted in its occurrence to burnt *Calluna* but there is some difference of opinion as to whether this rather tough, elastic species with dark sombre cap, greyish gills, and dull brown stipe with a rooting base, is really distinct from *M. megaspora* Kauff.

Mycena urania (Fr.) Gillet has been collected in the Rothiemurchus Forest, Inverness-shire. It belongs in the section *Filipedes* and has a bluish violet or lilac-grey cap and stem, and similarly but paler coloured gills which bear 'cystides en brosse' at the margin. The elliptical amyloid spores measure $7-9 \times 4-5\mu$.

Mycena viscosa (Secr.) Maire is very similar to *M. epipterygia* (Scop. ex Fr.) S. F. Gray, but has broader spores, $8-12 \times 5-9\mu$, and is associated with conifers.

Mycena vulgaris (Pers. ex Fr.) Kummer has a glutinous cap, stem and gill edge. The cap is grey-brown and distinctly striate, the gills horizontal and broadly adnate to subdecurrent, while the stem is whitish and the spores measure $7-10 \times 3.5-5\mu$. The fungus occurs in large numbers on fallen pine needles.

Mycena zephirus (Fr. ex Fr.) Kummer grows under conifers and has a dirty whitish, sulcate-striate cap which soon becomes

spotted or flushed with red or reddish brown as do the gills and stem. The spores are cylindric and measure $9.5\text{--}13 \times 4\text{--}5\mu$.

Naucoria alnetorum (Maire) Kühn. & Romagn.

Naucoria centunculus (Fr.) Kummer

Naucoria graminicolor (Nees ex Fr.) Gill. The Scottish record from Glamis, Angus, (Berkeley & Broome, 1897) refers to *Deconia inquilina* (Fr. ex Fr.) Romagn.

Naucoria luteolofibrillosa (Kühn.) Kühn. & Romagn.

Naucoria pseudoamarescens (Kühn. & Romagn.) Kühn & Romagn.

Naucoria rubi (Berk.) Sing.

Naucoria scolecina (Fr.) Quél.

Naucoria sphagneti Orton. See Orton (1960).

Naucoria stagnina (Fr.) Orton

Naucoria stagninoides Orton

Naucoria striatula Orton

Naucoria subconspersa Orton

Naucoria zetlandica Orton

Nolanea cuneata Bres. resembles *N. cetrata* (Fr. ex Fr.) Kummer, but is distinguished by having a pale yellowish spot in the centre of the conical cap, and by its 4-spored basidia.

Nolanea cuspidifer (Kühn. & Romagn.) Orton is a sphagnophilous species with 2-spored basidia.

Nolanea farinolens Orton. See Orton (1960).

Nolanea infula (Fr.) Gillet

Nolanea juncinus (Kühn. & Romagn.) Orton [= *N. junceus* Fr.]

Nolanea radiata (J. Lange) Orton. This fungus, which usually occurs in grassland, has a dingy date-brown, acutely umbonate, coarsely striate cap, and more or less isodiametric spores.

Nolanea rhombospora (Kühn. & Boursier) is most easily recognized by its rectangular spores and the presence of ventricose-fusiform or clavate cheilocystidia, which are abruptly narrowed above into a short beak. The hygrophanous cap, up to 3 cm in diam., is dirty grey-brown, sometimes tinted with yellow; the flesh has a mealy taste.

Nolanea solstitialis (Fr.) Orton

Nolanea tenuipes Orton [= *Rhodophyllus mammosus* var. *tenuis* Kühn.] is very like *N. mammosa* (L. ex Fr.) Quél. but has narrower spores measuring $(8\text{--}) 9\text{--}12 \times 5.5\text{--}6.5$ (-7) μ and usually occurs in grassland on basic soils.

Nolanea testacea (Bres.) Orton. See Orton (1960).

Nolanea xylophila (J. Lange) Orton is a small, delicate, lignicolous species with a pallid, pellucid-striate, convex cap.

Omphalina brownii (Berk. & Br.) Orton sensu Orton, nec Berkeley & Broome grows in bogs. It has a cap $1.5\text{--}1.8$ cm

in diam., which is at first very dark ochre-brown beneath a silvery pruina. On handling and with age this hoary effect is lost and the cap becomes paler. The gills are very much branched, and also dark ochraceous brown at first but soon develop a pinkish tint; the very broadly elliptical or subglobose spores measure $6-8 \times 5-6.5\mu$.

It is unfortunate that the fungus described above is still without a valid name, for the type specimen of *Cantharellus brownii* Berk. & Br., which is preserved at Kew, is a semi-sterile form of *Agrocybe semiorbicularis* (Bull. ex St. Amans) Fayod [= *Naucoria pediades* (Fr.) Kummer] with narrow, fold-like, slightly forked gills. This was first noted by Patouillard (1898), who also suggested that Berkeley and Broome's species was very similar, if not identical, to *Ptychella ochracea* Roze & Boud. However, according to Singer (1962) the latter name was probably based on an abnormal form of *A. vervacti* (Fr.) Maire.

Omphalina chrysophylla (Fr.) Moser is a rare lignicolous species with a yellowish brown, umbilicate cap up to 5 cm in diam. and yellowish ochre to bright orange gills. The spore print is egg-yellow to pale orange in colour, and the spores measure $8.7-12.2 \times 5-6\mu$.

Omphalina cupulata (Fr.) Orton grows amongst mosses and lichens in sandy soils. It has a small dirty brown, depressed cap and similarly coloured, irregularly branched fold-like gills. The spores measure $7.5-9 \times 4.5-5.5\mu$.

Omphalina demissa (Fr.) Quél. has a small, hygrophanous, reddish brown or reddish flesh-coloured cap which becomes pale greyish flesh-coloured on drying. It has a subfloccose or minutely tomentose surface, thick, distant, fleshy-purple, arcuate-decurrent gills, a similarly coloured stem, purplish wine-red flesh, and spores measuring $10-12 \times 6-8\mu$.

Omphalina fusconigra Orton was described from Blair-drummond, Perthshire. It grows on *Sphagnum* and also rarely on other mosses. It differs from related sphagnicolous species in having a darker blackish brown cap and stem. Further, the stem is minutely pubescent. It has ellipsoid spores $6-9 (-10) \times 3.5-4.5 (-5)\mu$. See Orton (1960).

Omphalina hepatica (Fr. ex Fr.) Orton. This small fungus has a pinkish, pellucid-striate cap, which dries out pallid and appears silky-pruinose. The rather thick, decurrent gills are subdistant, have a dirty pink tinge, and are often either forked or anastomosed. The stem is concolorous with the cap and when fresh is entirely pubescent since it is covered with cylindrical-flexuose, subcapitate hairs. This fungus, which has probably been confused with *O. pyxidata* (Bull. ex Fr.) Quél. produces broadly ovoid spores $5.5-7.5 (-8) \times 4-5\mu$.

Omphalina luteolilacina (Favre) Henderson is an alpine species which has been found on several Scottish peaks always

in association with lichens. It has a small, infundibuliform cap up to 1.5 cm in diam., with a pubescent surface when young, varying in colour from cream or cream tinged with apricot to white in old specimens. The stipe is white, tinged with violet, especially toward the base, and is minutely pubescent with cylindrical hairs; the gills are pale cream, rather thick and adnato-decurrent, and the oblong spores measure $7-8 \times 4-4.5\mu$.

Omphalina luteovitellina (Pilát & Nannf.) M. Lange [= *O. flava* (Cooke) Möller]. This is a characteristic high alpine species which is not uncommon on many of the Scottish mountains. It resembles *O. ericetorum* (Fr. ex Fr.) M. Lange [= *O. umbellifera* (L. ex Fr.) Kummer] in habit but is distinguished by its bright yellow colour.

Omphalina mutila (Fr.) Orton [= *Pleurotellus mutilus* (Fr.) Konrad & Maubl.] is a very small, pure white fungus with a somewhat excentric to lateral stem which grows in marshy places at the edges of lakes, etc. The cap is seldom very deeply depressed, and the spores measure $6.5-8.5 (-9) \times (3-) 3.5-5 (-5.2)\mu$. This species has been collected at Loch Morlich, Inverness-shire.

Omphalina obatra (Favre) Orton closely resembles *O. obscurata* but differs in its smaller size, darker blackish brown cap with grooved margin, and shorter, broadly elliptical spores, $7-9 \times 5-6\mu$.

Omphalina obscurata Reid is a northern species with a dark grey, grey-brown or dark brownish bistre cap, up to 7 mm in diam. The pileus, which is convex or flattened with a depressed centre, is hygrophanous, while the dark grey-brown gills are very broad, distant and decurrent. This fungus bears spores measuring $8.5-11.5 \times 5-6\mu$.

Omphalina oniscus (Fr. ex Fr.) Quél. grows amongst *Sphagnum* and other mosses. It has an umbilicate or funnel-shaped, strongly striate cap which is greyish or blackish brown and finely marked with innate radiating fibrils. The gills are pale brown to ashy-grey and the spores measure $6.5-9 \times 4.5-5-5\mu$.

Omphalina philonotus (Lasch) Quél. occurs in *Sphagnum* bogs and differs from the preceding species in having a paler cap with innate, radiating, linear scales. It has spores $7.5-12 \times 4.5-8\mu$.

Omphalina postii (Fr.) Sing. is another sphagnicolous species but one with an orange cap up to 5 cm in diam., pale yellowish orange stem and yellowish gills.

Omphalina velutina (Quél.) Quél. grows amongst lichens and grass on heaths or in open situations. It resembles a very small delicate *O. ericetorum* (Fr. ex Fr.) M. Lange with less strongly decurrent gills, and narrower spores measuring $8 \times 3.5\mu$, borne on 2-spored basidia.

Omphalina velutipes Orton differs from all other small species of the genus with pubescent stems in having a blackish cap and stipe. The gills are decurrent, pale greyish brown, subdistant, sometimes forked, and the spores are $6-9 (-10) \times 4-6\mu$. *O. fusconigra* is very similar but grows on *Sphagnum*, is more robust and has longer subcylindric hairs on the stipe. *O. velutina* is also closely related but has whitish gills, 2-spored basidia and clavate cells on the stipe.

Omphalina wynnei (Berk. & Br.) Orton grows on and around coniferous stumps. It resembles *O. ericetorum* (Fr. ex Fr.) M. Lange but has a pallid or lemon yellow pellucid-striate cap and concolorous arcuate-decurrent gills. The spores measure $8-10 \times 4.5-5.5\mu$.

Panaeolus retirugis (Fr.) Gillet

Panellus mitis (Pers. ex Fr.) Sing. is a very small, lateral-stemmed agaric, with a pale cap and narrow, cylindrical, amyloid spores measuring $3.5-5 \times 1-1.2\mu$. This fungus, which grows on coniferous wood, has a gelatinous surface formed of erect filiform hyphae.

Panellus ringens (Fr.) Romagn. forms small, circular, reddish brown pilei, which are dorsally attached by a short stipe-like prolongation; the margin of the pileus is often strongly striate. The gills are flesh-coloured and bear small amyloid spores $4-5 \times 1.5-1.7\mu$. It is known from a single collection from Forres, Morayshire, and was originally determined by Cooke as *Panus patellaris*. See Orton (1960).

Panellus serotinus (Schrad. ex Fr.) Kühn. has a dark olive-green, brownish, or yellowish brown cap with a viscid pellicle which is at first minutely tomentose, pale yellow decurrent gills and a short, stout, lateral, yellow stipe ornamented with small, punctuate, olive-brown squamules. This fungus produces small, allantoid, amyloid spores, $4-5.5 \times 1-2\mu$, and has clavate pleurocystidia with yellowish contents.

Paxillus panuoides (Fr. ex Fr.) Fr.

Phaeocollybia jennyae (Karst.) Heim is a small slender species with a bay-brown cap $1-2.5$ cm in diam. It has a concolorous stem with a long rooting base, light rusty-brown gills and spores measuring $5.5-6.5 \times 3.5-4\mu$. This fungus grows on the ground under conifers.

Phaeocollybia lugubris (Fr.) Heim is a rather robust species with a remarkably cartilaginous stipe up to 1 cm in diam. which is whitish in colour and has a rooting base; the slightly viscid conical cap is yellowish ochre, and the brown warted spores measure $7-8 \times 4-5\mu$. It smells and tastes of radish.

Phaeolepiota aurea (Mattuschka ex Fr.) Maire ex Konrad & Maubl. This very robust fungus has an ochraceous, yellowish or orange-brown cap up to 14 cm in diam. and a concolorous stipe, up to 25 cm high and 3.5 cm wide, sheathed

by an inferior veil which terminates in a spreading ring. Both the surface of the cap and stipe are powdery or granular due to a covering of globular or ovoid cells. The gills are rusty yellow, while the spore print is ochraceous-straw-coloured or yellowish brown; the spores are ellipsoid-fusiform, finely verrucose, and measure $9-15 \times 4-6\mu$.

Phaeomarasmium erinaceus (Fr.) Kühn. has a small ochraceous or rusty-brown cap, densely covered with erect pointed scales. The stem is similarly coloured and may be either scaly or tomentose. This species occurs on branches or twigs of various trees.

Phaeomarasmium rimulincola (Rabenh.) Orton [= *Naucoria horizontalis* (Bull. ex St. Amans) Kühn. sensu Kühn. & Romagn.] grows on tree trunks. The cap, which is often strongly grooved and of a chestnut colour, seldom exceeds 10 mm in diam. It is minutely pilose but never scaly as in the preceding species. The brownish or reddish stipe is glabrous or at most pruinose.

Phaeomarasmium wieslandri (Fr.) Sing. There is only one British collection of this fungus, from Glen Einich, near Aviemore, Inverness-shire. The fruitbodies have a rusty-brown cap, up to 1 cm in diam., covered with small pyramidal scales formed of chains of elliptical cells, heavily encrusted with pigment and bearing clamp-connexions at the septa. The stipe is dark brown with a mealy apex, while the gills are coloured like the cap but paler. This fungus has rather long, narrow spores, $6.5-10.5 \times 3.5-4.5\mu$, which vary in shape from elliptical or phaseoliform to subcylindric; the cheilocystidia, up to 37μ long and $5-13\mu$ wide at the apex, may be narrowly cylindrical-flexuose, broadly cylindrical, ovate, clavate or subcapitate. The collection described above grew on bare peaty soil.

Pholiota adiposa (Fr.) Kummer. The records of this species from Scotland require confirmation, since the fungus seems to be more characteristic of the English beechwoods (*Fagus*) on chalk. It has a bright yellowish, viscid cap, covered with upturned, flattened, dark rusty-brown, gelatinous scales. The stipe is similarly coloured and covered with squarrose scales. This species, which has spores measuring $5-7 \times 3-4\mu$, forms large clusters of fruitbodies at the base of tree stumps—especially *Fagus*.

Pholiota alnicola (Fr.) Sing. has a non-scaly, bright yellow cap, and a pale yellow stem which becomes dark red-brown from the base upward. This species grows in tufts on stumps and has a characteristic fruity smell.

Pholiota apicrea (Fr.) Moser apud Gams is similar to the preceding fungus but more robust and has a rusty-brown cap.

Pholiota aromatica Orton resembles *P. adiposa* but is

distinguished by its strong aromatic smell, larger spores $9-11 \times 4.5-5.5\mu$, and lack of facial cystidia.

Pholiota astragalina (Fr.) Sing. grows in clusters from the roots of conifers and has a reddish or pinkish-orange cap, and a yellowish, often-rooting stem with a reddish brown felty-fibrillose base. The spores measure $6.5-7.5 \times 4-4.5\mu$.

Pholiota conissans (Fr.) Moser apud Gams. This is a less robust species, usually found in small clusters on roots of *Salix cinerea*. It has a pale yellowish cap which soon becomes fawn or reddish-ochre at the centre. The gills lack all trace of yellow; they are at first pallid then dirty brown, greyish or pale beige and finally cinnamon-brown. The spores are subcylindric to reniform and measure $6.5-9 \times 3-4.5\mu$.

Pholiota curvipes (Fr.) Quél. The Scottish record of this species needs confirmation. It resembles *P. tuberculosa* (Schaeff. ex Fr.) Kummer, but is usually smaller, while the cap is covered with rather dense and minutely fibrillose-pilose or reflexed scales in contrast to the broad adpressed scales of the latter species. The phaseoliform spores measure $7-9 \times 4-5\mu$. For a discussion of these two fungi see Orton (1960).

Pholiota flammans (Fr.) Kummer is a very characteristic species of Scottish pinewoods, where it is not uncommon. It is easily recognized by the bright golden-yellow colours of its cap and stem, both of which are covered with concolorous or slightly paler squarrose scales. On the cap, usually up to 2.5 cm in diam., the scales are rather large, distant and triangular. The small spores measure $4-4.5 \times 2.5\mu$.

Pholiota lenta (Pers. ex Fr.) Sing. has a whitish or pallid cap bearing small evanescent squamules in a thick gluten, a concolorous, floccose-squamulose stem, pale gills with only a flush of yellow, and a fruity smell.

Pholiota lubrica (Pers. ex Fr.) Sing. grows under conifers and has a viscid, dark reddish brown cap with a pallid margin, which often bears small fugacious white scales. The stem is white and covered with cottony scales; the flesh is white, but brown in the base of the stipe, and the spores measure $6-7 \times 3.5-4\mu$.

Pholiota myosotis (Fr. ex Fr.) Sing. occurs frequently in *Sphagnum* bogs. It has a viscid brown cap with a distinct olive tint and a tall concolorous stipe. Microscopically it is well characterized by its enormous spores, $14-21.5 \times 7-10\mu$.

Pholiota scamba (Fr. ex Fr.) Moser apud Gams is another typically Scottish fungus with a small whitish cap, often tinted with pale yellowish brown and entirely covered with an arachnoid veil; the spores measure $8 \times 5.4\mu$. It is usually found growing on or near coniferous debris.

Pholiota spumosa (Fr.) Sing. has a slimy yellowish cap with a brownish centre. The stipe is yellow, becoming olive-brown towards the base, both internally and externally; the spores

measure $7\text{--}8\cdot5 \times 4\text{--}4\cdot5\mu$. This fungus is found in the vicinity of conifers, and often grows on sawdust.

Pholiota subsquarrosa (Fr.) Quél. This fungus has a viscid, rusty-brown cap with adpressed floccose squamules and a yellowish-rusty stem clothed with darker squarrose scales. It grows in caespitose clusters on and around the base of conifers.

Phyllotopsis nidulans (Pers. ex Fr.) Sing. [= *Panus stevensonii* Berk. & Br.] produces dimidiate sessile fruitbodies, with a tomentose, yellow, or orange-tinted surface and brilliant orange gills. The small allantoid spores measure $5\text{--}6 \times 2\text{--}3\mu$.

Pleurotellus hypnophilus (Pers.) Fayod grows on some of the larger living mosses. It is a small white fungus with narrow elongated spores, $6\text{--}8 \times 2\cdot6\text{--}3\mu$. There are no recent Scottish records.

Pleurotellus porrigens (Pers. ex Fr.) Kühn. & Romagn. is a very characteristic and common Scottish fungus. It is a pure white sessile species with a thin, flabby, spathulate cap which is often lobed at the margin, and may reach as much as 10 cm in width. This species grows on trunks, branches and buried wood, and has subglobose spores $5\text{--}6\mu$ in diam.

Pleurotellus tremulus (Schaeff. ex Fr.) Konrad & Maubl. is a small greyish, spathulate fungus with a distinct stipe. It grows amongst various mosses in damp places and has subglobose spores $6\cdot5\text{--}8 \times 5\text{--}6\cdot5\mu$.

Pleurotus algidus (Fr.) Quél. The Scottish record, based on a specimen collected by J. C. Bauchop in West Lothian, is of a *Crepidotus* sp., probably *C. mollis* (Schaeff. ex Fr.) Kummer.

Pleurotus euosmus (Berk. apud Hussey) Sacc. is very similar to *P. cornucopiae* (Paulet ex Pers.) Rolland [= *P. sapidus* (Schulz. apud Kalchbr.) Sacc.] in having a number of more or less centrally stipitate, shallowly umbilicate pilei arising from a common base. The pilei are at first white but darken to umber-brown and have a smell of tarragon (*Artemisia dracunculus*). The spore print is pale lilac.

Pleurotus lignatilis (Pers. ex Fr.) Kummer is a rare fungus, usually found in hollow trunks of *Fagus*. It has a rather thin cap up to 8 cm in diam., crowded gills, and a long, central ascending stipe. The entire fungus is white and has a strong mealy smell. There are no recent Scottish records.

Plicatura crispa ([Pers.] Fr.) Rea [= *Trogia crispa* [Pers.] Fr.] should perhaps be excluded from the Agaricales and placed near *Merulius* sensu stricto. It produces small white, lignicolous, dimidiate or campanulate, hirsute fructifications. These may be solitary or densely imbricate and either almost sessile or with a distinct dorsal stipe-like prolongation. They are tough and eventually become brownish in colour. The undersurface of the sporophore is covered with a system of irregular branching fold-like gills; the small allantoid spores measure $(2\cdot2\text{--}) 3\cdot2\text{--}4\cdot2 \times 0\cdot75\text{--}1\cdot5$ ($\text{--}1\cdot75$) μ .

Pluteus atromarginatus (Konrad) Kühn. is easily recognized amongst species of the genus with hooked facial cystidia on account of its dark brown gill edge.

Pluteus phlebophorus (Ditm. ex Fr.) Kummer

Pluteus plautus (Weinm.) Gillet belongs in the section *Hispidodermi*. It has a dark brown granular-scaly cap, and a whitish stem bearing similarly coloured scales toward the base. This fungus, which grows on coniferous wood and smells rather like *Lepiota cristata* (Fr.) Kummer, has been found recently at Loch Rannoch, Perthshire.

Pluteus punctipes Orton has been found in the Darnaway Forest, Morayshire. It grows on *Fagus* and has a very dark, blackish cap when young, becoming sepia, vandyke, or umber-brown in older sporophores. It is entirely covered with minute pointed fibrillose, darker scales and when moist the cap has a striate margin. The stipe is concolorous with the cap or paler, and entirely punctate-scaly. The scales on the cap are formed of cylindrical-fusoid cells and the cheilocystidia are fusoid or lageniform.

Psathyrella ammophila (Durieu & Lév.) Orton is a characteristic fungus of sand dunes, where it is often abundant.

Psathyrella bifrons (Berk.) A. H. Smith

Psathyrella caput-medusae (Fr.) Konrad & Maubl. has a hypholomatoid appearance and a fasciculate habit. The cap, which is whitish with a brown disc, is covered with brown fibrillose scales toward the margin. The stout, whitish stipe bears fuscous, recurved scales toward the base and a distinct annulus.

Psathyrella caudata (Fr. ex Fr.) Quél.

Psathyrella cernua (Vahl ex Fr.) Moser apud Gams lacks all trace of a veil and bears utriform cystidia capped with crystalline material. It has the habit of *P. hydrophila* (Bull. ex Mérat) Maire.

Psathyrella chondroderma (Berk. & Br.) A. H. Smith is a rather short, stout species which grows in small fascicles on coniferous wood. It has a hygrophanous, dark bay-brown, campanulate cap with a white appendiculate veil, a pale brown stem with felty squamules below, slightly phaseoliform spores measuring $6-8 \times 4-4.5\mu$, and according to Kühner and Romagnesi (1953) it develops a smell of bitter almonds after gathering. This species was described from material collected at Glamis, Angus.

Psathyrella coprobia (J. Lange) A. H. Smith

Psathyrella cotonea (Quél.) Konrad & Maubl. is yet another hypholomatoid species resembling *P. caput-medusae* but with a rather paler and less strikingly scaly cap. This species lacks a distinct annulus.

Psathyrella jerdonii (Berk. & Br.) Konrad & Maubl. is a subfasciculate, hypholomatoid species with a date-brown cap

densely beset with small white fibrillose scales when young, but these soon disappear. The stipe, which is white and somewhat scaly towards the base, is distinctly annulate. This fungus has an aromatic smell. It was named after Mr. A. Jerdon, a prolific collector of Scottish fungi, who gathered the type material at Mossburnford, Roxburghshire. See Orton (1960).

Psathyrella leucotephra (Berk. & Br.) Orton. This robust, fasciculate species has a *Hypholoma*-like aspect. The flattened or concave cap, up to 7 cm in diam., is cream-coloured with a yellowish centre; the stem is tall, white, annulate and may reach a height of 11 cm and a width of 15 mm near the base. It has spores measuring $8-10 \times 5-6\mu$.

Psathyrella lutensis Romagn. is well characterized by having cystidia producing a mucilaginous exudate which turns green in NH_3 .

Psathyrella prona (Fr.) Gillet

Psathyrella scobinacea (Fr.) Konrad & Maubl. occurs in small clusters at the base of trees. It has a light grey or very pale blue-grey cap with an ochraceous-brown disc, and is covered with moderately large, adpressed, brown scales which become more dispersed toward the margin. The stem is silky-white with a pale yellowish or yellowish brown base, while the phaseoliform spores are $7-11 \times 4\mu$.

Psathyrella semivestita (Berk. & Br.) A. H. Smith. See Orton (1960).

Psathyrella sphagnicola (Maire) Favre is best recognized from its sphagnophilous habit, its annulate stem and its hygrophanous, striate, brown cap.

Psathyrella spintrigera (Fr.) Konrad & Maubl. has a rather hypholomatoid appearance. The hygrophanous cap is date-brown when moist and often appendiculate with the remnants of the veil. The stipe is white and somewhat floccose up to the ring-like zone.

Psathyrella xanthocystis Orton, described from Glen Affric, Inverness-shire, resembles *P. jerdonii* but differs from it in having shorter spores, $7.5 \times 4.75-5.5\mu$, cap with veil mostly marginal, and thick-walled facial cystidia which become yellowish in NaOH. See Orton (1960).

Pseudohiatula esculenta (Wulf. ex Fr.) Sing. is recognized by its occurrence on *Picea* cones, to which it is attached by a long 'root'. The cap is brown and has a cellular cuticle, while the cheilo- and pleurocystidia are thick-walled, fusiform, and apically encrusted. The non-amyloid spores are elliptical, $5-7 \times 3-4\mu$. The collection cited by Berkeley from Blackadder plantations, Berwickshire, and one named by Klotzsch from Castle Semple, Renfrewshire, are correctly determined but another unlocalized Scottish collection so named by Klotzsch is of *Baeospora myosura* (Fr. ex Fr.) Sing. The latter also occurs on cones or coniferous debris but has amyloid spores, $3-4.5 \times$

1.5–2 μ , a non-cellular cuticle and thin-walled hair-like cheilocystidia.

Pseudohiatula stephanocystis Hora differs from the preceding species in growing from pine cones and in having more or less thin-walled pleuro- and cheilocystidia and distinctly swollen heads capped with a very conspicuous mass of crystalline material. There is at Kew a collection of this fungus from Perth, determined by Berkeley as *Agaricus esculentus*, and another from Aboyne, Aberdeenshire, 1862, identified by the same authority as *A. conigenus*. In addition there is recent material from West Lothian and Wester Ross.

Pseudohiatula tenacella (Pers. ex Fr.) Métrod also grows from pine cones but differs from the previous species in having thin-walled, pointed pleuro- and cheilocystidia with very little apical encrustation. There is a collection at Kew from Aboyne, 1862, determined by Berkeley as *Agaricus conigenus*, and more recent material from West Lothian and the Isle of Rhum.

Psilocybe areolata (Klotzsch) Sacc. is given as doubtful in the Check List, but is in fact *Lacrymaria velutina* (Pers. ex Fr.) Konrad & Maubl.

Rhodocybe caelata (Fr.) Maire grows on heaths in open situations. It has a dark brown to blackish cap, dirty brown sinuate-emarginate gills, rugulose spores measuring 6.5–7.5 \times 3.5–4.5 μ and prominent cheilo- and pleurocystidia.

Rhodocybe popinalis (Fr.) Sing., which occurs in grassy places, is a grey-brown fungus with a mealy smell, concolorous decurrent gills and subglobose, verrucose spores measuring 6.5–7 \times 6 μ .

Rozites caperatus (Pers. ex Fr.) Karst. is a characteristic northern species which is virtually confined to the Scottish Highlands, occurring amongst *Calluna* and scattered pines. It is a robust species with the habit of an *Amanita*. The cap is at first ovate or globular then convex and of a pale ochre-brown, delicately covered with the silky arachnoid veil which soon disappears. The stipe is white and bears a membranous ring, while the gills are pallid ochre, and the spores, 10–13 \times 8–9 μ , are strongly punctuate.

Russula aeruginea Lindblad ex Fr. has a greenish cap, pale cream gills and spore print, and a mild flesh. It occurs under *Betula* and conifers.

Russula albonigra (Krombh.) Fr. This species belongs in the same group as *R. nigricans* (Bull. ex Mérat) Fr. It has a cap which soon becomes dry, is whitish in colour but blackens on bruising and may finally become entirely black in old age. The flesh, if it reddens at all, does so only patchily, and the gills, which are of uniform length, are rather crowded.

Russula alpina (Blytt.) F. H. Möller & J. Schaeffer has been found on the summits of many mountains in the Scottish

Highlands. It has a dark purple cap, up to 3.5 cm in diam., with a brighter margin, white gills and spore print, and flesh which is at first mild then acrid with the hot taste soon fading.

Russula amoena Quél. is widespread but not common. The cap may be either olivaceous, purple, violet or carmine and has a minutely velvety cuticle. The gills are ochraceous-cream often with a salmon tint and the spore print is deep cream [D].

Russula aquosa Leclair occurs in *Sphagnum* bogs in the vicinity of pines. The cap is lilaceous brown or rosy lilac with a more brownish centre. The print and gills are white and the flesh slightly acrid.

Russula aurata [With.] Fr. is an uncommon fungus with a bright yellow colour to the cap, stem and gill edge; the cap itself often becoming brick-red in places. The spore print is dark ochre and the flesh is mild.

Russula azurea Bres. grows under conifers and has a violet, dirty amethyst, or bluish lilac cap which often becomes greenish with age, and has a minutely pruinose surface. The spore print is white and the flesh mild.

Russula badia Quél. is not uncommon in native Scottish pinewoods (*Pinus*). It is recognized by its dark reddish or purplish brown cap, which tends to be rather large and firm, its very acrid flesh and its dark ochre spore print.

Russula betularum Hora. This is a widespread fungus of birchwoods (*Betula*). It has a deep rose-pink cap discolouring yellowish at the centre, with a somewhat tuberculate-sulcate margin. The gills and spore print are white, and the flesh is acrid.

Russula brunneo-violacea Crawshay has a cap which may be dull violet or bluish violet, rarely purplish or brownish violet or it may be spotted with brown or olive. The spore print is cream and the flesh mild.

Russula carminea (J. Schaeff.) Kühn. & Romagn. has a purplish cap with a darker centre when young, becoming carmine-rose with age, a white stem which may be flushed with rose-pink toward the base, moderately acrid flesh, white gills and a white spore print. This fungus has the habit and texture of *R. fragilis* (Pers. ex Fr.) Fr.

Russula cessans Pearson. This species grows under conifers and is distinguished by its dark crimson or dull violaceous-purple cap with a blackish centre, its cream then ochraceous gills, its ochraceous spore print [G] and mild taste.

Russula claroflava Grove is found in very damp, acid birchwoods (*Betula*). It has a bright egg-yellow cap, cream-coloured gills, and flesh which becomes slowly greyish or blackish on exposure. The spore print is cream and the flesh mild.

Russula curtipes F. H. Möller & J. Schaeff. has a dark ochre spore print and mild flesh. The cap is pinkish brown with an ochraceous centre.

Russula decolorans (Fr.) Fr. This species has a mild flesh and a cream spore print. The cap is tawny, orange, reddish orange with a salmon tint or somewhat coppery, and the flesh blackens on exposure. It usually occurs in boggy places under conifers.

Russula farinipes Romell apud Britz. belongs in the section *Foetentinae*. It bears some resemblance to *R. foetens* (Pers. ex Fr.) Fr. but is less robust and has a pale ochraceous or ivory-coloured cap, and white spore print. This fungus, which has an acrid flesh, is fairly widespread in deciduous woods.

Russula firmula J. Schaeff. resembles *R. badia* in having a dark purplish-coppery-brown cap with a tuberculate-striate margin, and deep yellow-ochre gills, but differs in being smaller, less acrid and in growing under deciduous trees.

Russula gracillima J. Schaeff. is a birchwood (*Betula*) species, with a cap which is typically red or rose-coloured at the margin. This colour gives way to a greenish zone and finally to a dark purplish- or olive-black centre. *R. gracillima* is somewhat reminiscent of small, slender, fragile fruitbodies of *R. queletii* Fr. apud Quél.

Russula heterophylla (Fr.) appears to be rather uncommon in the South but is more widespread in Scotland. It resembles *R. cyanoxantha* (Schaeff. ex Secr.) Fr. but has a greenish, olivaceous or yellowish green cap, and flesh which rapidly becomes bright orange-salmon-pink with FeSO_4 .

Russula intactior (J. Schaeff.) J. Schaeff. resembles *R. luteotacta* but unlike that species does not bruise orange-yellow.

Russula laricina Vel. has been found several times in the Rothiemurchus pinewoods (*Pinus*). When young it has a smallish cap varying from dull reddish or copper-colour to purple often mixed with violet or brown, but these colours soon fade so that the mature fruitbodies appear rather pale pinkish with a dark blackish purple centre. The gills are golden-yellow, the spore print pale yellow and the flesh mild.

Russula luteotacta Rea. This species has a scarlet cap which often fades to a whitish colour. The gills and spore print are white and the flesh acrid. The entire fungus bruises bright orange-yellow.

Russula luteoviridans Martin is recognized by its large yellowish green cap with a tuberculate margin, butter-yellow gills sometimes with a salmon tint, pale yellow spore print, and mild or very slightly acrid flesh.

Russula maculata Quél. has a bright brick-red cap fading to

yellowish at the centre, and becoming marked with rusty spots. The spore print is light ochre.

Russula mustelina Fr. occurs under conifers and is distinguished by its yellowish or clay-brown cap, white or brownish stipe, mild flesh and cream spore print.

Russula nauseosa (Pers. ex Secr.) Fr. is fairly common in Highland pinewoods (*Pinus*) although less so in other parts of the country. It has a cap, 3-5 cm in diam., varying in colour from purplish pink to date-brown, bright yellowish-ochre gills and spore print, and mild flesh.

Russula nitida (Pers. ex Fr.) Fr. This species has a violet, reddish purple or carmine-coloured cap, and a stem flushed rose or rose-red and with a tendency to become yellowish. It has a slightly acrid flesh and a pale ochre spore print.

Russula obscura Romell grows in damp places under conifers. It has a purplish violet or dark red cap which quickly fades to a dirty brownish-olive and the mild flesh becomes distinctly grey on exposure to air.

Russula paludosa Britz. is a species of *Sphagnum* bogs with a crimson cap, cream-coloured gills and spore print, stipe flushed with pink, and mild flesh.

Russula polychroma Hora [= *R. integra* sensu Kühn. & Romagn. and Pearson]. This species is not uncommon in the Highland pinewoods (*Pinus*). It has a dark purplish or reddish-brown cap and yellow-ochre gills. It resembles *R. badia* but has a mild flesh and spores with prominent isolated warts. It differs from *R. integra* [L.] Fr. in its coniferous habitat.

Russula pulchella Borszczów occurs in birchwoods (*Betula*). It has a pale pink cap which often fades patchily or it may be whitish with only a flush of pink. The gills are cream while the spore print is yellowish ochre; the flesh is mild except in the gills.

Russula romellii Maire has a violaceous, reddish or purplish cap with a greenish olive centre, but these colours may appear irregularly in patches over the surface. The gills are cream while the spore print is ochre-yellow [G. ++].

Russula rubra ([Lam.] Fr.) Fr. is recognized by its large, blood-red or scarlet-coloured cap with a hoary surface like that of *R. lepida* Fr., yellow gills and bright ochre spore print. The flesh is very acrid.

Russula sanguinea (Bull. ex St. Amans) Fr. is not uncommon in Scottish pinewoods (*Pinus*). It has a blood-red cap, a pink stalk which often becomes yellow on bruising, acrid flesh and a cream spore print [C].

Russula scotica Pearson was described from specimens collected at Aviemore, Inverness-shire. It is a birchwood (*Betula*) species with a light to dark buff-coloured cap, and striate-sulcate margin. The gills are light cream, the spore print ochre [F], and the flesh is mild.

Russula smaragdina Quél. belongs in the same group as *R. ochroleuca* (Pers. ex Secr.) Fr. and *R. fellea* (Fr.) Fr. but it differs from these species in having a white spore print and pale yellowish green cap with a very pale margin. It differs from *R. raoultii* Quél. in having a more greenish tint to the cap and also in having spores with long, narrow, isolated warts.

Russula velenovskyi Melzer & Zvara has a light brick-red cap with a matt, granular surface, cream to pale ochre-coloured gills, white stem often flushed with pink, mild flesh and an ochraceous spore print [E — F].

Russula violacea Quél. is recognized by its pale violaceous-purple cap with lilac patches and whitish striate margin, its ivory-white gills, tardily acrid flesh, smell of cloves or laudanum and its very pale spore print [B]. This fungus grows in damp woods. There are no recent Scottish records.

Russula violaceoides Hora was described from material collected in moribund birchwoods (*Betula*) at Rothiemurchus, Inverness-shire. It has a cap which is at first dull purplish and often washed with brownish, becoming purplish-violet with the brownish wash more evident toward the centre. The gills are white then dull cream, the spore print cream [C] and the flesh at most subacid. This fungus resembles *R. brunneo-violacea* but its spores lack the long isolated spines of the latter species.

Schizophyllum commune Fr. is too well known to need a description, but although quite common in the south of England it becomes rare further north and there are very few reports of it in Scotland.

Squamanita odorata (Cool) Imbach, known from a single collection under pines in the Rothiemurchus Forest, Inverness-shire, has a greyish or lilaceous cap up to 4 cm in diam., with dark purplish erect scales on the disc. The stem is violaceous above, swollen and yellow below with a fusoid base, and with purplish scales in the middle portion. The flesh is violaceous in the cap, paler in the stem and yellow at its base, and has a strong, pleasant smell. The ovoid spores measure 7–8 (–9) × 4.5–5 μ .

Strobilomyces floccopus (Vahl ex Fr.) Karst. [= *S. strobilaceus* (Scop. ex Fr.) Berk.] is too well known to need a description but is rare in Scotland.

Stropharia albo-cyanea (Desm.) Quél. resembles *S. aeruginosa* (Curt. ex Fr.) Quél. but has a whitish or slightly yellowish cap.

Stropharia melanosperma (Bull. ex Fr.) Gillet

Stropharia merdaria (Fr.) Quél. grows on manured ground and has a viscid cap varying from pale cream to tan colour.

Stropharia thrausta (Schulzer apud Kalchbr.) Sacc. is very similar to *S. squamosa* (Pers. ex Fr.) Quél. but has a bright orange-brown cap and stem.

Tricholoma acerbum (Bull. ex Fr.) Quél. is a robust, pale tan to cinnamon-coloured species, with a coarsely grooved margin to the cap, which may be up to 11 cm in diam.

Tricholoma aurantium (Schaeff. ex Fr.) Ricken is a very distinctive coniferous species with a large orange-brown cap bearing granular squamules at the disc. The stem is concolorous but the surface disrupts into numerous bands of scales on a whitish background. This fungus has a mealy odour.

Tricholoma bisporigerum J. Lange is very similar to *T. argyraceum* (Bull. ex St. Amans) Gillet but has slightly larger spores, $6.5\text{--}7 \times 4.25\text{--}4.75\mu$, borne on 2-spored basidia.

Tricholoma caligatum (Viviani) Ricken has a robust reddish brown cap with dark brown or blackish adpressed squamules and a stipe which is concolorous and coarsely scaly below, but white and furfuraceous above the well formed inferior ring. It has a fruity smell and spores measuring $6\text{--}7.5 \times 4.5\text{--}5.5\mu$.

Tricholoma carneum (Bull. ex Fr.) Kummer is distinguished by its rosy or flesh-coloured pileus, which may be 4–5 cm in diam.; the spores measure $4.7\text{--}5.5 \times 2.5\text{--}3\mu$.

Tricholoma cerinum (Pers. ex Fr.) Kummer has a waxy yellow, yellowish fawn, or brown cap, 1.5–5 cm in diam., and yellow gills. The stipe is cream, becoming brownish from the base upward, and the flesh is white or very pale cream. Microscopically the species is characterized by its very small elliptic-ovoid spores, $3\text{--}4 \times 2\text{--}3\mu$. There is a specimen at Kew correctly so determined by Berkeley, from Ballinluig, Perthshire.

Tricholoma colossus (Fr.) Quél. This rare species of coniferous woods has a very large, viscid cap up to 20 cm in diam., which is tawny or brownish with flesh-coloured or rosy tints. The stipe is also very robust and may reach 10 cm in width, and the flesh becomes salmon-pink on exposure to air. The large spores measure $8\text{--}10 \times 5\text{--}6\mu$.

Tricholoma constrictum (Fr.) Ricken is a pure white fungus with a cortinate, floccose-fibrillose stem, strong mealy smell and verrucose spores, $7 \times 5\mu$. It grows in pastures.

Tricholoma elyroides (Scop. ex Fr.) Karst. occurs in coniferous woods and is recognized by having both its cap and stem covered with blackish granules. In addition it has grey gills, and amyloid spores measuring $7\text{--}9\text{--}(10) \times 3\text{--}4\mu$.

Tricholoma flavovirens (Pers. ex Fr.) Lundell [= *T. equestre* (L. ex Fr.) Kummer]. This species is decidedly uncommon in the south of England but is a characteristic fungus of Highland pinewoods (*Pinus*). It has a greenish yellow cap with brownish disc, bright yellow gills and pale sulphur-coloured stem.

Tricholoma focale (Fr.) Ricken resembles *T. caligatum* but lacks the fruity odour of that species, although it may have a faint mealy smell; it also bears smaller spores, $4\text{--}5 \times 2\text{--}3\mu$.

Tricholoma fucatum (Fr.) Kummer is a rare species of coniferous woods with a yellowish olive cap, up to 10 cm in diam., which may be covered with minute brown flocci or squamules especially toward the darker-coloured disc. The stipe is concolorous and covered with similar scales while the gills are whitish or very faintly tinted with yellowish green, the spores are ellipsoid-ovoid, $6-8 \times 4-5\mu$. There are no recent Scottish records.

Tricholoma imbricatum (Fr. ex Fr.) Kummer is a not uncommon fungus in Scottish pinewoods (*Pinus*).

Tricholoma inamoenum (Fr. ex Fr.) Gillet can only be distinguished from *T. sulphureum* (Bull. ex Fr.) Kummer by its pale alutaceous cap flushed with brown at the disc and its occurrence in pinewoods (*Pinus*).

Tricholoma onychinum (Fr.) Gillet has been collected at Loch Rannoch, Perthshire. It is a striking fungus with a purplish brown cap, purplish silky-fibrillose stem, bright yellow gills and mealy smell. Furthermore this species, which grows under conifers, has a cellular cuticle.

Tricholoma pessudatum (Fr.) Quél. is not uncommon in Highland pinewoods (*Pinus*), and may be recognized by its viscid, reddish brown cap with darker centre, ornamented with small dark brown spots toward the margin. It has a somewhat paler but similarly spotted stem, whitish gills with the edge becoming red-brown in places, and a strong smell of meal. This fungus may grow in caespitose clusters.

Tricholoma portentosum (Fr.) Quél. This species is quite frequent in Highland pinewoods (*Pinus*). It has an innately fibrillose conical-campulate cap which is steely or blackish grey in colour, and a mealy odour.

Tricholoma robustum (Alb. & Schw. ex Fr.) Ricken is an annulate species which closely resembles *T. focale* but differs in having a less brightly coloured pileus.

Tricholoma sciodes (Secr.) Martin resembles *T. portentosum* but has an acrid-tasting flesh. It is also similar to *T. virgatum* (Fr. ex Fr.) Kummer but differs from this species in that its cuticle is never reticulate with innate fibrils.

Tricholoma sejunctum (Sow. ex Fr.) Quél. is recognized by its slightly viscid greenish yellow cap, up to 10 cm in diam., closely streaked with innate, radiating, darker fibrils. There are no recent Scottish records.

Tricholoma vaccinum (Pers. ex Fr.) Kummer grows in pinewoods (*Pinus*) and has a red-brown, fibrillose scaly cap with a woolly appendiculate margin and concolorous fibrillose stem. Its flesh, which smells of meal, becomes rosy especially in the stem.

Tricholomopsis decora (Fr.) Sing., found only in Highland pinewoods (*Pinus*), is easily recognized since it grows on *Pinus*

stumps and is bright yellow throughout, although the cap surface is densely covered with small, brownish, felty fibrillose scales.

Volvariella parvula (Weinm.) Orton has a somewhat silky or silky-scaly, white cap which may become pale brown or dirty yellowish when old, and a white volva. This species grows amongst grass.

Volvariella volvacea (Bull. ex Fr.) Sing. differs from the preceding fungus in having a brownish volva, and a cap which is densely covered with dark brown adpressed fibrils.

Xeromphalina campanella (Batsch. ex Fr.) Maire grows in dense swarms on rotting pine stumps. It has a bright orange-brown, striate, umbilicate cap, strongly decurrent, interveined brownish cream gills and a dark brown stipe. Microscopically it is well characterized in having cheilocystidia. Its amyloid spores measure $6.5-7.5 \times 2.7-3.2\mu$.

Xeromphalina caucinalis (Fr.) Kühn. & Maire [= *X. fulvobulbilloso* (R. Fries) Kühn. & Romagn.] occurs in troops on fallen needles of *Pinus*. It is recognized by its rather tough yellow hemispherical cap, up to 2 cm in diam., which often has a small central umbilicus, and a sulcate margin. This contrasts with the black stem densely covered with rusty-orange fibrils especially towards the minutely swollen base from which arise dark brown rhizoids. The cream-coloured subdecurrent gills bear amyloid spores which measure $5-6 \times 2.5-3.5\mu$.

Xeromphalina picta (Fr. ex Fr.) A. H. Smith is a rare species with a tiny conical cap which appears sharply truncated owing to a very well defined umbilicus. The cap is yellowish brown and bears exceptionally broad gills (deeper from the top of the cap to the gill edge than they are wide i.e. from cap margin to stalk). There are "cystides en brosse" on the gill edge; the spores are weakly amyloid and measure (7-) 8-10 (-11) \times 4-5 (-5.5) μ .

APHYLLOPHORALES

POLYPORACEAE

Bjerkandera (Polyporus) fumosa (Pers. ex Fr.) Karst. resembles *B. adusta* (Willd. ex Fr.) Karst. but is far less common. It differs from the latter species in its tendency to produce rather thicker fruitbodies with paler pores, and in having a smell of anise.

Caloporus (Polyporus) cristatus (Pers. ex Fr.) Quél. [= *Polyporus flavo-virens* Berk. & Rav.]. There are no recent records of this common central European fungus from Scotland but its green colour and terrestrial habit are sufficient to distinguish it from any other species.

Caloporus leucomelas (Pers. ex Fr.) Quél. is a very rare species in Britain, but has been recorded several times from the Rothiemurchus Forest, (Berkeley & Broome, 1878; Smith & Rea, 1906). It is easily recognized by its centrally stipitate, terrestrial fruitbody and its peculiar knobbly spores.

Cartilosoma (Trametes) subsinuosa (Bres.) Kotlaba & Pouzar occurs on coniferous wood and forms resupinate—rarely minutely pileate—fruitbodies, up to 7 cm in diam., which become free from the substrate at the margin on drying. The pores are angular, whitish or cream-coloured, and measure 0.4–1.5 mm in diam. The spores are subcylindrical or narrowly elliptic, 6–10 × 2.5–4 μ . There is at Kew a gathering from Forres, Morayshire, recorded as *Polyporus polymorphus* Rostk. by Berkeley & Broome (1879). This has slightly narrower spores measuring 6–8.5 × 2–2.5 μ but many are immature. See also *Poria ramentacea*.

Cerrena (Daedalea) unicolor (Bull. ex Fr.) Murrill is widespread in Britain, but rather uncommon in Scotland. It resembles *Coriolus versicolor* (L. ex Fr.) Quél. but has small, greyish, daedalioid pores. *D. latissima* Fr. is usually regarded as a form of this species.

Daedalea ferruginea (Schum.) Fr. is a doubtful species.

Fomes fomentarius (Linn. ex Fr.) Kickx is a characteristic species of the Scottish Highlands growing on *Betula* and rarely *Fagus*. There is only one authentic record of its occurrence in the British Isles outside Scotland (Knowle Park, Kent). It was formerly collected for use as amadou in tinder boxes. *F. fomentarius* ssp. *nigricans* (Fr.) has a shiny black surface.

'Fomes' fraxineus (Fr.) Cooke is a comparatively rare species usually growing at the base of *Fraxinus excelsior*. At first white, it gradually changes to pinkish and then brown, especially when handled, and has obovate or subglobose spores 6–9.5 × 5–6.5 μ . This species has sometimes been incorrectly called *F. cystinus* (Berk.) Gillet but the latter epithet is a synonym of *F. ulmarius* (Sow. ex Fr.) Gill.

Fomitopsis (Fomes) pinicola (Sw. ex Fr.) Karst. The single Scottish record, based on a specimen collected by Klotzsch, seems highly suspect, to judge from Berkeley's description (1836).

Fomitopsis rosea (Fr.) Karst. is an exotic species with pink flesh, and was recorded on dressed wood of *Pinus* in a hothouse at Glamis, Angus, by Berkeley & Broome (1879).

Ganoderma lucidum (Leyss. ex Fr.) Karst. is an uncommon fungus, usually found at the base of trunks of *Quercus*. It has a thick, laccate, reddish brown, dark brown, or blackish stipe, which expands above into a concentrically sulcate, lateral pileus, of a reddish chestnut colour and with a varnished surface. The spores are brown and have the typical *Ganoderma* shape and ornament.

Gloeophyllum (Lenzites) abietinum (Bull. ex Fr.) Karst. is very similar to the following species but is distinguished by the presence of thick-walled cystidia in the hymenium. The only Scottish record, based on a Klotzsch collection from Glasgow preserved at Kew, appears to be *G. sepiarium*.

Gloeophyllum sepiarium (Wulf. ex Fr.) Fr. grows extensively on coniferous wood left after forestry operations. It is found throughout Scotland but is rare in England. It has small dimidiate, concentrically sulcate, hairy strigose fruitbodies which are at first tawny or rusty-brown with a brighter orange-brown margin, but soon become glabrous and dark brown or blackish, although long retaining the bright coloured edge. The gills are also tawny or brownish in older fruitbodies.

Grifola (Polyporus) frondosa (Dicks. ex Fr.) S. F. Gray occurs at the base of trunks of *Fagus* and *Quercus* but is less common in Scotland than in England. It is recognized by the large caespitose fruitbody, up to 30 cm in diam., formed of densely imbricate, stalked, pubescent, grey-brown pilei. In *G. frondosa* forma *intybacea* (Fr.) Pilát, also recorded from Scotland, the fruitbody smells of mice. *Meripilus (Polyporus) giganteus* (Pers. ex Fr.) Karst. is similar to this fungus and more frequent, but its pores blacken on bruising and the fruitbodies are usually larger, commonly arising on the ground some distance from the base of the trunks.

Grifola umbelata (Pers. ex Fr.) Pilát produces very large caespitose clusters of small, umbilicate, centrally stipitate pilei, each of which may be up to 4 cm in diam. These pilei spring from a common base which in turn arises from an underground sclerotium. There are no recent reports of this fungus from Scotland.

Heteroporus (Daedalea) biennis (Bull. ex Fr.) Laz. [= *Polyporus rufescens* [Pers.] Fr.] occurs on the ground amongst the roots of trees, on buried wood chips or on trunks, and is

widespread in Britain. It produces fruitbodies which may be either infundibuliform, flabellate, irregularly lobed or dimidiate, with a spongy white or pinkish surface. Microscopically it is well characterized by the presence of gloecystidia and chlamydo-spores in the tubes and subglobose or broadly elliptical spores measuring $4\text{--}7.5 \times 3\text{--}6\mu$.

Leptoporus (Polyporus) albellus (Peck) Boud. & Galz., found in Scotland by Corner (Austwick, 1955), on *Pinus sylvestris*, is distinguishable in the field by the greyish fruitbody with very soft, watery flesh; it develops a marked pellicle on drying. It is frequently attacked by a *Hypomyces*. The spores are (3-) $4\text{--}5 \times 1.5\text{--}2$ (-2.3) μ .

Leptoporus albo-brunneus (Romell) Pilát is restricted to northern pinewoods (*Pinus*) where it is locally common. It is recognized by the thin effuso-reflexed pileus with bright reddish brown, tomentose surface, and the long allantoid spores, $5\text{--}6 \times 1\mu$. The pores stain brown on bruising.

Leptoporus borealis (Fr.) Pilát. There is still some doubt as to whether this species occurs in Britain, since most of the old collections are wrongly named. However there is a collection filed amongst British material at Kew from Klotzsch (No. 176) which is correctly determined, but there is no direct proof that this is a British gathering. The species is easily recognized by the presence of conspicuous thick-walled, conical, hyaline cystidia in the tubes.

Leptoporus kymatodes (Rostk.) Pilát [= *P. balsameus* Peck]. This species has been confused with many of the thin-fleshed white polypores. The colour of the surface may vary from white or tan to dark reddish brown, but the small spores, $4\text{--}5 \times 2.5\text{--}3.5\mu$, and the small pointed cystidia, sometimes difficult to find, are characteristic.

Leptoporus mollis (Pers. ex Fr.) Pilát sensu auct. Brit. [nec sensu Pilát nec Overholts = *L. fragilis* (Fr.) Quél.] is an uncommon fungus found only on conifer wood. The thick fleshy fruitbody is at first white but turns rapidly reddish brown on handling; the spores are (3-) $3.5\text{--}5 \times 1.5\text{--}2$ (-2.2) μ . The external appearance is sufficient to distinguish it from the common *P. trabeus* Fr. sensu Lowe [= *P. fragilis* sensu Bourd. & Galz.], which is thinner, smaller, stains less readily, possesses gloecystidia and has longer and narrower spores.

Leptoporus revolutus (Bres.) Bourd. & Galz. is now known to occur in many parts of Britain, especially on conifer wood. It has white, pendulous, confluent pilei with a dorsal point of attachment. These are frequently accompanied by *Ptychogaster alba* Corda, the brown chlamydo-spores of which are sometimes formed in and around the fruitbodies. However, it is possible that *Pt. alba* is the chlamydo-spore state of more than one polypore.

Leptoporus spumeus (Sow. ex Fr.) Pilát. This rare species usually grows on *Ulmus*. The large, white, fleshy fruitbody discolours reddish with age and when dried has a characteristic syrupy texture. The spores are elliptical to subglobose, $6.5-9 \times 5-7\mu$, with a large oil guttule.

Oxyporus populinus (Fr.) Donk [= *Fomes connatus* (Fr.) Gillet] produces small, relatively thin effuso-reflexed, imbricate brackets up to 6 cm in diam. with a whitish or pallid ochraceous, tomentose surface. The flesh is white, and there are often very numerous, densely crowded tube layers each about 2-3 mm in thickness. When moss-covered the fruitbodies could be mistaken for *Coriolus versicolor* (L. ex Fr.) Quél., but the layered tubes together with the presence of coarsely encrusted, subcylindric cystidia and ovoid to elliptical spores, $4-5.5 \times 3-4\mu$, distinguish it.

Phellinus (Fomes) conchatus (Pers. ex Fr.) Quél. forms rather thin, effuso-reflexed, tawny brown, tomentose brackets which eventually develop a hard, black, glabrous crust. The flesh and small pores (5-6 per mm) are cinnamon-coloured. This fungus, which grows on deciduous trees, possesses setae in the tubes, and hyaline or pale brown spores, varying in shape from globose to subglobose and measuring $4-7 \times 4-6\mu$.

Phellinus (Trametes) pini (Thore ex Fr.) Pilát produces large, thick, dimidiate brackets up to 14 cm in diam., with stratified tubes. These fruitbodies are very hard and have a concentrically furrowed, rusty-brown or black surface. The pores, 2.5 per mm, are cinnamon-coloured and either rounded, angular, irregularly elongated or sublabyrinthoid, and the flesh is rusty-brown. Microscopically, this species is characterized by the presence of setae in the tubes and ovoid or elliptical spores, $5.5-6 (-9) \times 4.5-5.5 (-7)\mu$, varying from hyaline to pale ochre-brown. This fungus is not uncommon on conifers in the Scottish Highlands but is rare in other parts of the British Isles.

Polyporellus (Polyporus) forquignonii (Quél.) Pilát is a common species of the west coast woodlands, resembling a very small *P. squamosus* [Huds.] Fr. The solitary, centrally stipitate fruitbodies are covered with dark brown scales but lack a black base to the stem.

Polyporellus lentus (Berk.) is very similar to *P. forquignonii* but has an umbilicate, pale ochraceous, centrally stipitate fruitbody up to 4 cm in diam. which is minutely scaly at first then smooth and uniformly coloured. It occurs on old stems of *Ulex*.

Polyporellus melanopus (Swartz ex Fr.) Pilát is a rare species not recorded from Scotland in recent years. It grows on the ground, usually attached to buried wood, and resembles *P. varius* (Fr.) Karst.

Polyporellus picipes (Fr.) Karst. is recognized by the dark, chestnut-brown, centrally stipitate fruitbodies, up to 15 cm in diam. The rather thin pilei are smooth and have a waxy lustre; the stipe is dark brown or blackish in colour. This fungus is most frequently collected on trunks of *Salix*.

Polyporus acanthoides [Bull.] Fr. Scottish records probably refer to *Meripilus (Polyporus) giganteus* (Pers. ex Fr.) Karst.

Polyporus alligatus Fr. This fungus is probably *Heteroporus (Daedalea) biennis*.

Polyporus armeniacus Berk. The type material collected by Carmichael is preserved at Kew and is almost certainly *Skeletocutis (Polyporus) amorphus* (Fr.) Kotlaba & Pouzar.

Polyporus cerebrinus Berk. & Br. was described from Glamis, Angus, and grew on fir. It consists of a single, resupinate, cushion-shaped fructification, 1.8 cm in diam. with a poroid surface. The pores have a slightly abnormal appearance and the dissepiments are rather thick. Bresadola has suggested on the packet at Kew that it is abnormal *Skeletocutis (Polyporus) amorphus* (Fr.) Kotlaba & Pouzar, but this does not appear to be the case. It is possible that it may be a resupinate condition of *Coriolus versicolor* (L. ex Fr.) Quél., since the structure is certainly dimitic and could be trimitic (the tissue is exceedingly hard and horny and difficult to tease apart) and the few spores found would support this view, since they were subcylindric and up to $7.75 \times 2.2\mu$.

Polyporus herbergii (Rostk.) Berk. & Br. Judging from British specimens so named at Kew, it is almost certain that Scottish records refer to *Phaeolus schweinitzii* (Fr.) Pat.

Polyporus keithii Berk. & Br. was described from Forres, Morayshire, in 1875. The type could be interpreted as *P. mollis* Fr. [= *P. fragilis* sensu Pilát, Overholts] having spores $3.7-4.5 \times 1-1.5\mu$, fairly thick-walled clamped hyphae up to 5μ wide and highly refractive conducting elements $5-11\mu$ in diam. filled with a brown sap.

Polyporus leptoccephalus [Jacq.] Fr. Scottish records probably refer to either *Polyporellus brumalis* (Pers. ex Fr.) Karst. or *P. varius* f. *nummularius* (Bull. ex Fr.) Pilát.

Polyporus polymorphus Rostk. See *Cartilosoma subsinuosa*.

Polyporus salicinus (Bull. ex Fr.) Grev. A specimen so determined by Klotzsch from Garscube, Dunbartonshire, is *Bjerkandera fumosa*.

Polyporus scoticus Kl. This is now regarded as a synonym of *Fomitopsis annosus* (Fr.) Karst.

Poria ancirina (Sommerf.) Cooke sensu Bourdot & Galzin. There is a specimen of this fungus at Kew which was collected by Keith at Forres, Morayshire, in 1884 and correctly determined by Cooke. This species has white then yellowish or ochraceous pores and large ovoid-ellipsoid spores, $5-8 (-9) \times 3.5-4.5\mu$. The Scottish collection has spores $4.75-$

$7.2 \times 3.5-4.2\mu$, clamped hyphae 3.5μ wide, yellowish brown pores and a white sterile margin.

Poria blephariostoma (Berk. & Br.) Cooke. The type specimen from Glamis, Angus, 1874, forms an extremely thin film, tinted with pale orange in places and bearing shallow angular pores, 3-4 per mm, with exceedingly fine dissepiments. The hyphae, $2.5-8\mu$ in diam., are hyaline, branched, lacking in clamp-connexions at the septa and often encrusted with a brownish pigment. Furthermore, the walls are thickened, though a wide lumen remains, and the septa are of the knee-bone type. The spores are allantoid, $4.5-5 \times 1.5-2\mu$. This may well prove to be a "good" species. A second collection so named by Berkeley, from Glamis, No. 37, is *Poria reticulata* (Pers. ex Fr.) Cooke.

Poria collabefacta (Berk. & Br.) Cooke, described from material collected by Stevenson at Glamis, Angus, is either *Corticium pelliculare* forma *merulioides* Bourd. & Galz. or *Merulius serpens*. The type is a resupinate fungus up to 8 cm long and 2.5 cm wide, with the hymenium thrown into distinct meruliooid pores, 2-3 per mm. In places, however, the fertile surface is quite smooth. The hyphae are $2.5-3\mu$ wide (up to 4μ fide Prof. J. L. Lowe), thin-walled, hyaline and branched, while the elliptical spores measure $3.2-4 \times 2-2.5\mu$ [(4-) $5 \times 2-2.5\mu$ fide J. L. Lowe].

Poria gordoniensis (Berk. & Br.) Cooke was described from material collected on "fir" at Aboyne Castle, Aberdeenshire. There are at Kew three collections so named by Berkeley; two are from Aboyne and one of these, collected in 1862, should probably be taken to be the type; both are identical with *Poria candidissima* (Schw.) Cooke. A third specimen, from Strachan, Kincardineshire, is sterile and indeterminate.

Poria hybrida (Sow. ex Berk. & Br.) Cooke. An unlocalized specimen so named by Berkeley in Kew herbarium has been selected as a neotype by Prof. J. L. Lowe, according to his annotation of the packet. This collection, as well as one from Glamis, Angus, collected by Stevenson, is *Poria vaillantii* (DC. ex Fr.) Cooke. The species is characterized by its peculiar hyphal structure and by the hyphae becoming indistinct or dissolving in 10 per cent KOH. In the tubes the hyphae are thin-walled with clamp-connexions but in the region of the thick, cottony margin and in the rhizomorph-like strands which run out from it, the tissue is seen, when mounted in aniline blue in lactic acid, to be formed of long, unbranched, thick-walled, almost solid hyphae, $2.5-3\mu$ in diam., which lack clamp-connexions and septa. The spores are elliptical, $4-6 \times 2.2-3.5$ (-4) μ .

Poria hymenocystis (Berk. & Br.) Cooke was described from material collected at Glamis, Angus, by Stevenson. It is a synonym of *P. candidissima* (Schw.) Cooke, a species with a

rhizomorph-fringed margin and small, echinulate, globose spores, $3.7-4.5 \times 3-4\mu$.

Poria incarnata (Alb. & Schw. ex Fr.) Bres. There are no recent Scottish collections of this fungus. Greville's (1824) record probably refers to *Skeletocutis (Polyporus) amorphus* (Fr.) Kotlaba & Pouzar.

Poria micans (Ehrenb. ex Fr.) Cooke. A collection in the Kew herbarium, from Forres, Morayshire, 1875, is *Poria reticulata* (Pers. ex Fr.) Cooke, a species with thin-walled hyphae, lacking clamp-connexions at the septa and having allantoid spores $6-9 \times 2.5-3\mu$.

Poria ramentacea (Berk. & Br.) Cooke was based on material from Glamis, Angus, collected by Stevenson, and grew on coniferous twigs. It is identical with *Cartilosoma (Trametes) subsinuosa* (Bres.) Kotlaba & Pouzar and thus offers a much older name for Bresadola's fungus. The type collection of *P. ramentacea* consists of two resupinate fructifications, up to 1.5 cm in diam., but one of these fruitbodies appears to have been reorientated during growth so that a small pileus has grown out from the margin on one side. This pileus is 1.3 cm in diam., with a pale ochraceous surface. The resupinate fructifications have a pronounced white margin which has become detached from the substrate in places. The pores are angular and yellowish-brown, 1-2 per mm. Judging from the dried material the hyphal structure is monomitic. The hyphae, up to 5.5μ wide, have strongly thickened walls, are freely branched and bear prominent clamp-connexions at the septa. Spores are plentiful, narrowly elliptical to subcylindric, and measure $(5.2-5.75-8 \times (2-2.2-2.75)\mu$. See also under *Cartilosoma subsinuosa*. The Scottish material has been compared with a collection from France, made by Galzin on branches of *Pinus* in 1897, and so named by Bresadola. This also has a monomitic hyphal construction, and similar spores, mostly $(4.75-5.75-8 \times 2.2-2.5)\mu$ but with a few larger ones intermixed, up to $9 \times 3.5\mu$.

Trametes heteromorpha (Fr.) Bres. has often been compared with the present species but is easily distinguished by its dimitic hyphal structure and spores which are usually appreciably larger than those of the Scottish collection, even when still attached to the basidia.

Poria rennyi (Berk. & Br.) Cooke. The type material is an imperfect fungus producing an abundance of subglobose or oval chlamydospores measuring $5-6 (-7) \times 4-4.5\mu$. The fructification consists of a thin membranous film spreading over soil and vegetable debris. There is no indication of the development of pores. A collection determined by Berkeley from Glamis, Angus, agrees generally with the type but is thicker, more powdery and of an ochraceous colour. A second specimen, also from Glamis and named by Berkeley, is,

according to a note on the packet by Prof. J. L. Lowe, "an acystidiate form of *Polyporus sericeomollis*" with spores "4.5-5 × 2-2.5μ".

Poria reticulata (Pers. ex Fr.) Cooke. See under *P. micans*.

Poria rhodella (Fr.) Cooke

Poria subgelatinosa (Berk. & Br.) Cooke. The type material, from Rannoch, Perthshire, collected by Buchanan White, is in extremely poor condition, sterile and much eaten by insects. Nevertheless, Prof. J. L. Lowe has annotated it as "surely *Poria sanguinolenta* (Alb. & Schw. ex Fr.) Cooke or *P. expallescens* (Karst.) Sacc.". This observation may be correct though the hyphae, which are up to 8μ in diam. and lack clamp-connexions, have appreciably thicker walls than is usual in the former species. A second collection, from "Scotland", so named by Berkeley, is presumably *Poria sanguinolenta* since its structure and spores agree with those of that species, though it has not darkened on drying.

Poria taxicola (Pers.) Bres. [= *Poria rufa* (Fr.) Cooke] is recognized by its occurrence on coniferous wood, reddish flesh-coloured then blackish-purple pores with fertile edges, and allantoid spores 3-7 × 1-1.5μ.

Poria violacea (Fr.) Cooke. A specimen collected by Keith at Forres, Morayshire, is *P. taxicola*.

Trametes cinnabarina (Jacq. ex Fr.) Fr. This species, which is bright red throughout, was found at Murthly, Perthshire, in 1913 (Rea, 1914).

Trametes suaveolens (Linn. ex Fr.) Fr., although very common in Europe, is a rare species in Britain, occurring chiefly on trunks of *Salix*. It forms large, thick, dimidiate, pubescent fruitbodies up to 12 cm in diam., varying in colour from white to cream but often becoming greyish with age; the pores are angular and rather large. This fungus has a strong smell of anise.

HYDNACEAE

Acia fusco-atra (Fr.) Pat.

Acia setosa (Pers.) Bourd. & Galz.

Acia stenodon (Pers.) Bourd. & Galz.

Acia stenodon var. *nodulosa* (Fr.) Bourd. & Galz. See *Hydnum nodulosum*.

Bankera fuligineo-alba (Schmidt ex Fr.) Pouzar [= *Hydnum fragile* Fr.; nec *H. fragile* Pers. ex Fr.] forms large, convex, somewhat knobby sporophores which become depressed in the centre and very irregular with age. The pilei are at first tomentose, but the tomentum collapses into a smooth pellicle, and the colour varies from pinkish brown to reddish brown with a whitish margin. The rather short, stout stipe is concolorous, with a conspicuous white zone towards the apex.

while the spines are either pinkish, whitish or grey. This fungus develops a smell of fenugreek when dried, and has finely echinulate, subglobose, hyaline spores. It is not uncommon in the Highland pinewoods (*Pinus*).

Caldesiella italica Sacc. produces fairly extensive, resupinate fructifications which are easily separable from the substrate. It resembles *C. ferruginosa* (Fr.) Sacc., but dried fruitbodies are cinnamon-coloured, covered with a conspicuous white pruina, and have a verrucose rather than a spinose surface.

Dacryobolus sudans (Alb. & Schw. ex Fr.) Fr. [= *Porothelium stevensonii* Berk. & Br.; *Porothelium confusum* Berk. & Br.] is a whitish, resupinate, hydroid fungus in which the tips of the spines are capped with a shining, viscous, amber droplet which dries to a resinous consistency. The spores are elongated and allantoid, $5-8 \times 1-1.75\mu$.

'**Grandinia**' **crustosa** var. **lignorum** Fr. The specimen recorded by Berkeley & Broome (1878) from Glamis, Angus, is *Odontia bicolor* (Alb. & Schw. ex Fr.) Quél.

Grandinia (**Thelephora**) **granulosa** (Pers. ex Fr.) Fr. Although this very common species undoubtedly occurs in Scotland, the old Scottish collections at Kew are all wrongly named. The Carmichael specimen from Appin quoted by Berkeley (1836) is *Odontia crustosa*. Later specimens are of *Odontia bicolor* (Alb. & Schw. ex Fr.) Quél. (Aboyne 1862, 2 collections; Glamis 1874; Perth, leg. Buchanan White); *O. arguta* (Fr.) Quél. (Aboyne 1862; probably also Glamis No. 506); *Peniophora setigera* (Fr.) Höhn. & Litsch. (Aboyne 1862, 2 collections); *Peniophora pallidula* (Glamis No. 503) and finally a collection by Buchanan White from Perth which is probably *Odontia papillosa* (Fr.) Bres.

Grandinia mucida (Pers. ex Fr.) Fr. The specimen recorded by Berkeley & Broome (1878) from Glamis, Angus, is *Odontia bicolor* (Alb. & Schw. ex Fr.) Quél. as is another gathering from the same locality.

Hydnellum aurantiacum (Batsch. ex Fr.) Karst., in common with other members of the genus, produces stipitate, tomentose fruitbodies which do not have a smell of fenugreek even when dried and have coarsely tuberculate, subglobose to angular brown spores. It is recognized by the delicate orange or salmon and finally yellow-brown or fulvous colour of the pileus, the duplex context which is yellowish in the cap and orange in the stipe, its mealy smell and absence of clamp-connexions on the hyphae. It grows in pinewoods (*Pinus*).

Hydnellum caeruleum (Hornem. ex Pers.) Karst. is best recognized by the numerous bluish lines in the context of the pileus and the orange-brown colour of the flesh in the stipe.

It has a mealy smell, possesses clamped hyphae and grows in pinewoods (*Pinus*).

Hydnellum compactum (Pers. ex Fr.) Karst. [= *H. acre* (Quél.) Donk] has a fairly large cap up to 10 cm in diam., is uniformly white or yellow when young, becoming dingy ochraceous, and finally darker with age, and often tinted with bistre or olive. The stocky stipe is concolorous and either velutinous or glabrescent. This fungus is distinguished from *H. aurantiacum* by the colour of the context, which is pallid in the cap and brownish in the base of the stipe, and by its acrid, bitter taste.

Hydnellum diabolus Banker was first reported from Europe by Maas Geesteranus (1957) but is now known to be widespread and is common in native Scottish pinewoods (*Pinus*). It has been much confused with the next species but is distinguished from it by the presence of clamp-connexions, by the strong sweetish spicy smell of the intact fruitbody and the mealy odour of the cut flesh. Its fruitbodies, which may be up to 10 cm in diam., are cushion-shaped, velutinate and at first somewhat colliculose. The young fruitbodies bruise reddish and also exude reddish droplets which leave a permanent red-brown or blackish stain. The flesh is acrid even in dried material.

Hydnellum ferrugineum (Fr. ex Fr.) Karst. has been frequently reported from Scotland but most of the collections on examination have proved to be *H. diabolus*. However, true *H. ferrugineum* is readily distinguished from the latter species by the absence of clamp-connexions on its hyphae. It produces solitary or gregarious and often connate sporophores, with a knobby centre. When young the fruitbodies are covered with a white tomentum and exude red droplets in wet weather, but with age the tomentum becomes pale pinkish brown or yellowish brown from the centre outwards. Eventually the tomentum becomes pitted and finally collapses to form a hard, dark brown surface. This species occurs in coniferous woods.

Hydnellum velutinum var. **scrobiculatum** (Fr. ex Secr.) Maas Geesteranus and var. **zonatum** (Fr.) Maas Geesteranus are both very common in Scottish pinewoods. They resemble *Phellodon tomentosus* but may be distinguished by their brown, angular, warted spores, and mealy smell.

'**Hydnum**' **limonicolor** Berk. & Br. Nothing is known of this fungus apart from the data given in the original description; there is no material at Kew.

'**Hydnum**' **multiforme** Berk. & Br. In the original diagnosis two collections were cited, from Glamis, Angus, and Menmuir, Angus, respectively. The latter specimen, in the Kew Herbarium, is *Corticium bombycinum* (Sommerf.) Bres., with the hymenium mostly smooth but floccose-hydroid or spiculose in parts and spores varying from broadly ovoid or even subglobose to elongate-elliptic. The larger spores are of

the latter shape and up to $12.75 \times 7.2\mu$. In the collection from Glamis the hymenium bears distinct hydroid spines and the spores tend to be rather more subglobose to oval, $9-12 \times 7.2-8.75\mu$. This latter material may also be *C. bombycinum* or more probably *Radulum membranaceum*.

'**Hydnum**' **nodulosum** Fr.—the specimen from Glamis, Angus, so listed by Berkeley & Broome (1878), is *Radulum membranaceum*.

Hydnum stevensonii Berk. & Br. The type material from Glamis, Angus, is *Grandinia farinacea* (Pers. ex Fr.) Bourd. & Galz.

Irpex johnstonii Berk. was based on a gathering from Berwick which is not preserved at Kew under that name. There is a specimen from J. Sim, Kincardineshire, determined by Berkeley, and this appears to be very poor material of *Steccherinum ochraceum* (Pers. ex Fr.) S. F. Gray. The needles consist of thick-walled to almost solid, unbranched hyphae, up to 3μ wide as measured in aniline blue in lactic acid, but there are others up to 6μ wide which have a distinct lumen towards the apex. These latter hyphae would seem to be cystidia which have not become encrusted. There is no trace of an hymenium. The needles are discrete, sometimes flattened, distinctly hydroid rather than irpicoid, and the whole aspect and structure suggest *S. ochraceum* rather than *Irpex lacteus* (Fr.) Fr., to which it was at one time referred by Berkeley.

Irpex pendulus Fr. The collection recorded by Berkeley & Broome (1876) is of *Radulum membranaceum*. Another collection, from Castle Semple, Renfrewshire, so named by Klotzsch, appears to be correctly determined. This fungus forms small imbricate brackets, up to 3 cm in diam., which are either dorsally attached or attached by a lateral stipe-like portion. The lower surface bears coarse hydroid spines, which tend to be rather sparse except towards the margin, where they may occur in groups and even become laterally confluent. According to Bourdot & Galzin (1928) the spores are subcylindric, $4.5-5 \times 2-2.5\mu$. Both on the Scottish collection and on one received from E. P. Fries, Uppsala, 1853, the spores appear to be amyloid but they have collapsed, so that the observation needs confirmation on fresh material.

Kneiffia subgelatinosa Berk. & Br. The type, from Glamis, Angus, is *Odontia bicolor* (Alb. & Schw. ex Fr.) Quél.

Odontia crustosa (Pers. ex Fr.) Quél. Most of the Scottish records of this fungus at Kew are *O. bicolor* (Alb. & Schw. ex Fr.) Quél. viz. Glamis leg. Stevenson Nos. 452, 860, 866, 1066 and 2 unnumbered gatherings. Another collection from Glamis, Stevenson 669, is *Grandinia farinacea* (Pers. ex Fr.) Bourd.

& Galz. and one by J. Sim, Kincardineshire, is *Odontia papillosa* (Fr.) Bres.

'*Odontia*' *sepulta* (Berk. & Br.) Rea. The original description was based on a gathering from Glamis, Angus, made by Stevenson, No. 818, but a second specimen from Forres, Morayshire, was also mentioned. Both are now at Kew. According to Berkeley & Broome the fungus was golden-yellow with a white margin and had moderately long acute spines. It was said to form "little scattered patches on stones buried amongst pine-leaves". The needles are densely crowded and up to 1 mm long. The hyphae are thin-walled, up to 5μ wide, with clamp-connexions at the septa, but running between them are others up to 8μ wide which often stain deeply in 10 per cent KOH + eosin. These latter hyphae have knee-bone-like septa with clamp-connexions and resemble conducting hyphae, but there are no gloeocystidia, cystidia or cystidioid hyphae. The spores vary in shape from ovoid to elliptical, are amyloid and measure $4.5-6.75 \times (2.75-3.2-3.5 (-4)\mu$. The fungus seems to be a "good" species of uncertain affinity. But for the lack of gloeocystidia it might be placed in *Gloeocystidiellum* Donk. At present it seems to form an isolated taxon among the resupinate Aphyllophorales. Although there is no traceable type material of *Hydnum limonicolor* Berk. & Br. at Kew the fact that it was collected on a stone buried amongst pine leaves in the same locality and in the same year as the type of *O. sepulta* suggests that the two fungi are conspecific.

Odontia (*Hydnum*) *stevensonii* (Berk. & Br.) Rea. The type material is identical with *Grandinia farinacea* (Pers. ex Fr.) Bourd. & Galz.

Phellodon nigrum (Fr. ex Fr.) Karst., in common with all members of the genus, produces small centrally stipitate, often confluent, tomentose fruitbodies formed of hyphae lacking clamp-connexions. The sporophores smell of fenugreek when dried and bear minutely echinulate, subglobose, hyaline spores. At maturity it has a uniformly blue-black, glabrescent, shallowly funnel-shaped cap, and a similarly coloured stipe with a thick spongy surface. The latter character provides the best way of distinguishing between *P. nigrum* and the closely related and not uncommon *P. melaleucus* (Fr. ex Fr.) Karst. [= *P. graveolens* (Pers.) Karst.] in which the surface of the stipe is hard and almost glabrous. Both fungi occur in coniferous woods.

Phellodon tomentosus (L. ex Fr.) Banker has thin, pliant fruitbodies which often occur in large numbers and become confluent. The sporophores resemble *Coltricia* (*Polystictus*) *perennis* (L. ex Fr.) Murrill in growth-form and have a yellowish or reddish brown, tomentose cap with concentric zones of varying shades.

Radulum corallinum Berk. & Br. The type is identical with *R. orbiculare* Fr.

Radulum epileucum Berk. & Br. The type, from Glamis, Angus, bears long, narrow, allantoid spores, $8-12 \times 2.5-3\mu$, similar to those of *R. orbiculare* Fr. It appears that *R. epileucum* is a form of *R. orbiculare* in which the fructification forms fairly extensive sheets but bears only scattered tubercles or spines.

Radulum membranaceum (Bull. ex Fr.) Bres. [= *R. molare* Fr.] is a resupinate fungus with rather coarse hydroid spines having much the same texture and microscopic details as *Corticium confluens* Fr. There are a number of Scottish collections in the Kew herbarium, including one collected by Anderson on "fir" at Menmuir, Angus, in 1876 and recorded by Berkeley & Broome (1876) as *Irpex pendulus* Fr. This has subglobose or ovoid spores, $8.75-9.75 \times 6.5-7.75\mu$.

Radulum quercinum Fr. differs from *R. orbiculare* Fr. in having smaller spores, $5-8.5 \times 2.5-4\mu$.

Radulum tomentosum Fr. This is a doubtful species. According to Bourdot & Galzin (1928) it is best regarded as a variety of *Odontia arguta* (Fr.) Quél. but the collection from Menmuir, Angus, is *Radulum orbiculare* Fr.

Sarcodon imbricatus (L. ex Fr.) Karst., formerly much more widespread in the British Isles, is now only commonly found in the Highland pinewoods. This centrally stipitate fungus is recognized by its large size and dark coarsely imbricate scaly cap.

Sarcodon laevigatus (Sw. ex Fr.) Karst. grows in coniferous woods but has not been reported of recent years. As interpreted by Maas Geesteranus (1956) it has a smooth cap which may become cracked into adnate membranous scales. The pileus varies in colour from pale purplish grey-brown to greyish tawny with darker scales: the stem is concolorous while the odourless, tasteless flesh is white, unchangeable and formed of clamp-bearing hyphae. In the sense of Bourdot & Galzin (1928), Bresadola (1932) and Konrad & Maublanc (1924-1935) the flesh becomes vinaceous on exposure, has a bitter taste after a while and a nauseating smell.

Sarcodon scabrosus (Fr.) Karst. resembles *S. imbricatus* but is more widespread and may sometimes occur in deciduous woods. It is distinguished by its mealy smell, the blue-grey colour of the flesh at the base of the stipe and the absence of clamp-connexions on the hyphae.

Sistotrema commune J. Eriks. is a white resupinate fungus which grows on mosses, and has urniform basidia with up to 8 sterigmata—a characteristic feature of this genus. It has been collected on *Hylocomium splendens* at Aberdeen.

Sistotrema confluens Fr. [*S. sublamellosum* [Bull.] Quél.] occurs on the ground in coniferous or deciduous woodland,

especially hazel (*Corylus*) coppices. It is commonly found amongst mosses but also in the deep crevices formed in clay soils following hot dry summers. The white or yellowish fruitbodies, up to 3 cm in diam., are soft, villose and often rather thin. They tend to be irregularly lobed and vary from centrally or laterally stipitate to almost sessile and have a more or less poroid hymenium.

Steccherinum (Hydnum, Odontia) fimbriatum (Pers. ex Fr.) Eriksson. Most of the old Scottish records are correct. The species is recognized by its resupinate habit, conspicuously fringed rhizomorphic margin and short spines, which often tend to be disposed in radiating lines. Microscopically it may be recognized by its long, thick-walled, cylindric, clavate or fusiform cystidia, with coarsely encrusted apices and by its small, ovoid, or elliptic spores, $3.5-4.5 \times 1.75-3\mu$.

CLAVARIACEAE

Aphelaria (Thelephora, Stereum) tuberosa (Grev.) Corner is a small whitish or pinkish-buff species of rather tough consistency. It has a stipe which normally gives rise to a number of rather broad wedge-shaped lobes which themselves become torn into smaller irregular cuneate segments. In depauperate sporophores the stipe expands into a single, narrow, more or less entire, strap-like segment. This fungus is commonly gregarious and adjacent sporophores may fuse and form compound fructifications which often appear funnel-shaped. The fruitbodies can thus vary in aspect from clavarioid to stereoid. Microscopically, *A. tuberosa* is well characterized in having elliptical spores, $13-18 (-20.8) \times 5-7\mu$, borne on 2- or 4-spored basidia which are incompletely longitudinally septate. It was originally described from Foxhall, West Lothian, and since that time there have been very few British gatherings.

Clavaria lavendula Peck is recognized by its brittle, densely tufted, branched fruitbodies which may be deep amethyst or violet in colour, fading to pale lavender-pink with age. Its hyphae lack clamp-connexions and its spores are hyaline-elliptical, $4-7 \times 3-4\mu$. Some authorities have used the epithet *zollingerii* Lév. for this fungus, but since the name refers to a species from Java, the type of which has yet to be critically examined, it seems preferable to adopt the epithet *lavendula* Peck for the present.

Clavaria purpurea Fr. is generally found in grass under conifers. The fruitbodies are simple, purple or amethyst-coloured, but become brownish with age, and are either solitary or produced in tufts which may be up to 12 cm high. Microscopically it is recognized by its cylindric cystidia and ellipsoid or oblong spores $5.5-9 \times 3-5\mu$.

Clavaria rosea Fr. has been recorded from Forres, Morayshire (Cotton & Wakefield, 1919). It has simple rose-pink fruitbodies up to 5 cm high with elliptical spores $5-8 \times 2.5-3.5\mu$.

Clavariadelphus fistulosus (Fr.) Corner var. *fistulosus* has tall tawny yellow to reddish brown fruitbodies up to 30 cm high, with spores $10-18.5 \times 4.5-9\mu$. It grows on sticks and branches, sometimes in very large numbers, but is never caespitose.

Clavariadelphus fistulosus var. *contortus* Corner grows on twigs, especially those of *Alnus*, and seldom exceeds 3 cm in height. The fruitbodies are cylindrical or spatulate, rather short, thick and often twisted. It has larger spores than var. *fistulosus*, measuring $14-23 \times 7-9\mu$.

Clavariadelphus junceus (Fr.) Corner has very tall, filiform, pale creamy brown fruitbodies up to 15 cm high and 2 mm wide. This species bears a striking resemblance to *Typhula phacorrhiza* but is distinguished by its lack of a sclerotium and smaller spores $6-12 \times 3.5-5.5 (-6)\mu$.

Clavariadelphus ligula (Fr.) Donk normally grows on coniferous needles and has characteristically flattened or ligulate, yellowish cream or ochraceous fruitbodies up to 10 cm high. It closely resembles *C. pistillaris* (Fr.) Donk but is usually less robust and has spores $8-15 \times 3-6\mu$ which are narrowly ellipsoid and twice as long as broad. This fungus has been found at Strachan, Kincardineshire, and also in the Rothiemurchus Forest, Inverness-shire.

Clavulina amethystina (Fr.) Donk closely resembles *C. cinerea* (Fr.) Schroet. in growth form and spore characters but has a lilaceous-violet colour.

Clavulina cristata var. *coralloides* Corner [= *Clavaria coralloides* Fr.]

Clavulinopsis umbrinella (Sacc.) Corner has branched white fruitbodies, up to 4.5 cm high, which become pale brown to umber with darker tips. It has clamped hyphae and subglobose or broadly pip-shaped spores, $4-6.7 \times 3-6\mu$.

Mucronella calva Fr. Except for the scattered habit, this species seems to be identical with *M. aggregata* Fr.

Pistillaria culmigena Mont. & Fr. is a small, white species up to 3 mm high, with an ellipsoid or ovoid head. It grows on dead grass in wet places and is recognized by its triangular or cordate spores, $3-5 \times 3-4\mu$.

Pistillaria micans Fr. is a small pink, clavate species up to 4 mm high which grows on dead leaves and herbaceous stems. It has spores measuring $8-13 \times 5-7\mu$.

Pistillaria uncialis (Grev.) Cost. & Dufour produces small cylindrical or subclavate fruitbodies up to 2.5 cm high, which are at first white but become yellowish or pale ochraceous from

below. This fungus occurs on herbaceous stems, especially of the Umbelliferae, and has spores $4-7 \times 2-3\mu$.

Ramaria abietina (Pers. ex Fr.) Quél. [*R. ochraceo-virens* (Jungh.) Donk]. This is a not uncommon fungus of coniferous woods, recognized by its deep, dull ochre-yellow, densely fasciculately branched fruitbodies up to 4.5 cm high, which become green on bruising.

Ramaria aurea (Fr.) Quél., in common with most other members of the genus, has densely branched cauliflower-like fruitbodies up to 12 cm high with a distinct stem-like base, and bears brown, roughened elongate-elliptical spores. The fructifications vary in colour from ochraceous-yellow to egg-yellow and eventually become deep ochraceous with age. It has finely roughened spores, $8-15 \times 5-6\mu$.

Ramaria botrytis (Fr.) Ricken forms large, tufted, fasciculately branched fruitbodies up to 15 cm high with a distinct stem-like base. They are ochraceous or tan-coloured with deep pink, red or purple tips. This fungus has elongate-elliptical spores $12-20 \times 4-6\mu$, ornamented with faint longitudinal striae.

Ramaria flava (Fr.) Quél. resembles *R. aurea* but has a more tufted, fasciculate habit, sulphur or lemon-yellow fruitbodies becoming ochraceous with age, which redden on bruising and larger, more distinctly roughened brown spores, $11-18 \times 4-6.5\mu$.

Ramaria flavo-brunnescens (Atk.) Corner is very similar to *R. flava* but the fruitbodies do not redden and the spores are smaller and less distinctly roughened, $7.5-12 (-15) \times 3-4.5 (-5.5)\mu$. It also resembles *R. aurea* but differs in its more tufted, fasciculate habit and smaller spores. This fungus has been found in the Pass of Killiecrankie, Perthshire.

Ramaria stricta (Fr.) Quél. var. *alba* Cotton & Wakefield is creamy white in colour and was found at Drumnadrochit, Inverness-shire, in 1908 and 1912. (Cotton & Wakefield, 1919).

Ramariopsis (Clavaria) crocea (Fr.) Corner forms golden-yellow branched fruitbodies up to 5 cm high, bearing small, hyaline, minutely asperulate spores, $3-4 \times 2-3.5\mu$. There are no recent Scottish records.

Ramariopsis kunzei (Fr.) Donk [= *C. krombholzii* Fr.] is a widespread fungus, recognized by its white, often densely branched fruitbodies, bearing small, subglobose, minutely echinulate spores, $3-5.5 \times 2.3-4.5\mu$. The record of this species published by Berkeley & Broome (1876), from Glamis, Angus, as *C. krombholzii*, is correct.

Typhula gracillima White apud Berk. & Br. According to Corner this is probably a synonym of *Pistillaria uncialis* Grev.

Typhula incarnata Lasch ex Fr. forms dark brown sclerotia from which arise one or more stalked fruitbodies with a

whitish or pinkish, filiform head. The fruitbodies are 3.4–30 mm high with heads 1–20 × 0.4–2 mm. The spore measurements for this species appear to be in the region of (6–) 7.5–15 × (2–) 3–6 (–8) μ . It occurs on grasses and vegetable debris and is parasitic on cereals.

Typhula phacorrhiza Fr. produces long filiform fruitbodies up to 14 cm high which are at first pale cream-coloured but later somewhat ochraceous. They are very similar in appearance to the sporophores of *Clavariadelphus junceus* but unlike that species arise from a sclerotium; the spores are also larger and measure (9–) 11–15 (–20) × 4–8 μ . This fungus grows on vegetable debris and is sometimes found on compost heaps.

Typhula translucens Berk. & Br. According to Masee (1892) and Corner (1950) this is not a fungus, but examination of the type material from Glamis, Angus, suggests that it is an immature sporocarp of a Myxomycete—a species either of *Hemitrichia* or *Arcyria*. The fructifications, said to have been pure white and translucent when fresh, consist of a stalk which expands into a very firm, rounded or ovoid head, the whole being about 2–3 mm high in the dried state. In microtome sections the stalk can be seen to consist of a number of cylindrical tubes—or possibly a membrane longitudinally folded to simulate such tubes—15–40 μ wide, surrounding a central mass or rounded units of protoplasm. A single layer of these tubes also surrounds the basal portion of the head. The head itself is composed of similar rounded protoplasmic masses, permeated by branched elaters, 4.5 μ wide, with annular thickenings like those in *Arcyria denudata*. It is noteworthy that Berkeley and Broome commented that this fungus resembled a “prematurely dried Myxogast”.

THELEPHORACEAE

Aleurodiscus amorphus (Pers.) Rabenh. appears to be less common than formerly. It forms thick, convex, cushion-shaped or discoid fructifications up to 5 mm in diam. with a raised margin. These fruitbodies are at first orange, but become pinkish buff with a whitish rim on drying, furthermore they have a distinctly pruinose surface. This fungus, which occurs on branches of various conifers, has large, broadly elliptical, amyloid spores, 24–30 × 10–25 μ , densely beset with warts or spines.

Aleurodiscus macrosporus Bres. produces small white resupinate patches with a pruinose and sometimes cracked surface. It has large allantoid, non-amyloid spores, 10–21 × 4.5–7 μ , and emergent cystidioid bodies with slightly thickened walls, which are more or less cylindrical with a truncate or somewhat swollen apex. This fungus, for which there is only

one British collection, from Loch Maree, Wester Ross, is very like *Vuilleminia comedens* (Nees ex Fr.) Maire, and should perhaps be transferred to that genus.

Amylostereum (Stereum) chailletii (Pers. ex Fr.) Boidin forms thick, narrow, effuso-reflexed brackets with a concentrically grooved, tomentose, umber-brown or tawny surface, and a pale nut-coloured or cinnamon-grey hymenium. Microscopically, it is characterized by having subcylindric, amyloid spores, 6-7 (-9) \times 3-4 μ , and a thickening hymenium with numerous thick-walled brown fusiform cystidia scattered throughout. These organs are roughened-asperulate towards the apex. This uncommon fungus occurs on coniferous wood.

Amylostereum laevigatum (Fr.) Boidin [= *Hymenochaete stevensonii* Berk. & Br.] differs from the preceding species in its resupinate habit. It is widespread, especially on *Taxus*.

Cladoderris minima Berk. & Br., based on material collected by Stevenson at Glamis, Angus, is *Corticium laeve* forma *cucullata* Bourd. & Galz., see Reid (1959, 1962).

Coniophora arida forma **flavobrunnea** (Bres.) Bourd. & Galz. differs from the type variety in its bright yellow colour.

Corticium anthochroom (Pers. ex Fr.) Fr. The Scottish record from Forres, Morayshire, is based on a collection of *Peniophora violaceo-livida* (Sommerf.) Masee.

'**Corticium citrinum** Pers.'—the specimen so recorded by Berkeley & Broome (1878) Dr Buchanan White, of Perth, is a very immature specimen of some *Coniophora* sp. A second collection from Glamis, Angus, is a corticioid fungus but not that to which the name is usually understood to refer today, i.e. *Gloeocystidium alutaceum* (Schrad.) Bourd. & Galz.

Corticium fastidiosum forma **alliacea** (Weinm.) Bourd. & Galz.

Corticium fuscostratum Burt

Corticium galzinii Bourd.

Corticium lacunosum Berk. & Br. This species, described from Aboyne, Aberdeenshire, is identical with *Peniophora byssoidea* (Pers.) v. Höhn. & Litsch.

Corticium scutellare Berk. & Curt. was recorded by Berkeley & Broome (1879) from a collection made by Stevenson at Glamis, Angus, and again from a gathering by J. Sim, both preserved at Kew. The former is *Peniophora hydnooides* Cooke & Masee, the latter is sterile and indeterminate.

Corticium sphaerosporum R. Maire

Corticium subseriale Bourd. & Galz.

Corticium trigonospermum Bres.

Corticium (Thelephora) viscosum (Pers. ex Fr.) Fr. The collection from Appin, recorded by Berkeley (1836), is correctly named, but later material determined by Berkeley from

Glamis, Angus, includes specimens of *Exidia nucleata* (Schw.) Burt, *Platyglœa vestita* and other tremelloid fungi.

Cyphella cernua [Schum.] Masee, as originally interpreted, has white, pendulous, funnel-shaped fruitbodies, and is almost certainly identical with *Calypotella* (*Cyphella*) *capula* (Holmsk. ex Pers.) Quél. In the sense of Masee (1892) and Rea (1922) it has entirely primrose-yellow, infundibuliform fructifications, bearing more or less globose spores $10 \times 8-9\mu$, and grows on the bark of *Sambucus*. The Scottish record, from the Glasgow area, probably refers to *C. cernua* sensu Masee.

Cyphella curreyi Berk. & Br. This is *Lachnella* (*Cyphella*) *alboviolascens* (Alb. & Schw. ex Pers.) Fr.

'*Cyphella*' *jucundissima* (Desm.) Höhn. resembles *Lachnella* (*Cyphella*) *villosa* (Pers. ex Schw.) Gillet, but has a slight stalk, stiff, spreading, granule-encrusted hairs, and smaller spores.

'*Cyphella*' *laevis* (Pers. ex Fr.) Lundell is a small white species associated with *Polytrichum*. This very rare fungus has fruitbodies ranging from spatulate or flabellate with well developed lateral stipes to others which are merely narrowed behind into a short, flattened, rudimentary, stipe-like base. The fruitbodies may be produced quite high up on the moss plant or on the ground. Microscopically, this species is easily recognized by its small, broadly elliptical spores, $3-4 \times 2-2.5\mu$, narrow protruding hair-like basidioles, and hyphae $2-3\mu$ wide which lack clamp-connexions.

Cyphella punctiformis (Fr.) Karst. var. *stenospora* (Bourd. & Galz.) Bourd. & Galz. [= *C. villosa* var. *stenospora* Bourd. & Galz.] occurs in dense colonies of small, globular, white, villose fruitbodies 0.15-0.4 mm in diam. The fructifications are covered with long, pointed, encrusted hairs, and bear spores $8-10 \times 3-4\mu$, which are narrow, elongated and obliquely attenuated at the base.

Cyphella stippea Berk. & Br., described from material on *Cytisus* collected by the Rev. Anderson in Scotland, is *Lachnella* (*Cyphella*) *alboviolascens* (Alb. & Schw. ex Pers.) Fr.

Cyphellopsis (*Cyphella*) *monacha* (Speg. apud Roumeg.) Donk [= *Cyphella leochroma* Bres., *C. tephroleuca* Bres.] forms small sessile cupulate, tawny or rusty-brown fruitbodies up to 1 mm in diam., with a cream-coloured hymenium. The fruitbodies are densely covered with long, narrow, cylindrical hairs which have slightly thickened brown walls, but become thinner and hyaline toward the apex. These hairs, which may be septate near the tips, are minutely granule-encrusted; the hyaline spores, $13-15 \times 6-9\mu$, are more or less amygdaliform. This very uncommon fungus is usually found on *Ulex*.

Cytidia rutilans Pers. [= *Corticium salicinum* Fr.] forms small, flattened, white, villose, discoid fructifications up to 10 mm in diam. with free margins, orange to blood-red hymenium, and gelatinous flesh. The spores are allantoid,

12-18 \times 4.5-5 μ . Although there are no recent Scottish collections of this fungus, which grows on dead branches of *Salix* spp., there is a bona fide collection from Forres, Morayshire, on *Salix aurita*. This was reported under the name *Corticium salicinum* by Berkeley & Broome (1876).

Exobasidium vaccinii Woronin

Exobasidium vaccinii var. **japonicum** (Shirai) McNabb. This variety is parasitic on various species of *Rhododendron*.

Exobasidium vaccinii-myrtilli (Fuckel) Juel

Flagelloscypha (*Cyphella*) **citrispora** (Pilát) Reid produces minute, white, villose fruitbodies, on woody or herbaceous debris. These fructifications are clothed with long hairs, which are covered with coarse acicular crystals except towards the whip-lash-like apex. The spores, very variable in shape and size, may be either short-limoniform or elongate-amygdaliform, depending on their maturity, and measure (6.2-) 8-12.2 \times (3-) 4-5 (-5.75) μ .

Flagelloscypha mairei (Pilát) [= *F. morlichensis* W. B. Cooke] forms small sessile, white, villose fruitbodies which are almost tumbler-shaped or short-tubular with flaring mouths. These fruitbodies have narrow, elongate-elliptical spores, 8-13 \times 3-3.5 μ , and are covered with long, narrow, tapering, granule-encrusted hairs with naked, whip-like apices. This fungus, which occurs on old fronds of *Blechnum spicant*, has been found only once in Britain, at Loch Morlich, near Aviemore, Inverness-shire.

Gloeocystidiellum ochraceum (Fr.) Donk

Gloeocystidium alutaceum (Schrad.) Bourd. & Galz.

Gloeocystidium (**Corticium**) **geogenium** (Bres.) [= *G. inaequale* Höhn. & Litsch.]

Gloeocystidium pallidum (Bres.) Höhn. & Litsch. is recognized by its whitish surface which, when examined under a lens, is seen to be dotted with red or brown; the dotting is due to included masses of resinous matter. This fungus has occasional fusoid gloeocystidia and allantoid spores 9-11 \times 2-3.5 μ .

Gloeocystidium porosum (Berk. & Br.) Donk was described from material obtained at Aboyne, Aberdeenshire, but this specimen has not survived at Kew. There is a collection from Glamis, Angus, so determined by Berkeley, which agrees with the current interpretation of the fungus, i.e. a gloeocystidiolate species with small, elliptical, strongly amyloid spores 4-6 (-7) \times 2.5-3 (-4) μ .

Hymenochaete cinnamomea (Pers. ex Fr.) Bres. has twice been recorded from Glamis, Angus, by Berkeley & Broome (1876), but unfortunately the single specimen formerly preserved in the Berkeley herbarium at Kew has been lost.

Hymenochaete corrugata (Fr.) Lév.

Hymenochaete stvensonii Berk. & Br. This is *Amylostereum laevigatum*.

Merulius aurantiacus Klotzsch was described from Dougalston Woods, near Glasgow, on dead *Fagus sylvatica*. Bourdot & Galzin (1928) considered this species to be a young form of *M. molluscus* Fr.

Merulius carmichaelianus (Grev.) Berk. was described from specimens collected at Appin, Argyll, by Carmichael. The fungus was "resupinate, . . . so thin as to be almost like a membrane, . . . of a pure white . . ., changing when dry to pinkish-brown, the margin membranaceous, and between byssoid and lacinate . . . Pores very shallow, minute, more resembling somewhat hexagonal little pits or cavities than real pores, the dissepiments very thin. Sporidia very minute globose." There is a specimen from Carmichael at Kew, labelled "*Merulius reticulatus* n. sp." by Klotzsch and "*Polyporus sanguinolentus*" by Carmichael. This was the collection described by Berkeley (1836) as *M. carmichaelianus* and is *Poria sanguinolenta* (Alb. & Schw. ex Fr.) Cooke but one cannot be certain it is part of the type collection. It seems likely, however, that the fungus sent to and described by Greville was also *P. sanguinolenta*.

Merulius molluscus Fr. [= *M. fugax* Fr.]. The Scottish records are very doubtful; specimens from Stevenson, Glamis and from Menmuir, now at Kew, appear to be *Poria taxicola*.

Merulius pallens Berk. The type collection and Scottish material so named by Berkeley at Kew appear to be *M. rufus* Pers. ex Fr. The type bears hyaline, cylindrical, or slightly curved spores, $3.75-5.75 \times 1.2-2.2\mu$.

Merulius serpens Tode ex Fr. forms closely adherent resupinate fructifications of a pinkish or isabelline colour, but these become yellowish or ochraceous on drying. The hymenium is waxy and thrown into reticulate-poroid folds, although large areas often remain smooth. The spores are elliptical, $4-6 \times 2-2.5\mu$. To judge from the literature it would seem difficult to distinguish between this fungus and *Corticium pelliculare* Karst. and more especially its variety *meruloides* Bourd. & Galz. There is a collection at Kew filed under *M. serpens* but labelled by Berkeley as *M. molluscus* which agrees with the above description. Material from Glamis, Angus, collected by Stevenson and determined by Berkeley as *M. serpens*, also a further gathering on "fir", collected by Jerdon and sent to Currey, are both *Poria taxicola*.

Peniophora accedens (Bourd. & Galz.) Wakef. & Pearson.

Peniophora crassa Burt [= *Stereum karstenii* Bres. nec *Peniophora karstenii* Masee] is an uncommon species, restricted to coniferous wood and characterized by its narrowly

cylindric or slightly curved spores $5-6 \times 1 (-2)\mu$, and its long cylindric cystidia which are completely dissolved in 10 per cent KOH. The latter organs are thick-walled, but retain a narrow lumen.

Peniophora farinosa (Bres.) Höhn. & Litsch. [= *P. candida* (Pers. ex S. F. Gray) Lyman].

Peniophora glebulosa (Fr.) Sacc. & Syd.

Peniophora livida Burt

Peniophora lycii (Pers.) Höhn. & Litsch.

Peniophora maculaeformis (Fr.) Bourd. & Galz.

Peniophora pallidula (Bres.) Bres. apud Bourd. & Galz. See under *Grandinia granulosa*.

Peniophora polygonia (Pers. ex Fr.) Bourd. & Galz.

Peniophora sanguinea (Fr.) Bres. is recognized by its pale cream, resupinate fruitbodies, often tinted with pink or vermilion, and always fringed with blood-red fibrils or rhizomorphs.

Peniophora scotica Masee, based on a specimen collected by Stevenson at Glamis, Angus, is *P. velutina* (DC. ex Pers.) Cooke.

Peniophora subulata Bourd. & Galz.

Phaeocyphella ochroleuca (Berk. & Br.) Rea has been recorded from Scotland on two occasions. The type material is identical with *Cellypha goldbachii* (Weinm.) Donk [= *Cyphella lactea* Bres.], a white, pendulous, funnel-shaped, cyphelloid fungus, clothed with small, hyaline, capitate hairs and bearing subcylindric to narrowly elliptical spores $(8-10-14 (-18) \times 3-3.75 (-4.5)\mu$, with a curved base terminating in a prominent apiculus. For further details see Reid (1955, 1958).

Porothelium confusum Berk. & Br., described from material collected in Glen Tanner, Aberdeenshire, is identical with *Dacryobolus sudans* (Alb. & Schw. ex Fr.) Fr.

Porothelium keithii Berk. & Br. is a dubious species.

Porothelium stevensonii Berk. & Br., described from material collected at Glamis, Angus, is identical with *Dacryobolus sudans* (Alb. & Schw. ex Fr.) Fr.

Serpula (Merulius) himantioides (Fr. ex Fr.) Bondartzew in Parmasto is very close to *S. lacrymans* (Wulf. ex Fr.) Schroet. but differs in its thinner fruitbodies occurring on natural substrata; *S. lacrymans* is restricted to worked wood inside buildings. *S. himantioides* has been recorded from Scotland on several occasions and no doubt occurs, but the only Scottish collection at Kew, from Glen Tanner, Aberdeenshire, 1870, is *Serpula pinastri*.

Serpula pinastri (Fr.) W. B. Cooke produces easily separable, resupinate, yellowish or reddish-brown fruitbodies with a reticulate-poroid or irpicoid surface and a white fibrillose

margin. This species is well characterized by its small brown spores $5-6.5 \times 3.5-4.5\mu$.

Solenia ochracea Hoffm. ex Fr. The Scottish records, like most of the early reports of this fungus in other parts of Britain, are incorrect and mostly refer to *Cyphellopsis anomala* (Pers. ex Fr.) Donk or *C. confusa* (Bres.) Reid.

Sparassis laminosa Fr. is very similar to *S. crispa* [(Wulf.) Fr.] Fr., but the branching is much laxer and the segments elongated, broad, strap-like and rather drooping. This fungus is said to grow in oakwoods (*Quercus*), although it may also occur under conifers.

'**Stereum**' **multizonatum** (Berk. et Br.) Masee is a terrestrial fungus which may either form rather amorphous, cushion-shaped fruitbodies, or rosettes of well developed, spathulate lobes up to 7 cm high. These fructifications are bright vinaceous-red, and the lobes are often concentrically zoned with varying shades. This fungus has spores measuring $4.75-6.2 \times 3.75-4.75\mu$. There is a single unconfirmed Scottish record from the Glasgow area in 1901.

Stereum ochroleucum (Fr. ex Fr.) Fr. Two specimens from Glamis, Angus, in Kew herbarium so determined by Berkeley, are respectively *Peniophora cremea* Bres. and *Corticium laeve* (Pers. ex Fr.) Fr.

'**Stereum**' **pini** (Schleich. ex Fr.) Fr. has a resupinate fruitbody up to 15 mm in diam. with a free margin. The hymenium is grey, with a blue, lilac, or flesh-coloured tint. It is well characterized by its occurrence on dead pine branches still attached to the trees, and microscopically by the presence in the trama of large oval or spherical cystidia with slightly thickened walls; similar cystidia occur in the hymenium, but these tend to be either clavate or fusiform. This fungus is closely related to members of *Peniophora*, section *Coloratae*. There are no recent Scottish records, although there are two genuine specimens at Kew from Glamis, Angus (probably the specimens reported by Berkeley & Broome, 1876), and another from Dr Buchanan White, presumably collected in Perthshire.

'**Stereum**' **rufum** Fr. has been reported from Glamis, Angus, by Berkeley & Broome (1876) but there are no specimens at Kew to substantiate the record. The fungus occurs on *Populus tremula* and forms scattered or gregarious cushion-shaped fructifications, 2-4 mm in diam. These vary from vinaceous-brown to haematite-red, often with a greyish pruina and strong radiating or irregular wrinkles, especially toward the margin. They possess gloecystidia and have allantoid spores $6-8 \times 2-2.5\mu$.

Stereum sulphuratum Berk. & Rav. is very similar to *S. hirsutum* (Willd. ex Fr.) S. F. Gray, but produces smaller and thinner fructifications with a silvery hirsute surface and a clay-coloured hymenium. It also has larger spores $6.5-8 (-9) \times$

2.75–3 (–3.2) μ (from print) and almost invariably grows on twigs and small branchlets. This fungus is widespread in the British Isles.

'*Stereum*' (*Thelephora*) *vitellinum* (Plowr.) Cooke. This is a stipitate species growing on the ground or on woody debris, which is easily recognized by its bright egg-yellow colour, small broadly elliptical spores $3\text{--}4 \times 2\text{--}2.75\mu$ and absence of sterile organs in the hymenium. This fungus is based on specimens collected near Aviemore, Inverness-shire; there are no subsequent British records.

Stereum vorticosum Fr. is treated as a synonym of *S. purpureum* (Pers. ex Fr.) Fr. by Rea (1922). The Scottish record, from Menmuir, Angus, published by Berkeley & Broome (1876), cannot be checked as the specimen has long since been destroyed by insects.

Stigmatolemma poriaeforme (Pers. ex Mérat) Kalchbr. [= *Solenia poriaeformis* (Pers. ex Mérat) Fuckel] produces small, pale grey, minutely tomentose, urceolate then cupulate sporophores, with a pale brown hymenium (becoming black in dried specimens) on a whitish then pale grey or blackish subiculum. The cups, 0.3 mm in diam., have a gelatinous texture and bear globose spores, 4.5–7 μ .

Stromatoscypha (*Porothelium*) *fimbriatum* (Pers. ex Fr.) Donk forms fruitbodies consisting of numerous discrete globose cups borne on a resupinate, white stroma with fringed radiating margin. These cups open and may appear discoid, but by continued growth and mutual pressure they coalesce, and the fructification then simulates that of a *Poria*. The spores are ellipsoid, $4\text{--}5.2 \times 2.2\text{--}3.2\mu$.

'*Thelephora*' *avellana* Fr. Scottish records almost certainly relate to *Stereum rugosum* (Pers. ex Fr.) Fr.

Thelephora caryophyllea [Schaeff.] Fr. differs from other European species of the genus in having small funnel-shaped fruitbodies.

'*Thelephora*' *livida* (Pers. ex Fr.) Fr. A specimen so annotated by Klotzsch in Kew Herbarium, which may have been the collection cited by Berkeley (1836), is *Peniophora cinerea* (Fr.) Cooke.

'*Thelephora*' *miniata* Berk. was based on two collections in Hooker's herbarium, annotated by Klotzsch, one from Appin, leg. Carmichael, the other on *Betula* from Gilmorehill, Glasgow. The former is still at Kew but there are only Klotzsch's notes on the latter. Carmichael's specimen is sterile but its hyphae, which have distinctly thickened walls though still retaining a fairly wide lumen, lack clamp-connexions and do not match those of *Peniophora sanguinea*. Moreover, Berkeley's fungus has a more arid appearance than is usual with the *Peniophora*. The identity of *T. miniata* remains uncertain.

Thelephora mollissima Pers. ex Fr. is a more or less resupinate species which grows over fallen leaves and other debris, emitting numerous spiculose branches from its surface. The fructifications are white or pallid at first, but where fertile become brown.

Thelephora palmata (Scop.) Fr. forms brown fructifications with a distinct stipe, giving rise to numerous erect branches which become somewhat flattened and cuneate toward the tips. This fungus has an unpleasant smell.

Tomentella caesia (Pers. ex Pers.) Pat.

Tomentella castanea Bourd. & Galz.

Tomentella fusca var. **radiosa** (Karst.) Bourd. & Galz.

Tomentella livida Litsch.

Tomentella mucidula (Karst.) Höhn. & Litsch.

Tomentella tristis (Karst.) Höhn. & Litsch.

Tomentella tristis forma **sitnensis** (Bres.) Bourd. & Galz.

Tomentella punicea (A. & S. ex Fr.) Schroet.

Tomentella zygodesmoides (Ell.) Höhn. & Litsch.

DACRYMYCETALES

Calocera stricta Fr. This epithet is a synonym of *C. viscosa* (Pers. ex Fr.) Fr.

Calocera tuberosa (Sow. ex Fr.) Fr. It is not known to what fungus the Scottish records refer, since according to Corner (1950) this epithet is a synonym of *Clavariadelphus fistulosus*.

Dacrymyces abietinus (Pers. ex Pers.) Schroet. sensu Schroet. produces small, flattened, orange pustules which dry down to thin, flat, amber or dark brown discs, 0.5–2 mm in diam. The spores, which measure $15\text{--}30 \times 6\text{--}9.5\mu$, develop 7–9 irregularly thickened, transverse septa. It occurs on coniferous wood, and was collected on the Isle of Rhum in 1962.

Dacrymyces deliquescens var. **stipitatus** (Bourd. & Galz.) Bourd. & Galz. [= *D. lutescens* sensu auct. Brit.] differs from var. *deliquescens* in having 3-septate spores in which the transverse septa do not become conspicuously thickened. When growing on corticated wood, the fruitbodies are stipitate, with the stipe penetrating the bark and flattening out on the surface.

Dacrymyces deliquescens var. **tortus** (Wild. ex Fr.) Bourd. & Galz. differs from var. *deliquescens* in having thin, flattened, discoid fructifications bearing spores which at maturity are 1–3 septate, with the septa usually remaining thin or becoming at most slightly thickened. The above interpretation follows that of Masee (1892) and Bourdot & Galzin (1928).

Dacrymyces estonicus Raitvir forms orange, discoid-cupulate fructifications up to 3 mm in diam. bearing broad cylindrical spores $19\text{--}25 \times 8\text{--}12\mu$, with 7–10 transverse septa.

This fungus, which occurs on coniferous wood, has been collected at Craigellachie, Banffshire, 1962.

Dacrymyces succineus (Fr.) Spree. As currently interpreted, this is an imperfect fungus found on fallen pine needles. It was transferred to *Sirocyphella* by von Höhnelt.

Guepiniopsis buccina (Pers. ex Fr.) Kennedy forms long stipitate, cupulate fruitbodies which are orange in colour and externally ornamented with longitudinal striae. The abhymenial surface is covered with hairs formed of chains of thick-walled oval cells. The allantoid spores, $12-15 \times 4-5\mu$, develop 3 transverse septa. It occurs on hardwood and was collected at Appin, Argyll, by Carmichael.

Guepiniopsis (Dacrymyces) chrysocomus (Bull. ex Fr.) Brasfield consists of substipitate-cupulate, orange fruitbodies, 3-4 mm in diam.; the hymenium is confined to the inside of the cup, while the abhymenial surface is covered with thick-walled hairs. The spores, $24-32 \times 7-11\mu$, are both longitudinally and transversely septate. There are no recent records from the British Isles.

TREMELLALES

Bourdotia cinerea (Bres.) Bourd. & Galz.

Eichleriella (Radulum) deglubens (Berk. & Br.) Lloyd [= *E. spinulosa* (Berk. & Curt.) Burt sensu auct. non Berk. & Curt.] This widespread but uncommon fungus is generally known as *E. spinulosa* but examination of the type of the latter, from Alabama, U.S.A., shows it to be a gloeocystidiate fungus with narrower spores, $15.6-16 \times 6\mu$, probably belonging to the genus *Heterochaete*. See Reid (1957).

Exidia recisa (Ditm. ex S. F. Gray) Fr. This fungus grows on broad-leaved trees and forms gelatinous, yellowish brown or cinnamon-coloured, stipitate fruitbodies, which are scabrous below and have a flattened or shallowly concave hymenial surface. With age, the fructifications tend to assume a less regular shape, and the hymenium frequently becomes conspicuously wrinkled or folded. The allantoid spores measure $10-16 \times 3.5-5\mu$.

Exidia repanda Fr. also occurs on deciduous trees, but the fructifications take the form of reddish or pinkish-cinnamon-coloured buttons, which, although centrally attached, do not appear obviously stipitate. These buttons, which are usually more or less convex and often shallowly umbilicate, may become radiately folded or somewhat lobed towards the margin.

Exidia saccharina Fr. is very like the preceding species but is restricted to conifers. It forms similar button-shaped fruitbodies varying in colour from tawny-cinnamon or

umber-brown to date-brown, but with age they frequently become thrown into brain-like folds and assume a very irregular appearance. The allantoid spores measure $10-19 \times 4.5-6\mu$.

Exidia thuretiana (Lév.) Fr. is a widespread fungus which forms opaline, gelatinous, discoid fructifications with free, white-ciliate margins. They later become irregularly wrinkled and confluent, extending for up to 10 cm in length and bearing large allantoid spores $15-22 \times 5-7\mu$. This species is sometimes difficult to distinguish from the common *E. nucleata* (Schw.) Burt, especially if specimens of the latter lack the usual embedded white nuclei of calcium oxalate. *E. nucleata* has smaller spores, measuring $11-14 (-15.5) \times 4-5 (-6.5)\mu$.

Exidia truncata Fr. is found on broad-leaved trees, and produces substipitate, turbinate or discoid fruitbodies with a papillate hymenium which is at first even, but later thrown into irregular undulating folds. The fructifications vary in colour from bistre to dark blackish brown, and bear allantoid spores $14-20 \times 4.5-6\mu$.

Exidia viscosa (Pers. ex Fr.) Rea. The correct application of this name is uncertain. It is often cited as "*Tremella viscosa* Berk.," but Berkeley never published this name, although he and Broome did transfer *Corticium viscosum* Pers. [= *Thelephora viscosa* (Pers.) Fr.] to the genus *Tremella* in 1854. It has been suggested by Neuhoff (1936) that *T. viscosa* Berk. is a synonym of *E. thuretiana*, but it is more probable that Berkeley and Broome applied the name to cover specimens of both *E. thuretiana* and *E. nucleata* (Schw.) Burt. The only Scottish collection in the Berkeley herbarium at Kew (i.e. from Glamis) bears spores $13-16 \times 5.75-6.2\mu$.

Heterochaetella crystallina (Bourd.) Bourd. & Galz. This fungus forms very inconspicuous fructifications, consisting of a resupinate film from which arise numerous small hair-like spines. These spines have a central axis formed of elongated, thin-walled, cylindrical cystidia up to 130μ in length and $7-15\mu$ wide. The spores are subglobose, $4-5 (-6) \times 3.5-4 (-4.5)\mu$. Luck-Allen (1960) has stated that this fungus appears to be the same as *Stypella papillata* Möller, which was described many years earlier from material collected in Brazil.

Naematelia encephala (Pers.) Fr. is an easily recognized fungus since it produces irregularly wrinkled, cushion-shaped fruitbodies with a hard white core, covered by a pinkish-flesh-coloured, gelatinous layer. The spores are spherical or broadly elliptical, $10-12 \times 7.5-9\mu$. According to Bandoni (1961), *N. encephala* represents a *Stereum* sp. parasitized by a tremeloid fungus.

Phaeotremella pseudofoliacea Rea forms large cinnamon-coloured fructifications 4–10 cm wide, consisting of numerous foliose lobes. It is easily recognized by its globose or broadly ovate, amber-brown spores, which measure $12 \times 9\text{--}12\mu$.

Sebacina calcea (Pers. ex Pers.) Bres. forms arid-waxy, chalk-white, corticioid fruitbodies bearing allantoid spores $12\text{--}19 \times 4\cdot5\text{--}7\mu$.

Sebacina epigaea (Berk. & Br.) Rea forms greyish gelatinous fructifications which grow on bare soil or spread over plant debris lying on the ground. The spores are oblong, $8\text{--}14 \times 4\text{--}9\mu$, but some collections also bear thick-walled, angular-spinous chlamydospores $7\text{--}12 \times 7\text{--}9\mu$.

Sebacina fugacissima Bourd. & Galz. In this species, the fructifications form a very thin gelatinous film. They are hyaline-greyish in colour and become almost invisible on drying. The spores are small, $6\text{--}7 \times 2\cdot5\text{--}3\mu$.

Sebacina mesomorpha Bourd. & Galz. produces a thin, gelatinous, hyaline-greyish then brownish film on wood. The allantoid spores measure $9\text{--}12 \times 4\cdot5\text{--}6\mu$.

Sebacina sublilacina Martin. This is an American species which was recently recorded from Denmark by Christiansen (1959). There are two British collections, one from Glasgow (1962) and one from Killarney, Eire (1946). The fungus forms a resupinate, waxy-gelatinous, pruinose, grey film on hardwood. It has small elliptical spores, $6\cdot2\text{--}7\cdot75 \times 3\cdot75\text{--}4\mu$, and also elongated, pointed cystidia which afford the best way of distinguishing it from *S. fugacissima*.

Tremella albida [Huds.] Fr. sensu Bourd. & Galz. produces gelatinous, intricately folded, brain-like fruitbodies which ultimately become dirty brown. The globose spores are $8\text{--}12\mu$ in diam. This fungus has been recorded from Applecross, Wester Ross. In addition, there are a number of other Scottish records, but since the name has been applied in many different senses, it is not clear to what fungus these refer.

Tremella atrovirens (Fr.) Sacc. forms small erumpent olive-green tubercles on branches of *Ulex*. These tubercles are up to 2 mm in diam. and may become confluent. The spherical spores are $7\text{--}11\mu$ in diam.

Tremella foliacea Pers. ex Pers. forms tufted, gelatinous fruitbodies consisting of broad, flattened, somewhat folded, cinnamon-coloured or reddish brown lobes. This species grows on conifers and deciduous trees and has globose or subglobose spores $7\text{--}9 \times 5\text{--}7\mu$.

Tremella frondosa Fr. is similar to the preceding species but the lobes are much thicker (up to 1 cm), very broad, and pale lemon-yellow or straw-coloured.

Tremella indecorata Sommerf. forms firm, gelatinous,

hyaline, amber or date-brown cerebriform fructifications, bearing spherical spores $5-8\mu$ in diam.

Tremella moriformis (J. E. Smith ex Fr.) Berk. The fruitbody of this fungus resembles a small blackberry (*Rubus fruticosus*). It is at first red and finally dark brown or blackish, with a botryoid surface. The spherical spores measure $6-8\mu$ in diam.

Tremella translucens Gordon was described from fallen needles of *Pinus sylvestris* at Peebles, in Southern Scotland, and was collected on the Isle of Rhum in 1962. It forms very small, greyish-white erumpent fruitbodies, $0.4-3$ mm in diam., which bear oval or elliptical spores $7-12 \times 3.7-6.2\mu$.

Tremella tubercularia Berk. The fructifications of this fungus consist of small erumpent, hyaline tubercles, $2-6$ mm in diam., bearing globose spores $5-9\mu$ in diam.

Tremella virescens (Schum. ex Fr.) Bourd. & Galz. differs from *T. indecorata* in its pale green or bottle-green colour, and from *T. atrovirens* in its cerebriform appearance.

Tremella versicolor Berk. & Br. Prof. G. W. Martin has annotated the type material at Kew indicating that it is probably a conidial state of some tremellaceous fungus.

AURICULARIALES

Herpobasidium filicinum (Rostr.) Lind is parasitic on fern fronds, forming white floccose patches on the leaves. The oval spores measure $10-18 \times 5-8\mu$.

Phleogena (Ecchyna, Pilacre) faginea (Fr.) Link. The fruitbodies of this fungus resemble minute whitish or pale grey drum-sticks up to 6 mm high, with heads up to 3 mm in diam. According to Bourdot & Galzin (1928), the basidia measure $27-30 \times 5\mu$ and the spherical spores $6-8 \times 5.5-7.5\mu$. However, in certain British gatherings the basidia are only $13-18.2\mu$ long and the spores measure $4.75-7\mu$. Some collections have a strong smell of fenugreek when fresh, and this is retained on drying.

Platyglœa vestita Bourd. & Galz. There is a single Scottish specimen at Kew from Glamis, Angus, collected by Stevenson and determined by Berkeley as *Corticium viscosum*. It forms more or less thick, waxy-gelatinous, hyaline or greyish, resupinate fructifications which become almost invisible when dried. Under a lens they can then be seen as a thin arid film, with a minutely granular-furfuraceous surface and a whitish margin. The species has gloecystidia and elongated allantoid spores $15-30 \times 5-9\mu$ ($17-26 \times 4.5-7.5\mu$ in the Scottish material).

GASTEROMYCETALES

Archangiella (Octaviana) asterosperma (Vitt.) Zeller & Dodge

Archangiella (Octaviana) stephensii (Berk. & Br.) Zeller & Dodge

Clathrus ruber (Mich.) Pers. occurs regularly in the Scilly Isles and occasionally in Southern England, but there are also two reports of Scottish gatherings, one of which was collected at Tynninghame, East Lothian, 1881 (Stevenson, 1882), and the other in a flower bed at Kilmelford, Argyllshire, 1917 (Paul, 1918).

Geastrum badium Pers. [= *G. umbilicatum* Fr.] is hygroscopic, and has a determinate, tall, conical, sulcate mouth, and a smooth, sessile, endoperidium.

Geastrum berkeleyi Masee forms large, non-hygroscopic fruitbodies with a determinate, sulcate mouth borne on a depressed area. The pedicellate endoperidium is minutely warted. There are no recent Scottish collections.

Geastrum bryantii Berk. is a non-hygroscopic species with a sulcate mouth and smooth, pedicellate endoperidium—the pedicel bearing a distinct collar at the base of the endoperidium.

Geastrum limbatum Fries is a large, non-hygroscopic species with a determinate, fimbriate mouth, and a stipitate endoperidium with a basal apophysis.

Geastrum mammosum Chev. is strongly hygroscopic and has a determinate, conical, fimbriate mouth, seated on a depressed area.

Geastrum rufescens Pers. [= *G. fimbriatum* Fr.] is recognized by its non-hygroscopic fruitbody, its indeterminate mouth, and sessile endoperidium.

Hydnangium carneum Wallr.—an exotic species found in association with roots of *Eucalyptus* spp.

Hymenogaster albus (Klotzsch) Berk. [= *Hymenogaster klotzschii* Tul.]. This is probably an exotic species since it has only been found in pots of cultivated plants, often *Eucalyptus* sp., in greenhouses. The British record is from the Botanic Garden at Sandyford, Glasgow, 1830.

Hymenogaster hessei Soehner

Hymenogaster olivaceus Vitt.

Hymenogaster tener Berk.

Hymenogaster vulgaris Tul.

Leucogaster floccosus Hesse

Lycoperdon ericetorum Pers. [= *L. pusillum* Pers.] is recognized by its small globose fruitbodies, 9–20 mm in diam., which lack a sterile base and are merely anchored by a thin tapering root. This species occurs in sandy places.

Lycoperdon perlatum var. **nigrescens** Pers. is a common and widespread fungus. One collection from Loch Ewe, Wester Ross, reported as *L. umbrinum* (Dennis, 1946), would seem to be better referred here.

Lycoperdon spadiceum Pers. forms small turbinate fruitbodies with a well-defined sterile, cellular base. The endoperidium is somewhat scurfy, but may become finely granular or smooth. The gleba is olive, then brown, but never purple.

Lycoperdon velatum Vitt. produces turbinate fructifications up to 6 cm high. The exoperidium forms a thick tomentose layer, which soon breaks up into white evanescent, floccose, star-shaped patches, but often remains at the apex of the stipe as a ring-like zone. The olivaceous endoperidium is minutely spinulose (seen under a lens), and the sterile base has a cellular structure. There are no recent Scottish collections of this fungus, which is more typical of the southern English beechwoods (*Fagus*) on chalk.

Melanogaster ambiguus (Vitt.) Tul.

Mycocalia (Nidularia) denudata (Fr.) Palmer forms small multiperidiolar peridia. The peridioles are yellow or tan, and have a double wall, while the peridium wall is formed of a loose evanescent web of hyaline, flaccid, branched hyphae bearing clamp-connexions at the septa. This fungus occurs on various plant remains.

Mycocalia (Nidularia) minutissima (Palmer) Palmer. This species is very like the preceding fungus, but the peridia are usually uniperidiolar. The peridioles are brick-red or yellow. It occurs on debris of *Juncus effusus*.

Nidularia farcta (Roth. ex Pers.) Fr. [= *N. confluens* Fr. & Nord., *N. pisiformis* [Roth.] Tul.] forms small heaps, up to 11 mm in diam., of brown peridioles surrounded by a thick, whitish, cinnamon or brownish felt-like peridial layer formed of spinose hyphae; the peridioles have a single wall. This fungus occurs on plant debris.

Rhizopogon luteolus Fr. grows in abundance in pine plantations, sometimes pushing up the ground and lying loose on the surface. It is an important mycorrhizal fungus frequently found in Culbin and Rothiemurchus Forests.

Scleroderma bovista Fr.

Scleroderma cepa Pers.

Phallus imperialis Schulz. [= *P. hadrianus* Vent. ex Pers.] is a characteristic sand-dune species differing from *Phallus impudicus* L. ex Pers. in the pinkish gleba.

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY

9TH JANUARY, 1962

The Annual General Meeting was held in the Glasgow Art Gallery and Museum, Kelvingrove. Mrs. I. J. Paton, retiring Vice-President, presided.

Reports of activities during 1961 were read, new office-bearers were elected (see page 337) and appointments made by Council were announced. The Report of Council stated that the total membership was 194 (22 joined and 5 resigned); eight meetings were held with an average attendance of 51; twenty-two excursions took place (2 general 5 botanical, 3 zoological, 5 joint botanical and zoological, one joint botanical and geological, 4 ornithological, and 2 geological); the Council met three times and the Executive Committee four. Mr. Basil W. Ribbons presided at the Annual Dinner held on 14th December, 1961, in the University of Glasgow in honour of Mr. Robert Mackechnie, A.L.S., ex-President.

One new member was admitted: John Watt, 154 Maryhill Road, N.W.

After tea, Mr. R. Mackechnie presided over a display of colour transparencies from four members. Mr. A. Maclaurin exhibited moths from Flanders Moss.

13TH FEBRUARY, 1962

Mr. Basil W. Ribbons presided over a joint meeting with the Botanical Society of Edinburgh held in the Department of Botany, University of Glasgow.

One new member was admitted: James Dunn, 28 Delburn Street, E.1.

Professor C. G. C. Chesters of the University of Nottingham gave an illustrated lecture entitled "The World of the Soil" and was thanked by Mr. L. S. Copley, Honorary Secretary of the Botanical Society of Edinburgh.

16TH MARCH, 1962

Mr. Basil W. Ribbons presided over a joint meeting with the Glasgow Branch of the Scottish Ornithologists' Club and the Hamilton Natural History Group in the Glasgow Art Gallery and Museum, Kelvingrove.

Mr. Stanley Jeeves, Films Officer of the Council For Nature and Resident Manager of Brantwood, gave an illustrated lecture entitled "The Changing Year". After tea Mr. Jeeves showed his film "Wild Life of the Brontë Moorlands" and gave a talk on The Council for Nature. He was thanked by Mr. C. E. Palmar, Chairman of the Glasgow Branch of the S.O.C.

10TH APRIL, 1962

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Four new members were admitted: Daniel R. Deegan, 730 Great Western Road, W.2; S. T. S. Skillen, 46 Munro Road, W.3; Mrs. Irene Swinton, 8 Norfolk Crescent, Bishopbriggs; and Matthew Welsh, 23 Balmoral Drive, Elderslie.

Mr. Tom Weir gave a lecture illustrated with colour slides and a sound film entitled "Exploring in North-East Greenland".

Exhibits were shewn by Mrs. A. Cross (mosses from Brodick Castle), Mrs. C. S. Nicol, Mr. R. Prasher and Mr. G. Rodway (mosses from basic ledges on Ben Reioch, Dunbartonshire).

8TH MAY, 1962

Mr. Basil W. Ribbons presided over a meeting held in the Department of Zoology, University of Glasgow.

Four new members were admitted: Miss Philomena McCallum, 61 Fergus Drive, N.W.; Charles Senior, 31 Dalry Street, E.2; Alexander F. Shaw, M.A., 41 Carnwath Avenue, S.3; and A. Travers, B.Sc., 139 Quarryknowe Street, E.1.

Three family members were admitted: Mrs. Mary B. Kennedy, 77 Castlemilk Crescent, S.4; Mrs. Hazel Rodway, East Lodge, Botanic Gardens, W.2; and Mrs. Esther E. Skillen, 46 Munro Road, W.3.

Mrs. Grace Hickling of Newcastle-upon-Tyne gave an illustrated lecture on Seals in the Farne Islands.

Exhibits were shewn by Mrs. A. Cross, Miss A. Drysdale, Mr. R. Mackechnie (oak-apples broken open by some unknown agency), Mr. R. Prasher, and Mr. A. M. Stirling (*Homogyne alpina* grown from an original Glen Clova specimen).

12TH JUNE, 1962

Mr. Basil W. Ribbons held a Reception in the Glasgow Art Gallery and Museum, Kelvingrove. Twenty-one members arranged exhibits.

11TH SEPTEMBER, 1962

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Five new members were admitted: Mrs. Grace Black, 43 Graffham Avenue, Giffnock; George Gordon, 385 Merry Street, Motherwell; Miss Eileen Hennessy, 10 Underwood Street, S.1; Miss Jean I. McLellan, 8 Park Quadrant, C.3; and D. Sangster, 24 Hillhead Street, W.2.

One junior member was admitted: James Forrester, 22 Burnett Road, E.3.

Mr. Ewan C. D. Todd talked about a botanical excursion to South-west England during Easter 1962 and Mr. William K. Stove gave a lecture-demonstration about acquiring and keeping smaller reptiles and amphibians.

There was an exhibit from Mrs. A. Cross.

9TH OCTOBER, 1962

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow.

One new member was admitted: Miss Helen Fullerton, 247 Bath Street, C.2.

The Rev. E. T. Vernon lectured on "The History and Romance of Bird Study".

Exhibits were shewn by Miss E. R. T. Conacher, Mr. A. M. Stirling (including *Equisetum hyemale*, new for Dunbarton, v.-c. 99) and Mr. W. K. Stove (newly hatched slow worms and caddis larvae).

31ST OCTOBER, 1962

Mr. Basil W. Ribbons presided over a joint meeting with the Botanical Society of Edinburgh and the Glasgow University Botanical Society in the Department of Botany, University of Glasgow.

Mr. James H. Dickson of the University of Cambridge gave an illustrated lecture entitled "Vegetation and Volcanoes of Tristan da Cunha", and was thanked by Mr. D. G. Gibson, President of the Glasgow University Botanical Society.

10TH NOVEMBER, 1962

A botanical exhibition, lecture and soirée were held in the University of Glasgow in conjunction with the Committee For The Study of The Scottish Flora. Mr. Basil W. Ribbons and Mr. Robert Mackechnie, Chairman of the C.S.S.F., presided. Eleven exhibits and six sets of colour slides were displayed (see *Proc. B.S.B.I.* 5, part ii and *Trans. Bot. Soc. Edinb.* 39, part iv). Dr. Mary S. Percival of the University College of South Wales and Monmouthshire gave an illustrated lecture entitled "Bees, Birds, Bats and Flowers".

11TH DECEMBER, 1962

Dr. Elsie Conway presided over a meeting held in the Royal College of Science and Technology, Glasgow.

Two new members were admitted: Mrs. E. B. Cockburn, 2 Doune Quadrant, N.W. and Peter Duncan, 16 Ascog Street, S.2.

Two new school members were admitted: Agnes R. C. Kirk, 5 Fenns-bank Avenue, High Burnside and Elizabeth Scott Stewart, 3 Wardlaw Drive, Rutherglen.

Dr. I. H. Forsyth of H.M. Geological Survey gave an illustrated lecture on the Geology of Raasay.

THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month except during July and August, usually in the Royal College of Science and Technology, but from time to time in the University and the Glasgow Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are: for Ordinary Members, twenty shillings; for Junior Members, ten shillings; for Family Members, five shillings, and for School Members, three shillings and sixpence. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary*—

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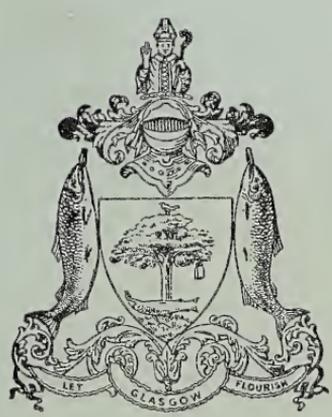
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THE GLASGOW NATURALIST

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SOME THOUGHTS ON THE CORRELATION OF ELECTRON AND LIGHT MICROSCOPY IN BIOLOGY*

By GORDON F. LEEDALE

Department of Botany, University of Leeds

(Received 8th June, 1964)

Since the first publication of an electron micrograph of a biological specimen in 1938 (dried bacteria at $\times 16,000$, see Martin 1938), a comprehensive range of biological materials has been examined with the electron microscope, some objects more successfully than others. In the last ten years in particular there has been a huge output of biological electron microscopy, as laboratories all over the world have applied the techniques perfected during the previous decade. For an excellent concise account of these techniques and their development up to 1960, I would refer you to the article by Professor I. Manton in "Contemporary Botanical Thought" (1961). Also in her article is the exciting story of the development of the electron microscope during the years of the Second World War, in particular the designing in secret of the prototype Philips microscope in occupied Holland.

We have now reached another period of major technical advance, and new procedures of fixation, staining and embedding are resulting in observations which generally outclass much of the work of the last decade. This does not mean, of course, that this previous work is invalidated, rather that the next few years will see new work produced showing finer and additional details, in studies which will increase the meaningfulness of observations already published.

Firstly, let us consider the limits of performance of the light and electron microscopes.

The resolving power of any microscope depends upon the effective numerical aperture of the system and upon the wavelength of the radiation used.

The wavelength of visible light is 4000–8000 Å and with the maximum obtainable numerical apertures of 1.25 to 1.4, the

* From the Goodfellow Lecture, 1964.

resolution limit of the visible light microscope is approximately 2,500 Å. * That is to say, two points less than 2,500 Å apart will appear as a single structure.

A modern electron microscope employs a beam of electrons emitted in vacuum from a hot filament, accelerated through a potential of 40–100 kV, and condensed and focused through electromagnetic “lenses”. At the velocities involved, the electrons have associated with them a wavelength of 0.03 to 0.06 Å. Unfortunately, the resolving power of the electron microscope is only one hundredth as great as it would be if the lenses could be made with the order of numerical aperture met with in lenses in the light microscope. Thus the minimum point to point resolution in the electron microscope is approximately 5 Å, that is one two-millionth of a millimetre.

The electron microscope will therefore reveal structures 500 diameters smaller than the smallest visible in the light microscope; and with lenses functioning at light microscope standards this could become a differential of 50,000 diameters (allowing resolution well below the diameter of a hydrogen atom!).

Now let us consider the biological specimen and what treatment is necessary before it can be studied microscopically.

For the electron microscope, this treatment is extended and severe. The material is examined in a vacuum and must therefore be dry and dead. Whole or fragmented cells can be studied directly, and the technique of casting shadows with directionally vapourised heavy metals (gold, palladium, platinum) was introduced in 1944 by Williams and Wyckoff and soon applied to studies of surfaces and cell appendages. Alternatively, plastic or carbon replicas can be made and examined, with or without shadow-casting.

It took another ten years to establish techniques by which biological material can be sectioned thinly enough for electron microscopy, and the stages in this advance are related by Manton (1961). Nowadays, cells are killed in a fixative which impregnates heavy metal (osmium, potassium) into the cell membranes and elsewhere, or, more recently, in organic fixatives such as glutaraldehyde, followed by osmication and “staining” with heavy metal salts. After fixation, the material is dehydrated, embedded in plastics (for example, Perspex) or resins (for example, Shell Epikote 812), cut into very thin slices (down to 200 Å in thickness) on an ultramicrotome, mounted on metal

* 1 mm. = 1000 microns (μ)
 1 micron = 1000 millimicrons ($m\mu$)
 1 millimicron = 10 Angstrom units (Å)
 \therefore 1 mm. = 10,000,000 Å.

grids and photographed in the electron microscope by passing a beam of electrons through the sections on to a photographic emulsion.

The biologist hopes that the final pictures of this maltreated material reflect, in some aspects at least, the state of the cells at one particular moment in life. What the electron microscope cannot yet do is give any useful information on a cell actually alive, whereas the light microscopist can observe living, moving, metabolising, dividing, behaving cells. Any dynamic process described from electron microscopy is an interpretation in time of a series of stills, usually separated only in space, and there is always the danger that a series may be read backwards. And though serial sections are possible, most descriptions in three-dimensional terms are based on interpretation of variously-angled two-dimensional views of the structure concerned.

The biologist who comes into electron microscopy from light microscopy is very much aware of these points and he often errs in the right direction by being over-sensitive about artefacts. The electron microscopist who trains as a physicist or who cuts his teeth, so to speak, on an electron microscope, sometimes makes gross misinterpretations of biological material which could have been avoided if he had had one good look at the living material in the light microscope.

Though it is true that much valuable light microscopy is based on the examination of fixed, dehydrated, stained material, manufacturers of light microscopes realised, as electron microscopy developed, that the future major advances in their instruments lay in examining living cells. The most important single advance was undoubtedly the invention of phase contrast microscopy by Zernike in 1942, for which he received a Nobel prize. This is a system of microscopy in which some of the light striking the object is half a wavelength out of phase with the rest. Areas of different density in the object (membranes, cilia, chromosomes, and so on, versus cytoplasm) bend the light to different extents so that some rays are reinforced at the expense of others. Finally, after correction of the phase difference in the objective, different densities in the object appear as different light intensities in the eyepiece.

The years since 1942 have seen the development and perfecting of positive and negative phase contrast systems, and also of interference microscopy (by which quantitative measurements of the dry mass of cell components can be made), dark ground systems (in which the eye sees only light reflected from

the object, and which can reveal the presence of structures below the resolution limits of light microscopy), polarizing equipment (which uses polarized light to reveal molecular orientation in cell components), and fluorescence microscopy (in which use is made of the various colours of visible light which biological materials and certain pigments emit under the influence of ultra-violet radiation).

At Leeds we have been particularly concerned to correlate, wherever possible, our electron microscopy with light microscopy of the live organism, and though the importance of this correlation could be demonstrated in many studies of cellular structure in the plant and animal kingdoms, I intend to confine myself to several projects being carried out in our laboratory. In doing so I hope to introduce features which are both interesting for their own sake, and of fundamental biological significance. The close correspondence between structure in living cells and in our electron micrographs has increased the confidence of our interpretation of the latter.

From this point, the remainder of my spoken lecture consisted of a commentary on numerous photographs in colour and black and white, comparing observations on living cells with electron microscopy of the same material. As a brief substitute for that here, I shall refer readers to the published accounts of my work on *Euglena* which I discussed in detail (Leedale 1964a, 1964b) and select a few points for illustration from a joint research project between the Leeds University Botany Department and the Marine Laboratory, Plymouth: the investigation of flagellates of the Chryso-phyceae.

Paraphysomonas vestita (Figs. 1-3) is a colourless chryso-phycean flagellate. Work on it at Leeds was begun accidentally when it appeared as a voracious contaminant of a culture of another organism. It appeared in blocks sectioned for electron microscopy and was seen in the light microscope, and when its suitability for the study of several problems became apparent it was subjected to a full investigation (Manton and Leedale 1961).

The living organism in Fig. 1 displays the two unequal flagella, the pyriform nucleus attached to the flagellar bases, a single contractile vacuole, and many large food vacuoles filling the cell.

A few points may be selected for comment. At the side of the nucleus is a rod of material which previous light microscopists had termed the "mouthband". Electron microscopy of sectioned cells showed this to be a Golgi body of unusually large size but normal construction. Secondly, the cell surface is seen to be covered with spine-bearing scales. The number of

scales per cell (100 or so) and their approximate size (2μ diameter disc, $2-10\mu$ long spine) can be recorded from light microscopy; the exact size-range and details of shape can be obtained only from electron microscopy (Fig. 3). Finally, electron microscopy of sectioned cells reveals that the scales are not formed *in situ* from the external body membrane, but have their origin in vesicles within the cell (Fig. 2) from which they are transferred to their external position.

A range of coloured flagellated members of the Chrysophyceae has also been investigated at Leeds, for example, *Prymnesium parvum* (Fig. 4). This flagellate was known to be of economic importance as the secretor of a serious fish poison, and we undertook a reinvestigation of its structure (Manton and Leedale 1963). The living cell (Fig. 4) has two flagella and a shorter third appendage, a large Golgi body immediately beneath the flagellar bases, two large chloroplasts with the nucleus between them in the anterior half of the cell, and a large vesicle of storage material (leucosin) in the posterior half of the cell.

An important observation to come from the chrysophycean studies is that the third appendage borne by some of these flagellates is not a flagellum but an organelle of different function. This has now been termed a "haptonema" (Parke, Manton and Clarke 1955). In living cells the haptonema (which may be shorter than the flagella, or very much longer) can be seen coiling and uncoiling, and acting as an attaching organelle in stationary cells. Electron microscopy of thin sections confirms that the haptonema is a fundamentally different organelle from flagella and cilia. A transverse section of a flagellum of *Prymnesium* (Fig. 5) shows the ring of 9 pairs of fibrils surrounding 2 central single ones, the construction characteristic of flagella and cilia in virtually all eucaryotic cells (i.e. cells above the level of bacteria and blue-green algae). The haptonema of *Prymnesium*, on the other hand, shows the completely different arrangement in section (Fig. 6) of a ring of 7 tubes or fibrils surrounded by 3 concentric membranes. Possession of this appendage has now been used as a taxonomic character to split off these organisms from the rest of the Chrysophyceae (Christensen 1962).

Many of these flagellates (especially species of the genus *Chrysochromulina*) have been shown to bear an external covering of scales. Some of these scales have spectacular and beautiful patterning, as shown by the examples chosen for illustration (Figs. 7, 8). *Chrysochromulina polylepis* (Manton and Parke 1962) has four distinct types of scale on one and the same cell, including the two types seen in Fig. 7. Cells of *Chrysochromulina pringsheimii* (Parke and Manton 1962)

have a cocoon-like scaly covering which is constructed from large and small plate scales and large and small spine-scales. The bases of two large spine-scales are shown in Fig. 8.

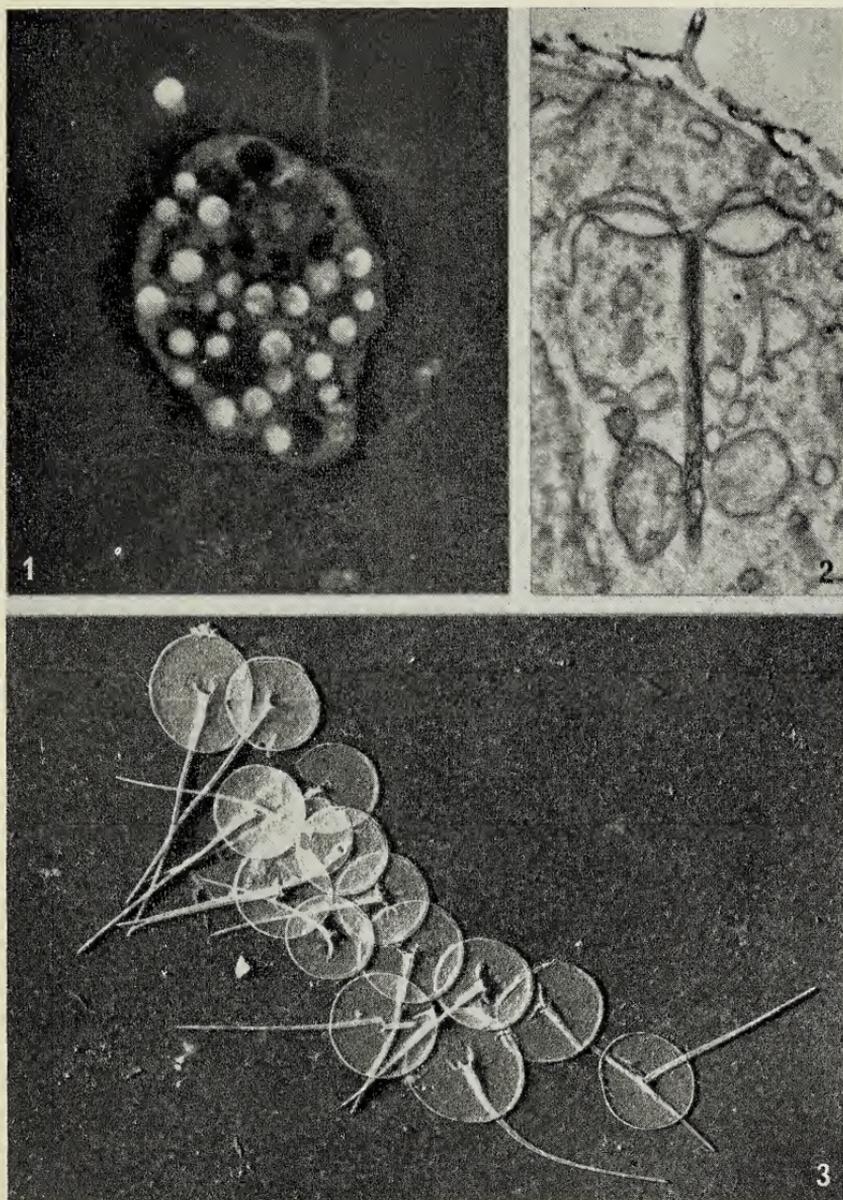
Leaving aside the aesthetic pleasure to be derived from contemplating pictures of these various scales, the most significant biological discovery to come from this study is that the scale-forming vesicles arise from the Golgi body. In some species there is the direct evidence of seeing scales in process of formation within vesicles of the Golgi body itself, in other species this origin can be inferred. This is a case of a recognisable cell component being formed by the Golgi apparatus, the functions of which remain largely unknown in cells of most plant and animal organisms.

One could cite many more studies where the close correlation of high resolution electron microscopy with light microscopy of (in particular) living cells is now producing excitingly new interpretations of cellular structure and function. However, the purpose of this lecture has now been fulfilled, to show how the advent of electron microscopy as a tool in biology has stimulated advances in light microscopy, and to stress the importance of careful correlation of the two observational methods in modern biological research.

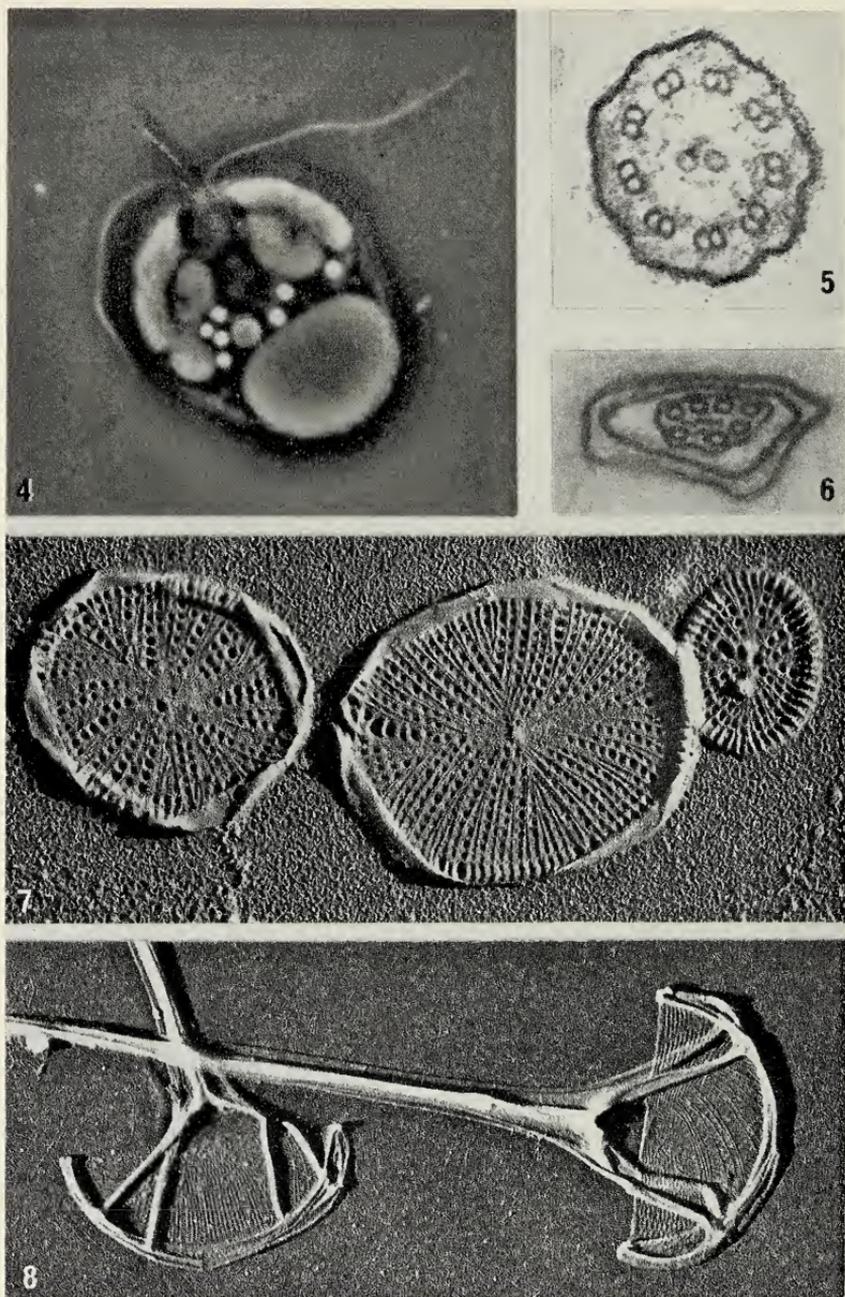
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PLATE I



Figs. 1-3. *Paraphysomonas vestita* (after Manton and Leedale 1961). Fig. 1. Living cell. Reichert anoptal contrast, $\times 1,500$. Fig 2. Section of a scale-containing vesicle. Electron micrograph, $\times 15,000$. Fig. 3. Shadowcast preparation of detached scales. Electron micrograph, $\times 7,500$.



Figs. 4-6. *Prymnesium parvum* (after Manton and Leedale 1963). Fig. 4. Living cell. Reichert anoptical contrast, $\times 2,000$. Fig. 5. Transverse section of a flagellum. Electron micrograph, $\times 100,000$. Fig. 6. Transverse section of a haptonema. Electron micrograph, $\times 100,000$.

Fig. 7. *Chrysochromulina polylepis* (after Manton and Parke 1962). Shadow-cast preparation of detached scales. Electron micrograph, $\times 30,000$.

Fig. 8. *Chrysochromulina pringsheimii* (after Parke and Manton 1962). Shadow-cast preparation of detached scales. Electron micrograph, $\times 15,000$.

A POPULATION OF COMMON CARP (*CYPRINUS CARPIO*) IN THE LOCH LOMOND DISTRICT

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Though the Common Carp (*Cyprinus carpio* L.) is abundant in many parts of England, this does not appear to be the case in Scotland, where the species is seldom recorded—those records which are available showing it to have a very erratic distribution. Scott and Brown (1901) list it as occurring in the West of Scotland in “various ponds doubtless introduced”, but no record of its presence in the Loch Lomond district is made by either Lumsden and Brown (1895) or Lamond (1931) in their accounts of the fish of this area. Hunter, Slack and Hunter (1959) have noted that there are no recent records for the Loch Lomond district. In 1959, however, reports were heard that this species had been found in the area, and since then several authentic specimens have been seen.

The population here recorded occurs in a small artificial loch in the Loch Lomond district (as defined by Hunter, Slack and Hunter, 1959) which is fed by two hill streams. The bottom of this loch is composed for the most part of soft mud, and though the water is normally rather turbid (possibly due to the feeding activities of Carp) there are well-established growths of several macrophytes, including *Chara*, *Potamogeton* and *Nymphaea*. The west side of the loch is a swamp and grown over by emergent grasses, whilst to the east and south the loch is well sheltered by tall trees whose leaves carpet the bottom of the loch each autumn. Not far to the north the ground rises steeply and the general situation of the loch is a markedly sheltered one.

In February, 1960, seine-netting was carried out in this loch in order to examine the fish population, but was found to be difficult because of the large numbers of twigs and branches occurring on the bottom. In spite of these, however, many Trout (*Salmo trutta* L.) were captured, as well as several Eels (*Anguilla anguilla* L.) and Three-spined Sticklebacks (*Gasterosteus aculeatus* L.). One small Common Carp was taken, this being a specimen some 8 centimetres in length, apparently in very poor condition and suffering from a fungus infection. (This fish soon recovered in an aquarium, where it lived for two years reaching a length of 13 centimetres in that time.) In June, 1960, the loch was again seine-netted, and though Trout, Eels and Sticklebacks were again caught in numbers, no Carp were taken.

Anglers have been more successful in this loch and several large Common Carp have been caught there during the past 4 years. Two of these fish were examined in some detail; both were captured in June, 1961, and both were ripe females weighing about 3 kilograms. There is a surprising lack of detailed information about the food of this species in Britain and accordingly the gut contents of these two fish were examined carefully. The gut of one specimen was almost empty and contained only a few larval Chironomidae (*Procladius* and *Endochironomus*) as well as some vegetable debris—which included 46 conifer needles. The gut of the other fish also contained conifer needles, but included as well numerous invertebrate remains among which *Caenis*, *Procladius*, *Orthocladius* and *Bezzia* larvae were common, whilst *Cyclops*, *Alona*, *Corixa*, *Pisidium* and the larvae of *Sialis*, *Athripsodes*, *Pentaneura*, *Tanytarsus* and *Prodiamesa* were also present. In neither gut was any macrophytic vegetation noted.

Though little detailed information is yet available about this population of Common Carp, it was felt that its existence was worth noting in view of the dearth of recent records of this species in Scotland. The population is certainly a viable one and, according to the owner of the loch in which it occurs, has been present for at least 70 years, probably much longer.

ACKNOWLEDGEMENTS

I am grateful to the owner of this loch for permission to work there, and to my wife for help with seine-netting. I wish also to thank Mr. J. Taylor for the gift of the two Carp intestines whose contents are noted above.

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THE EFFECTS OF DEPOPULATION ON THE ISLAND OF SOUTH RONA

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(Received 11th January, 1964)

The Island of South Rona is situated between Skye and the mainland of Wester Ross, Scotland. It is a little less than 5 miles (8 km.) from north to south and never quite reaches $1\frac{1}{2}$ miles (2.4 km.) in width. During the latter half of the last century the fertile, though frequently wet, low-lying land was able to support a crofting community of up to 181 persons. Apart from the presence of lighthouse keepers and the occasional visits of the tenant, the island is now uninhabited. The last permanent residents left in 1943.

Depopulation has been gradual and has resulted in a number of changes. The inbye land has largely reverted to natural vegetation; the crofting system of agriculture has been supplanted by sporadic large scale grazing of cattle and sheep; woodlands have become more extensive, and buildings have appreciably deteriorated. The present paper attempts to record the nature and extent of these changes in the light of a visit the authors made to South Rona from July 30th to August 5th, 1958 and to compare the situation with that observed by Peacock *et al.* (1934, 1935) in 1933.

Since 1871 the population density of South Rona has followed the following pattern. Numbers increased from 157 in 1871 to 181 in 1891. At that time six families lived at Braig, seventeen at Dry Harbour, one at Big Harbour and ten at Doire na Guaile (Figs. 1 and 2). Thereafter, numbers declined steadily. In 1898 the last inhabitants left Braig and by 1901 the total population was 161. The 1911 and 1921 figures were 133 and 98 respectively. The final exodus began in 1921 when seven families moved from Dry Harbour to the adjoining Island of Raasay. Doire na Guaile was vacated about 1924 and the last family left Dry Harbour in 1931. One family remained at Big Harbour until 1943.

The Department of Agriculture for Scotland purchased Rona in 1922 and from 1940 to 1946 kept, in the charge of two shepherds, 60 cattle and 300-400 sheep on the island. The present tenant, who has leased the island since 1950, now (1958) has approximately 700 black-faced sheep.

The authors wish to express their gratitude for assistance from various persons and organisations. Sgt. M. Macleod of

Portree was of considerable help with the preliminary arrangements; the Department of Agriculture for Scotland permitted us to visit Rona and their factor, Mr. S. L. Hamilton was most helpful at all times. Our thanks are also due to the tenant, Mr. Donald MacCallum, and a former inhabitant, Mr. John Macleod. The visit was partly financed by the Mammal Society of the British Isles and the University of Southampton. Dr. F. Perring assisted with the naming of the flowering plants and Mrs. J. Paton identified the bryophytes.

For the plants, the nomenclature of Clapham, Tutin and Warburg (1962), Macvicar (1926) and Richards and Wallace (1950) has been adopted.

TOPOGRAPHY

The east coast of Rona consists of unbroken cliffs without natural inlets. Along the west coast there are three major inlets. The southernmost (An Dubh Chamas) is surrounded by steep cliffs making access from sea to land difficult. At Dry Harbour there is a large bay having an expanse of sand exposed at low water whilst at Big Harbour there is a large sheltered inlet. A small stone jetty makes landing practicable at all states of the tide.

Geologically the island is formed of Lewisian gneisses which provide a well dissected terrain with the major valleys running north-west—south-east. The highest point is Meall Acairseid (404 ft.; 123 m.) which is situated immediately south of Dry Harbour. The high ground supports little vegetation and rock exposures are frequent. Many of the valleys, although now wet and badly drained, were cultivated when the island was inhabited.

Streams are short, shallow and seldom more than 18 in. (46 cm.) wide. The only sizeable stretch of fresh-water is at Loch Braig. This is a seasonal loch and when observed the water level was low. A large expanse of reed (*Phragmites communis*), growing from mud rather than standing water, surrounded a small area of open water. This contained a considerable quantity of *Potamogeton natans* and *Nymphaea alba*.

REVERSION OF INBYE LAND

The 6-inch Ordnance Survey map for 1875 (1901 revision) gives the location of 41 plots of inbye land. All but two in the north-west were visited and their dominant vegetation recorded. This former agricultural land generally occurred in readily recognizable pockets of lowland although it was not always possible to define boundaries precisely.

BRAIG AREA

Five plots were examined. The dominant associations were *Molinia caerulea*, *Calluna vulgaris*, *Juncus conglomeratus*, *Pteridium aquilinum* and mixtures of these species. The vegetation was indistinguishable from the surrounding moorland. The plot immediately north of Loch Braig also contained *Myrica gale*, *Phragmites communis* and a little *Eriophorum angustifolium*.

DRY HARBOUR AREA

The vegetation was more varied than at Braig with two major types of plot present. In areas 1-10 (Fig. 1) *Juncus* and bracken were dominant in varying proportions and trees were absent. Bracken tended to occur on the higher drier ground and particularly on slopes at the margins of plots. The commoner plants in plot 1 were:—

<i>Bellis perennis</i>	<i>Lychnis flos-cuculi</i>
<i>Calluna vulgaris</i>	<i>Molinia caerulea</i>
<i>Carduus</i> sp.	<i>Myosotis secunda</i>
<i>Carex echinata</i>	<i>Myrica gale</i>
<i>C.</i> spp.	<i>Narthecium ossifragum</i>
<i>Cynosurus cristatus</i>	<i>Pedicularis palustris</i>
<i>Drosera rotundifolia</i>	<i>Pinguicula vulgaris</i>
<i>Epilobium palustre</i>	<i>Potentilla anserina</i>
<i>Eriophorum angustifolium</i>	<i>P. reptans</i>
<i>Erica tetralix</i>	<i>Prunella vulgaris</i>
<i>Festuca vivipara</i>	<i>Ranunculus acris</i>
<i>Filipendula ulmaria</i>	<i>R. flammula</i>
<i>Hydrocotyle vulgaris</i>	<i>Rhynchospora alba</i>
<i>Juncus acutiflorus</i>	<i>Rumex acetosella</i>
<i>J. conglomeratus</i>	<i>Senecio aquaticus</i>
<i>Lolium perenne</i>	<i>Trifolium</i> sp.
<i>Acrocladium cuspidatum</i>	<i>Ctenidium molluscum</i>
<i>Brachythecium rutabulum</i>	<i>Philonotis fontana</i>
<i>Breutelia chrysocoma</i>	<i>Sphagnum subsecundum</i>
<i>Bryum pseudotriquetrum</i>	var. <i>auriculatum</i>
<i>Cratoneuron filicinum</i>	<i>Aneura sinuata</i> var. <i>major</i>

There was greater floristic variety in this plot than in the remainder where the plants associated with *Juncus* were comparatively few. In plot 3 the following were present:

<i>Juncus conglomeratus</i>	<i>Ranunculus acris</i>
<i>Potentilla anserina</i>	<i>R. flammula</i>
<i>Prunella vulgaris</i>	<i>Rubus</i> sp.

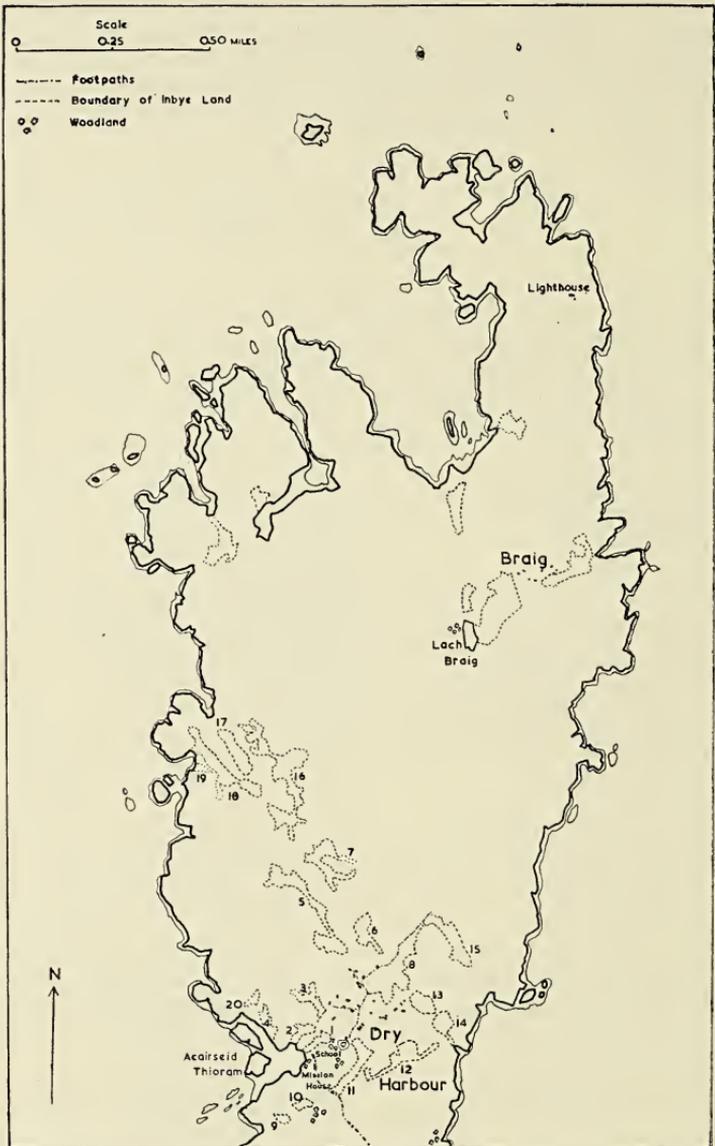


Fig. 1.—Island of South Rona, northern section.

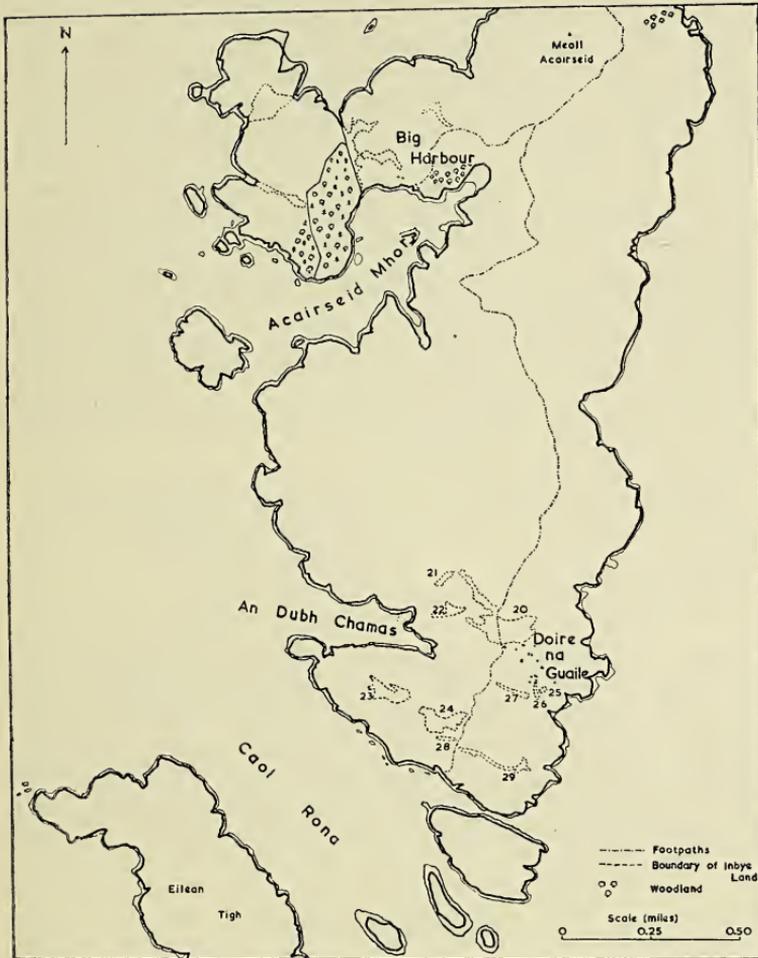


Fig. 2.—Island of South Rona, southern section. The unenclosed portion of the major wood is a recent extension.

Bulrush (*Typha latifolia*) occurred in plot 5 and the following bryophytes: *Pleurozium schreberi*, *Polytrichum commune*, *Rhytidiadelphus squarrosus* and *Thuidium tamariscinum*. A patch of iris (*Iris pseudacorus*) occurred in plot 8 whilst *Calluna*, *Erica* and *Eriophorum* were common at its north end.

Birch (*Betula pubescens*)—rowan (*Sorbus aucuparia*) wood was present in varying amounts and in varying stages of development in plots 11 to 18. Little birch occurred in plots 17 and 18 where bracken and *Juncus* were dominant. In contrast, plot 14 was composed of dense birch-rowan-hazel (*Corylus avellana*) wood with a moss-covered floor and with a small central area into which trees had not completely penetrated although here birch saplings were very numerous. The narrow, low-lying necks of plots 12 and 16 were thickly wooded. Within the latter the vegetation displayed considerable variety. The northern sector contained bracken and a strip of birch and the hybrid willow, *Salix atrocinerea* x *S. aurita*. This gave way to more bracken with birch encroaching from the sides. The large central portion contained:

<i>Athyrium filix-femina</i>	<i>Eriophorum angustifolium</i>
<i>Carex echinata</i>	<i>Filipendula ulmaria</i>
<i>C. spp.</i>	<i>Molinia caerulea</i>
<i>Dryopteris filix-mas</i>	<i>Myrica gale</i>
<i>Erica cinerea</i>	<i>Prunella vulgaris</i>

Remains of peat cuttings were apparent in this portion of the plot. Further south a dense patch of birch was followed by an area dominated by *S. atrocinerea* x *S. aurita*. This willow has become well established on the island and is frequently associated with birch. In the remaining plots birch and rowan encroached from the sides with *Juncus* common on low ground. Much of plot 13 was covered in bracken from 5 ft. (1.5 m.) to 7 ft. (2.1 m.) high.

Big Harbour Area

Juncus was prominent in four of the five plots and was accompanied by *Eriophorum* in three of them. The largest plot had little *Juncus* and consisted of *Calluna vulgaris*, *Eriophorum angustifolium* and *Erica tetralix*. The following bryophytes were common:

<i>Aulacomnium palustre</i>	<i>P. formosum</i>
<i>Eurhynchium praelongum</i>	<i>Pseudoscleropodium purum</i>
<i>Gymnocoles inflata</i>	<i>Rhytidiadelphus squarrosus</i>
<i>Hypnum cupressiforme</i> var.	<i>Sphagnum compactum</i>
<i>ericetorum</i>	<i>S. fimbriatum</i>
<i>Plagiothecium undulatum</i>	<i>S. palustre</i>
<i>Pleurozium schreberi</i>	<i>S. plumulosum</i>
<i>Polytrichum commune</i>	

Doire na Guaile Area

Juncus was dominant in four, including the largest, of the ten plots. The hybrid *Salix* was common and formed a dense shrubbery over most of plot 22. Birch-rowan woodland was established in the deeply cut plot 29. Plot 26 was completely covered by bracken. The remaining plots contained typical damp heath associations including, *Molinia*, *Myrica gale*, *Calluna*, *Erica* spp., *Juncus* and *Carex* spp..

The depopulation data suggest that not all land fell into disuse simultaneously. It appears likely that no land has been tilled around Braig for sixty years although at Dry Harbour it must have been worked up to twenty-seven years ago. However, as the population was steadily declining it is probable that the remoter lands fell into disuse earlier than those nearer the township. The same is probably true of Doire na Guaile, although here the land fell into disuse about seven years earlier.

The abandoned inbye land was last surveyed in 1933 (Smith, 1934), two years after the last residents left Dry Harbour. Smith identified thirty-six areas and found that, "... thirty-three had reverted completely to an almost pure society of *Juncus communis*, two had become lowland marsh or wet meadow, and one had gone over to wild grasses". Comparison with the present survey is hampered by Smith not specifying the situation in particular plots. The 1958 data suggest greater diversity in the vegetation than in 1933. This could be due to Smith's incomplete examination of the plots or to modifications in the vegetation between 1933 and 1958. The latter has probably occurred in many localities although it would seem unlikely to have done so around Braig. The existing diversity can probably be largely attributed to variations in drainage and the amount of available shelter. *Juncus* is still abundant but apparently not to the same extent as before. The appearance of woods is a new development as Smith referred to the complete absence of natural woodland. Woods have appeared in the deep valleys along the east coast and elsewhere in sheltered situations.

Bracken has become very prominent; in 1958 it occurred in thirty-three plots and covered large areas. It was present in some quantity on the island in 1933 but the absence of reference by Smith to large swards and high stature of bracken at Dry Harbour suggests that further encroachment and development of this plant has taken place.

Much of the inbye land has become covered in the typical heath association of *Erica*, *Calluna* and *Molinia* with *Eriophorum* and *Juncus* dominant in wetter localities. Plot 1 with its floristic variety is probably the "wet meadow" referred to by Smith.

GROWTH OF WOODLANDS OUTSIDE
INBYE LAND

A small mixed wood was planted on the north shore of Big Harbour in about 1873. The wood still persists and (in 1958) the following plants were recorded:

<i>Acer pseudoplatanus</i>	<i>Oxalis acetosella</i>
<i>Betula pubescens</i>	<i>Picea abies</i>
<i>Blechnum spicant</i>	<i>Pinus sylvestris</i>
<i>Calluna vulgaris</i>	<i>Poa nemoralis</i>
<i>Dryopteris filix-mas</i>	<i>Potentilla erecta</i>
<i>Erica tetralix</i>	<i>Primula veris</i>
<i>Fagus sylvatica</i>	<i>Prunella vulgaris</i>
<i>Galium saxatile</i>	<i>Pteridium aquilinum</i>
<i>Larix decidua</i>	<i>Quercus petraea</i>
<i>Lonicera periclymenum</i>	<i>Salix atrocinnerea</i> x <i>S. aurita</i>
<i>Luzula multiflora</i>	<i>Sorbus aucuparia</i>
<i>Molinia caerulea</i>	<i>Tilia</i> x <i>europaea</i>
<i>Dicranodontium uncinatum</i>	<i>Rhytidiadelphus loreus</i>
<i>Eurhynchium striatum</i>	<i>R. triquetrus</i>
<i>Isoetecium myosuroides</i>	<i>Thuidium tamariscinum</i>
<i>Plagiothecium silvaticum</i>	<i>Sphagnum palustre</i>
<i>Polytrichum formosum</i>	

The wood has slightly increased its area to the south-west (Fig. 2). Trees in more exposed situations were short and windswept, with trunks seldom exceeding 5 ins. (12.7 cm.) in diameter. Only in more secluded situations did they attain the heights of 30–35 ft. (9.1–10.6 m.) observed by Smith (1934).

Birch-rowan associations were observed in the valley of a small burn to the south-east of Dry Harbour and on the west shore of the bay at the north end of Acairseid Mhor (Fig. 2). A small plot of mixed woodland at Dry Harbour had extended its original boundaries southwards and westwards with thick bracken bounding its north-east corner. Dense thickets of *Salix viminalis* occurred between the School and Mission House and the shore. A patch of birch wood had developed approximately 100 yds. (91 m.) south of the Mission House (Fig. 1) in the lee of Meall Acairseid. A small patch of hawthorn (*Crataegus monogyna*) was present on the west shore of Loch Braig.

The survey of woodlands was not exhaustive as certain sections of the island, notably along the east coast immediately north of Doire na Guaile, were not examined. Although Smith (1934) refers to the absence of woodland on Rona, one of her maps shows in the region of Dry Harbour, several small areas of "scrub". Since her survey these areas appear to have developed further.

Two small areas of woodland are indicated on the Ordnance Survey map along the west borders of plots 2 and 8. They are now represented by occasional windswept trees and show no apparent regeneration.

HUMAN ARTEFACTS

Except for the lighthouse, the lodge at Big Harbour (which is periodically inhabited) and the Mission House, the buildings on South Rona were in an advanced state of decay. The majority were completely roofless, two had the last vestiges of thatched roofs, and some could only be recognised as ground plans. Owing to their delapidation it was not possible to distinguish between out-buildings and those previously inhabited. One of Smith's (1934) photographs shows two crofts with intact roofs; both are now roofless. A small number of buildings had the remains of their thatch roofs on the ground about them. The environs of the buildings were frequently covered in nettles or bracken. A few shoots of rhubarb were growing outside a croft at Dry Harbour. The condition of the buildings has been summarised in Table 1.

TABLE I.
Condition of the buildings on the Island of South Rona

	Roof Intact	Remains of roof present	Walls but no roof	Plan
Braig	—	—	8	—
Dry Harbour	1	1	38	5
Big Harbour	1	1	2	2
Doire na Guaile	—	—	18	2

The main north-south path was well marked between the south end of the island and the Mission House at Dry Harbour. It was overgrown where it used to run alongside plot 11 but was again apparent in the centre of Dry Harbour to as far north as plot 15. Between there, Braig and the lighthouse it could not be traced. The westerly path from Dry Harbour to Big Harbour also could not be traced.

Both wells at Dry Harbour and Big Harbour were functioning, the latter being regularly used by the tenant and yachtsmen using Acairseid Mhor as an anchorage. A third well, not marked on the O.S. map, was found on the east border of plot 2.

Lazy beds were visible at the most northerly and westerly plots (Figs. 1 and 2) and the remains of drainage channels in plot 5.

FAUNISTIC

Changes in the fauna that can, with certainty, be attributed to the depopulation of South Rona are few. Mr. J. Macleod, formerly of Braig, informed us that rats and mice were abundant in 1896 whereas Mr. D. MacCallum, the tenant, claims that rats are now absent. Their disappearance could be associated with the absence of human habitations. It is not certain whether Mr. Macleod referred to house or field mice. After an extensive series of trappings (Delany and Copland, 1960) as few as six field mice (*Apodemus sylvaticus* (L.)) were caught.

Few measures have been taken to control the number of rabbits; myxomatosis has never reached the island with the result that they are now extremely abundant. Their only natural enemies appear to be buzzards (*Buteo buteo* (L.)). Mr. Macleod claims that rabbits were introduced to Rona as late as 1940 although Harrison (1937) records that they were present, though not numerous in 1934-36.

DISCUSSION

The regeneration of woodlands is one of the major developments on South Rona. When the island was inhabited several factors helped to suppress tree growth. Crofters felled timber for fuel and building; the feeding of their grazing animals would have restricted regeneration (it has not been possible to obtain information on the soumings); also many of the more sheltered valleys that were favourable for tree growth were tilled and so encroachment was prevented. When man left the island all these agencies were removed and natural regeneration could proceed uninhibited. Darling (1955) has drawn attention to the severe effects of overgrazing on the regeneration of woodland in north-west Scotland. The two recent reintroductions of sheep may have impeded woodland regeneration although the present condition of woods suggests that grazing pressure has not been sufficiently heavy to cause marked deforestation. A number of woods possess wet, rocky moss-covered floors. In these, sheep would find little suitable food and an uncompromising terrain, so that here development could probably continue unhampered. Elsewhere, mixtures of herbage and saplings, usually in juxtaposition with established woods, and apparently offering suitable pasture for sheep have not, in fact, been frequently visited. Sheep may not yet have fully exploited all the available grazing areas on the island.

St. Kilda was depopulated in 1930 and affords an interesting comparison with South Rona. The vegetation was surveyed in 1931 (Petch, 1933) and 1948 (Boore and Robertson, 1949).

In 1930, 500–600 black faced sheep were taken off Hirta, and in 1931, 107 Soay sheep were introduced. They have since increased in numbers. In 1952 1,114 were counted and in 1955, 710 (Boyd, 1953, 1956). Thus Hirta, which is appreciably smaller than Rona, has experienced heavy grazing since depopulation. Grazing has modified the moorland, maritime grassland, *Agrostido-Festucetum* and inbye land so that the *Holcus lanatus* and *Rumex acetosa* have become dominant. Trees are absent from Hirta and their establishment is hampered by the distance seeds have to travel and by the presence of large numbers of sheep. On Hirta grazing has made for uniformity in vegetation whilst on Rona with less grazing and greater opportunity for tree growth considerable variety of vegetation has appeared in the former inbye land.

Rabbits assisted the sheep in keeping the grasses closely cropped in the Rona townships; rabbits are absent from St. Kilda.

SUMMARY

South Rona is a long narrow, hilly Hebridean island composed of Lewisian gneisses. The population gradually left the island during the first half of the present century with the last residents leaving in 1943. The results of depopulation have been the reversion of inbye land to natural vegetation, the supplanting of crofting by sporadic large-scale grazing of cattle and sheep, the extension of woodlands and the deterioration of buildings.

All but two of the plots of inbye land were visited and the vegetation recorded. Much of the land is covered with typical heath association of *Erica*, *Calluna* and *Molinia* with *Eriophorum* and *Juncus* dominant in the wetter areas. There is considerable encroachment of bracken on the inbye land and in sheltered situations regeneration of birch-rowan woodland. There was evidence of extension and maturation of existing woodland during the past twenty-five years.

Most of the buildings were found, in 1958, to be in an advanced state of decay.

Rats (and possibly house mice) have disappeared from the island, and rabbits have been introduced and have multiplied unchecked.

The changes associated with depopulation are rather different from those occurring on St. Kilda.

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**THE HERBARIUM OF THE
ROYAL COLLEGE OF SCIENCE AND TECHNOLOGY
GLASGOW***

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During a re-organisation of the biology departments some ten years ago, a herbarium of about 9,500 specimens was discovered after having been lost sight of for almost fifty years. It had its beginnings in the contemporaneous collections of Professor John Scouler M.D., LL.D. (1804–1871) and Professor Roger Hennedy (1801–1876). These naturalists collected in the field and exchanged widely, so that the herbarium as a whole has an interesting representation of exotic flora and a characteristic representation of British flora, particularly of Scotland and especially of the Clyde area. This account has therefore been prepared in order to make known its location in Glasgow and its availability to those interested (Kent, 1957).

The various collections have recently been rearranged in three sections, and named to perpetuate the two founders as follows:—

- (i) The Hennedy Herbarium: native phanerogams
- (ii) The Scouler Herbarium: exotic phanerogams
- (iii) The Cryptogamic Herbarium, native and exotic.

HISTORY

The history of this herbarium and its vicissitudes reflects the activities of the successive professors of biological subjects in the college. It also illustrates the activities of the various natural history societies of the district, particularly during the past century.

The earliest collection was that of Scouler, who served the college first as Curator of the museum and professor of Natural History from 1829–1833, and later in his retirement as informal custodian of the Museum from 1855–1871. His collection came into the possession of the college on his death and was the first herbarium to be owned by the college, apart from specimens in *Materia Medica*. His material was partly named and classified by Professor Hennedy from 1871 till he died in

* now the University of Strathclyde.

1876, when Hennedy's herbarium, including his diatom slide collection, was donated to the college by his widow. Hennedy's Clydesdale collection was related to his *Clydesdale Flora* (Hennedy, 1865), which was the definitive regional flora from 1865 until 1933 when Lee (1933) published his *Flora of the Clyde Area*. On these two collections the subsequent development of the herbarium is based.

A period of inactivity followed in the next two decades, marked only by the acquisition of Professor T. King's collection of gymnosperm cones and some native bryophytes. The appointment of Professor Scott-Elliot produced a revival of interest during the period 1896-1911. The herbarium was enlarged more particularly by the incorporation of lichens and bryophytes collected by himself, his students and his colleagues from societies now forming the Andersonian Naturalists of Glasgow. Several Glasgow naturalists interested themselves in the herbarium by checking the nomenclature, classifying and remounting some of Scouler's earlier specimens. Under the direction of Scott-Elliot (1901), their work formed to a large extent a basis for the preparation of the detailed handbook on natural history of the area for the visit of the British Association in 1901.

With the retirement of Scott-Elliot and the development of the bacteriological side of the department during the period 1911-1937 under Professor Ellis, the herbarium work lapsed; except for some attention to the lichens and the mycetozoa by his assistant Miss W. Zamorska and some transient relabelling, it seems to have remained static until its discovery by chance in 1953.

Since 1953 the work done has been chiefly that of rehabilitation and classification by the writer, with the assistance of departmental technicians. A comprehensive cursive catalogue in typescript has now been completed, and the collection is in sufficiently good order for consultation and study. A start has been made in securing good nomenclature from regional and taxonomic experts and in documenting the various collectors and certain specimens of particular interest.

COLLECTORS

The collection of Scouler (Lloyd, 1962 and MacNair and Mort, 1908) ranges over his life time from the age of about 16 to his sixties, and include all groups except the fungi. His first specimens were gathered during his early years as a student of Sir William Hooker and later in Paris and Montpellier. His voyage to the North-west Pacific coast yielded the first herbarium specimens collected in Oregon (1) and his material was largely drawn upon by Hooker for his monograph on the flora of Northern America. Those sheets retained by Scouler

in his personal collection, including some apparent isotypes, are in this herbarium. On this voyage he also collected en route, from Madeira, Rio, the Juan Fernandez Islands, and the Galapagos Islands; the latter were thus visited seven years before Darwin arrived in the "Beagle".

From a subsequent voyage as ship's surgeon to the Far East, Scouler added to his collection plants from the Cape of Good Hope, Mauritius, Madras and Calcutta. On his return to appointments first in this institution (1829-1833) and then at The Royal Dublin Society, Eire (1833-1854), he resumed collecting of native material, more particularly of algae and alpine phanerogams. His travels in Europe, notably in Sweden and Portugal during his retirement years, are also illustrated by plant specimens, more particularly a collection from Sweden labelled by Johan Emanuel Wikström (1789-1856) and collected by himself, J. B. Björnström, N. J. Andersson and perhaps also Robert Hartman. There is also one Poplar leaf, No. 420, from the collection of Caspar Bauhin.

Scouler's botanical interests were thus global, and his collecting, both in manner and in kind, is evidence that his predilection for geographical distribution and local variation took precedence over taxonomic identity. His large circle of corresponding and personal colleagues also enriched his collection; it includes specimens from the collections of Asa Gray (N. America), Ravenel (Carolina), Wallich (Nepal), Harvey, Zeyher and Meyer (Cape of Good Hope), Telfair (Mauritius), Cuming (Philippines), Douglas (N. W. Pacific, Arctic, Hawaii), Gardner (Brazil) and the Erebus-Terror expedition of 1841-43 (Antarctica).

In contrast to Scouler, Hennedy did not begin his collecting until the age of forty; he was selective in his work, which was primarily directed to a resolution of the flora of the Clyde area. He meticulously included rarities, casuals and aliens, and his collection now gives a highly informative picture of the flora of this district a century ago. An old herbarium of this type lends itself not only to ecological study of the emergence of some species and the failure of others, but also to ethnobotanical consideration of the effect of man in these habitats.

Hennedy also made a fairly representative collection of algae, particularly on the island of Great Cumbrae. He exchanged and acquired from other collectors, including Landsborough, Balfour, Walker-Arnott, Gardner, Greville and Gourlie in Scotland, and Bloxam and Hore in England. Among his exotic material are specimens from Campbell and Cleghorn (India), Sinclair and Buchanan (New Zealand), and a well-mounted selection of Harvey's Australian algae.

The third collector in the history of the botanical professoriat was Scott-Elliot. Although his own main herbarium is

housed in Dumfries, and is related to his *Flora of Dumfriesshire* (Scott-Elliot, 1896), he added to the college collection of bryophytes and lichens, secured Mycetozoa from G. Lister and specimens from British Columbia and Tasmania. A major contribution during his term of office was to obtain material from his immediate colleagues in Scotland and specimens from England by way of the Watson Botanical Exchange scheme.

The herbarium also contains material from unknown or so far undocumented sources, for example, specimens from Kuling, China (1901), and the Faroes (1818).

GEOGRAPHICAL REPRESENTATION

The herbarium catalogue has not yet been fully analysed, but it would seem that the major regions are represented in varying degree. Specimens from the various itineraries and collections of Martius, Claussen, Hohenacker, Lechler and Schimper amplify the exchanges of the college collectors. Western European material comes from Scouler, Seringe and the Scottish naturalist J. Gourlie; eastern Europe is hardly represented. In the Americas the northern continent is exemplified by arctic material from Parry's expedition and the journey of David Douglas along the Red River and subsequently into California; north-west Pacific coast specimens have come from Scouler, Douglas and the Scottish naturalist G. R. Thompson. The north-eastern and southern states of America are illustrated by material collected by Asa Gray, Moir, Oakes, Sullivant. Schweinitz provided plants from the Caribbean. South American specimens from Gardner, Scouler, and others represent most of the republics except the Argentine.

The Polynesian and Malaysian material from Scouler's herbarium is largely of unknown provenance so far, but the Indian specimens, apart from Scouler's own collection come from Wallich, Cleghorn, Wight and Campbell. New Zealand, North Island is well represented by plants from Buchanan and Sinclair; some Australian specimens from Scouler lack the collectors' names. The herbarium also contains Tasmanian plants collected by C. J. Forrester, in 1901.

TAXONOMIC REPRESENTATION

Within the limits of the size of this herbarium, the various plant groups are fairly represented. There are about 1,200 native and exotic algae, and some 600 slides, chiefly of diatoms, in the Hennedy collection. There about 150 fungal specimens, 250 lichens and 750 bryophytes, the latter being chiefly Scottish. The pteridophytes number about 600, chiefly exotic;

many of these are from unknown collectors, and so far unidentified. Among the phanerogams there are about 1,500 native and 4,500 exotic specimens.

In a small herbarium of this kind, drawn from many sources, the validity of identification becomes a matter of some significance, and determines much of its value. This was realised by Scott-Elliot, who secured authentications in some of the plant groups, notably the freshwater algae by W. West, the marine algae by E. M. Holmes, the fungi by Plowright, the Cyperaceae by C. B. Clarke, and the bryophytes and the native phanerogams by a team of local naturalists. After the lapse of fifty years, a re-examination has become necessary, and a start has been made. The Cape of Good Hope plants have been identified through the good offices of the Government herbarium at Pretoria, and the Mauritius specimens by the Mauritius herbarium. The Mycetozoa have been examined by Mr. Bruce Ing, and certain marine algae by Dr. E. Conway and Mr. Peter Dixon. It is hoped that in due course the material from all groups and the leading regions will have received expert examination, and that this relatively small but neatly representative nineteenth century herbarium will be duly documented as far as possible in accordance with modern practice.

It is hoped also that this account may be of use to those who have an interest in particular groups or regions, or who wish to trace the location of specimens from particular collectors, more especially those in the early part of last century. Perhaps also it may elucidate the existence of other early local herbaria.

The recent rehabilitation of the herbarium was initiated on the lines of acceptable modern practice after advice kindly given by Dr. (later Sir) George Taylor when he was Keeper of Botany at the British Museum (Natural History), by Sir Edward Salisbury and staff of the Herbarium of the Royal Botanic Gardens, Kew, and by Mr. B. L. Burtt of the Herbarium of the Royal Botanic Garden, Edinburgh. Acknowledgements for ready acceptance of the task of identifications are made to those previously mentioned, and also to the specialists in various groups at the Government Herbarium, Pretoria, through the good offices of their Director, Dr. R. A. Dyer and their librarian Miss M. Gunn; and to Mr. R. E. Vaughan, Curator of the Mauritius herbarium at Reduit. In pursuance of a more detailed investigation, the writer has received considerable assistance with research into bibliographic data from Miss Katherine Anderson, Library Association of Portland, Oregon; Miss J. Lancaster of the India Office Records at the Commonwealth Relations Office, Professor R. C. Rollins, Director of the Asa Gray Herbarium, Harvard; Miss R. deBerg, Auckland University College; Professor W. T. Batson, University of South Carolina; Dr. Rolf Santesson, Keeper of the University Herbarium, Uppsala;

Mr. Black and staff of the Mitchell Library, Glasgow, and Mr. C. J. Wood of the Andersonian Library of this college. Grateful thanks are also due to Professor E. O. Morris, Dr. W. W. Fletcher and the staff of the Department of Applied Microbiology and Biology, Royal College of Science and Technology, for encouraging the maintenance and continuation of this herbarium.

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NOTES ON
THE GLASGOW UNIVERSITY COPY OF FRIES'S
SCLEROMYCETI SUECIAE

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Elias Fries issued these Exsiccati from Lund in the years 1819 to 1825. The few surviving copies are particularly valuable, as the specimens form part of the types for the species which he describes in his "Systema Mycologicum" (1821-1832). Article 20 of the "Code for Botanical Nomenclature" (1956) establishes this work as the starting point for the names of Fungi other than the Uredinales, Ustilaginales, Gasteromycetes and Fossils. The Exsiccati were issued in 34 "Decads", bound into 9 "Fascicles". Holm and Nannfeldt (1963) have recently described the editorial history and condition of several copies. It appears that most of these have been broken up for filing into Herbaria, and they say "... a whole set of the nine Fascicles as originally issued perhaps no more exists". They comment particularly on the rarity of the indices and other notes, which they say were issued as loose sheets with each Fascicle. They also discuss the uncertainty about the real existence of Fascicle 9, and they draw attention to the little known second edition which was issued in simpler form before 1834. Because of the rarity and importance of this collection they suggest that the custodians of any copy should determine its edition, and that they should report on its contents in the hope that some of the existing gaps in the numbers may be filled. These notes record the present condition of the Glasgow copy.

It is one of the first edition, and it consists of Fascicle I, Decads I-IV (1819), Fascicle 2, Decads V-VII (1820), Fascicle 3, Decads VIII-XI (1820), Fascicle 4, Decads XII-XIV (1820), Fascicle 5, Decads XV-XVIII (1821), Fascicle 6, Decads XIX-XXII (1821) and Fascicle 8, Decads XXVIII-XXX (1822). It is likely that it was purchased as part of the Walker-Arnott Collection in 1860, together with the University copy of the Systema Mycologicum. There is, however, no record of its arrival, or of its condition until Professor Walton discovered it in the files in 1958. At that time Fascicle 7 was missing, and it has not been found since. The whole Department has moved several times since 1860, and this fascicle may now be permanently lost. No trace of the second edition has been found in any collection in the Department.

The specimens are glued on to sheets measuring approximately 21 cm. × 16 cm. These are bound with the notes and/or index between what appears to be the original grey paper cover of each Fascicle. The specimens and notes etc. of each Fascicle are complete and agree with Holm and Nannfeldt's account, except that:—

- (a) Spaces and labels are present for numbers* 36 (*Sphaeria complanata* Tode), 88 (*Lophium excipuliforme* Fries), 120 (*Sphaeria pulvis-pyrus* Pers. variet.), 185 (*Sphaeria microstoma* P.), 274 (*Sphaeronema pyriforme* Sph.P.), but the actual specimens are missing. There is a glue stain on the sheet from which specimen 88 was apparently removed. The other sheets have been examined carefully under a × 10 lens; this revealed no evidence of any material having been attached to them. Fries cited specimens 36, 185 and 274 in the *Systema Mycologicum*, without suggesting that they were rarities. Holm and Nannfeldt comment on the fact that specimen 120 is not cited in the *Systema*. In their note on specimen 312 they draw attention to the possibility that no material of specimen 120 was in fact ever issued. The appearance of the herbarium sheets suggests that the other 3 specimens were not issued in this set.
- (b) The label of specimen 26 has been cut to read “26 *Sph* (*Cer*)” only, and the fascicle index gives “26 *Sph*. (*Cer*) *Gnomon* Tode”, without amendment. Holm and Nannfeldt say that when distributing the material Fries amended this label by writing “*Sphaeria tubaeformis*” on it in ink. Curators of other copies may wish to examine their labels to see how consistently he made this amendment. The Glasgow label seems to be firmly glued to the sheet in the original condition, and to suggest that he wished to issue the material as a “species incertae sedis”.

The Collection is now kept in a special cabinet in the Herbarium of the University Botany Department, and it can be seen on application to the Regius Professor.

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* The names and abbreviations are those used by Fries on the labels

**ADDITIONAL RECORDS OF COLEOPTERA
FROM SCOTTISH OAK-WOOD SITES**

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(Received 1st June, 1964)

In a previous issue of this journal (Crowson, 1962), some records of beetles in Scottish oakwoods, mainly from my own collecting, were assembled; the present paper provides some further data on species considered in 1962, and adds some new species (marked with an asterisk) to the Scottish list.

**Calosoma inquisitor* (CARABIDAE). Two specimens of this were caught, in June 1963, in pitfall traps in an oak wood at Spean Bridge, Invernesshire, by my friend Mr. I. L. Crombie. The insect is well known as a predator of caterpillars on trees; its northernmost authenticated British record seems hitherto to have been in Cumberland.

Xylodrepa quadripunctata Mull. (SILPHIDAE). A larva of this species, in litter from an oakwood on the NW shores of Loch Goil, extends its known range into Argyll; it will probably be found to occur still further north.

**Cephennium thoracicum* Mull. (SCYDMAENIDAE). A number of adults of this species, apparently not hitherto found in Scotland or even in the north of England, emerged from a mixed leaf-litter sample from the grounds of Galloway House, Garliestown, Wigtownshire, collected on April 10 1964. The species of *Cephennium* are flightless and generally of rather restricted natural distribution; *C. thoracicum* is known from the western and south-central parts of Europe, but appears not to have been recorded from Scandinavia; it occurs in Ireland, which probably derived a major part of its insect fauna via the "short sea routes" from Galloway.

Scaphidium quadrimaculatum L. (SCAPHIDIIDAE). Additional localities are Inversnaid, on the Stirlingshire shore of Loch Lomond (several adults in a fungus-attacked oak stump, 27.5.62); and Wood of Cree, near Minigaff, Kirkcudbrightshire (adults in pile of oak-sticks, 29.9.62).

Coryphium angusticolle Steph. (STAPHYLINIDAE). Adults under bark of fallen trees, Cambusnethan Priory, Wishaw, Lanarkshire, 14.3.62.

Thectura cuspidata Er. (STAPHYLINIDAE). One adult was found under oak bark at Rossdhu, Luss, Dunbartonshire on 19.5.62, and another under bark at Milton Lockhart, Carluke, Lanarkshire on 29.3.64.

**Homalota plana* Gyll. (STAPHYLINIDAE). Adults of this were collected under bark at Dundonald, Ayrshire on 30.3.59,

also at Cambusnethan Priory, Wishaw, Lanarkshire on 19.5.62, and at Galloway House, Garliestown, Wigtownshire on 9.4.64. In Sweden the species extends into the northern coniferous forests.

Sinodendron cylindricum L. (LUCANIDAE). An additional locality is Milton Lockhart, Carluke, Lanarkshire. The distribution of the species in the Clyde valley suggests that it was formerly restricted to the Hamilton Palace estate, but since so many planted beech trees on adjacent estates have grown old and decrepit it has begun to extend its range both upstream (where it appears not to have reached the Crossford area yet) and down to Bothwell Castle.

Trixagus dermestoides L. (TRIXAGIDAE or THROSCIDAE). There is an old record of this from Dumfriesshire (Lennox), and a specimen in the Fergusson collection from near Troon (Ayrshire). A single specimen was found by Mrs. E. A. Crowson in a *Luzula* tuft in the Avon gorge near Bo'ness (W. Lothian).

Hedobia imperialis L. (ANOBIIDAE). A new locality for this is Milton Lockhart, near Carluke, Lanarkshire, where larvae were found (in association with *Clytus*) under bark of a sound fire-damaged oak on 29.3.64.

Ochina ptinoides Marsh. (ANOBIIDAE). On more than one occasion I have found adults or larvae of this in dead Ivy in the lower part of the Fiddler Glen, near Crossford, Lanarkshire.

Ptinus subpilosus Sturm (PTINIDAE). A relatively large Ptinid larva, presumably of this species, was found in decayed oak in the lower part of the Fiddler Glen, Crossford, Lanarkshire on 1.3.64.

Phloiophilus edwardsi Steph. (PHLOIOPHILIDAE). An extended account of this species is being published elsewhere. Larvae of it were found under *Phlebia* on dead Ash at Port Castle, Glasserton, Wigtownshire, on 7.4.64, and under the same fungus on dead oak branches at Kilsture, Kirkcinner, Wigtownshire on 10.4.64.

Soronia punctatissima Ill. (NITIDULIDAE). Both this species and *S. grisea* L. appear to be widespread in the oak-wood areas of Scotland; both breed in sap-flows from injured deciduous trees of many species, and both extend into the coniferous forest areas of Sweden.

Micrurula melanocephala Marsh. (NITIDULIDAE). Additional localities are Milton Lockhart, Carluke, Lanarkshire (adults in oak-beech leaf-litter, 29.3.64) and Dundonald, Ayrshire (adult in leaf-litter, 19.11.61).

Cychramus luteus F. (= *fungicola* Heer) (NITIDULIDAE). Adults and larvae were collected by my friend M. de Viedma in decaying agarics on trees at Garroch, Dalry, Kirkcudbrightshire on 26.9.62.

Caenoscelis ferruginea Sahlb. (CRYPTOPHAGIDAE). An adult was found in mixed leaf-litter at Cambusnethan Priory, Wishaw, Lanarkshire on 14.3.62.

Dacne bipustulata Thunb. (EROTYLIDAE). Adults in fungi on beech stumps, Hopetoun House Estate, W. Lothian, 13.10.63.

Triplax aenea Schall. (EROTYLIDAE). An additional Clyde valley locality is Cambusnethan Priory, Wishaw, Lanarkshire, 20.5.62, in *Pleurotus* on dead Holly.

Orthoperus brunnipes Gyll. (CORYLOPHIDAE). My records of this are: in grassy litter on oakwood, Braidwood, Lanarkshire, 2.3.58; in rotten birch, Dinnet oakwood, Ballater, 20.8.58; decaying log-pile, lower end of Fiddler Glen, Crossford, Lanarkshire, 17.5.61; in fungus infested oak bark, Darnaway Forest, Morayshire, 11.7.61.

Orthoperus mundus Matth. (CORYLOPHIDAE). Two specimens from the vicinity of Cadzow Castle, Hamilton, Lanarkshire appear to be of this species—one from beech litter, 1.9.57, the other from mixed litter, 2.2.58.

Metophthalmus serripennis Broun (LATHRIDIIDAE). An additional locality for this introduced New Zealand species is the lower end of the Fiddler Glen, Crossford, Lanarkshire, where specimens were found in an old decaying log-pile on 3.5.64.

Cerylon fagi Bris. (CERYLONIDAE or COLYDIIDAE). Specimens were found in a sample of fungus infested bark from Milton Lockhart, Carluke, Lanarkshire, on 29.3.64.

***Cis bilamellatus** Fowl. (CISIDAE). Several adults of this, in a fungus (?*Stereum* sp.) on dead Beech at Cambusnethan Priory, Wishaw, Lanarkshire represent an interesting addition to the Scottish fauna. The species is of Australian origin, and its progressive spread in Britain has been studied by Paviour Smith (1960).

Triphyllus bicolor F. (MYCETOPHAGIDAE). An adult was found in fungus infected beech bark at Cambusnethan Priory, Wishaw, Lanarkshire, on 14.3.62, (cf. Crowson, 1961).

Tetratoma desmaresti Latr. (TETRATOMIDAE or MELANDRYIDAE). Data on this species have been published elsewhere (Crowson, 1963).

Oncomera femorata F. (OEDEMERIDAE). Larvae of this were found in fairly thick dead ivy stems at Portencross, West Kilbride, Ayrshire on 9.10.62, and others together with a pupa in similar circumstances at the same locality on 25.8.63 by myself and F. A. Hunter.

Clytus arietis L. (CERAMBYCIDAE). A new locality for this is Milton Lockhart, near Carluke, Lanarkshire, where a larva was found in a sound dead part-burnt standing oak on 29.3.64.

Pogonochaerus hispidulus Pill. et Mitt. (CERAMBYCIDAE). During the Andersonian zoological excursion to Coilsholme Wood, Failford, Ayrshire on 9.6.62 I found a larva of this in a

dead oak branch. The few previous Scottish records include one from flood-drift near Forres, Morayshire (Chitty, 1893)—probably derived from Darnaway Forest, a few miles upstream.

***Choragus sheppardi** Kirby (ANTHRIBIDAE). Several adults of this were beaten from hazel in the Fiddler Glen, near Crossford, Lanarkshire on 24.7.62. A small Anthribid larva from a dead ivy stem at Dumbarton Castle, Dunbartonshire is probably of the same species. In Sweden (Palm, 1959) it is restricted to the deciduous woods of the south.

Rhynchites aeneovirens Marsh. (ATTELABIDAE or CURCULIONIDAE). Several Rhynchitine larvae, found by my wife E. A. Crowson, in cells in moss under oaks at the lower end of the Fiddler Glen, Crossford, Lanarkshire are probably assignable to this species.

***Caulotrumpis aeneopiceus** Boh. (CURCULIONIDAE). My previous record of *Rhyncolus lignarius* from Portencross (W. Kilbride, Ayrshire) was based on mis-identified specimens of this species (see Viedma, 1963).

***Trachodes hispidus** L. (CURCULIONIDAE). An adult of this, beaten from oak foliage at Garroch, Dalry, Kirkcudbrightshire, on 29.6.62, was a notable addition to the Scottish fauna. Larvae and a pupa of the same species had been found at Airds of Kells, New Galloway, Kirkcudbrightshire, on 28.6.62, under bark of dead fallen beech; further adults were found at Wood of Cree, Minigaff, Kirkcudbrightshire, on 1.10.62. The larvae have been described by M. de Viedma (1963). In Sweden (Palm, 1959) the species extends north of the limits of oak but is recorded from deciduous trees only.

Acalles turbatus Bohem. (CURCULIONIDAE). Additional localities for this species are Portencross, W. Kilbride, Ayrshire (larvae in dead ivy stems, 9.10.62) and Nun Mill, Kirkcudbrightshire (adult in dead ivy stems, 27.9.62, M. de Viedma).

Rhynchaenus avellanae DONOV. (CURCULIONIDAE). One adult, beaten from oak foliage at Rosdhu, Luss, Dunbartonshire on 19.5.62.

Balaninus villosus F. (CURCULIONIDAE). An additional locality is Cambusnethan Priory, Wishaw, Lanarkshire, where an adult was beaten from flowering oaks on 20.5.62.

Brachysomus echinatus BONSD. (CURCULIONIDAE). Adults in herbage under trees, Avon gorge, near Bo'ness, W. Lothian, 3.6.62.

***Dryocoetes alni** Georg. (SCOLYTIDAE). Adults of this were present in bark of dead standing alders at Coilsholme Wood, Mauchline, Ayrshire, on 20.5.64.

GENERAL OBSERVATIONS

These records may serve to draw attention to two interesting Lanarkshire localities—the Cambusnethan Priory and Milton Lockhart estates. Both have woodlands on sheltered southern slopes above the Clyde, most of the trees in both being no doubt of planted origin but relatively well placed for colonisation from adjacent remnants of natural woods; river-drifted material derived from gorges further up the Clyde may have contributed to the fauna of both places. The flightless species *Cephennum thoracicum* and *Trachodes hispidus* appear to belong in the group of species for which the Southern Uplands have acted as a distributional barrier—if either species occurred in the woods of the Clyde valley I should almost certainly have found it before now.

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SHORT NOTES

Compiled by R. MACKECHNIE

An invitation to members and others having interesting information such as new stations (not necessarily new county records) for a species, unusual dates of flowering—early or late, rediscoveries of old records, occurrence of a species known to be rare in an area, note of an unusual colour form of a species, an interesting locality not usually visited by naturalists, ringed birds recovered, weather notes, additions to records in the *Atlas of the British Flora*, etc., etc.

The nomenclature of vascular plants should be as in Clapham, Tutin and Warbury, *Flora of the British Isles*, 2nd edition, 1962. Where a number of notes on the same topic are received they may be put together in a single narrative but acknowledgement will be made to each individual contributor.

Notes should be sent with as little delay as possible to Mr. R. Mackechnie, 9 Skirving Street, Glasgow, S.1.—*Editor*.

INVERTEBRATES

Fresh-water Mussel (*Anodonta cygnea* (L.)) in Renfrewshire

In the *Third Statistical Account of Scotland; Counties of Renfrew and Bute*, p. 29, it is suggested that the Fresh-water Mussel is now extinct in Renfrewshire.

During the autumn of 1960, Ryat Reservoir (Gorbals water-works) was emptied to allow of repairs to valves, etc. At that time I found these mussels in the half-dry mud, and counted 23. They were alive then, but I do not know if they survived until the reservoir re-filled. On the adjoining roadway there were several smashed shells; there were no signs of the occupants, so gulls may have been responsible. One mussel which I removed at the time survived until the frost of the winter 1960-61.

J. D. MORTON

FISH

Miller's Thumb (*Cottus gobio* (L.)) in Renfrewshire

The number of these fish in the small burn which drains the northern end of the Black Loch, Mearns, appears to have increased since they were first reported there in June, 1961, *Glasg. Nat.*, 18, 213).

H. GEMMELL

Scarcity of the Minnow (*Phoxinus phoxinus* (L.)) in the Glasgow area

Visits during the summer of 1963 to small burns where Minnows were formerly abundant have shown this fish to be

now very scarce. In early May I collected a few adults from one locality, but on subsequent visits to this and other stations only a few young minnows were seen.

H. GEMMELL

The Painted Goby in the Clyde Sea Area

Although the Painted Goby, *Pomatoschistus pictus* (Malm), is probably a common sublittoral fish around the British coasts, there are relatively few published records of this species. From the west coast of Scotland the only record is that by Elmhirst (*S.M.B.A. Ann. Rep.*, 1924-25, 13-14; *Scot. Nat.*, Sept.-Oct. 1926, 151-158) of an example taken north of Ardentinny (on the western shore of Loch Long, Argyllshire) at a depth of 8 fathoms (14.6 m.).

On 21st January, 1964, a specimen, 36 mm. in standard length (total length 42 mm.) was taken by beam trawl in Brodick Bay, on the eastern coast of Arran, in 12 fathoms (21.9 m.). The bottom deposit in Brodick Bay is of very coarse sand, which is the habitat apparently preferred by this species (Holt, E. W., and Byrne, L. W., *Rep. Sea. Inl. Fish. Ireland*, 1901, Pt. 2, 37-66 (1903)). Methods of age-determination and gonad classification already established for *P. pictus* from Manx waters (Halliday, R. G. and Miller, P. J., unpublished) make it possible to recognise this specimen as an O-group male (i.e. in its first winter of life) at an early stage of ripening. Sampling with suitable gear would no doubt produce many more specimens of this goby from the Clyde Sea area.

In general distribution, *P. pictus* is known in the Eastern Atlantic boreal region from Norway to Brittany (Duncker, G., *Tierw. N.-u. Ostsee*, 12g, 121-148, 1928), and has been recorded from the Adriatic (Ninni, E., *Mem. R. Com. Talassogr. Ital.*, No. 242, 169 pp., 1938). On the east coast of Scotland, the species has been reported from the Firth of Tay (Alexander, W. B., *Trans. Perthshire Soc. Nat. Sci.*, 9, 35-41, 1932), and Aberdour Bay, Aberdeenshire (Rae, B. B., and Wilson, E., *Scot. Nat.*, 68, 23-38, 1956).

R. G. HALLIDAY

BIRDS

Collared Turtle Dove (*Streptopelia deaoccto* Friv.) in Renfrewshire

We first heard the distinctive call of this bird on July 14th, 1963, at Bridge of Weir. Three weeks earlier it was first noted in the same area by Mr. W. Wild. The calls have been heard right up to the time of writing (3.11.63), and three birds have

been observed feeding on a lawn. This is one of the first recorded appearance of the species (native in Central Europe) in Renfrewshire.

E. R. T. CONACHER

Hen Harrier (*Circus cyaneus cyaneus* L.) in Argyll

A male Hen Harrier was seen on 9th March, 1963, near Dunadd, Kilmichael Glassary. The bird flew low over a turnip field, in which Grey Geese were feeding. The geese took no notice of the harrier, which alighted on a turnip stump; it remained there for a long time, giving us an excellent view.

E. R. T. CONACHER

Greenland Wheatear (*Oenanthe oenanthe leucorrhoa* Gm.) in Glasgow

On the evening of 20th June, 1963, at 9.15 p.m., I saw a female Wheatear in the car park at the playing fields of Glasgow High School, adjacent to Munro Rd. Lane. The bird remained in the area until dusk, within 15 to 30 yards of me, and I had prolonged observation of it through binoculars. The identification was confirmed by my wife and by John C. Cunningham, Esq. The large size, upright stance, deep buff underparts and date of observation suggest that the bird was of the Greenland race. Strong westerly gales preceded the observation. When I looked for it on the following morning the bird had gone.

S. T. S. SKILLEN

(On 3.10.63 Mr. Skillen wrote that he had on that day seen another Wheatear (also a female) in the back garden of a demolished bungalow in Chamberlain Road. There was, on this occasion, insufficient evidence to establish the race to which the bird belonged, but the garden is adjacent to Glasgow Academy playing fields, and Mr. Skillen suggests that the two records may indicate regular use of playing fields in the area by migrating Wheatears.—R.M.)

Mute Swans (*Cygnus olor* (Gm.)) in Queen's Park

During the spring of 1962 a pair of Mute Swans attempted, unsuccessfully, to breed beside the larger pond in Queen's Park. What appeared to be the same pair of birds repeated the attempt on the same site in 1963. Eight eggs were laid and seven cygnets hatched on 12th June, 1963; all survived and are now (November, 1963) as large as their parents. So far as I have been able to discover, this is the first record of this species nesting in the Park.

R. MACKECHNIE

MAMMALS

“ How clever are mice ? ”

(The incidents related here occurred in the house of Dr. R. McG. Carlaw at Comrie, Perthshire; this note is condensed from a more detailed account, accompanied by photographs, sent by Dr. Carlaw to Dr. Hutchinson.)

“ In this old, stone-built house ” Dr. Carlaw writes, “ we have an attic cupboard open at its back to the inaccessible remoteness of rafters and cobwebs. Here my wife places her potted bulbs in autumn, until they are ready to be brought down to the warmth and light of the living rooms. During the winter months small numbers of mice (varying in type from house mice to field mice, and even the odd shrew) occasionally find their way to these upper regions and, unless liquidated quickly, nibble and destroy the bulb shoots. To combat this nuisance I have, for a number of years, placed an oatmeal/warfarin rodent poison (‘ Swarfega ’) beside the flower pots, and in this way have successfully prevented damage to the bulbs.”

During the past autumn a 2 oz. tobacco tin was placed in the cupboard. A few weeks later it was noticed that the tin had disappeared; it was never found. A second tin also vanished within a few days, the only apparent explanation being that the tins had been “ dragged by some animal to a distant corner of the roof, or slipped down a hole in the wall rubble ”. Mouse droppings were the only evidence of animal activity, but it “ seemed impossible that a single mouse could have moved so relatively cumbrous a container over the rough floor surface ”, thus raising questions of cooperation between mice and of motive.

Poison was now put on a china plate and by the following day it appeared that some had been eaten. But a few days later wood chips and other debris were found covering the bait. The rubbish was removed, but by next day an even larger quantity covered the bait; this too was removed. Later it was found that the whole plate was “ entirely covered with a neatly-built pyramid of assorted refuse, including wood chips (some quite large), dead leaves, sparrows’ egg-shells and feathers. Although these items must have been carried several feet from the dark recesses of the rafters, not one had been left on the cupboard floor; each piece was carefully stacked symmetrically on top of the plate.” There was “ no sign of nest-building, and the poison bait underneath was apparently intact ”.

Dr. Carlaw concludes: “ Thoroughly mystified, I now set two ‘ back-break ’ traps with cheese bait, and that night caught two ordinary house-mice in sleek and excellent condition. Since then there has been no fresh manifestation, so

that it seems almost certain that these two small creatures were the sole agents of activity.”

Dr. Carslaw's photograph shows the two mice, rather unequal in size, suggesting an adult and a juvenile.

R. MACKECHNIE

FLOWERLESS PLANTS

New Moss records

(i) *Orthodontium lineare* Schwaegr. in Dunbartonshire.

On a bryophyte-collecting trip with Mr. Clear we found this moss, a new county record, at Balloch Park. The species, which appears to be spreading, is now recorded for nine Scottish vice-counties, and should be looked for in others.

(ii) *Tortula ruraliformis* (Besch.) Rich. and Wall. in Argyll.

Found on sandy soil near Easdale, Island of Seil, by A. McG. Stirling and myself; new to V.-c. 98.

G. RODWAY

Calcareous mosses in an unusual habitat

During a bryological excursion in 1963, members of the party were shown an interesting habitat for calcareous mosses. This was the refuse dump from an old lime-kiln at the side of the Crow Road, just beyond Lennoxton (V.-c 86). In this artificial habitat occurred such uncommon species as *Entodon concinnus* (De Not.) Paris and *Rhytidium rugosum* (Hedw.) Kindb.; the latter was of especial interest in that it is unknown elsewhere in the neighbourhood, the nearest known stations being on Ben Lomond (an old record) and in the Ochil Hills. Other calcicolous species seen in this habitat were *Ctenidium molluscum* (Hedw.) Mitt. and *Encalypta streptocarpa* Hedw., both in fine condition.

G. RODWAY

FLOWERING PLANTS

Shepherd's Cress (*Teesdalia nudicaulis*) in an unusual habitat.

In 1948 I was surprised to find a considerable quantity of Shepherd's Cress on a pit bing near Dalry (V.-c. 75). Since then it has appeared on two other bings, lying a quarter of a mile to the north and east of the original station. The usual habitat of the species is sandy ground on the coast; the shale on the bings probably offers similar conditions of quick drainage.

The dispersal agent may be birds; like many other members of its family this little plant spreads rapidly once established.

R. PRASHER

White Melilot (*Melilotus alba*) at Carmyle

In the *Flora of the Clyde Area*, pp. 106-7, the author states: "*Melilotus alba* and *M. arvensis* seemed to have become fully established at Tollcross, but the station has been destroyed".

M. alba still grows at Carmyle Avenue (V.-c. 77), which is not quite in Tollcross village, but is reasonably near. I first saw it there in 1956, at which time I reported it to the late Dr. Patton. He was of the opinion that the station was the one referred to in the *Flora*. At present the plant is well established, and unless the site is disturbed looks like maintaining its position.

J. D. MORTON

Salad Burnet (*Poterium sanguisorba*) in Renfrewshire

Several plants of this species were found on 8th May, 1963, by members of the Extra-mural Botany class, growing on the embankment of a disused railway north of Barrhead (V.-c. 76). Later (20th July, 1963), I saw the same plants in fruit.

In the *Flora of the Clyde Area* the species is referred to (p. 128) as "very rare"; two stations are given—at Tinto (D. Patton) and at Dalmuir (L. Watt). I have no knowledge of any recent records.

B. W. RIBBONS

Scots Lovage (*Ligusticum scoticum*) at St. Cyrus, Kincardine

Plants of this species were seen on 26th June, 1963, growing among marram grass; it appears to be new to St. Cyrus (V.-c. 91).

B. W. RIBBONS

Woody Nightshade (*Solanum dulcamara*) with white flowers.

One station for this form of Woody Nightshade was destroyed when the petrol station at Crossmyloof (V.-c.76) was built; another was recently discovered near the eastern (Shawholm) entrance to Pollok Estate (V.-c. 76). In the *Flora of the British Isles* (1962, p. 670) the corolla is described as "very rarely white".

R. MACKECHNIE

"Shaggy Soldier" (*Galinsoga ciliata*) in Ayrshire

Mr. Hugh A. McAllister collected a specimen of this plant, in a municipal garden at Beith (V.-c. 75). C. E. Hubbard, of Kew, who kindly confirmed the identification, wrote: "a rapidly increasing South American adventive", (per Dr. I. M. Case).

The only other Clyde Area records I know of are from Kilmarnock in 1957 (*Proc. B.S.B.I.* 2, 1957, p. 254), and from Maybole in 1963 (Mrs. Wilson in correspondence); in both cases the plant is believed to have come in with garden plants from nurseries.

R. MACKECHNIE

A Hawkweed (*Hieracium praealtum*) new to Scotland

I first saw this plant in a hedgerow at Crookedholm near Hurlford (V.-c. 75), in June, 1963; later on the same day I found it again, this time in considerable quantity, about 3 miles further east, spreading over an old pit bing on the right bank of the River Irvine. Members who attended the Botanical Section's outing to Loudon Castle on 3rd August, 1963, were able to see the plant in fine condition in this second station.

R. PRASHER

Dr. Cyril West, to whom we are indebted for the final determination, writes: "I believe this is the first time it has been recorded in Great Britain north of Bucks. It is widely distributed in south-west Devon, where in certain areas it is abundant".

The species is fully described in H. W. Pugsley's *Prodromus of the British Hieracia*, p. 326, with the information that G. C. Druce discovered it in 1899 near Hanslope, Bucks. At the time of publication of the *Prodromus* (1948, in *J. Linn. Soc. (Bot.)* 54) it had not been recorded elsewhere in Britain.

R. MACKECHNIE

"Floating Water-Plantain" (*Luronium natans*) in Argyll

During the excursion on 2nd June, 1963, a party of Andersonians and some B.S.B.I. members visited the fresh-water loch in Glen Creran (V.-c. 98). Along the north shore, which is largely free of trees, many plants of common Water-Plantain (*Alisma plantago-aquatica* L.) were seen. Near a small sandy spit were some plants with leaves which were not characteristic of that species. At that season determination was not possible, but Mr. Kenneth, who had first noticed the leaves, undertook to return later in the year. He did so in August, when the plants proved to be *Luronium natans*; they appear to be restricted to a relatively small area and the species seems to have been so far unrecorded for Argyll.

A. A. SLACK

“Narrow Water-Plantain” (*Alisma lanceolatum*) in Lanarkshire

Alisma lanceolatum was found growing in considerable quantity in the River Clyde opposite Carmyle in 1962, and in a second station some distance from the north bank in 1963 (both in V.-c. 77).

This species has only been twice previously recorded in Scotland during the present century, near the east coast and in Skye. Old records exist for Lochend, near Edinburgh (1839) and for Tiree (1899).

At a casual glance the plant appears very similar to common Water-Plantain (*A. plantago-aquatica*), the most obvious difference being its lanceolate leaves. Other differences are pink instead of pale lilac flowers and the style inserted near the top of the fruit, unlike the common species, where it arises below the middle. Clapham, Tutin and Warburg's *Flora of the British Isles* (1962) states that the flowers open from 9 a.m. to 2 p.m., in contrast to those of *A. plantago-aquatica* which open from 1 p.m. to 7 p.m. This is not strictly correct, and from somewhat limited observations I have concluded that flower-opening appears to be influenced not only by time of day, but by the prevailing weather and possibly by the soil/water relationship. Entire plants taken home and placed in water out of doors, for convenience of observation, seemed to conform roughly for a day or two and then become very erratic in opening and closing their flowers. Very variable weather at this time was probably responsible as this irregularity was also observed amongst plants in their natural habitat in the second station. It is hoped to make a more thorough investigation into these relationships during 1964.

Thanks are due to R. Mackechnie for the original confirmation of identity in 1962, and to Miss C. W. Muirhead, Edinburgh (per B. W. Ribbons) for further confirmation in 1963. A specimen is lodged in the herbarium of the University of Glasgow.

ALFRED A. PERCY

Sedges at Possil Marsh

Small colonies of Hairy Sedge (*Carex hirta*) and of “Lesser Panicked Sedge” (*C. diandra*) were noted at the marsh during the Botanical Section's excursion on 28th June, 1963. This seems to be the first recorded occurrence of Hairy Sedge at Possil (V.-c. 77), the other species is mentioned by Patton and Rennie (*Glasg. Nat.* 17, 160) in a record dated 1883.

R. MACKECHNIE

“Bushgrass” (*Calamagrostis epigeios*) in Argyll

This grass, which is a very local species in Scotland, has recently been discovered in four localities in Knapdale and one

in the Craignish area of mid-Argyll. The favourite habitat appears to be what may best be described as low "grass-cliff", marking the 25 ft. raised beach. The Craignish occurrence constitutes a new record for V.-c. 98.

A. McG. STIRLING

Flora of a Serpentine outcrop in Glendaruel, Argyll

Serpentine rock outcrops extensively between 1000 and 1200 ft. altitude on the high ground to the south-west of Kilbridemore, Glendaruel (V.-c. 98).

A visit to this area on 7th July, 1963, revealed the occurrence of several interesting plants. The two most noteworthy species were Mountain Avens (*Dryas octopetala*) and Northern Rock-cress (*Cardaminopsis petraea*); this is a new locality for both species, though they occur elsewhere in the vice-county. Other interesting species seen in the area were "Green Spleenwort" (*Asplenium viride*), "Alpine Meadow-rue" (*Thalictrum alpinum*), "Kidney Vetch" (*Anthyllis vulneraria*) and "Hairy Oat" (*Helictotrichon pubescens*). There were also several plants particularly typical of serpentine outcrops:—

Sea Campion (*Silene maritima*), Yellow Mountain Saxifrage (*Saxifraga aizoides*), Sea Plantain (*Plantago maritima*) and Broad-leaved Cotton-grass (*Eriophorum latifolium*).

A. McG. STIRLING

New localities for Renfrewshire plants

Information relating to these hitherto unrecorded localities for some local plants has been almost entirely compiled by Mr. J. D. Morton; most of the records are his own, and where another is responsible this is indicated by initials in brackets following the record: Miss Flora Black (F.B.), Miss Elizabeth Conacher (E.R.T.C.), Mrs. Elder (F.M.E.), Mrs. May Little (M.L.) and Mr. Ribbons (B.W.R.). Mr. Morton has also supplied additional information, such as map-references and nearest recorded stations for most of the plants; I shall be pleased to make this material available on request. (R.M.)

Weld (*Reseda luteola*): Colville-Clugston brickworks, August, 1962.

Common Melilot (*Melilotus altissima*): Barr Loch, August, 1963, (M.L.).

Star Flower (*Astrantia major*): Pollokshields West Station, June, 1963.

Masterwort (*Peucedanum ostruthium*): near Jock's Craig, August, 1962.

- Giant Hogweed (*Heracleum mantegazzianum*): Pollokshields West Station, June, 1962; R. Cart at Pollokshaws, May, 1961.
- Lesser Wintergreen (*Pyrola minor*): Craigbog Quarry, August, 1963.
- Cowslip (*Primula veris*): Glentyan Estate, June, 1961 (B.W.R.).
- Chickweed Wintergreen (*Trientalis europaea*): Torr Hall, Bridge of Weir, June, 1961 (F.B.).
- Yellow Archangel (*Galeobdolon luteum*): Capelrig, July, 1963.
- Giant Bell-flower (*Campanula latifolia*): Duchal, Kilmacolm, May, 1963 (F.M.E.); Rouken Glen, June, 1961; Craigbog Quarry, August, 1963; Kittoch Water, August, 1962.
- Guelder Rose (*Viburnum opulus*): Giffnock, June, 1963.
- Scarlet Elder (*Sambucus racemosa*): Armadale, Skye, July, 1962; Duchal, Kilmacolm, May, 1963.
- Teasel (*Dipsacus fullonum*): Crossmyloof Ice Rink, August, 1963; Yorkhill Basin, September, 1963.
- "Trifid Bur-marigold" (*Bidens tripartita*): Lochwinnoch (E.R.T.C.); Ryat Dam, Barrhead, 1960.
- Melancholy Thistle (*Cirsium heterophyllum*): Uplawmoor, June, 1963.
- Star of Bethlehem (*Ornithogalum umbellatum*): near St. Fillan's Church, Kilellan, June, 1963 (B.W.R.).
- Solomon's Seal (*Polygonatum multiflorum*): Southbar, May, 1962 (E.R.T.C.); Rouken Glen.
- Broad-leaved Helleborine (*Epipactis helleborine*): Craigbog Quarry, August, 1963 (M.L.); Maxwell Park Station, 1961; Rouken Glen, 1963; Pollok Estate, 1963; Bothwell Castle, 1963.
- Cuckoo-pint (*Arum maculatum*): Church Street, Kilbarchan, June, 1963.

I am very grateful to those who have taken the trouble, sometimes considerable, to supply the material necessary to launch what we all hope will be a valuable permanent feature of our publication.

It would be specially helpful if section conveners and leaders of excursions would keep this feature in mind when making their reports; we must in future depend much on our own field meetings for material. I hope that they will be particularly watchful for the appearance of species new to an area, so that we can record not only their arrival but also their success, or otherwise, in establishing themselves.

R. MACKECHNIE

OBITUARIES

JEAN C. D. CRAIG, B.Sc., A.R.I.C.

(PLATE III)

By the death of Miss Jean Craig on the 9th February, 1964, the Society lost one of its more prominent and active members.

On the morning of 22nd November, 1963, as the result of a fall at her own door Miss Craig sustained a fracture of the skull of such severity that deep cerebral concussion supervened. She was removed as quickly as possible to Killearn Hospital where she lay unconscious for over eleven weeks before her injury proved fatal.

Miss Craig was principal science teacher in the Glasgow High School for Girls.

In 1935 she joined the Glasgow Andersonian Natural History and Microscopical Society as it was then named and from the first became a regular attender at meetings and field excursions. By 1942 she had been elected to the Council and on the resignation of Mr. James Anderson in 1945 she was persuaded to assume "temporarily" the office of Secretary until a suitable successor could be found. Her success in this post prolonged the temporary period for ten years until 1955. These were critical years for the Society but it flourished. The highlight of the period was the celebration of the centenary of the old Natural History Society of Glasgow, the senior of the societies which amalgamated in 1931. In the arrangements for the celebration Miss Craig played an important and effective role.

While taking a general interest in all aspects of Natural History she found her greatest pleasure in Geology. She was an active member of the Geological Section to which she contributed some papers.

If the Society can continue to recruit members to whom its well-being is of as much concern as it was to Miss Craig it has nothing to fear for the future.

R. H. JOHNSTONE

FLORA M. ELDER, B.Sc.

(PLATE III)

Quite suddenly on 14th January, 1964, Mrs. Elder, a member of Council and a former Librarian, died and natural history in Scotland thereby suffered a great loss. Mrs. Elder was a graduate in Chemistry of the University of Glasgow and had recently become Senior Woman Adviser at Rutherglen Academy. She took up the study of plants in middle life and quickly mastered the complexities of botanical nomenclature and classification. She joined the University Extra-Mural

PLATE III



JEAN C. D. CRAIG



FLORA M. ELDER



Block by courtesy of the Joint Editors of the Hutcheson's Girls' Grammar School Magazine.

The Misses Sheila Ross, Katherine Young, Lorna McDougall and Jean Harvey
above Keppel Pier.

*NATIONAL NATURE WEEK EXCURSION TO THE ISLE OF GREAT
CUMBRAE, 19th MAY, 1963.*

Photographs by courtesy of The Glasgow Herald.

The Misses Catherine McFadzean, Dorothy Pollitt and Grace Kelly.



Department's classes in Botany, and was, up to the end of 1963, still attending informal meetings which had arisen from those classes.

Her knowledge coupled with her charming personality made her much sought after as a leader of botanical excursions both for the Andersonian Naturalists of Glasgow (whom she also served as Librarian, 1957-62) and for the Botanical Societies of Edinburgh and of the British Isles (of whose joint Scottish Committee she was still Field Meetings Secretary when she died). She loved living things and there are many, adult as well as young, in whom she kindled a similar love. The loss in the prime of life of one so agile and vigorous both mentally and physically, is a set-back which Scottish botanical exploration and field work can ill afford.

B. W. RIBBONS

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY

8TH JANUARY, 1963

Mr. Basil W. Ribbons presided over a meeting held in the Glasgow Art Gallery and Museum, Kelvingrove. About 50 were present.

Two new members were elected: Mrs. Mabel McLachlan, 77 Garrowhill Drive, Baillieston; and Miss Hazel P. Wilkinson, B.Sc., 12 Queen Margaret Drive, W.2.

Five films were shown: *The Dragon of Komodo*, *Protozoa*, *Limestone in Nature*, *Bats*, *The Alder Woodwasp and its Insect Enemies*.

16TH JANUARY, 1963 *

Mr. Basil W. Ribbons presided over a meeting held in the Department of Botany, University of Glasgow. About 40 were present.

Dr. F. H. Perring, Director of the B.S.B.I. Distribution Maps Scheme, gave an illustrated lecture, "Further Studies in the Distribution of the British Flora".

12TH FEBRUARY, 1963

The thirty-third Annual General Meeting was held in the Department of Botany, University of Glasgow. About 55 members were present and the President, Mr. Basil W. Ribbons, presided.

Reports of activities during 1962 were read, new office-bearers were elected (see page 388) and appointments made by Council were announced. The Report of Council stated that the total membership was 204 (24 joined, 8 resigned and 6 were removed from the Roll); eleven meetings were held with an average attendance of 58; twenty-nine excursions took place (3 general, 16 Botanical, 7 Zoological, 2 Ornithological and 1 Geological); the Council met three times and the Executive Committee ten times. Mr. Basil W. Ribbons presided at the Annual Dinner held on 13th December, 1962, in the University of Glasgow in honour of Professor K. W. Braid, O.B.E., ex-President. The President and Council gave a party for new members on 13th February, 1962. Two issues of the Bulletin were sent to members during the year.

Ten new members were elected: Peter Barr, 62 Owen Avenue, Murray 12, East Kilbride; Frank Cowan, 2 Lime Street, W.4; Allan F. C. H. Doig, Mollance, Castle Douglas; Charles Doyle, M.A., 66 Brunton Street, S.4; William W. Fletcher, B.Sc., Ph.D., F.L.S., Royal College of Science and Technology, C.1; Frank Gilmour, 446 Parkhouse Road, S.W.3; Howard W. Hall, D.A., 19 Lindsay Drive, W.2; Miss Marion Laird, 14 Haldane Place, East Kilbride; Peter S. Maitland, B.Sc., Woodside, Woodlands Street, Milngavie; and John Rieley, 6 Southpark Terrace, W.2.

Two family members were elected: Mrs. Diana Hall, 14 Lindsay Drive, W.2; and Mrs. Margaret Stove, 37 Stamperland Avenue, Clarkston.

Exhibits were shown by Miss E. R. T. Conacher (work of bird artists referred to in the lecture given on 9th October, 1962), Mrs. A. Cross and Mr. P. Duncan (postage stamps relating to natural history).

12TH MARCH, 1963

Mr. Thomas Robertson presided over a meeting held in the Department of Botany, University of Glasgow. About 60 were present.

Eight new members were elected: David Betteridge, 5 Lilybank Gardens, W.2; George Bond, Ph.D., D.Sc., 23 Westland Drive, W.4; Ronald M. Dobson, M.A., Ph.D., 664 Clarkston Road, S.4; Hugh Y. Elder, B.Sc., 32 Burnside Road, High Burnside; John M. Findlay, 11 Westbank Quadrant, W.2; Philip Gaskell, M.A., Ph.D., Maclay Hall, 17 Park Terrace, C.3; Miss Janet McBain, 27 Mingulay Crescent, N.Z.; and Mrs. Ellison Young, M.A., 2 Belhaven Terrace, Rutherglen.

Dr. S. A. Hutchinson of the University of Glasgow gave an illustrated lecture on Antibiotics and Growth Stimulants.

23RD APRIL, 1963

Dr. Blodwen Lloyd presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 65 were present.

One new member was elected: David Cathro, 221 Main Street, Bellshill. One junior member was elected: Peter Mellon, 4 Morrin Square, C.4.

Dr. Elsie Conway of the University of Glasgow gave an illustrated lecture entitled "A Botanist on British Shores".

Mr. A. McG. Stirling exhibited *Polypodium interjectum*, *P. vulgare* and *Petasites albus*.

NATIONAL NATURE WEEK, 18-25TH MAY, 1963. (PLATE IV).

The Andersonian Naturalists of Glasgow played a prominent part in arranging most of the following events: Natural History Book Exhibition in the Mitchell Library (543); Wildlife and Natural History Art Exhibition in the Art Gallery and Museum, Kelvingrove (14,000); Residential Course on Spring in the Highlands at Garth Field Studies Centre (2); Scottish Opening Ceremony by Sir Arthur Duncan (120); Lecture by Professor W. H. Pearsall, F.R.S., on Nature Conservation and the Future (91); Lecture-Demonstration by Len Fullerton on A Nature Artist at Work (44); Films, *The Return of the Osprey* and *Highland Birds* presented by George Waterston (294); Prize-winning films from the B.B.C.—Council for Nature, 1961 and 1963 Competitions, *The Alder Woodwasp and its Insect Enemies*, *Highland Heronry* and *The Wood* (300); Excursions to Island of Great Cumbræ (42) (Plate IV), Lochwinnoch (15), Bothwell Castle Grounds (70), Loch Lomond and Islands (42), and Beinn Laoigh (21); University Study School, 27-31 May on Scotland's Natural Heritage—Destruction or Conservation? (60); and a Lecture for young people by Professor C. M. Yonge, F.R.S., on A Biologist in East and Central Africa (230). The figures in brackets give the numbers attending.

11TH JUNE, 1963

Mr. A. M. Maclaurin presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 36 were present.

Eight new members were elected: Professor Percy W. Brian, Sc.D., F.R.S., Clauchlands, Charlotte Street, Helensburgh; Mrs. Joan W. Clark, 3 Sydenham Road, W.2; Nigel Grant, M.A., Ed.B., 4 Athole Gardens, W.2; Mrs. Elizabeth Gray, 60 Craigpark, E.1; Mrs. Irene L. Shearer, B.Sc., Welbrae Park, Strathaven; Miss M. E. Tod, B.Sc., c/o Evans, 253 Renfrew Street, C.2; Miss M. Young, B.Sc., Dip.Ed., c/o Birrell, 29 Algie Street, S.2; and Rev. Peter Youngson, The Manse, 140 Lochend Road, E.4.

One junior member was elected: James P. Brock, 40 Egilsay Place, N.2.

Two family members were elected: Mrs. Jean G. Findlay, 1 Westbank Quadrant, W.2; and Mrs. Margaret Semple, 27 Mitchell Drive, Rutherglen.

Mr. R. A. Crowson of the University of Glasgow gave an illustrated lecture on Beetles in Scottish Oakwoods.

There was a geological exhibit from Mrs. A. Cross.

10TH SEPTEMBER, 1963

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 60 were present.

Five new members were elected: Leonard Aldebert, M.A., 6 Barrachnie Road, Baillieston; Alexander Harrold, Woodlands Gate Hotel, 10 Lynedoch Place, C.3; Miss Ann McGregor Hunter, 31 Thornwood Place, W.1; E. L. Sharp, M.A., 74 Hilton Road, Bishopbriggs; and Reginald Ernest Way, 3 Woodlands Terrace, C.3.

One junior member was elected: Robert Smith, 35 Fernie Street, N.W.

Eleven school members were elected: Caroline Frew, 20 Lochbroom

Drive, Newton Mearns; Doreen George, 59 Campsie Gardens, Clarkston; Jean Harvey, 442 Kilmarnock Road, S.3; Sandra F. Henderson, 93 Merton Drive, S.W.2; Rosalie B. Rawson, 62 Newlands Road, S.3; Judith Reid, 15 Carmunnock Road, Busby; Sheila M. Ross, 1 Victoria Crescent, Clarkston; Patricia Watson, 11 Third Avenue, S.4; Moira Wright, 183 Brownside Road, Burnside; Katherine Young, 19 Netherpark Avenue, S.4; and Hazel Zuckerman, 24 Merrylee Road, S.3.

Mr. J. Anthony of Edinburgh gave an illustrated lecture on the Flora of Sutherland.

Exhibits were shewn by Mr. A. A. Percy (*Alisma lanceolatum*—see page 383) and Mr. G. Rodway (distribution of *Hedwigia integrifolia* and *Dicranum strictum*, two rare British Mosses).

24TH SEPTEMBER 1963

Mr. C. E. Palmar presided over a meeting held in the Art Gallery and Museum, Kelvingrove. About 50 were present.

Nine members shewed colour transparencies and Mr. R. Prasher shewed an exhibit of living plants.

8TH OCTOBER, 1963

Mr. Basil W. Ribbons presided over a meeting held in the Department of Zoology, University of Glasgow. About 65 were present.

One new member was elected: Miss D. Pollitt, 4 Dolphin Road, S.1.

One junior member was elected: Desmond J. Norden, 52 Stoneyhurst Street, N.2.

Two school members were elected: Irene Hutton, 145 Duke's Road, Burnside; and Elizabeth Wright, 2 Blairbeth Terrace, Burnside.

The Earl of Cranbrook, C.B.E., of Saxmundham gave a lecture on Noctule Bats illustrated with a film.

Exhibits were shewn by: Mr. P. Mellon (fossils), Mr. A. McG. Stirling (*Mastigophora woodsii* from Glen Orchy), and Mr. E. C. D. Todd.

23RD OCTOBER, 1963

Mr. John Logan and Mr. Basil W. Ribbons presided over a joint meeting with the Glasgow University Botanical Society in the Department of Botany, University of Glasgow. About 110 were present.

Professor P. W. Brian, F.R.S., of the University of Glasgow gave an illustrated lecture on the Gibberellins.

There was an exhibit from Mr. E. C. D. Todd.

19TH NOVEMBER, 1963

Dr. Blodwen Lloyd presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 40 were present.

One new member was elected: Mrs. S. M. Clarke, B.Sc., 15 Spey Road, Westerton.

One family member was elected: Mrs. Sheila Maclaurin, Oldhall House, Kilmacolm.

Mr. T. Huxley of the Nature Conservancy, Edinburgh, gave an illustrated lecture on Conservation of Sites of Local Natural History Importance.

Exhibits were shewn by Mrs. A. Cross, Mr. J. D. Morton, Mr. G. Rodway (*Orthothecium rufescens* from Tyndrum), Mr. A. McG. Stirling and Mr. E. C. D. Todd.

10TH DECEMBER, 1963

Mr. Basil W. Ribbons presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 30 were present.

Two new members were elected: Kenneth A. Beckett, West Lodge, Botanic Gardens, W.2; and Mrs. Marion D. Mackie, 12 Milverton Road, Whitecraigs.

Five School members were elected: Kathleen Birrell, 29 Algie Street, S.2; Margaret B. Gilchrist, 3 Regent Park Square, S.1; Lorna M. H. Macfarlane, 37 Kingshurst Avenue, S.4; Valeri Parkinson, Abbotsford, Douglas Avenue, Giffnock; Molly Yuille, 42 Corrou Road, S.3.

Dr. Gordon Leedale of the University of Leeds gave the fourteenth Goodfellow Lecture on Viewing objects by the Light and Electron Microscopes (see pages 343-348) (and Plates I and II).

ACKNOWLEDGEMENT

The Council of the A.N.G. again wishes to acknowledge its indebtedness to the Royal Society for a grant of part of the cost of publishing the papers occupying pages 219-248 of *The Glasgow Naturalist*, Volume XVIII, part 5.

THE ANDERSONIAN NATURALISTS OF GLASGOW

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The Glasgow Naturalist

The Journal of the
ANDERSONIAN NATURALISTS OF GLASGOW

Volume XVIII, part 8, published June, 1966



Edited by B. W. RIBBONS

Assisted by

A. C. Crundwell, R. M. Dobson, R. Mackechnie

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MR. B. W. RIBBONS,
DEPARTMENT OF BOTANY,
THE UNIVERSITY,
GLASGOW, W.2.

An invitation to members and others having interesting information such as new stations (not necessarily new county records) for a species, unusual dates of flowering—early or late, rediscoveries of old records, occurrence of a species known to be rare in an area, note of an unusual colour form of a species, an interesting locality not usually visited by naturalists, ringed birds recovered, weather notes, additions to records in the *Atlas of the British Flora*, etc., etc.

The nomenclature of vascular plants should be as in Clapham, Tutin and Warburg, *Flora of the British Isles*, 2nd edition, 1962. Where a number of notes on the same topic are received they may be put together in a single narrative but acknowledgement will be made to each individual contributor.

Material for **SHORT NOTES** should be sent to the *Compiler*—

MR. R. MACKECHNIE,
9 SKIRVING STREET,
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THE GLASGOW NATURALIST

The Journal of the
ANDERSONIAN NATURALISTS OF GLASGOW

Vol. XVIII. Part 8

Published June, 1966

THE ECOLOGY OF SOME FRESH WATER AMOEBAE

By SISTER MONICA TAYLOR

Notre Dame College of Education, Glasgow

(Received 29th July, 1964)

Food supplies fundamentally determine the habitat of all animals, including the protozoa—no food, a desert. In the case of the Amoebae a pabulum which by its decomposition supplies food organism as prey, or the presence of micro plants which are able to utilize inorganic nutrients, must be present in the ecological niché. In this article the term "food chain" occurs frequently. The pabulum (i.e. hay water, wheat or rice grains) is decomposed by the putrifying bacteria. These feed minute flagellates, the μ flagellates, upon which large flagellates feed. In the ecological environments about to be described these flagellates are: *Menoidium curvatum*, *Chilomonas*, *Astasia* and *Euglena*. The decomposition products of the pabulum also nourish Ciliates such as *Colpidium* and *Paramecium aurelia*. Rotifers (i.e. *Philodina* and *Cathypna*) are at the apex of the food chain.

Also to be found, along with the Amoebae are *Diffugia* of various kinds, *Centropyxis* of various sizes, *Arcella*, *Trinema*, *Actinophrys* and moulds.

Nematodes are often abundant, as are the busy-body little gastrotrichs—especially *Tetradium podura*. *Trachelomonas* is sometimes an inhabitant. Among plants *Scenedesmus* is prolific, *Chlorella* a pest, though food for rotifers. Desmids and algal gametes appear occasionally.

It is a wonderful sight to see clusters of *Philodina*, reddish in colour, on the sides of a microaquarium, and to note amoebae making their way up to prey upon them.

This general description having been given, I should like now to deal with the individual amoebae.

The story of the ecology of *A. proteus* interests me. My colleague, Miss Jane O'Donoghue, came across a small pool of water which had collected at the base of a stack of peats in the bog land around Killarney. In it was a luxurious growth of bladderwort. She thought it would be interesting for our botany classes, so she filled a tin box to capacity and posted it

to Glasgow. On receiving it, I turned out the weed into a glass aquarium, added Glasgow tap water and put it in a sunny place. You will remember that this plant is copiously supplied with little bags, in which there is a secretion capable of digesting crustacea. I realized, of course, that it would be impossible to keep the plant alive for very long. Adhering to the bladderwort were specimens of the microscopic inhabitants of this bogland pool, which, having been kept moist, were alive and well, and so we were provided with an ecological study. As the bladderwort gradually disintegrated and died off, it provided pabulum for this microscopic life.

The greatest thrill for us all, however, when we examined the contents, was that the dominant species was *Amoeba proteus*, lovely large creatures, characterized by their coffin-shaped crystals. There were almost as many specimens of that beautiful freshwater oligochaete *Aeolosoma*. The plant and animal specimens were quite the most luxurious I have ever seen—flagellates, ciliates, rotifers of every variety, desmids, diatoms, small algae. *Arcella* and *Centropyxis* were likewise present.

It was, of course, impossible to maintain the environment of the bog pool exactly, so the more exotic inhabitants died out leaving those which could maintain themselves in spite of the *Amoeba proteus* predator.

As the nutrient of decaying bladderwort began to give out, a pabulum became a desideratum. To Libbie H. Hyman we are indebted for discovering the value of wheat grains for this purpose. Thus was established in Notre Dame the first ecological site of *A. proteus*. To this day their descendants flourish. Sub-cultures sent to Trinity College, Dublin, and to Cardiff are still in existence.

In connection with the account I have just given, two factors need emphasis:—

- (1) The acid character of the bog pond.
- (2) The fact that bladderwort eliminates crustacea. Crustacea are common to most pools. Amoebae cannot thrive in rivalry with these voracious feeders—they just die out. In the Killarney material the bladderwort had eliminated all the crustacea and so aided the successful establishment of the culture.

A. discoides is not quite so large as *A. proteus* but can be seen with a lens. Now, in Milngavie, a village about 700 feet above Glasgow, are two large reservoirs which supply Glasgow with water. The moorland drainage of the district around Milngavie is collected in Loch Tannoch to prevent contamination of the water supply. The level of Loch Tannoch is maintained by an overflow stream running into the tributaries of the Clyde. This stream flows through a hummocky moor and is rather swift flowing. But in one position, in a depression, it was banked up with stones and grass sods to make an oval

miniature pond. This seemed to offer an attractive ecological study. The slowing down of the stream caused the deposition of nutrients and facilitated the growth of microscopical life. Pond dippings revealed a rich culture of *A. discoides*: an ecological site where the dominant organism was an amoeba. Food organisms, similar to those required for all the large amoebae, were plentiful though not so rich in variety as in the Killarney site. Crustacea were absent, the reason being that a small hydra was plentiful in the pond.

The conditions making this ecological site so suitable for *A. discoides* were an acid water i.e., moorland water, and a predator for crustacea, in this case hydra. In miniature ponds kept at Notre Dame, *A. discoides*' life cycle has been worked out.

A. villosa, so-called because of a very characteristic tuft of protoplasmic villi on the posterior pseudopodium, occurs in muddy places around Loch Tannoch. It was first found in a similar ecological niche on Hampstead Heath by the earliest naturalists—1863. It feeds on a miscellaneous diet including diatoms. Often it has a picturesque appearance due to food vacuoles of an orange colour.

The story of the elucidation of the source of these orange masses is arresting. They occur in all the large amoebae but we could not find the organism responsible for them anywhere in the environment. Many years afterwards, as is narrated in a paper on *A. hugonis*, we had a luxuriant growth of *Euglena gracilis*, almost of pea soup consistency. This was allowed to die down, but during its deterioration it was seen that many euglenae had large brownish masses in them, of a colour resembling the eye spot. Professor Pringsheim investigated the phenomenon and concluded that the pigment was carotene; whether this carotene coated a substratum or not, he did not decide.

Now all the large amoebae eat euglenae, and these degenerate euglenae are evidently very popular. So at long last the problem was solved.

Specimens of *A. nobilis*, a multinuclear amoeba about same size as *A. proteus*, were often found along with *A. discoides* and *A. villosa*. It was the dominant organism in a small stream near a manure heap on a farm situated on Loch Long. But its ecological environment has not yet been completely worked out.

In my recent article to the *American Scientist*, I devoted much attention to *A. lescherae*, a large amoeba not much smaller than *A. proteus*. The reason for this is that I am convinced it is being confused with *A. proteus*. Although its diet is very similar, it is not a mud-inhabiting amoeba. It lives in floating vegetation and can undergo fission while balanced on a floating leaf. Decaying vegetation forms the pabulum for a chain of bacteria, flagellates, ciliates, rotifers,

crustacea. It was first discovered as a dominant organism in a mass of water weed from Aberystwyth which was matted together, partly decaying and free from crustacea. I found it burrowing into the weed, seeking rotifers. It was easily attuned to living in the laboratory in ecologically suitable surroundings. Its crystals are cubic shaped, and so it is easily distinguished from *A. proteus*. It provided me once with the most spectacular experience I have ever had of the ruthlessness of cyprids in devastating what might have been a rich collection of lovely microscopical organisms. Water weed had been collected from the River Leven which forms the outlet from Loch Lomond, and a few pieces of *Elodea* were washed and put into a micro-aquarium. In a short time *A. lescherae* appeared with its ecological accompaniment. Pabulum was added, since decaying *Elodea* is not a very nourishing water plant. But cyprids also appeared and grew so luxuriantly that they ousted everything. The whole experiment had to be abandoned for there was no predator present for the cyprids.

The ecological conditions obtaining in the pool which supplied us with our first catch of *A. kerrii* are interesting. A small pond just above high water mark, a short distance from the Marine Biological Station at Keppel contained much garden refuse. It was, therefore, a good breeding ground for crustacea. To a botanist, the plants growing in the deeper parts of the pond were interesting. Miss Maureen McAlister, therefore, brought back to Glasgow specimens of these which she put into Glasgow tap water. They died off eventually, and in the macerating weed was discovered later a good crop of an amoeba which was named to honour Sir John Graham Kerr. It was somewhat of a mystery that no crustacean appeared—a result to be greeted with gratitude, but the puzzle was to discover the predator. I wrote to my friends on the Millport Staff for more material. They, however, more accustomed to emptying a trawl net, sent such quantities of the debris from the pond that it was a problem to dispose of it all. But, in examining this material I discovered the predator of the crustacean, which normally should have been plentiful. Numbers of tiny newts had been trapped in the catch. These of course, in great contrast to frog tadpoles, devour crustaceans! So, *A. kerrii* became the dominant protozoan.

A. taylorae, visible to the naked eye, is to be found in muddy pools, in haunts similar to *A. villosa*, and like it, devours *Euglena gracilis fusca punctata*. But its ecology is not well known and has not yet been copied in laboratory cultures, one difficulty being that it requires a very gentle trickle of water. Its highly granular endoplasm, packed as it is with slender crystals, makes it a challenging amoeba.

A very distinguished amoeba, because in it was demonstrated for the first time a case of mitotic division of the

nucleus, is *A. dubia*. It lives on diatoms chiefly, and, therefore, its ecological surroundings must occur in shallow water exposed to plentiful sunlight, rich in diatom nutrients, not necessarily acid. We have never cultivated this very beautiful amoeba at Dowanhill, its diatom requirements being the obstacle. However, King's College, London, maintains, what is designate as *A. dubia* King's College Strain.

Mr. Bolton, a very famous naturalist of Birmingham, could up to 1918, always give a few dozen of *A. dubia* specimens on request.

The story of the ecology of *A. hugonis*, an amoeba not visible to the naked eye, but easily seen under a magnification of 120, that is 104×52 microns, is an interesting one. Debris, mostly the remains of a fertilizer thrown out from the gardens abutting the east side of the Loch Tannoch, was collected in May 1947, fed copiously with a chemical nutrient commonly used for plants, and left in the sunlight. Five months later the culture was swarming with *Euglena gracilis*, almost to a pea-soup consistency, many of these encysted, forming the well-known epithelium-like sheets. No sub-cultures were made, no further food was added; consequently, the euglenae developed the golden-brown bodies already described. An examination of the water revealed a most luxuriant crop of *A. hugonis* feeding copiously on *E. gracilis fusca punctata*. Later on, as the euglenae disappeared, ciliates developed, but for the time being an ecological situation consisting of two organisms only (!) had been created.

One of the loveliest of amoebae to my mind, is *A. radiosa*. It was beautifully described by Leidy, whose diagnosis was repeated by Pénard in 1902. In May, on a lovely afternoon, we were taken by friends to a historic village called Gartmore. In the grounds of Gartmore House, famous in Scottish history as having been the home of several royal brides, now alas a Borstal School, is a fish pond situated in the woods. We filled our collecting tubes by taking the top layer of mud at the bottom of the pond. We used the diatom bulb-sucker in other places, and tow nettings were made from the boat by Dr. Inglis Cameron. When we arrived home, the collection tubes were uncorked and examined subsequently, hungry catches being fed with hay water. A rich micro flora and fauna turned up, and the beautiful *A. radiosa*. Especially plentiful were the *Chilomonas* and *Euglena*, both useful as food organisms for the amoebae. Green hydra were also present, and fortunately no crustacea. The fish would keep these in check. There seemed to be a complete absence of paramecia, a fact which surprises me. Never did the macerated weed from the pond yield this ubiquitous ciliate. The great discovery, to my mind, however, was the fact that the whole lake was a

pure culture of *A. radiosa*. A year's search failed to reveal any other amoeba. In a paper I wrote on this subject, for the *Glasgow Naturalist*, I called my article "Camouflage in Amoeba." So completely does *A. radiosa* resemble the surrounding water that it is difficult to discern it. It reminded me of the concealing devices of salps, ctenophores, medusae, and other marine organisms. The food vacuoles, whether empty or full, helped rather than hindered the concealment.

The micro flora and fauna were obviously supplied with their nutritional requirements by the decomposition of the faecal remains of the fish and the decay of the leaves falling from the trees, crustacea kept in check by the fish and the green hydra—but why one solitary species of amoeba in such a large area? Professor Russell Hunter, now of Syracuse, but up to June 17, 1963, of Glasgow, whose knowledge of ecology is wide, informs me that such places exist elsewhere, where one species of animal has established itself to the exclusion of all other related ones.

All the amoebae discussed in this paper live in water which is on the acid side—a pH ranging about 6.6. My friend Mr. R. F. Crowther tells me that Proteus-type of amoebae has never been collected on a Keuper marl drift, even though dozens of collectors working in widely separated locations during the course of ten years have searched systematically! However, from some in which rotting cow dung created an acid environment, he found an amoeba which he sent to me. It was one of the species of *A. verrucosa* type, with abundant stages of development. Unfortunately, I had to destroy the material because it became so highly infected with mites.

As a practical hint to any of my readers who are engaged in breeding amoebae, I end by saying that if ever *Podura* popularly called *springtails* appears on a culture, exterminate it at once. The faecal masses of this primitive insect appear to be poisonous to micro-organisms.

**NEW VICE-COUNTY RECORDS OF LEECHES
(HIRUDINEA) IN SCOTLAND, WITH
SPECIAL REFERENCE TO THE LOWER VALLEY
OF THE ABERDEENSHIRE DEE**

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The few scattered records of the occurrence of freshwater leeches (Hirudinea) in Scotland were recently brought together and added to by Warwick and Mann (1960) who dealt with their distribution from a regional aspect. Later, Warwick (1961) discussed these records and some new ones on the more exact vice-county basis, and Williams (1961) gave an account of the distribution of the group in the Glasgow region. Two records not included by Warwick and Mann (1960) or Warwick (1961) are those given by Neill (1938) of *Helobdella stagnalis* and *Erpobdella octoculata* in the River Don (v.-c. 92, Aberdeen South), whilst two more records for v.-c. 86 (Stirling) were added by Maitland (1963). Though Warwick (1961) refers to the records of Reynoldson (1952) from Islay, two species (*Haemopsis sanguisuga* and *Hirudo medicinalis*) are omitted from his table of vice-county records; for this reason South Ebudes (v.-c. 102) is included here in Table I with its full list of species, one of which (*Haemopsis sanguisuga*) has been verified recently for the area by the present author. Table I, then, complements that in Warwick (1961) and summarizes the additional Scottish records to date.

TABLE I.

New vice-county records of Hirudinea in Scotland (+), including those from Aberdeen South noted by Neill (1938) and from Stirling noted by Maitland (1963) (+*). Former records from these vice-counties listed by Warwick (1961) are also given in this table (×).

VICE-COUNTY	<i>Theromyzon tessulatum</i>	<i>Hemiclepsis marginata</i>	<i>Glossiphonia complanata</i>	<i>Glossiphonia heteroclita</i>	<i>Bairacobdella paludosa</i>	<i>Helobdella stagnalis</i>	<i>Erpobdella octoculata</i>	<i>Dina lineata</i>	<i>Trocheteta subviridis</i>	<i>Haemopsis sanguisuga</i>	<i>Hirudo medicinalis</i>
72 Dumfries	+	+	×	+	+	+	+	+	-	+	-
75 Ayr	+	+	+	+	+	×	+	-	-	×	-
76 Renfrew	×	+	×	-	-	×	×	×	-	+	-
77 Lanark	×	+	×	×	+	×	×	×	×	×	-
86 Stirling	×	+	×	×	+	×	×	×	-	×	-
91 Kincardine	+	-	+	-	-	+	+	-	-	-	-
92 Aberdeen South	+	+	+	+	+	+	+	-	-	-	-
99 Dunbarton	×	+	×	×	+	×	×	+	-	+	-
102 South Ebudes	×	-	×	-	-	×	×	-	-	×	×
111 Orkney	+	-	+	-	-	+	+	+	-	+	-

The present account deals with new records in 8 vice-counties in Scotland (3 of which are among those noted by Warwick (1961) to have no records of Hirudinea), and includes a more detailed account of the distribution of the group in the lower valley of the River Dee in which the above records of Neill (1938) are verified for v.-c. 92 (Aberdeen South).

METHODS

Most of the records from the west of Scotland were made incidentally during 1963 and 1964 in connection with collections of *Batrachobdella paludosa* which were being taken for taxonomic purposes. In the lower valley of the River Dee (which includes parts of 2 vice-counties—91, Kincardine and 92, Aberdeen South) a more comprehensive series of timed collections (Mann, 1953) was made, each lasting for 30 minutes. Such samples were taken at 22 different stations, covering as wide a range of environmental conditions as possible, from a small stagnant pond to a large swift-flowing river. All of these collections were made in July 1963; at each place the pH of the water was estimated using a B.D.H. comparator set, and ecological notes on the habitat were taken.

NEW VICE-COUNTY RECORDS

The new vice-county records given here are listed in Table I, which includes also the previous records of other Hirudinea from these areas which are noted by Warwick (1961). It can be seen that there are 37 new records altogether, dealing with 9 species of leech in 8 vice-counties. Relevant notes on the distribution of each of these species are given below. No detailed information on localities in v.-c. 111 (Orkney) is given here, for it is hoped that a comprehensive account of the freshwater fauna of this area will shortly be published.

Theromyzon tessulatum (Müller) is here recorded in vice-counties 72 (Dumfries: Castle Loch, Mill Loch), 75 (Ayr: Kilbirnie Loch), 91 (Kincardine), 92 (Aberdeen South) and 111 (Orkney). This leech appears to be one of the most widespread of the British forms; a parasite of waterfowl, it has great opportunities of dispersal and is probably much less dependent on the trophic conditions of its environment than most other species.

Hemiclepsis marginata (Müller) is here recorded in vice-counties 72 (Dumfries: Castle Loch), 75 (Ayr: Kilbirnie Loch), 76 (Renfrew: Houstonhead Dam), 77 (Lanark: Woodend Loch), 92 (Aberdeen South) and 99 (Dunbarton: Caldarvan Loch). Warwick and Mann (1960) note that this is one of the rarest of Scottish leeches and it is recorded by Warwick (1961) from only 5 vice-counties. The record noted

by Maitland (1963) and the present data bring this number to 13. Mann (1955) considers that this species prefers eutrophic waters and most of the present records are in agreement with this, coming from rich lakes (e.g. Castle Loch) or lake outflows (e.g. the outflow from Crathes Castle Loch).

Glossiphonia complanata (L.) is here recorded in vice-counties 75 (Ayr: Kilbirnie Loch), 91 (Kincardine), 92 (Aberdeen South) and 111 (Orkney). This species is undoubtedly one of the commonest of British leeches, and the fact that it has still to be recorded from 15 vice-counties in Scotland is more indicative of the lack of collecting in these areas than the likelihood of its being absent or even rare there.

Glossiphonia heteroclita (L.) is here recorded in vice-counties 72 (Dumfries: Castle Loch), 75 (Ayr: Kilbirnie Loch) and 92 (Aberdeen South). All these records are from weedy eutrophic lakes similar to the type of habitat described for the species by Mann (1953).

Batracobdella paludosa (Carena) is here recorded in vice-counties 72 (Dumfries: Castle Loch, Mill Loch), 75 (Ayr: Kilbirnie Loch), 77 (Lanark: Woodend Loch), 92 (Aberdeen South) and 99 (Dunbarton: Caldarvan Loch, Loch Lomond). Warwick (1961) records this species from only one vice-county in Scotland (87: Perth West) and a second (86: Stirling) was added by Maitland (1963). As the above records show, this species is undoubtedly less rare than was formerly supposed, and in several of the places listed it was found to be common. It has also been found commonly at several new localities in vice-counties 86 (Stirling) and 87 (Perth West). Most of the Scottish data indicate that this species is most abundant in eutrophic waters; it may be found in both still and running water. Examination of very many specimens of *Batracobdella paludosa* from many localities has indicated that the eye variation described by Maitland (1963) is common, and, in Scotland at least, may be nearer the normal condition than that indicated by Mann (1953).

Helobdella stagnalis (L.) is here recorded in vice-counties 72 (Dumfries: Castle Loch, Mill Loch), 91 (Kincardine) and 111 (Orkney); and confirmed for 92 (Aberdeen South). This species is a very common one throughout Great Britain and is able to tolerate a wider range of environmental conditions than any of the other non-parasitic species of British leech. It was the only leech found in the Dee valley living in waters with a pH value of less than 6.6.

Erpobdella octoculata (L.) is here recorded in vice-counties 72 (Dumfries: Castle Loch, Mill Loch), 75 (Ayr: Kilbirnie Loch) 91 (Kincardine) and 111 (Orkney); and confirmed for 92 (Aberdeen South). This leech is a relatively common one in Great Britain; known to be tolerant of soft water (Mann, 1955), it was the most abundant species found in the Dee

valley and was the commonest leech occurring in the River Dee itself.

Dina lineata (Müller) is here recorded in vice-counties 72 (Dumfries: Castle Loch), 99 (Dunbarton: Caldarvan Loch, St. Germain's Loch) and 111 (Orkney). Since the species was first recorded in Great Britain by Mann (1952) it has been shown to be a relatively common one and is now listed from 13 vice-counties in Scotland. It was not found, however, in any of the waters examined in the lower valley of the River Dee during the present survey.

Trocheta bykowskii (Gedroyc). No new vice-county for this species is recorded here, but in view of its rarity in Great Britain it is worth noting that in March 1964 it was still present in the Braid Burn at Peffermill (v.-c. 83, Edinburgh), the only locality in which this species has so far been found in Scotland (Warwick, 1961).

Haemopsis sanguisuga (L.) is here recorded in vice-counties 72 (Dumfries: Castle Loch, Mill Loch), 76 (Renfrew: Houstonhead Dam, Long Loch), 99 (Dunbarton: Ditch near Milngavie, St. Germain's Loch) and 111 (Orkney). This species was never found to be common at any of the above localities, and was not seen at any of the stations examined in the Dee valley. It is also verified here for v.-c. 102 (South Ebuades—Mull of Oa, Islay) from which, as noted above, it was first recorded by Reynoldson (1952).

LEECHES FROM THE DEE VALLEY

The results of the collections made in the lower valley of the River Dee in 1963 are given in Table II. Several features of interest can be noted from this table, the most outstanding one being the relative scarcity of leeches in most of the waters examined; Williams (1961) noted a similar paucity in his results from waters in the Glasgow region compared to those of Bennike (1943) in Denmark and Mann (1955) in England. Only 3 species of Hirudinea can be considered common in the Dee area: *Glossiphonia complanata*, *Helobdella stagnalis* and *Erpobdella octoculata*. This is partly due to the fact that much of the freshwater occurring in this region is fast-flowing (over half of the stations examined come into this category); both Bennike (1943) and Mann (1955) note that these leeches are the only European species which are ever abundant in running water. Also, since the predominant rocks of the area are granite, quartzose and mica schists, most of the waters tend to be rather acid (the highest pH recorded during this survey was 7.3, and only 4 out of the 22 stations examined had pH values over 7.0); *Glossiphonia complanata*, *Helobdella stagnalis* and *Erpobdella octoculata* are three of the most common species found in soft waters in Great Britain (cf. Williams, 1961).

At 4 stations in the lower valley of the River Dee no leeches were collected: 3 of these were streams with acid water, 1 was a bog pool (pH: 5.8). The largest numbers of leeches were collected from the Gormach Burn, Dunecht Loch and the River Dee at Aberdeen. At none of these places did any of the species reach the abundance found in richer waters elsewhere in Great Britain (Mann, 1955; Maitland, 1963).

TABLE II.

The numbers of leeches collected in 30 minutes at each of 22 stations in the lower valley of the River Dee.

STATION	pH	<i>Theromyzon tessulatum</i>	<i>Hemiclepsis marginata</i>	<i>Glossiphonia complanata</i>	<i>Glossiphonia heteroclita</i>	<i>Batrachodella paludosa</i>	<i>Helobdella stagnalis</i>	<i>Erpobdella octoculata</i>	TOTAL
1 Bog Pool near Crathes Castle	5.8	—	—	—	—	—	—	—	
2 Loch near Birsemore	6.2	—	—	—	—	—	4	4	
3 Outflow from Woodend Mill Lade, Banchory	6.2	—	—	—	—	—	—	—	
4 Forest pool near Strachan	6.3	—	—	—	—	—	3	3	
5 River Dee at Aboyne	6.5	—	—	—	—	—	—	—	
6 Outflow from Loch of Skene	6.7	2	—	3	—	1	1	14	
7 Gormach Burn near Peterculter	6.7	—	—	23	—	—	11	18	
8 Water of Feugh at Strachan	6.7	—	—	—	—	—	—	—	
9 Outflow from Crathes Castle Loch	6.8	2	2	11	—	—	6	18	
10 Dunecht Loch	6.8	—	—	5	—	1	43	20	
11 Hillhead Loch	6.8	2	1	3	—	1	11	—	
12 Stream near Crossroad	6.8	—	—	—	—	—	3	—	
13 Inflow to Crathes Castle Loch	6.8	—	—	4	—	—	—	4	
14 Outflow from Doualty Dam near Crathes	6.9	—	—	—	—	—	3	—	
15 Burn of Canny	7.0	—	—	11	—	—	—	—	
16 Inverord Loch	7.0	10	—	6	—	—	20	—	
17 River Dee at Banchory	7.0	—	—	1	—	—	—	6	
18 River Dee at Peterculter	7.0	—	—	—	—	—	—	4	
19 Laurieston Loch	7.1	2	—	11	—	—	1	3	
20 River Dee at Aberdeen	7.1	—	—	26	—	—	7	24	
21 Small stream near Lumphanan	7.1	—	—	—	—	—	2	—	
22 Loch of Aboyne	7.3	2	1	4	2	1	3	—	
TOTAL		20	4	108	2	4	118	111	367

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**SENECIO SQUALIDUS L. IN THE BRITISH ISLES*—
8, THE RECENT SPREAD IN SCOTLAND†**

By DOUGLAS H. KENT

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The nineteenth century Scottish records of *Senecio squalidus*, the dubious twentieth century records and what was thought to be the first certain occurrence of the species in Scotland during the present century have already been reviewed (Kent, 1955).

It now seems that the earliest record of the certain occurrence of *S. squalidus* in Scotland during recent times was made by Richard Prasher in 1953; for while walking from Aberdour to Kirkcaldy and approaching Burntisland, Fife, by the seaside path, during that year, he noted a fine clump on a rubbish-dump.

Since being reported at Musselburgh, Edinburgh, in 1954, the plant has become well established in the Edinburgh area and is spreading both north and south of the city. In 1955 it was reported to be abundant at Levenhall, near Musselburgh, and at Craighall Colliery railway junction, and was noted growing sparingly on waste ground at Portobello. These three localities are all near Edinburgh.

During 1956 Miss E. P. Beattie recorded a few plants by a roadside near Ormiston, Haddington, and a large colony in a dockyard railway siding at Burntisland, Fife. The latter would appear to be an extension of Mr. Prasher's 1953 locality. In 1957 the species was discovered at Torthorwald by E. B. Bangerter and E. Milne-Redhead, and near Englefield by J. G. Dony; both these localities are in Dumfries. D. McClintock also recorded it "in masses by the railway leaving Edinburgh", and Miss McCallum Webster found a solitary plant in the goods yard at Forres railway station, Moray. In 1959 Miss Beattie noted that it was abundant on waste ground at Leith Docks, Edinburgh, and still persisting at Musselburgh despite the tidying up and turfing of its waste ground habitat. During this year a solitary plant was found at 1,700 ft on disturbed ground at the north end of Lochan na Lairige, Mid Perth (Mackechnie, 1961). This is an altitudinal record for the species in the British Isles. During the following year a small colony was discovered on a railway siding at Milton, by Bowling, near Glasgow, Dunbarton, by D. C. Gwynne. In 1962 A. Younger and Miss M. McCallum Webster found *S. squalidus* growing in fair quantity on a rubbish-tip by the

* See also page 453.

† For references to parts 1-7, see Kent, D. H., 1964. *Irish Nat. J.* 14, 203-204.

railway at Borthwick, Edinburgh, and in 1963 Miss Beattie noted it at North Queensferry, Fife, and reported, also, that it had been established for some years in railway sidings at Inverkeithing, Fife. During recent years, while working on the railway track, around north Ayrshire, R. Prasher has several times encountered casual plants of *S. squalidus*, and suggests that the seeds have been carried from one place to another in goods wagons. Finally, in 1964, D. McClintock noted the plant at Lochside station, near Lochwinnoch, Renfrew, close to the Ayrshire border, where it was also apparently ephemeral.

S. squalidus is now well established in southern Scotland, particularly near Edinburgh, and will undoubtedly spread. It is important to trace this spread, and I should be grateful for additional records. The present Scottish vice-comital distribution, with casual occurrences shown in brackets, is v.-c. 72, [75], 76, 82, 83, 85, [88, 95] and 99.

The following herbarium specimens supporting some of the records given above have been seen by the author. The abbreviations used for herbaria are those given in Kent (1957):

83, *Edinburgh*. Roadside and waste ground, New Craighall, in quantity, 1955, E. Beattie and C. W. Muirhead; Musselburgh Links, on waste-dumps, in quantity, 1955, E. Beattie and C. W. Muirhead; waste ground, Kings Road, Portobello, rare, 1955, E. Beattie and C. W. Muirhead (E). Railway tip, Borthwick, in fair quantity, 1962, A. Younger and M. McCallum Webster (BM). 95, *Elgin*. Distillery yard, Knockando, 1956, M. McCallum Webster, det. A. Melderis (BM).

ACKNOWLEDGEMENTS

I am greatly indebted to Miss E. P. Beattie and R. Mackechnie for information on *S. squalidus* in Scotland, and to the latter for kindly providing details of records made by R. Prasher. Thanks are also due to E. B. Bangerter, D. McClintock, Miss C. W. Muirhead and Miss M. McCallum Webster for records and information.

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JENNY'S BURN

By J. D. MORTON and R. MACKECHNIE

(Received 12th January, 1965)

Before another of Glasgow's historic water-courses follows the Molendinar into the oblivion of a subterranean pipe, it may be of interest to put on record the plant life which at present adorns its banks. The stream in question, Jenny's Burn (Polmadie Burn) has two sources; the principal one is Moll's Mire, near the Hangingshaw just east of Mount Florida. Not so long ago the Mire was an open area of swampy ground; now it is fast disappearing under truckloads of waste. It seems likely that the end of 1965 will find the entire hollow filled in; already tennis courts cover the pools where swans had their home. The Moll was Mary, Queen of Scots, who is reputed to have passed that way on her flight from Langside. The effluent stream, Moll's Mire Burn, still flows away to the north-east, eventually passing under the main railway track from Central Station through Rutherglen to the south. It is then joined by a tributary, the West Burn, coming in from the secondary source below Cathkin Braes. From this meeting of the waters Jenny's Burn is born. Its entire course measures scarcely half a mile; it flows almost due north and, within a few hundred yards, passes through a culvert under Rutherglen Road and by way of Richmond Park to the Clyde, just west of Rutherglen Bridge.

To the naturalist the whole area looks unpromising; Moll's Mire is set among the slag-heaps from the now-derelict Dixon's Blazes, and further on its course the banks of the burn provide a dumping ground for chromium waste and oily residues from chemical works on the plateau of waste land above the stream-bed. But a short visit by one of us (J.D.M.) in September 1963 had suggested that more plant life was to be seen there than might have been expected. This suggested a recording trip, made on a sunny evening almost a year later and producing the surprisingly large total of 79 flowering plants:—

<i>Aegopodium podagraria</i>	<i>Aster novi-belgii</i>
<i>Agropyron repens</i>	<i>Atriplex hastata</i>
<i>Agrostis gigantea</i>	<i>A. patula</i>
<i>A. stolonifera</i>	<i>Betula pendula</i>
<i>A. tenuis</i>	<i>Calystegia sepium</i>
<i>Alisma plantago-aquatica</i>	<i>Capsella bursa-pastoris</i>
<i>Angelica sylvestris</i>	<i>Centaurea nigra</i>
<i>Arctium minus</i>	<i>Cerastium holosteoides</i>
<i>Arrhenatherum elatius</i>	<i>Chamaenerion angustifolium</i>
<i>Artemisia vulgaris</i>	<i>Crataegus monogyna</i>

<i>Dactylis glomerata</i>	<i>Poa trivialis</i>
<i>Epilobium hirsutum</i>	<i>Polygonum amphibium</i>
<i>Equisetum arvense</i>	<i>P. aviculare</i>
<i>Festuca gigantea</i>	<i>P. bistorta</i>
<i>F. rubra</i>	<i>P. persicaria</i>
<i>Filipendula ulmaria</i>	<i>Potentilla anserina</i>
<i>Fraxinus excelsior</i>	<i>Ranunculus repens</i>
<i>Galium aparine</i>	<i>Reseda luteola</i>
<i>Glyceria plicata</i>	<i>Rubus fruticosus</i>
<i>Heracleum sphondylium</i>	<i>Rumex crispus</i>
<i>Hieracium umbellatum</i>	<i>R. obtusifolius</i>
<i>Holcus lanatus</i>	<i>Salix atrocinerea</i>
<i>Iris pseudacorus</i>	<i>S. caprea</i>
<i>Juncus articulatus</i>	<i>S. fragilis</i>
<i>J. bufonius</i>	<i>Senecio viscosus</i>
<i>J. effusus</i>	<i>S. vulgaris</i>
<i>Lathyrus pratensis</i>	<i>Sonchus asper</i>
<i>Leontodon autumnalis</i>	<i>S. oleraceus</i>
<i>Linaria vulgaris</i>	<i>Sparganium erectum</i>
<i>Lolium perenne</i>	<i>Stachys × ambigua</i>
<i>Luzula multiflora</i>	<i>Stellaria media</i>
<i>Matricaria matricarioides</i>	<i>Symphytum officinale</i>
<i>Melilotus officinalis</i>	<i>Taraxacum officinale</i>
<i>Mentha × gentilis</i>	<i>Tragopogon pratensis</i>
<i>Petasites hybridus</i>	<i>Trifolium pratense</i>
<i>Phalaris arundinacea</i>	<i>T. repens</i>
<i>Plantago lanceolata</i>	<i>Tripleurospermum maritimum</i>
<i>P. major</i>	<i>Tussilago farfara</i>
<i>Poa annua</i>	<i>Urtica dioica</i>
<i>P. pratensis</i>	<i>Vicia cracca</i>

The burn itself contained an abundance of a green filamentous alga, as well as a rich supply of unicellular organisms, including *Vorticella*. In one area a profusion of rabbit droppings, and the footprints of rats in the drying mud, suggested some nocturnal activity, but no mammals other than humans were seen, and the only birds were feral pigeons drinking from the stream.

THE NON-MARINE MOLLUSCA OF ISLAY, INNER HEBRIDES

By N. F. McMILLAN
City of Liverpool Museums
(Received 10th February, 1965)

Islay, the most southerly and one of the larger of the Inner Hebrides, has an area of 235 sq miles and although readily accessible little is known of its molluscan fauna. Therefore, when I was invited to join a party of Scottish botanists for a week's field-work on Islay I was glad to accept. We spent June 20th-27th 1964 on the island with headquarters at Port Ellen in the S.E. corner, and were fortunate in our weather.

To an Irish zoologist Islay, lying as it does at one end of the great submerged moraine which curves northward from Inishowen in Co. Donegal, held interesting possibilities, although Mitchell (1963) on geological grounds considers it unsafe to assume a morainic land-bridge between Islay and Inishowen. As far as I know no detailed comparison of the flora or fauna of Donegal with that of Islay has been made, but it may be mentioned that the solitary Scottish record of the "warm" littoral gastropod *Monodonta lineata* (da Costa) is from Islay (Knight, 1906) its nearest station being Whitestrand, Bay, on the western side of Inishowen, Co. Donegal, (McMillan, 1939). An unsuccessful attempt was made to refine the species in Islay, but there seems no reason to doubt the record; there is apparently suitable ground and Malin Head in Inishowen is only about thirty miles S.W. of Islay.

Islay is roughly the shape of the capital letter "H", the Rhinns of Islay forming the western upright. Loch Gruinart on the north and Loch Indaal on the south almost divide the island into two parts, only a strip of alluvium forming the central bar of the "H". Geologically the Rhinns comprise pre-Cambrian grits, slates and gneisses, with numerous intrusive dykes, and the eastern part of Islay is occupied by metamorphic rocks. There is a good deal of limestone with a consequent enrichment of both flora and fauna when compared with those of the adjacent quartzite island of Jura. The largest limestone area lies centrally on either side of the road from Bridgend to Port Askaig, with some smaller outcrops in the peninsula of the Oa in the south. Of the lochs examined Loch Lossit is on limestone, Loch Ardnave lies between raised beach and blown sand, Loch Clach a Bhuaile, Loch Ardnahoe, Dubh Loch, Loch Tallant and Loch Gorm are all soft-water lochs. Loch Finlaggan, despite its close proximity to limestone, is also soft water.

The great peat-bogs are innocent of all Mollusca except the big black slug *Arion ater* s.l.

The fine sand-dunes of Laggan Bay, Lossit Bay, Machir Bay and those on both sides of Loch Gruinart have a limited but interesting fauna. In blown sand at Sanaigmore on the Rhinns a "shell-pocket" yielded a dozen species, two of which (*Vertigo pygmaea* and *Vallonia costata*) were not otherwise obtained. All these shells appeared to be quite recent.

An old land-surface, consisting of a 4 in thick earthy layer, was noted over a fairly large area in the dunes at Ardnave Pt., on the western side of Loch Gruinart. It contained (in order of abundance) *Helicella itala*, *Cochlicella acuta*, *Vallonia excentrica* (one shell), and *Helix nemoralis*, apparently rare. In hollows, although not found *in situ*, were abundant *H. nemoralis* and one immature *Arianta arbustorum*. The only living species seen was *Helicella itala*.

The island of Texa, off Port Ellen, was visited one evening. It is mostly gneiss, is about $\frac{1}{2}$ mile by $\frac{1}{4}$ mile and was once inhabited (there are the remains of a house and an ancient chapel). The following Mollusca were obtained: *Lymnaea peregra* (Müller) in a spring at the "pier"; good-sized specimens of *Helix nemoralis* L. were abundant about the old chapel and nowhere else, almost all banded 12345, one 00300 and one white-lipped; *Discus rotundatus* (Müller) a few near "pier"; *Arion ater* L. (s.l.) abundant; *Agriolimax agrestis* (L.) (s.l.) several, all plain cream-coloured.

Of previous work on the Islay Mollusca there seems to be very little. William Thompson's discovery of *Limax arborum* (now *L. marginata*) on Islay is enshrined in Forbes and Hanley (1853) and appears to be the only published record of his visit to the island during January, 1849. Recently, however, Mr. A. W. Stelfox gave me his transcript of Thompson's notes on non-marine Mollusca, extracted from his MSS. in the National Library, Dublin, and among them were those on Islay. From these we learn that the great Irish zoologist collected about thirty species of land and freshwater snails during his stay in the Ardimersy district in the south of the island. He refers frequently to Ardimersy grounds and plantation and to Kildalton church-yard. He refers also to "Rabbit Island about two miles off Islay from shore at Ardimersy Cottage" (and lists seven species of land snails thence), but this islet does not appear to be marked on the current One Inch Ordnance Survey map.

Of Thompson's thirty species nine were not refound by us and only one of these (*Balea perversa* (L.)) by Musham on his two visits to Islay in 1908 and 1913. Details of these eight species are as follows; comments in inverted commas are Thompson's.

Carychium minimum Müller (the aggregate species) "everywhere".

Columella edentula (Drap.). "Plantation, Ardimersy, not uncommon. All obtained of the ordinary short form".

Lauria anglica (Wood) (sub. *Helix Scarburgensis*). "After looking particularly for this shell since I came to Islay I only found it today (Jan. 24th) and when not at all expecting to see it. The specimen was adhering to a large stone, about which nettles grew, on the right-hand side of the walk from the cottage down to the beach north of the boathouse. One specimen only procured".

Acanthinula aculeata (Müller). "One on a fallen branch in a wet place. A place always moist".

Hygromia subrufescens (Miller). "January 24th. To this date I have obtained but two, both adhering to fallen branches, one of which was near *Luzula sylvatica*; the other on level ground far from it. Although I never saw such fine banks of *Luzula* anywhere or in such profusion, I have been unable at any time of day, even at dusk, to obtain *fusca* on it".

Punctum pygmaeum (Drap.). "I found adherent to a fallen branch and on an open marshy spot near sea-side".

Arion hortensis Férussac. (No comment).

Retinella pura (Alder). "A dozen obtained, about half pearly hyaline and others wax-yellow".

He does not record any of the following "garden" species, *Milax sowerbyi*, *M. budapestensis* and *Hygromia striolata*, all of which were obtained in Port Ellen gardens during our visit. This indicates a fairly recent date of introduction for these species, for Thompson collected in plantation, orchard and garden, according to his notes.

Knight (1906) (p. 148) mentions a Dr. R. F. Gilmour of Islay who had a collection of local shells, but I have not ascertained anything further of either the man or his collection.

Musham (1916) took twenty-one species in Islay during his two visits there, and one of his species (*Arion intermedius* Normand) was not found by our party. Our united efforts resulted in a list of forty-one species, but not all of these additional species are new vice-county records, for in the Conchological Society's Census of the British non-marine Mollusca Islay is grouped with Jura, Scarba, Lunga, the Garvellachs, Colonsay and Oronsay as the South Ebudes (v.-c. 102), and the following species, listed from v.-c. 102, have been recorded from one of these other islands and not Islay: *Limax tenellus*, *Retinella radiatula*, *Helix hortensis*, *Arianta arbustorum*, *Monacha granulata*, *Columella edentula*, *Helicella virgata*, *Arion hortensis*, *Planorbis leucostoma*, *Acanthinula lamellata*, *Hygromia subrufescens*, *Zonitoides nitidus* and *Lauria anglica*.

A solitary Islay record (of *Helix nemoralis* var. *libellula*) appears in Roebuck (1891).

Speaking generally, snails were not common in Islay, except on the blown sand. The scarcity of such species as *Cochlicopa*

lubrica (s.l.), *Discus rotundatus*, and *Retinella nitidula* which are almost ubiquitous in northern England and Ireland is noticeable, and two noteworthy absentees from the blown sand areas are *Helicella virgata* and *H. caperata*. A puzzling feature is the apparent absence of *Balea* of which we did not obtain a single example, yet Thompson wrote of the species "More abundant at Ardimersy than I have ever seen it . . ." and Musham (1916) found it plentiful about Port Ellen.

Freshwater species were few and individuals also scarce ; in many cases breeding seemed to be just completed and no living adults were found.

The most promising area for further work is the central limestone area on which we had only one day.

Of the localities mentioned below Lossit Bay, Kilchieran, and Traigh Machir are on the west coast of the Rhinns (N.B. Loch Lossit is near the *east* coast of Islay) ; Sanaigmore is in the northern part of the Rhinns. Kepollsmore is on the limestone, a mile north of the road and about midway between Bridgend and Port Askaig. The locality referred to as "Cladach Fionn" is the site of a vanished intrusive dyke, forming a sheltered trough-like cutting, on the north coast of the Rhinns. Rubha Bholsa is a rocky headland in N.E. Islay.

LIST OF SPECIES OBTAINED

Potamopyrgus jenkinsi (Smith). Only found once ; very small specimens sparingly in a burn where it ran out onto Traigh Machir. Hunter and Warwick (1957) in their study of the Scottish distribution of this species give no records for the Inner Hebrides, and it is still apparently rare in the west of Scotland.

Bithynia tentaculata (L.). Two living specimens in Loch Lossit (K. Beckett). This was our best find and a noteworthy extension of range for this hard-water species. The nearest stations are in Dunbarton, Stirling and Bute ; in the last doubtfully native (see *J. Conch.* 21, 337).

Lymnaea truncatula (Müller). Lossit Bay and Kilchieran ; near Loch Finlaggan ; lochan near Cladach Fionn. Only one or two specimens were taken from each site.

L. peregra (Müller). Loch Clach a Bhuaile in the Rhinns ; L. Finlaggan ; L. Lossit ; Ardnave Loch ; Dubh Loch. At Ardtalla in the S.E. good-sized specimens were abundant in a roadside splash.

Planorbis contortus (L.). Only in L. Finlaggan where specimens were fairly frequent.

Ancylus fluviatilis Müller. Burn at Kilchieran, and burn entering Traigh Machir south of War Memorial. This is the burn which yielded *Potamopyrgus jenkinsi* but the two species did not live together ; *Ancylus* lived in the upper part where the

stream cut steeply through boulder-clay and *Potamopyrgus* where it spread out upon entering the sand-dunes.

Succinea pfeifferi Rossmässler. These specimens presented some puzzling features but were eventually determined as this species by Dr. H. Walden and Mr. A. W. Stelfox independently. Localities are Port nan Gallan, Mull of Oa; burn at Traigh Machir; Cladach Fionn; Lossit Burn (very plentiful).

Cochlicopa lubrica (Müller), s.s. Sanaigmore, recent shells.

C. minima (Siemaschko). A shell at ruined crofthouse, Finlaggan; top of salt-marsh, Loch Indaal, several alive; Machir Bay, not infrequent; shells, with *C. lubrica*, at Sanaigmore.

Vertigo pygmaea (Drap.). Sanaigmore, recent shells.

Pupilla muscorum (L.). Sanaigmore, recent shells; dunes at Machir Bay, one shell.

Lauria cylindracea (da Costa). Port Ellen, frequent; one, on limestone near Kepollsmore; Mullach Dubh (a limestone bluff), above Loch Lossit, frequent; Laggan Bay, frequent at edge of golf-links; head of Loch Indaal, few; Finlaggan, a shell.

Vallonia costata (Müller). Sanaigmore, recent shells.

V. excentrica (Sterki). As *V. costata* (q.v.). A single shell was taken from an old land-surface in the dunes at Ardnave Point.

Clausilia bidentata (Ström). Mullach Dubh above L. Lossit; head of Loch Indaal, under an old stump, frequent. This large old stump lay at the upper margin of the salt-marsh and yielded a rich harvest of snails, 9 species in all being present; near Ballygrant Loch, several; Sanaigmore, recent shells.

Arianta arbustorum (L.). Abundant along the west coast of the Rhinns and on the limestone along the Bridgend-Ballygrant road; at the head of Loch Indaal numerous fragments were found at a thrush-stone; at Machir Bay occurred abundantly on the sand-dunes together with numerous *Helix nemoralis* and *Helicella itala*, and, more sparingly, *Helix aspersa*. Such an association of species on blown sand appears to be unique; in one or two places in Caithness and west Sutherland *Arianta arbustorum* lives with *Helix hortensis*, and rarely *Helicella caperata*, on blown sand (Peach, 1884; Oldham, 1929; Boycott and Oldham, 1936) but nowhere else as far as I know. *Arianta* is generally considered a woodland or hedgerow snail (Stratton, 1954).

Helix nemoralis (L.). Widely distributed but individuals not very numerous except on the blown sand.

H. aspersa Müller. Port Ellen, common; dunes at Machir Bay and Lossit Bay, sparingly.

Hygromia striolata (C. Pfeiffer). Port Ellen only, common about gardens and waste places.

H. hispida (L.). On limestone, 1 mile S.W. of Kepollsmore, on the Bridgend to Ballygrant road, two specimens. Musham

recorded it from "Port Ellen, scarce", where we failed to refind it.

Helicella itala (L.). Abundant on all the blown sand, and inland at Lossit Farm (on the limestone).

Cochlicella acuta (Müller). On all the dunes, always the mottled form only.

Discus rotundatus (Müller). Uncommon, in ones and twos only. At Ardnahoe and Ballygrant lochs; cliff at Rubha Bholsa; lower end of Claggain glen; Ardnave; two shells from Cladach Fionn.

Arion circumscriptus Johnston. Claggain glen, one; Portnahaven, two.

A. subfuscus (Drap.). Kilchieran, one; near Finlaggan and on the Bridgend to Ballygrant road, a mile S.W. of Kepollsmore.

A. ater (L.), s.l. Generally distributed. A specimen on moorland at Kilchieran was var. *aterrima* Taylor.

Euconulus fulvus (Müller). Head of Loch Indaal, two under stump.

Vitrea crystallina (Müller), s.s. A shell (*det.* M. P. Kerney) from "Islay".

Oxychilus cellarius (Müller). Apparently widely distributed but nowhere abundant except at Port Ellen where it occurred in gardens and waste places. At Finlaggan it was frequent about a ruined croft-house.

O. alliarius (Miller). Also widely distributed but specimens not numerous, except at Finlaggan about a ruined croft-house.

Retinella radiatula (Alder). Cladach Fionn, two; Sanaigmore, recent shells.

Retinella nitidula (Drap.). Portnahaven and Kilchieran, a single shell in each case; Machir Bay, two shells; Finlaggan, at ruined croft, several specimens.

Zonitoides nitidus (Müller). Cladach Fionn, two.

Vitrina pellucida (Müller). Laggan Bay, Machir Bay, and Sanaigmore, all shells only.

Milax sowerbyi (Férussac). One small specimen, sole uniform pale-grey, in a Port Ellen garden.

M. budapestensis Hazay. A pale-coloured slug, 40 mm long, was at first thought to be *M. sowerbyi* but proved to be *M. budapestensis* when dissected by Mr. A. E. Ellis; from a Port Ellen garden.

Limax maximus L. Port Ellen garden, one.

L. marginatus Müller. Probably generally distributed. Specimens from Portnahaven; Kilchieran; Cladach Fionn; Ardnahoe Loch; cliff at Rubha Bholsa.

Agriolimax agrestis (L.), the aggregate species. Common as usual but all the specimens were plain cream-colour. None of the darkly-blotched form often found in gardens was seen.

Agriolimax sp. A small brown specimen in a Port Ellen garden which was either *laevis* (Müller) or a young *caruanae* Pollonera was unfortunately not retained for anatomical examination.

Pisidium casertanum (Poli). One, in a ditch at the head of Loch Indaal (*det.* A. W. Stelfox).

P. personatum Malm. In a trickle entering Laggan Bay near the Machrie Hotel, a few (*det.* A. W. Stelfox).

Of the species enumerated twelve are new to v.-c. 102 (South Ebudes) viz. *Potamopyrgus jenkinsi*, *Bithynia tentaculata*, *Lymnaea truncatula*, *Planorbis contortus*, *Succinea pfeifferi*, *Cochlicopa minima*, *Vertigo pygmaea*, *Pupilla muscorum*, *Hygromia striolata*, *Milax budapestensis*, *Pisidium casertanum* and *P. personatum*. Specimens of all these have been deposited in the Voucher Collection of the Conchological Society. In addition *Milax sowerbyi* was obtained but as the specimen was not retained the record cannot be accepted until verified.

SUMMARY

The non-marine molluscan fauna of Islay is listed and is now 51 species. Three are fairly recent introductions, viz. *Hygromia striolata*, *Milax sowerbyi* and *M. budapestensis*. The unique occurrence of *Arianta arbustorum* living on blown sand, and associated there with *Helix nemoralis*, is noted. Attention is drawn to William Thompson's pioneer work in Islay in 1849.

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SURVEY OF SITES OF SPECIAL SCIENTIFIC IMPORTANCE IN THE GLASGOW AREA

By S. A. HUTCHINSON

(Received 10th April, 1965)

The Council of the Andersonian Naturalists of Glasgow has set up a sub-committee (listed below) to investigate and record the Society's information on the above sites, and to co-operate with the Nature Conservancy and other interested bodies in future work.

These sites have been notified by the Nature Conservancy under Section 23 of the National Parks and Access to the Countryside Act, 1949. The Conservancy considered the Society's records when it chose the first list of sites, and the Society's advice has been asked for about amendments. A number of such amendments have been made to take account of movements of the population and changes in land use and some additional sites have been recorded since the first list was published. The Society is a particularly suitable one to give such advice as its sections can provide information on most branches of Natural History and its membership includes a wide range of amateur and professional scientists. Some proposals for amendments have to be made at short notice, particularly when changes in land use may affect the conditions in a notified site. The sub-committee has therefore started by designing an administration system for the most urgent task, i.e. the collation of information which members have at present of the existing sites. This system needs to be sufficiently simple and flexible to deal conveniently with records from members, each of whom may be interested in one or more different branches of natural history and whose contributions may vary from brief comments to detailed reports, or reprints of publications of organised research. It must also allow for the continued addition of new records or amendment of old ones.

To meet these needs a file of loose-leaf folders has been prepared. The folder for each site contains a photograph of the Nature Conservancy's map showing the current boundaries, and a copy of the form reproduced in Figure 1. Brief comments can be inserted on the form in full, and longer ones put as references to manuscripts or publications which are deposited in the file. A space is given for the name of the member, and for the date of the comment. Used in this way the form gives the existing information, it shows whether it is up-to-date, and it draws attention to gaps in our knowledge.

At present the sub-committee is concentrating on the collation of records from the Lanarkshire sites. This was decided after consultation with the Nature Conservancy, and because of the very rapid changes in land use which are going

on in that county. This is not intended to be a restrictive priority, however, and information about other areas is being recorded as it becomes available. Substantial gaps in our information have become apparent, and the General Secretary and the Conveners of Sectional Committees have been asked to consider these when planning excursions in 1965-66. It is

THE ANDERSONIAN NATURALISTS OF GLASGOW

Survey of Sites of Special Scientific Importance

Please complete any relevant paragraph, sign your report legibly and date it. Detailed reports should be attached.

<i>Name of Site</i>		Signature of Surveyor	<i>Date</i>
Notes on access, landowner, etc.			
Reasons for <i>Conservation</i>	Botanical		
	Geological		
	Zoological		
Boundaries	<i>Nature Conservancy Boundaries agreed.</i>		
	or/ <i>Proposed amendments and reasons, or new area boundaries. (Mark on attached map.)</i>		
General Condition			
Expected Developments			
Notes			

Fig. 1

not suggested that the need for such information should be a dominant factor in planning excursions, but it seems likely that planned contribution to this survey could add much pleasure and purpose to some excursions. Individual members are also invited to examine the records at any time, with a view to contributing an individual comment or making a private foray to an area.

The most pressing need seems to be the recording of the necessary information concerning existing sites, but the sub-committee is also considering the need for amendments, and

for recommendations for new sites. In this connection it will be most grateful for proposals from any member of the Society. It is suggested that such a proposal might conveniently be made by the completion of the relevant sections on one of the standard forms. Copies of these can be obtained from the General Secretary or from the President. The committee will then seek and collate all other available comments or information on the area proposed. It is emphasised that the making of a proposal to the sub-committee is simply a way of getting a collated statement of opinion from the Society's members. It is not intended in any way to impinge on the right of any individual member to make his or her own recommendations direct to any other body.

Members of the Society are invited to inspect the file of records as they wish. For general convenience it has been deposited in the President's laboratory in the University of Glasgow; it can be seen there at any time when the University is open, or at other times by arrangement.

Members of the Sub-Committee

E. A. Crowson, G. Hosie, S. A. Hutchinson (Convener), P. S. Maitland, R. Mackechnie, C. E. Palmar, A. A. Percy, W. D. I. Rolfe, A. A. P. Slack, A. McG. Stirling, E. C. D. Todd.

RAINBOW TROUT, *SALMO IRIDEUS* GIBBONS, IN THE LOCH LOMOND DISTRICT

By PETER S. MAITLAND

Department of Zoology, University of Glasgow

(Received 21st May, 1965)

The Rainbow Trout, *Salmo irideus* Gibbons, is indigenous to North America west of the Mississippi basin, where it is common in many lakes and rivers. As with the Common Trout, *Salmo trutta* L., in Great Britain, there are two distinct races of Rainbow Trout in North America; one of these is the normal Rainbow form which stays permanently in freshwater whilst the other (usually known as the Steelhead form) passes down to the sea for some years before returning to spawn. Rainbow Trout of both forms have been introduced many times in Great Britain, even as far back as the 19th century (Malloch, 1912), but, as discussed further below, they have rarely succeeded in establishing themselves here.

In the Loch Lomond district (as defined by Hunter, Slack and Hunter, 1959) there appears to be only one previous authentic record of this species. One of the earliest accounts of the fish of the area (Lumsden and Brown, 1895) includes no mention of Rainbow Trout, nor do Scott and Brown (1901) in their detailed list of the fish fauna of the Clyde area. Lamond (1931) records that Rainbow Trout have undoubtedly been introduced into several of the small lochs and reservoirs in the Loch Lomond district, but notes only one definite record—of a fish of 0.23 kilograms caught near the Endrick Bank in Loch Lomond. He suggests that this fish had doubtless escaped from some reservoir, and that this single record does not warrant the inclusion of the Rainbow Trout as a Loch Lomond species. Hunter, Slack and Hunter (1959) make no mention of Rainbow Trout in their recent account of the lower vertebrates of the Loch Lomond district.

The specimen mentioned by Lamond (1931) was caught about 1925 and there appear to have been no authentic records from the area since that time. However, in June 1964, Mr. J. H. Daly caught a Rainbow Trout of 0.68 kilograms in the middle reaches of the River Endrick (at Ballochairn), the largest river flowing into Loch Lomond. A second, larger specimen, some 35 centimetres long and 0.91 kilograms in weight was caught on 1st August 1964 by Mr. P. Anderson, also in the middle reaches of the River Endrick (at Craigbel). No more were reported until 30th March 1965, when another Rainbow Trout, 30 centimetres in length and weighing 0.45 kilograms, was caught by Mr. A. M. Lindsay very close to where the first specimen had been taken—the middle reaches

of the River Endrick at Ballochairn. This specimen was presented to the author and is now preserved in the Department of Zoology at the University of Glasgow.

The origin of these fish in the Loch Lomond district remained rather obscure until it was found that a small loch in the valley of the Blane Water (the main tributary of the River Endrick) has been stocked regularly over the past few years with fry of both Brown Trout and Rainbow Trout. These Trout are reared in this loch for some time before being transferred to a loch in Argyllshire for angling purposes. It seems highly probable that the fish being caught in the River Endrick originate from this stock, especially when it is considered that the Rainbow Trout is well known as being liable to escape from lochs in which it is placed, if a suitable outlet is available (Malloch, 1912).

In most places in this country the introduction of Rainbow Trout has been unsuccessful as far as the establishment of a permanent population is concerned (Malloch, 1912); in most lochs and rivers where the species has been introduced, it has soon died out—in spite of the fact that individual fish may have grown well, and may even have spawned. The only exceptions to this have been in a few English lakes and reservoirs (e.g. Blagdon, Chew, etc.) where for some reason Rainbow Trout have thrived. It seems improbable, therefore, that this species will establish itself in the Loch Lomond district, though the distances travelled by the present specimens show that if suitable conditions are present anywhere, the species will probably find them.

It is unlikely that there is any possibility of these Rainbow Trout hybridising with local Brown Trout, for whilst the latter spawn in the autumn, most Rainbow Trout breed later than this—often not until the spring. Hybrids between the two species have been known to occur, however, and it is interesting to note that among the many Trout from Loch Lomond examined recently by the author, there were some which showed heavy spotting of the adipose and caudal fins—a feature which is normally characteristic of Rainbow Trout. There may therefore be some slight introgression by Rainbow Trout in the population of Brown Trout in Loch Lomond.

Future records of Rainbow Trout in the area will be watched with interest. The present record brings the total number of freshwater fish species authentically recorded in the Loch Lomond district in recent years (Hunter, Slack and Hunter, 1959; Maitland, 1964) up to seventeen.

ACKNOWLEDGEMENTS

I am grateful to Mr. A. M. Lindsay for giving me the specimen of Rainbow Trout mentioned above, and to Mr. A.

Bulloch for information concerning his rearing of Rainbow Trout fry in the area.

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THE CRAB *PIRIMELA DENTICULATA* (MONTAGU)
IN THE FIRTH OF CLYDE

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(Received 15th February, 1966)

The discovery in the Firth of Clyde, an area so assiduously studied, of a species of crab new to the area is worthy of record. On 14th September 1965 a specimen of *Pirimela denticulata* (Montagu) was obtained from clean, rather coarse sand in 10 metres off Brigurd Spit, Hunterston, during collecting from the Scottish Marine Biological Association's research vessel "Calanus" with a class of students. It is an adult female, 17 mm in width of carapace, not "in berry". The carapace is finely mottled with greenish brown, and the legs and the abdomen are marbled with purplish brown on a pale background.

The specimen was kept under observation in the laboratory. It was very active in burying itself beneath the surface of sand or clean gravel. In this operation it used its four pairs of legs for digging and pushing aside the material and for pulling its body downwards and its two chelipeds for pushing material forwards from beneath its anterior region. When covered it was quiescent and lay with its carapace horizontal. In sand the anterior margin of the carapace, the eyes and the antennae remained visible. In gravel the crab was completely hidden a little below the surface. Its legs are structurally well adapted for digging, being curved towards the ventral side of the animal and rather short, with strong pointed dactyli.

Since this report was prepared a second specimen has been found, on 25th November 1965, in 3 metres depth about 600 yards south of Brigurd Spit, in medium coarse sand. It is a male, 8 mm in width of carapace. Both specimens were obtained with a Knudsen sampler.

It is a small species not exceeding about 20 mm in width of carapace, and is the sole member of its genus. (For descriptions and figures see Bell (1853, p. 72) and Bouvier (1940, p. 225).) It is found in clean siliceous or shelly sand and in shelly gravel, especially on rocky coasts, from extreme low-water mark to depths (in British waters) of about 30 fathoms, and specimens are occasionally found intertidally under stones or in pools. Its apparent rarity in the Firth of Clyde may in part be due to the general muddiness of the area and the scarcity of suitable grounds.

The species is found from western Norway to the Cape Verde Islands, including the Mediterranean and the Adriatic. In Norway, western Sweden, Denmark, the German North

Sea coast, and the Netherlands it is a scarce species, but it is commoner in France and other more southerly parts of its range. It has been found on most of the coasts of the British Isles, but only in very small numbers except in the south-west where (in Devon, Cornwall and the Channel Islands) it occurs fairly frequently. In Scotland it has rarely been found, the following specimens being recorded: two specimens from "the coast of Scotland" (Montagu, 1808; Leach, 1815); occasionally from deep water off St. Andrews, rare (McIntosh, 1875); one specimen from Gair Loch, Wester Ross (Henderson, 1886); one specimen from Canty Bay, near North Berwick, Firth of Forth, in an intertidal rock-pool, probably washed there by high seas (Evans, 1921); and one specimen from the Isle of Muck, dug at the mouth of a sandy creek at extreme low water (Nicol, 1939).

ACKNOWLEDGEMENTS

I wish to thank Mr. A. Rodger Waterston of the Royal Scottish Museum for help with Scottish records; and Mr. B. L. S. Hardy of this Station for reporting the second specimen mentioned above.

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RECORDS OF MAMMALS AND THEIR ECTOPARASITES FROM FOUR SCOTTISH ISLANDS

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(Received 8th March, 1966)

INTRODUCTION

The faunal history of the Hebrides (and of Britain as a whole) is intimately associated with Pleistocene and post-glacial geography and human history, of which our knowledge is inevitably fragmentary. But knowledge of *present* distribution and variation of species is also fragmentary and if investigated more thoroughly could provide a solid factual basis for speculation about past events. Small mammals, by virtue of their low powers of dispersal, are especially useful subjects for such work.

This paper records the terrestrial mammals of four islands: Lismore (Loch Linnhe, Argyll), Shuna (Loch Melfort, Argyll), Eilean Gamhna (Loch Melfort) and the Crowlin Islands (Ross-shire). Records of ectoparasites from the first three islands are tabulated.

All specimens, except fleas, are preserved in the British Museum (Natural History). The measurements were taken as follows. Head and body, and tail: from the posterior surface of the pelvis. Hind foot: without claws. Pelage: the length of the melanic zone of the pelage in the mid-dorsal position.

LISMORE

Lismore is a low lying limestone island 10 miles long by about $1\frac{1}{2}$ wide. It approaches closest to the mainland at its north-eastern extremity where it is separated from Appin by a strait $\frac{3}{4}$ mile wide and 5–10 fathoms deep. The island is heavily grazed by sheep and cattle, and rough ground with trees and shrubs is almost confined to the cliff on the landward side of the encircling raised beach.

Small mammals were collected from 17th to 22nd May, 1964, in the central part of the island between Achnacroish and Sailean in three habitats: the wooded cliffs, the edge of a sedge swamp amongst tall rushes, and the walls of a farmyard.

Sorex araneus—common shrew. Ten adults were collected, five of each sex. They show an interesting sequence of moult stages, proving the presence of an intermediate pelage between the normal winter and summer pelages. All five males had a 4 mm pelage (length of melanic zone) and none was moulting. Each of the five females was different, showing the

following stages: (1) 6 mm (i.e. normal winter) pelage, no moult; (2) 6 mm pelage, moult just starting on muzzle; (3) anterior half 4 mm, posterior half 6 mm; (4) 4 mm pelage complete except that the hair was still growing on two small patches on the abdomen; (5) 2 mm pelage (i.e. normal summer length) with a little 4 mm left on the rump and posterior part of abdomen.

There is little difference in colour between these three pelages. They are all very dark dorsally, similar to the winter pelage of mainland animals and darker than the normal short summer pelage. The flanks are also very dark and the ventral surface grey with almost no trace of yellow or brown. They resemble specimens from Scarba (Corbet, 1964) and Shuna (described below) but are darker than comparable skins from Mull, Jura and Islay. In size they resemble both mainland and other island forms, but show an unusually large range of variation (condylo-basal length 17.8 to 18.7, plus one at 19.3; mean of nine 18.42). The dentition is normal, all having both fifth unicuspid present.

All the males were in breeding condition (testes 6 to 7 mm in length); four of the females were pregnant with 6, 6, 8 and 9 embryos and the fifth had the uteri enlarged although not apparently pregnant.

Sorex minutus—pygmy shrew. One was obtained, amongst willow bushes. It was an adult male in breeding condition with the melanic part of the pelage 2 mm. This may represent an early summer pelage. The colour and size are normal (condylo-basal length 15.0 mm).

Pipistrellus pipistrellus—pipistrelle. Two colonies were located in the roofs of farm buildings 200 yards apart. About twenty individuals were seen to emerge from one of these and ten, all females, were caught. Forearm measurements ranged from 30.9 to 33.1, mean 31.81 mm. Two specimens, each pregnant, with one embryo, were preserved.

Mustela erminea—stoat. Reported by the local people to be present.

Lutra lutra—otter. Spraints were found by a stream.

Lepus sp.—hares. Hares were reported to be present, but none was seen.

Apodemus sylvaticus—wood mouse. Nine males and six females were collected. All were in adult pelage, apparently of winter length (melanic zone 7 to 8 mm). All the males were sexually mature (testes 11 to 13 mm). One female was imperforate; two were perforate but with the uteri in anoestrous condition; one had the uteri thin but vascular; and one was pregnant. It therefore seems that breeding was just starting and all are likely to have been over-wintered animals. This is borne out by the teeth.

In size they agree with samples from the mainland of Argyll and most of the Inner Hebrides. The tail is in every case less than the length of head and body. The dorsal pelage is a little more yellow and less grey than comparable skins from the mainland (Sunart) and Shuna. Ventrally they are identical. The pectoral spot is present and fairly prominent on all.

Mus musculus—house mouse. One adult was trapped in the farm-yard. It appears normal in every respect.

Rattus norvegicus—brown rat. Seen in a store-shed by the pier at Achnacroish.

Microtus agrestis—field vole. Seven males and five females were collected, all adult, over-wintered animals. The males were all in breeding condition (testes 10 mm); all the females were pregnant (embryos 4, 5, 6, 6, 6) and one was also lactating. All are in a pelage of winter length (11 mm). Only one female shows sign of moulting, on the head, but all the males show small irregular moult-marks.

The pelage is indistinguishable from that of comparable skins from the mainland of Argyll and Perthshire. Size, length of tail and length of hind foot also agree with mainland samples. The first upper cheek-tooth has the postero-internal loop small, agreeing with mainland samples from south of the Great Glen. Only one has the loop exceeding 100μ (beyond the preceding bay); none has it exceeding 200μ .

Absent species. The following species all appeared to be genuinely absent: mole, hedgehog, fox, badger, rabbit, all deer, squirrel, bank vole.

SHUNA

Shuna is about three miles by one and is surrounded by water over ten fathoms deep. It is half a mile from the island of Luing and $1\frac{1}{2}$ miles from the mainland. It is probably the most heavily wooded of all the smaller Scottish islands, about half the area being wooded, mostly with birch. It is grazed by sheep, cattle and deer, but nevertheless there is much long, rough grass (mostly *Molinia*) providing adequate cover for small mammals. Only one house is occupied. Collecting was carried out near Shuna Castle from 25th to 29th May, 1964. All the animals were caught in, or close to birch wood, with ground cover of rushes, bracken and grass, and never far from streams.

Sorex araneus—common shrew. Sixteen were collected, eight of each sex, all adult. Of the males seven had a 4 mm pelage showing no moult, the other was in 4 mm pelage with a large oval area of 2 mm pelage on the rump, the rest of the dorsal skin being black indicating imminent moult. Of the females one had a 3 mm pelage. Since this individual showed a small

patch of black skin in the middle of the back it probably represents the 4 mm pelage about to moult. The other five (two skins were not preserved) all had a 2 mm pelage and showed no moult. It is therefore clear that the females were moulting from the 4 to 2 mm pelage before the males.

In colour the pelage resembles that of the series from Lismore except that the flanks are lighter (i.e. normally coloured). Size is normal (condylo-basal length 17.9 to 18.8, mean 18.54), and so is the dentition.

All were sexually mature. Three females were pregnant (each with six embryos). One of these was also lactating as were the remaining five.

Neomys fodiens—water shrew. Three were obtained, in open birch woodland by a stream, amongst boulders and rotting sea-weed on the shore and amongst irises just above high-water line. All were adult males in breeding condition. The melanic zone of the dorsal pelage is 4.5 to 5 mm, which seems to indicate a spring pelage intermediate between that of winter (6 to 7 mm) and summer (3 mm).

The dorsal pelage is like that of specimens from the mainland, but ventrally the pelage is pure grey with a tinge of pink on the throat and the slightest tinge of brown elsewhere on two specimens. There is no trace of a yellow wash nor of dark brown markings, which makes them unique amongst the British *Neomys* examined (50 specimens, all but twelve from England). (Only three specimens are available from the west coast of Scotland—two from Applecross, Ross-shire, in the collection of Mr. M. J. Delany, and one from Tighnabruaich, Argyll, in the Glasgow Museum—and they seem comparable with other mainland specimens, having a distinct yellowish wash ventrally.) The hair fringes on the feet and tail are well developed and there are white ear-tufts. The measurements of body and tail fall within the range of mainland specimens (79/49, 80/50, 76/53) but the hind feet are smaller than any others recorded (15.7, 15.7, 15.5). The condylo-basal lengths are small (19.4, 20.1) the first being below the range of 14 British specimens given by Miller (1912), whilst the lengths of the upper tooth-rows (9.2, 9.5) are both below the minimum given by Miller (9.6).

Water shrews have been found on several of the Inner Hebrides, namely Raasay, Skye, Kerrera and Mull, and on Arran and Bute, and the small numbers that have been collected indicate that it could have been overlooked on others. No adequate series exist. Two specimens from Raasay show a strong wash of orange ventrally; three from Mull include two melanics and one with the under parts pure grey without even a tinge of colour on the throat; and one from Arran is similar to the mainland form, with a yellowish wash and a streak of dark brown. On the basis of this meagre data the

Shuna specimens come closest to the single non-melanic individual from Mull.

Lutra lutra—otter. Frequently seen by the residents.

Dama dama—fallow deer. At least ten.

Capreolus capreolus—roe deer. Present.

Oryctolagus cuniculus—rabbit. Abundant. Introduced in 1912.

Apodemus sylvaticus—wood mouse. This species was much more abundant than on Lismore and 22 were collected, 17 male and 5 female. All were in adult pelage of about 7 mm. All the males were sexually mature. Of the females one was imperforate; two were perforate with the uteri large but not obviously pregnant; and two were pregnant, one with five embryos, the other with one large foetus and one apparently undergoing abortion.

In size they agree with mainland animals. The tail is on average longer than in most of the other island forms, being equal to or greater than the length of head and body in eight out of nineteen. The pelage is indistinguishable from that of mainland animals, lacking the yellowness above characteristic of the sample from Lismore.

Absent species. The following appeared to be absent: mole, hedgehog, fox, stoat, badger, hares, bank vole, field vole. The absence of voles is especially significant in view of the optimum habitat for these species. Although no pygmy shrews were collected their absence cannot be considered proven.

EILEAN GAMHNA

Eilean Gamhna is a small island (about four acres) at the entrance to Loch Melfort, Argyll. It is half a mile from the mainland but is beyond the ten fathom contour. There are neither trees nor shrubs, the only vegetation providing any cover being rushes. It is grazed by a few sheep; and eider duck, lesser black-backed gulls and herring gulls were nesting.

Traps were set for 24 hours (26th to 27th May, 1964) and one water vole, *Arvicola terrestris*, was obtained. Over most of the island runs and holes were everywhere, many of the holes having heaps of fresh soil looking very like mole-hills. It seems likely that the water vole is the only mammal on the island but the absence of shrews cannot be considered certain.

Arvicola terrestris—water vole. The specimen obtained was an adult male in breeding condition (testes 13 mm) with well developed lateral glands. Externally it is typical of *Arvicola* from the Scottish Highlands (*A.t.reta*), but the skull shows several peculiarities. The pelage is entirely black except for the hairs of the lips, prepuce and tail-tip which are white. (Albinism of the tail-tip is of frequent occurrence in *Arvicola* especially in the north of Britain (Corbet, 1963).) The external

measurements are: head and body 183; tail 106; hind foot 30.1; ear 14.9; weight 168 g. Cranial dimensions: condylo-basal length 39.8; maxillary tooth-row (at alveoli) 8.6; zygomatic width 25.0; inter-orbital width 4.4; nasal length 10.7; diastema 13.7; mandibular tooth-row 9.2. The temporal ridges are completely united in the inter-orbital region.

These cranial measurements are related to those of mainland samples in Table 1. Condylo-basal length is small, but two out of twenty mainland specimens are smaller. The maxillary tooth-row is both absolutely and relatively smaller than in the mainland sample. The relative length (39.6 per cent of

TABLE 1.

Cranial measurements of *Arvicola terrestris* from Eilean Gamhna compared with those from the British mainland. (Only skulls with united temporal ridges are included.)

	Mainland			E. Gamhna
	No.	Range	Mean	
Condylo-basal length	20	39.2-44.4	41.9	39.8
Maxillary tooth row	50	9.1-10.6	9.77	8.6
Zygomatic width relative to condylo-basal length	20	55%-62%	58.6%	63%
Nasal length relative to condylo-basal length	20	24.8%-28.9%	27.0%	29.6%

condylo-basal length) is equalled only by the smallest out of twenty mainland skulls; the absolute length is outside the range of variation on the mainland, as shown by the 50 adult skulls included in Table 1, and also by an additional 40 adult skulls examined. The other two cranial proportions in which the Eilean Gamhna skull is unique are the relative zygomatic width and the relative length of the nasals, which are both larger than in any of 20 mainland skulls. A further cranial peculiarity is the presence of a transverse ridge across the basioccipital, continuous with the anterior margins of the condyles on either side. This condition is present in only two out of ninety British skulls examined. The dentition shows one unique character, namely the extremely simple third upper cheek-teeth which lack any closed triangles (Fig. 1, *a* and *b*). The entire collection of *Arvicola* in the British Museum has been examined without finding anything approaching this condition, i.e. in 222 British and 247 Continental specimens. The second lower cheek-tooth is unusual in having the first and second dentine spaces separate. This condition is, however, present in a small minority of animals on the mainland.

The upper incisors are rather pro-odont but not more so than many from northern England and Scotland. Using the technique devised by Thomas (1919) for measuring the degree of pro-odonty the angle is 97° , which is similar to many specimens from northern England that Thomas (1928) described as *A. amphibius brigantium*. Thomas considered Scottish specimens to be orthodont like those of southern England but in fact additional specimens from Scotland show great variation, extremes of 82° and 105° being found in two specimens both from Inverness-shire.

To sum up, the specimen from Eilean Gamhna falls outside the range of variation observed in the mainland samples with respect to maxillary tooth-row (small), relative length of

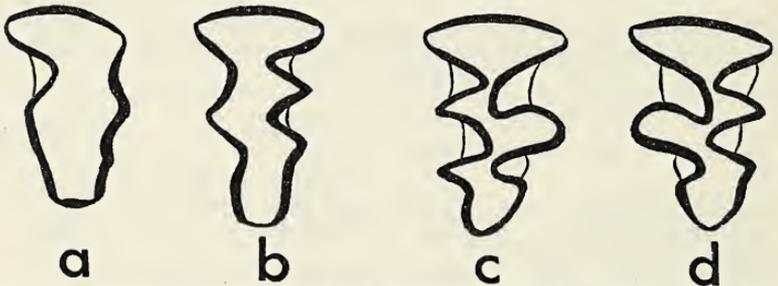


Fig. 1. Third upper cheek-teeth of *Arvicola terrestris* from Eilean Gamhna (*a*, right; *b*, left) and from the mainland of Scotland (*c*, right; *d*, left).

nasals (large), relative zygomatic width (large) and shape of M^3 (simple). It falls near one extreme of the range with respect to size (small), the presence of a transverse ridge on the basioccipital, and the pattern of M_2 (first and second triangles separated). The chances of these all being individual, rather than racial, characteristics are remote. If even half of these peculiarities are characteristic of the population as a whole, it should be considered a distinct subspecies. However, it seems advisable to refrain from naming it until further specimens are available. It should also be pointed out that no specimens are available from the adjacent parts of the mainland and only twenty from the whole of Scotland.

The only other British islands on which water voles are known to exist are Skye, Bute, Anglesey, Wight (all very large islands) and Read's Island in the estuary of the Humber. The only insular specimens available for comparison are from Read's Island and these appear to be indistinguishable from mainland specimens. The ecological conditions on Read's Island are similar to those on Eilean Gamhna (Southern and Crowcroft, 1956), but the degree of isolation differs since it is separated from the mainland at low water by only 300 yards of estuarine water.

CROWLIN ISLANDS

The Crowlins are a group of three islands $1\frac{1}{2}$ miles from the south-western coast of the Applecross peninsula, Ross-shire. They are surrounded by water over ten fathoms deep. The following records refer to the largest of the three, Eilean Mor, which has an area of almost one square mile. They were collected by Mr. R. J. Horton between 28th June and 4th July, 1963.

Sorex araneus—common shrew. One adult and one juvenile collected, both females. Having been in formalin and spirit the pelage cannot be accurately compared with others. The skulls are damaged, but the lengths of the upper tooth-rows are 8.1 mm for the juvenile and 7.7 mm for the adult, the latter being unusually small. Both have the fifth unicuspid present.

S. araneus is less widespread than *S. minutus* on the Scottish islands and has apparently not been hitherto found on such a small island.

Oryctolagus cuniculus—rabbit. Plentiful on at least the two larger islands (which are connected at low tide).

Apodemus sylvaticus—wood mouse. Three were collected. Two are adults with exceedingly worn teeth, the first lower cheek-teeth being almost divided into two; the third a young adult with little wear. The skulls are all damaged but appear normal in structure and size.

Voles. No runs were detected and it seems likely that voles are absent.

DISCUSSION

The most remarkable feature of the mammalian fauna of these islands is the absence of voles on Shuna in spite of apparently ideal habitat. This lends support to the theory that most of the islands have never been in contact with the mainland in post-glacial times and have received all their mammals by fortuitous colonization. This is less likely, but not unlikely, in the case of Lismore, which is within the ten fathom contour.

THE PARASITES

Each animal was chloroformed in a plastic bag on removal from the trap. All fleas observed were collected but only samples of lice and Acarina were taken. In Table 2, the islands are indicated by L (Lismore), S (Shuna) and G (E. Gamhna); and the mammalian hosts by their initial letters, e.g. *S.a.* (*Sorex araneus*).

ACKNOWLEDGEMENTS

My grateful thanks are due to the Viscountess Selby for her kind hospitality on Shuna; to Mr. R. J. Horton for presenting

the specimens from Crowlin and allowing me to record them; to Dr. Theresa Clay, Mr. R. S. George and Mr. K. H. Hyatt for identifying the lice, fleas and Acarina respectively; to Mr. M. J. Delany for lending skins of *Neomys* from Raasay, Mull and Applecross; and to Mr. C. E. Palmar for supplying a description of the *Neomys* in the Glasgow Museum.

TABLE 2.
Ectoparasites

	Hosts							
	S.a.	S.m.	N.f.	P.p.	A.s.	M.m.	M.a.	A.t.
Fleas								
<i>Hystrichopsylla talpae</i> (Curtis)								L
<i>Palaeopsylla soricis</i> (Dale)	L, S	L			L			L
<i>Doratopsylla dasyneumus</i> (Rothschild)	L, S	L	S					
<i>Ctenophthalmus nobilis vulgaris</i> Smit	L		S		L, S			L
<i>Ischnopsyllus octactenus</i> (Kolenati)				L				
<i>Dasyopsyllus gallinulae</i> (Dale)								L
Lice								
<i>Polyplax serrata</i> (Burmeister)					L, S	L		
Acarina								
<i>Argas vespertilionis</i> (Latreille)				L				
<i>Ceratoptia bipilis</i> (Hermann)			S					
<i>Cosmolaelaps claviger</i> (Berlese)					L			
<i>Eugamasus remberti</i> Oudemans					L			L
<i>E. loricatus</i> (Wankel)			S					L
<i>Eulaelaps stabularis</i> (C. L. Koch)					L, S			L
<i>Euryparasitus emarginatus</i> (C. L. Koch)	L		S		L			L
<i>Haemogamasus ambulans</i> (Thorrell)					L			
<i>H. horridus</i> Michael	L		S		L			
<i>Haemogamasus</i> sp.					S			
<i>Hermannia scabra</i> (L. Koch)					S			
<i>Hirstionyssus isabellinus</i> (Oudemans)					L			
<i>Ixodes ricinus</i> (L.)	S	L	S		L, S			L
<i>I. trianguliceps</i> Birula	L	L			L			L
<i>Labidophorus hypudaei</i> (C. L. Koch)								G
<i>Laelaps amphibius</i> Zachvatkin								G
<i>L. agilis</i> C. L. Koch					L, S			
<i>L. hilaris</i> C. L. Koch								L
<i>L. kochi</i> Oudemans								L
<i>L. muris</i> Ljungh								G
<i>Listrophorus leuckarti</i> Pagenstecher								L
<i>Myonyssus gigas</i> (Oudemans)					L			G
<i>Pachylaelaps longisetis</i> Halbert					L			
<i>Pergamasus robustus</i> (Oudemans)					L			
Beetles								
<i>Leptinus testaceus</i> Müller					L, S			

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WEST OF SCOTLAND MOSS NOTES

By G. RODWAY and A. McG. STIRLING

(Received 10th March, 1966)

The purpose of the present paper is to place on record some of the more interesting mosses noted in the West of Scotland during the past few years. The nomenclature used follows that of Warburg (1963). Those records which are new for a particular vice-county are indicated by *.

Vice-county 75, Ayr

* *Dicranoweisia crispula*, a species more commonly met with on the higher hills, was found on basalt rocks at about 700 feet altitude on the hills above Largs. The only non-highland Scottish records are "Near Dumfries" (Cruikshank) and "Milyea, New Galloway" (McAndrew).

In the Penwhapple Burn near Girvan the uncommon *Orthotricum rivulare* was got, growing in the usual habitat—stones in the bed of the stream, while on Knockdolian Hill near Ballantrae we noted *Hedwigia integrifolia*, a local species first recorded from this station by Miss E. Armitage in 1921. This moss occurred in great abundance on rather dry outcrops of the volcanic agglomerate of which the hill is composed, and appeared to be absent from the north and west sides of the hill.

Vice-county 86, Stirling

Several species new to the vice-county have been noted recently. * *Dicranum starkei*, an alpine species of general distribution in the Highlands but previously unrecorded for Stirling was found near the summit of Ben Lomond, and in nearby Cailness Glen the calcicolous * *Seligeria domiana* was growing on calcareous schist. * *Tortula princeps*, a moss of very local distribution, was found in small quantity on floristically rich basalt rocks at Double Craigs, Fintry Hills. The characteristic interrupted stems were readily apparent, and abundant fruit was present. Double Craigs and the banks of the nearby Cammal Burn also proved to be new Stirlingshire stations for the local *Rhytidium rugosum* a calcicole moss previously known in the Campsie area only from old limestone workings near Lennoxton. A note on the last-mentioned occurrence has been published by Rodway (1963).

A report that the calcicole moss * *Orthothecium rufescens* had been seen in the Corrie of Balglass, Campsie Fells, led to a visit in October 1965, when this beautiful moss was found to occur in considerable quantity, some being in fruiting condition. *Grimmia torquata* was also obtained in this locality where the rock appears to be a very basic volcanic agglomerate. Later in the same month a *Fissidens* was found in earth-filled

crevices at the old limestone workings, Corrie Burn, Kilsyth. This proved to be * *Fissidens bambergeri*, a moss not previously reported from Scotland.

Vice-county 98, Argyll

The basic andesite crags of Creag an Sturra, Loch Melfort, have been found to support an interesting moss flora which includes *Rhytidium rugosum*, * *Weissia microstoma* and *Tortula intermedia*. *Rhytidium* also occurs on several other crags in the district. *Anomodon viticulosus*, a moss associated with limestone and other basic rocks occurs in several places in Mid-Argyll, being found on andesites in the Kilmelford area, on epidiorite near Ford, Loch Awe, and on limestone in the Kilmartin district. Seldom found fertile, this species had abundance of capsules in the latter locality in October 1964. Another limestone moss, *Gymnostomum calcareum*, occurs in a few Argyll stations including Kilmartin, Kilmelford and Port Appin. In the latter locality it is accompanied by abundance of *Neckera crispa* and *Anomodon viticulosus*.

Glen Gallain near Kilmelford appears to be a particularly favourable locality for the occurrence of mosses in the fertile condition. The following species, rarely found fruiting, were noted with capsules in this locality—*Neckera crispa*, *Breutelia chrysocoma* and *Hylocomium umbratum*.

In July 1964 a visit to Meall Mor, Glencoe, a hill largely composed of limestone, produced two new vice-county records—* *Mnium spinosum* and * *Catoscopium nigrum*. The *Mnium* was growing on basic rock ledges, and the *Catoscopium* in calcareous flushes. The other known occurrences of *Mnium spinosum* are on floristically rich hills of the central and eastern Highlands (Ben Lawers, Caenlochan, Glas Thulachain and the Ben Alder range), so that this western locality is noteworthy. Several other rarities of a calcicolous arctic-alpine nature are known to occur in the Glencoe area, including *Timmia norvegica*, *Pseudoleskea patens*, *Brachythecium glaciale* and * *Cirriphyllum cirrosum*. The last-mentioned species, previously known only from Ben Lawers, was found on one of the Glencoe hills in September 1965 by Mr. E. C. Wallace in company with one of us (A.McG.S.). On Meall Mor the abundance of the handsome *Orthothecium rufescens* was particularly noteworthy. On one part of the hill this moss was fruiting, a comparatively rare occurrence with this species.

Beinn Udlaigh in Glen Orchy, a mountain with a particularly good bryophyte flora, proved to be a new locality for *Acrocladium trifarium*, *Leptodontium recurvifolium* and *Orthothecium rufescens*. This hill is rich in hepatics of a western distribution.

Vice-county 99, Dunbarton

During an A.N.G. excursion to Murroch and Auchenreoch Glens in September 1964 the rare moss * *Aloina rigida* was

found growing on the crumbling surface of the isolated rock known as Lot's Wife. This species has previously been recorded from only six Scottish vice-counties and the only two previously known Clyde area localities, Paisley Canal (McKinley) and Possil Road (Stirton) are now probably very much altered in character and it is doubtful if the *Aloina* still exists in these stations. Fruiting specimens of *Gyroweisia tenuis* were seen at one spot in Murroch Glen growing on the cementstone bands in the Ballagan Beds. This is the second record for Dunbarton, the first being from an Old Red Sandstone quarry near Dumbarton where Mr. A. C. Crundwell recorded the moss (which was fruiting here also) in 1956.

Tortula princeps was apparently first found in the county "on trap rocks at Bowling Bay by the Clyde" in 1840 by G. S. Lyon. Though his specimen in the British Museum herbarium was wrongly named *T. ruralis* its true identity was established by Mr. A. C. Crundwell, and the old record has recently been confirmed by the discovery of a quantity of *T. princeps* on basalt crags at Glenarbuck, Bowling.

On Beinn Tharsuinn, Luss Hills, in June 1964 the interesting moss * *Tetraplodon mnioides* was collected. This species is usually associated with decayed sheep or deer bones or other organic remains, but in the present instance the organic nature of the substratum was not immediately apparent. Later examination however showed that the moss was growing on a small mass of fur and bones, beetle wing cases, etc.—probably a buzzard or owl pellet. The apparent rarity of this species in Dunbarton is surprising since it is recorded from all the other highland counties except Shetland.

Orthothecium rufescens was found beside the Invergroin Burn, Glen Douglas, and in abundance in a ravine above Stuckgowan, Tarbet. Previous records from the same area are—Glen Douglas (Lee 1907) and "roadside below Arrochar". At Stuckgowan *Seligeria doniana* was also seen together with abundance of *Ptilium crista-castrensis*, *Bartramia hallerana* and, in small quantity, the rare hypnoid moss * *Sematophyllum novae-caesareae*, a new record for Dunbarton, though recently reported from Cailness Glen on the Stirlingshire side of Loch Lomond. There is also an old record from the area immediately to the west of Loch Long—Succoth Hill, Arrochar (McKinley 1866). We believe the plant has not since been seen in this Argyll locality.

We are indebted to Mr. A. C. Crundwell for his valued advice in the preparation of this paper.

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ON THE DISTRIBUTION IN BRITAIN
OF *Pinguicula lusitanica*

By A. A. P. SLACK

(Received 30th March, 1966)

Searches in the literature on behalf of the Distribution Maps Scheme in the late 1950s indicated that *Pinguicula lusitanica* might still occur in north-east Scotland as far south as the Black Isle, although no recent records were traced. Such a locality for a species usually regarded as hugging Scotland's west coast seemed to merit investigation. *Pinguicula lusitanica* is most abundant in the western parts of the counties of Ross and Sutherland, where, within a few miles of the sea every third or fourth suitable flush examined will almost always yield specimens. A suitable flush is as follows:

Near sea-level *Pinguicula lusitanica* occurs in fairly flat small stoney flushes washed by peaty water. As a rule, it avoids acid areas where *Trichophorum cespitosum* occurs. It is rarely found beside larger flushes and streams where it is likely to be inundated and seldom inhabits areas with tall close vegetation such as *Juncus acutiflorus*. Its typical associates are *Drosera anglica*, *D. rotundifolia*, *Saxifraga aizoides*, *Pinguicula vulgaris*, *Utricularia minor*, *Eleocharis pauciflorus*, *Carex hostiana*, *Rhynchospora alba* and *Schoenus nigricans*.

But at 300–1000 feet above sea-level *Pinguicula lusitanica* occurs in steeper flushes with bare black peat and relatively few stones. It is frequently found in places where water oozes out of the ground but inundation is unlikely and, almost as if seeking protection, in gaps between taller plants such as *Myrica gale* and *Pteridium aquilinum*.

Throughout the north of Scotland, with the exception of Caithness, the plant remains reasonably abundant west, centre, and east almost as far south as the railway line from Kyle of Lochalsh to Strathpeffer, but south of this it can regularly be found on the west only, though a few isolated localities occur elsewhere.

South of Wester Ross the species gradually decreases in abundance so that it becomes necessary to search more and more flushes to find it. Moreover, there are pockets, such as around Glenelg in Inverness-shire, from which it appears to be absent, in spite of the existence of *Saxifraga aizoides* flushes. The Hebridean islands harbour plenty of *Pinguicula lusitanica*, but on the mainland at relatively short distances inland the plant becomes difficult to find. This pattern extends through the counties of Ross, Inverness, Argyll and Bute. Thus two areas may be defined—the main area of Sutherland and Ross with the Hebrides and adjacent mainland of Inverness and Argyll where *Pinguicula lusitanica* is reasonably abundant, and

a fringe area extending for a few miles on either side of a line following the railway from Strathpeffer to Strathcarron and from there running due south to Loch Lomond. This fringe "strip" appears to extend farther south from Loch Lomond along the coasts of Renfrewshire and Ayrshire to Galloway. In the main area the conditions outlined above hold, but in the fringe strips a further feature appears, *viz.* all the habitats slope to the south or south-west. Not only this, but all are of

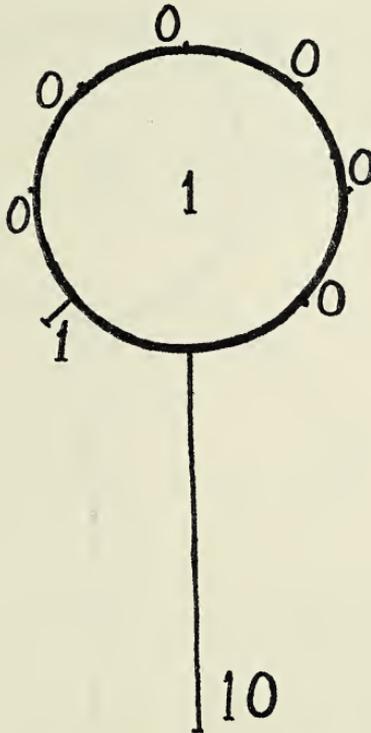


Fig. 1a. Fringe area observations (12).

the nature of sun-traps, i.e. they have some protection to east and west so that the typical set-up resembles in greater or lesser degree a bowl with the southern half cut away.

I have attempted to confirm this last statement in the field and the results are given in the form of two diagrams. Sixty observations are included, each from a different 10 Km national grid square. Where more than one site in a grid square was examined, that with an aspect furthest removed from the south or south-west was used for the diagram. The numbers against each direction indicate the number of sites having a slope in that direction; the central numbers indicate

the sites on flat ground. It is apparent that in all areas there is a tendency to a south-west orientation, but that in the fringe areas this becomes a dominant factor.

Searching for correlations in this very marked distribution it is to be observed that the 400 line for Meyer's Precipitation—

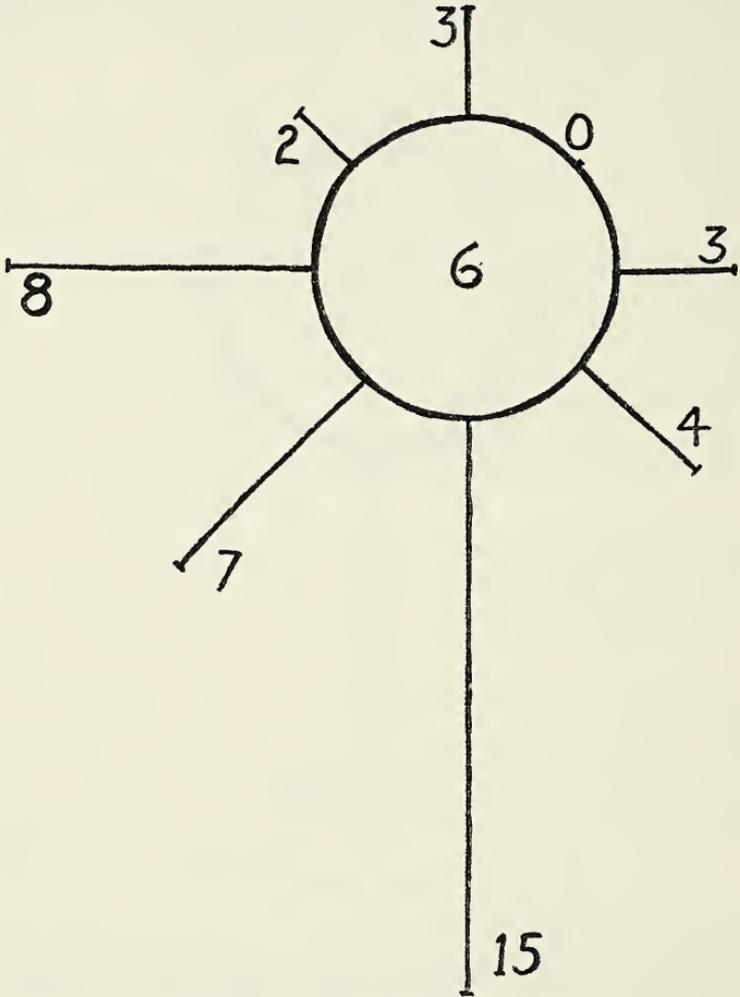


Fig. 1b. Main area observations (48).

Saturation Deficit Quotient in Scotland follows the fringe strip very closely, and it is suggested that to the north and west of this line the general humidity of the atmosphere may contribute to the survival of *Pinguicula lusitanica*. On the fringe however, the local humidity will only be high enough where the sun vaporises water from the very wet habitats selected by

the plant. On the other hand it may be that other factors come into operation in the fringe area such as summer temperature, winter frost, etc., which are not operative in the more humid conditions farther north and west.

It must be noted that it is quite possible to propose habitat preferences for a plant and then by always hunting in such places "prove" that one's hypotheses are correct. To avoid this lack of logic, I have searched for *Pinguicula lusitanica* on otherwise suitable east and north facing slopes in the "fringe" zone, with singularly little success.

Before making further comments on the Highland distribution it is worth glancing at the distribution farther south in Britain. In West Ireland the plant is abundant but as in the Highlands there appears to be a rather sudden decrease in abundance just east and south of the 400 Meyer's line. The result is that a very high percentage of all Britain's *Pinguicula lusitanica* grows in a humidity of at least that indicated by the 400 line. The regions of growth at lesser humidities include:—

- (a) Galloway—not abundant and decidedly local.
- (b) The Isle of Man—not much seen recently.
- (c) The Mourne Mountains—local.
- (d) The Wicklow area—local.
- (e) Pembroke—local.
- (f) Devon and Cornwall—locally common
- (g) The Hampshire Basin—fairly well distributed.

Of these the Hampshire Basin is the least humid, having a Meyer quotient of only 200. The impression left is that the farther south one goes the less is the humidity demanded by the plant. This may be due to the manner of expressing humidity which has been given in terms of Meyer's Quotient. As *Pinguicula lusitanica* grows in extremely wet soil it is possible that precipitation is unimportant and relative humidity may prove more informative. Further, as the leaves are spread at ground level, the humidity there rather than higher in the atmosphere is undoubtedly of greater significance.

Two further points concerning these seven localities are that all except Hampshire are mountainous and that all include large areas left uncultivated for a considerable period.

Turning now to the question of temperature limits it seems that in Britain there are none unless a minimum July mean of 12°C is needed. This could account for the plant's absence in Shetland and rarity in Orkney and parts of Caithness. Low winter temperatures down to a February mean minimum of about 0°C do not destroy the plant which at that time is in the condition of a resting bud.

The typical associates of *Pinguicula lusitanica* have been listed above. They are all plants of wet flushy peaty places though *Saxifraga aizoides* can grow in rockier habitats than the others. In a well developed West Inverness or Ross-shire flush there is a zoning of the associates, thus in one Ross-shire flush scattered plants of *P. lusitanica* grew along both sides of the flush along with *Hammarbya paludosa*. At the head of this flush the individuals of *P. lusitanica* tended to close their ranks, and this happens regularly in such flushes. In a West Inverness flush *Carex hostiana* occupied the central line of the flush with *Drosera anglica*, *Rhynchospora alba*, *Pinguicula lusitanica* and *Drosera rotundifolia* at progressively greater distances on either side. This Inverness locality may be more fully described from field notes as being very typical:—

“Near highest point on road from Acharacle to Kinlochmoidart. Hillside above woods concave to S.W. *P. lusitanica* abundant, zoned. Altitude 500 ft.

Associates:—

<i>Carex demissa</i>	<i>Myrica gale</i>
<i>C. echinata</i>	<i>Narthecium ossifragum</i>
<i>C. hostiana</i>	<i>Pinguicula vulgaris</i>
<i>Drosera anglica</i>	<i>Rhynchospora alba</i>
<i>D. rotundifolia</i>	<i>Schoenus nigricans</i>
<i>Juncus bulbosus</i>	<i>Selaginella selaginoides</i>
<i>Molinia caerulea</i>	<i>Triglochin palustre</i>
	<i>Utricularia intermedia</i>

The area is an array of colonies with drier ground between. One typical colony of 20 plants was observed particularly. It was growing on a slope of 15° to the west and consisted of small specimens, only one of which was flowering on the 11th August 1962”.

Certain plants are rarely associated in Scotland with *Pinguicula lusitanica*. First of all, trees are in that category, though colonies do grow in clearings within woodland, especially alder-woods. I know however of one locality on the North shore of Loch Leven, Inverness-shire, where *Pinguicula lusitanica* grows in the quite dense shade of a birch-alder-wood. Secondly, fairly tall growing shrubs such as *Myrica gale* seem to preclude development, though here again where clearings exist, as they often do, *Pinguicula lusitanica* can survive. Finally, plants such as *Juncus acutiflorus*, which form dense stands, again preclude *Pinguicula lusitanica* and it is instructive to observe that *Juncus acutiflorus* is much less common in W. Ross and Sutherland than it is in W. Inverness and Argyll, suggesting that an important factor in the relative rarity of *Pinguicula lusitanica* in the S.W. Highlands is the abundance of *Juncus acutiflorus*. It is my experience that

visits to possible localities for *Pinguicula lusitanica* in Argyll usually lead to stands of this *Juncus*.

No accurate soil analyses have been made but approximate pH tests in the field indicate that *Pinguicula lusitanica* does not grow in the most acid flushes.

Perring (1959) in the chalk grassland of England, and Gimingham and Cormack (1964) in Sutherland, mapped the vegetation facing various points of the compass on conical hills. But neither of these investigations included flush species such as *Pinguicula lusitanica* and for flush species a bowl is a more appropriate shape to consider. Moreover, it has to be borne in mind that a plant orientated to face south over part of its range may behave differently elsewhere as *Pinguicula lusitanica* bears witness. Gimingham and Cormack found that *Carex demissa* was south-facing, *Molinea caerulea* predominantly south-facing, *Carex echinata*, *Juncus bulbosus*, and *Pinguicula vulgaris* north-facing, and *Narthecium ossifragum* unorientated. These are all associates of *Pinguicula lusitanica* and it is clear that the three which are north-facing on dry ground in Sutherland are not so when growing in flushes.

It is difficult to see much correlation between the presence of *Pinguicula lusitanica* in a flush and the type of rock from which drainage is taking place. At Kishorn, Glencoe and Bettyhill drainage is from calcareous areas, in Mull and Skye from basalt and gabbro, near Kilmartin, Argyll, from epidiorite, from schistose grits at Lochgoilhead, from blown sand at Gruinard Bay. Sandstone and granite more rarely provide suitable flushes.

Disturbance to the soil, e.g. cultivation, much trampling, etc., seems to decrease the chance of survival of a colony of *Pinguicula lusitanica*. This is no doubt connected with the summer development of the plant as distinct from the spring development of *P. vulgaris*, which survives more disturbance. *P. vulgaris* completes its seed setting before the season of maximum activity of farmers and their animals whereas *P. lusitanica* requires to survive the summer flowering and autumn seed-setting period. Drainage is of course inimical to both species. Dunbartonshire, Renfrewshire and Ayrshire should as "fringe" areas support a few colonies; possibly disturbance partly explains why no one has yet found any.

The almost complete restriction of *P. lusitanica* to the skirts of mountains similarly seems to bear relation to its life cycle. A summer drought can dry up flushes in lowland areas and so decimate a colony, but in mountainous areas flushes remain reliably damp. This consideration together with the matter of disturbance may well account for failure to find the plant in Ayrshire.

Colonies of *P. lusitanica* vary in the number of individuals. Though isolated individuals do occur, separated from the

nearest other individuals by yards, or even chains, isolation in terms of miles does not seem to occur. The smallest colonies usually encountered number a dozen plants or slightly less with a good deal of variation from year to year. Large colonies of 100 or 200 plants can only develop where rather uniform flush conditions cover a wide area. The general tendency in such cases is for flushes to become subdivided with the development of drier ridges between and hence several colonies are recognised. The Glen Falloch locality is such an array of colonies, the total number of plants probably topping the 1000 mark.

SUMMARY

The distribution of *P. lusitanica* in Britain is described and the influence of summer temperature, winter cold, humidity, disturbance of the soil, type of rock, nearness of mountains briefly discussed. The chief associates of the species are noted and their influence discussed.

Two areas of distribution are recognised in Scotland, a "main" area and a "fringe" area. In the "fringe" area *P. lusitanica* appears to be restricted to "sun-trap" localities.

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SHORT NOTES

Compiled by R. MACKECHNIE

INVERTEBRATES

The Pearl-bordered Fritillaries

There is confusion in the text-books regarding the distribution in Scotland of two closely-related butterflies, the Pearl-bordered Fritillary (*Argynnis euphrosyne* (L.)) and the Small Pearl-bordered Fritillary (*A. selene* (Schiff.)), and while the writer has not made a close study of the species over a wide area of Scotland, the following notes may help towards a more accurate record of their occurrences.

Of all the specimens taken since 1943, only three are identifiable as *A. euphrosyne*, and all of these were secured on 31.5.58, during the Society's excursion to Torlum Hill, near Muthill in Perthshire (V.-c. 88). The others are all referable to *A. selene*, and were recorded as follows:—

Kilmacolm (V.-c. 76):—22.6.52; 23.6.49; 24.6.51;
28.6.43; 28.6.59; 17.7.43.

Morar (V.-c. 97):—30.6.47.

Crianlarich (V.-c. 88):—4.7.43.

Ben Lomond (V.-c. 86):—21.7.49.

It will be noted that the records of *A. euphrosyne* were made in May, while the dates for *A. selene* range from late June to late July. This is more or less in line with the times suggested by Kirby (*Butterflies and Moths of the United Kingdom*), who gives May and June for *A. euphrosyne* and June and July for *A. selene*.

It is practically impossible to separate the two species by examining the wing upper-surfaces, but the undersides of the hind-wings show considerable differences. In *A. euphrosyne*, as well as silver spots on the outer margin, there is a prominent tapered, oblong, silver spot in the centre, adjoining the discoidal cell, and one other near the base of the wing; *A. selene* has at least four other silver spots in the same area. Further, while in each species there are seven marginal spots, in *A. euphrosyne* these are all in silver; *A. selene* has six silver spots, but the basal one is yellow. Finally, the discoidal spot in *A. euphrosyne* is set in a yellow ring, while *A. selene* has this spot set directly on the brown ground colour.

Most writers regard *A. selene* as the species more commonly found in Scotland, but in *The Naturalist's Library*, published 1885, James Duncan writes "in Scotland the Small Pearl-bordered is much scarcer than the Pearl-bordered". Keppel and Kirby (*British and European Butterflies and Moths*) state "the Small Pearl-bordered is less common and more local than the Pearl-bordered, but in Scotland the reverse holds good", while South (*Butterflies of the British Isles*) says "the Small Pearl-

bordered seems to be commoner in Scotland than the Pearl-bordered". E. B. Ford (*Butterflies*) states that "the Small Pearl-bordered is rarer in the south and the Pearl-bordered in the north". In *Fauna, Flora and Geology of the Clyde Area* (1901) the Small Pearl-bordered is stated to be "universally distributed, locally common", but for the other species there are "no recent records"; localities quoted for it are Gareloch-head, 31.5.88; Dundonald; Castle Hill, Ayr; Arran.

It would therefore appear that *A. euphrosyne* is much less common in Scotland, but more records over a wider area would be needed to ascertain if this is indeed the present position.

ALAN M. MACLAURIN

Microplitis sp. at Anniesland

On 15th July 1962 I collected a small green lepidopterous larva from sallow on the Forth and Clyde Canal towpath at Anniesland. The caterpillar was kept in captivity with a view to determining the species. On 23rd July I noticed a small cocoon, presumably of a hymenopterous parasite, attached to the side of the box containing the larva; the latter remained alive until 11th August, although apparently without feeding. On 4th August 1962 a braconid wasp emerged from the cocoon.

The wasp was identified by A. W. Stelfox, A.L.S., as a male of a species of *Microplitis*, Foerster, possibly *M. medianus* Ruthe. Mr. Stelfox writes: "it is unusual, but has been recorded, that a host larva survives the emergence from it of a parasite. It is, in fact, on record that a caterpillar has completed its life cycle after the emergence of the parasite".

The specimens are now in the Museum of the Hope Department, University of Oxford.

S. T. S. SKILLEN

Notes on Rare Hemiptera

Cymus glandicolor Hahn (Hemiptera Heteroptera; Berytinidae)

During the excursion to Aberlady Bay, East Lothian (V.-c. 82), on 29 August 1964, this bug was found to be quite plentiful on the salt marsh vegetation—especially on *Filipendula ulmaria*. Southwood and Leston (*Land and Water Bugs of the British Isles*) report it as being found in most English counties, common throughout Ireland and frequently recorded from Wales. No mention is made of Scottish records. Its typical habitat is in marshes with rich vegetation, where it finds its host plants *Carex vesicaria*, *C. acuta*, and *C. nigra*. It can also be taken on sand dunes.

A. R. HILL

Ceratocombus coleoptratus (Zett.) (Hemiptera Heteroptera; Cryptostemmatidae)

This rare species emerged from a moss sample[†] taken at St. Ford Links, Earlsferry, Fife (V.-c. 85) on 29 July 1964, when it was heated in a Tullgren funnel. The species is generally rare and there are only four previous Scottish records, three from Forres (V.-c. 95) and one from "Minkie Moss".* The specimen has been deposited in the collection in the Hunterian Museum of the University of Glasgow.

R. A. CROWSON

Notes on Rare Spiders

Argyroneta aquatica (Clerck) (Agelinidae)

The water spider, *Argyroneta aquatica*, has few Scottish records and the last published record for the Clyde area is from Possil Marsh in 1877. On 23 May 1964, Dr. P. Maitland led an excursion to Baldernock Pond (Stirling, V.-c. 86) where he had previously collected the species. Mr. A. Brown who attended the excursion tells me that he and Mr. F. Sinclair had known of this locality for several years. When we visited the pond there was a thriving population of the spider and we collected a mature male and several females. It would be of great interest to discover if the species still occurs at Possil Marsh and if there are any other localities in which it is established.

E. A. CROWSON

Dolomedes fimbriatus (Clerck) (Pisauridae)

A mature female of *Dolomedes fimbriatus* was found by Mr. D. Walkinshaw on free water amongst sphagnum at the Black Wood of Rannoch (Perth, V.-c. 88) during the excursion on 21 July 1964. This is the second adult female taken in Scotland and confirms the record from the Black Wood in 1913 which was based on immature specimens (Jackson, A. R. *Proc. Roy. Phys. Soc. Edinb.* **19**, 108-128; and Crowson E. A. *Glasg. Nat.* **18**, 213).

E. A. CROWSON

BIRDS

The Green Woodpecker (*Picus viridis*) in Lanarkshire

On 14.8.62, while on a Nature Conservancy survey of Cleghorn Glen, near Lanark (V.-c. 77), with Mr. T. Huxley I heard this bird calling among the woods of the glen. Although the bird itself was not seen, its laughing note is unmistakable, and there was no doubt of its presence.

The Green Woodpecker is resident in Europe and the Middle East, reaching 65°N in Scandinavia, but although

* According to Mr. A. W. Robson, Minkie Moss is about 2 miles S.W. of Perth at NO 082213.—*Editor*.

common in wooded parts of England, it is very sparsely distributed in Scotland. In the Handbook of British Birds (Witherby *et al.*, 1938) it is listed as a rare vagrant here, having been seen or heard in a few counties as far north as Shetland, but not in Lanarkshire. Since the last war, however, the bird has bred in the border counties and seems to be spreading northwards. The first recorded nest in Lanarkshire was at East Kilbride in 1961, and the bird has been seen at Craignethan and Larkhall in 1963.

E. C. D. TODD

Mr. Palmar comments:—The 1961 Lanarkshire nest referred to is recorded in *Scottish Birds*, 1, 454, and the birds have since been reported from as far north as Kincardine and as far west as Lochgilphead (*ibid.*, 2, 3).

Moorhens (*Gallinula chloropus*) in Glasgow

During the past few years I have noticed these birds in quite busy parts of the city. They now regularly frequent the Monkland Canal just a few yards from Castle Street and Alexandra Parade. In 1963 and 1964 they bred by the River Cart in at least two places; one was near Weir's engineering works at Cathcart and the footbridge at Sinclair Drive, the other between the McQuisten Bridge on Kilmarnock Road and the Riverford Road bridge. The presence of the birds in these industrial areas suggests that the alternative name "Waterhen" is more appropriate than the one in common use.

J. D. MORTON

A pair of Moorhens bred successfully at the lesser pond in Queen's Park during the years 1959 to 1962 inclusive. In 1962 other waterfowl were introduced to the pond; that, or the fact that the pond was ice-bound for several weeks early in 1963, may account for the disappearance of the Moorhens; I have not seen them there since the autumn of 1962.

I shall be grateful for other records of these birds occurring in similar places.—*Compiler.*

Hooded Crow (*Corvus cornix*) at Bridge of Weir

On 20.10.64 a Hooded Crow was observed feeding with a group of Carrion Crows in a field near here; I have not seen the bird since. It is twenty years since I last saw one in this neighbourhood.

E. R. T. CONACHER

How clever are Blue Tits?

While it is unlikely that Blue Tits read *The Glasgow Naturalist*, it seems that those which conduct their affairs under

the watchful eye of Mr. J. D. Morton are not to be out-done in intelligence by Dr. Carslaw's mice ; one of them has solved the problem of taking a bath without getting its feet wet. Mr. Morton writes :—" I have often seen Blue Tits bathing, and this summer (1964) I watched one do so in an unusual way. This bird arrived at the water's edge, where several other birds were bathing, but neither competed nor queued for a place in the shallows. Instead, it hung on to an *Alisma* stem, so that its body was parallel to and just above the surface of the water. It then flapped vigorously with the wing nearest the water ; this caused the stem to sway, and each time it swung downward the bird was partially immersed in the water. When satisfied it reversed its position and repeated the process with the other wing. Thereafter it retired to a branch to preen and fluff its feathers."—*Compiler*.

FLOWERLESS PLANTS

Some Unusual Fungi

On 17 May 1963 we visited Castle Hill Point, Kirkcudbrightshire (V.-c. 73) where we had previously collected several species of rare insects and spiders (Crowson, R. A. and Crowson, E. A. *Glasg. Nat.* 18, 228-232). Growing on the steep slope down to the bay we found several fruiting bodies of *Tricholoma gambosum* (Fr.) Kummer, the St. George's Mushroom, which is rare in Scotland but common on calcareous downs in England.

When collecting insects in the short mixed turf at the base of the concrete tank traps at Aberlady Bay (V.-c. 82) in May 1964, our attention was caught by a small fungus which, when it was struck by raindrops, emitted puffs of spores through a pore at the middle of its upper surface. It was the stalked puffball *Tulostoma brumale* Pers. which is restricted to calcareous sands.

On the zoological excursion to Callander (V.-c. 87) on 2 May 1964, Mr. David Boomer found a strange fungus growing on a rotten log at the roadside. This proved to be *Leucoporus brumale* (Pers.) Quel, which is one of the less common group of the genus, having a sporophyll with a central stalk. There are only four local records of this species.

Identification of all three species has been confirmed by Dr. S. A. Hutchinson.

R. A. & E. A. CROWSON

New Hepatic Records

(i) *Targionia hypophylla* L. in Mid Perth.

On 22.11.64, while examining some calcareous schist crags near Ardveich, Lochearnhead (V.-c. 88), this thallose hepatic was found in small quantity, growing with the rather similar species *Preissia quadrata* (Scop.) Nees.

Targionia has a very local distribution in Britain, favouring rather basic rocky situations, usually where a southerly exposure is combined with some degree of shelter. It has not previously been recorded for V.-c. 88.

(ii) *Cololejeunea minutissima* (Sm.) Schiffn. in Argyll.

This tiny hepatic was discovered in May 1964 growing on the trunks of two large poplar trees near Lunga House, Craignish, Argyll (V.-c. 98); the identification has been confirmed by Mrs. J. A. Paton.

Cololejeunea minutissima has a southern and western distribution in Britain, most of its recorded localities being in the south and west of England and in Ireland. In Scotland the only previous records are from Moidart in Inverness-shire, and from Tobermory in Mull.

A. McG. STIRLING

Aulacomnium androgynum in Renfrewshire

On 25 April, 1964, on an excursion of the University Department of Botany to Lochwinnoch (V.-c. 76), Mr. H. A. McAllister pointed out to me the moss *Aulacomnium androgynum* (Hedw.) Schwaegr., growing on the trunks and branches, both living and dead, of old willows by Castle Semple Loch. This is new to Renfrewshire and a rare moss in the Clyde area, having only in 1961 been discovered in Ayrshire (*Glasg. Nat.* 18, 215), and in 1964 on Arran. The Lochwinnoch area has been well searched in the past by Ewing, Lee and other Glasgow bryologists who would have been unlikely to overlook so distinctive a moss. It is probably a fairly recent immigrant to Lochwinnoch. It is likely that it is extending its range in the western parts of the British Isles, where it is very local.

A. C. CRUNDWELL

Pohlia pulchella in the Clyde Area

During an excursion on 3 October, 1964, to Dougalston Woods, Milngavie (V.-c. 86), several members saw in damp ruts at the bottom of a field a considerable quantity of a sterile moss which it was thought might be *Pohlia pulchella* (Hedw.) Lindb. This identification has been confirmed by Dr. E. F. Warburg, who has published elsewhere (*Trans. Br. bryol. Soc.* 4, 760-2, 1965) an account of this species in the British Isles, from which it had not previously been recorded. There are records from six vice-counties in the southern half of England and from one other Scottish locality, a grassy sea cliff on the south side of Arran. The moss is an inconspicuous one and is likely to prove less rare than the fewness of the records suggests.

A. C. CRUNDWELL

FLOWERING PLANTS

Spring Cinquefoil (*Potentilla tabernaemontani*) in Argyll

In August 1964, while exploring some south-facing crags north of Loch Melfort (V.-c. 98) a colony of Spring Cinquefoil was discovered on dry ledges at about 500 ft.

This species is rare in Scotland; indeed, throughout Britain it is a very local plant, confined to dry basic rocks and grassland. Here it grew on basic andesite rock with, among other interesting species, Shining Cranesbill (*Geranium lucidum*), Red Broomrape (*Orobanche alba*), Hoary Whitlow-grass (*Draba incana*), Wood Vetch (*Vicia sylvatica*) and the mosses *Rhytidium rugosum* (Hedw.) Kindb., *Anomodon viticulosus* (Hedw.) Hook. & Tayl. and *Tortula intermedia* (Brid.) Berk.

G. RODWAY & A. McG. STIRLING

Thorow-wax (*Bupleurum rotundifolium*) at Milngavie

A single specimen* of this plant appeared casually during the summer in the garden of Mr. P. O. Wright at Milngavie. Mr. Wright, who is Administrative Officer in the Glasgow Museum, carefully potted the plant and brought it to Mr. Palmar, who passed it to me when he went on holiday in July. The plant itself, and photographs of it taken by Mr. Roddam, were exhibited at the December, 1964 meeting of the Society.

Thorow-wax is a cornfield annual in England, thinning out northwards; in Scotland it has occurred in Wigtown. The Milngavie (V.-c. 86) record is the first I know of from the Clyde valley.

R. MACKECHNIE

Annual Mercury (*Mercurialis annua*) in Renfrewshire

In the spring of 1964 an unidentified seedling appeared in our slightly-heated greenhouse at Bridge of Weir. In September the plant,* then tall and much-branched, was identified as the above species by Mr. R. Mackechnie. This plant has not previously been recorded for Renfrewshire (V.-c. 76), and it seems likely that seed came in soil with Geraniums purchased from a Chichester nursery.

E. R. T. CONACHER

Annual Mercury is a plant of waste places and a garden weed, rarely met with in Scotland; there are records from Fife and Angus—*Compiler*.

* Now in the Herbarium, Department of Botany, University of Glasgow.

Woody Nightshade (*Solanum dulcamara*) with white flowers

This form (reported in *Glasg. Nat.* 18, 381) was observed during 1964 at Meldrum Gardens, Crossmyloof, adjoining Clydesdale Cricket Club ground (V.-c. 76) and also at the roadside east of Kilcreggan Pier (V.-c. 99).

J. D. MORTON

A Ragweed (*Ambrosia psilostachya* DC.) established in Scotland

On 15.10.64, while botanising in Ayrshire with Mr. Mackechnie and Mr. Prasher, the latter mentioned an *Ambrosia* which he had found about ten years ago on the dunes at Seafield (Low Green), south of Ayr, V.-c. 75. The plant, said Mr. Prasher, had been named *A. artemisiifolia* at Kew (*Glasg. Nat.* 17, 76) and was still flourishing in the original station.

I knew that an *Ambrosia* naturalised on dunes in West Lancashire had passed as *A. artemisiifolia* until, in recent years, it had been correctly identified as *A. psilostachya*. My surmise that the same error could have been made in this case proved correct; when we visited the locality there was a fine colony of *A. psilostachya* extending over some hundreds of yards, and covering a greater area than the plant now occupies in any of its Lancashire stations.

All the Ragweeds (*Ambrosia* spp.) are American, and three in particular are frequent adventives here. *A. artemisiifolia* (including *A. elatior*) is a regular and widespread casual, while *A. trifida*, normally with trifid leaves, occurs fairly frequently in areas associated with suitable American commerce, such as the dumps of the Manchester Ship Canal. *A. psilostachya* differs radically from the other two in being perennial, with a far-ranging rhizome. All three have been recorded many times from the docks at Barry and Avonmouth, though apparently not from Liverpool itself.

In the field *A. psilostachya* can be distinguished from the other species by its thicker, greyer, smaller and less dissected leaves; the plant tends to form open patches and the shoots are under 18" tall. Under the lens the staminate involucre are seen to have long, rough hairs, and the fruits have either blunt or no teeth. It is well-established in four places on the west Lancashire (V.-c. 59) coast, at Blundellsands, Hightown, Ainsdale and Birkdale. At St. Anne's (V.-c. 60) it persists on a dune which has become a mown lawn; here, and further south, it has been known for over 60 years, when it "covered several acres of ground". Ten years later much of this land was covered by roads and houses, but it had even then extended to fresh areas. So far as I know it has only one inland station in Britain, on the edge of Broughton Gifford Common

in north Wiltshire (V.-c. 7), where it has persisted since first recorded (as *A. coronopifolia*) over 30 years ago. It has also established itself in several other European countries, but while it has been recorded from Scotland on various occasions, notably at Leith, it never seems to have been other than a casual here, and the Ayr record is apparently the first of the species as an established member of the Scottish flora.

I am grateful to Mr. N. Y. Sandwith for his help in searching the material at Kew (where, he reports, there is no specimen of this genus from anywhere in Ayrshire), and for reading the draft of this note.

DAVID McCLINTOCK

New Records of Oxford Ragwort (*Senecio squalidus*)

On 2.6.65 Mr. A. D. Chisolm introduced me to Mr. John McCuaig at the James Watt Dock in Greenock (V.-c. 76), and together we examined several small colonies of Oxford Ragwort, varying in size from single plants to small groups of about a dozen, on waste ground just inside the eastern entrance to the Dock. Mr. McCuaig is a port official, who is at the dock daily, while Mr. Chisolm calls there occasionally; both are emphatic that the *Senecio* was not in evidence last year. A few plants of *Thlaspi arvense* and of *Linaria vulgaris* grew in the same area, but there were no other obvious introductions. This seems to be the first recorded occurrence of Oxford Ragwort in Renfrewshire as an established species.

Mr. Prasher wrote on 17.6.65: "spending a day at Portobello (V.-c. 83) I found abundance of *S. squalidus* (with *Carduus crispus*) near the Power Station, also on railway banks at the bridge close by; it was very abundant on the shore at the north end of the Bathing Pool".

R. MACKECHNIE

Hieracium chloranthum Pugsley in Renfrewshire

Dr. C. West has confirmed as *H. chloranthum* a plant collected by Mr. D. McClintock on a roadside wall near Lochwinnoch (V.-c. 76) on 15.10.64.

H. chloranthum, which may be endemic to Scotland, is noteworthy for its dull greenish-yellow florets. It belongs to a section (*Oreadea*) of the genus which favours rocky districts, and its occurrence in such a habitat in a lowland area is unusual. Previous records from ten Scottish vice-counties are quoted in Pugsley's *Prodromus of the British Hieracia* (*J. Linn. Soc. (Bot.)* 54, 100); they do not include any from Renfrewshire.

R. MACKECHNIE

Water Plantain (*Alisma plantago-aquatica*): opening of flowers

It may be of interest to record that, during the 1964 flowering season, I kept close watch each Saturday and Sunday on two very healthy and vigorous plants of this species in my own garden pond; the flowers remained open, sunshine or not, from about 9.30 a.m. (G.M.T.) till dusk (see *Glasg. Nat.* 18, 383).

J. D. MORTON

Garden (Large) Cuckoo-pint (*Arum italicum*) in Ayrshire

A small clump of this plant grows on the bramble-covered bank of the roadside between Kilmarnock and Hurlford (A 76); the exact situation is some 10 yards on the Kilmarnock side of the signpost to Crookedholm (V.-c. 75).

I first saw the plant there in the winter of 1961-62, and since then I have observed it periodically; so far I have not seen it flower. Behind the steep road embankment there was at one time a colliery, but apart from some Michaelmas Daisies growing nearby I have not noticed any alien plants in the neighbourhood. A sheet, containing leaves collected at different seasons, is in the Herbarium, Department of Botany, University of Glasgow.

HUGH A. McALLISTER

In the vegetative state *A. italicum* differs from ordinary Cuckoo-pint (*A. maculatum*) in having leaves with pale midribs, well developed by December, whereas the leaves of *A. maculatum* do not appear until early in the year and have dark green midribs. *A. italicum* is widely distributed in southern Europe; as a native plant in Britain it is restricted to the southern and western counties of England, and the Channel Islands. There it grows in light shade, often under brambles and usually within a mile of the sea. The British form was in 1938 distinguished as a separate species, *A. neglectum* (H. N. Ridley, in *Journ. Bot.* 76, 144), but this now appears to be unjustified (see Prime, C. T., 1960. *Lords and Ladies*, p. 76. London—*Editor*).

Mr. McAllister's station for *A. italicum* seems to be quite close to the place where Mr. Prasher first saw *Hieracium praealtum* in 1963 (*Glasg. Nat.* 18, 382)—*Compiler*.

Sand Sedge (*Carex arenaria*) in an inland station

On 17.9.61 I visited Glen Fruin (V.-c. 99) and on the floor of a quarry by the Auchengaich Burn came upon a strange *Carex*. It was growing in shallow water which was gently flowing over the hard gravelly base of the quarry. The fruiting stems stood 5 or 6 inches high and presented the appearance

of *C. disticha* or *C. arenaria*. As the quarry is about 3 miles from the sea as the crow flies, over a range of hills reaching 1000 ft in places, and fully 10 miles from the sea as the water flows, the usually maritime *C. arenaria* seemed unlikely, but on submitting specimens to Mr. Mackechnie, *C. arenaria* it turned out to be. The features which Mr. Mackechnie specially mentioned were: leaves narrow, shorter than flowering stems; terminal spike male; no leaf-like bracts; female glumes 5.5 mm; fruit broadly winged.

It is believed that this is the most inland habitat for *C. arenaria* in Scotland.

A. A. P. SLACK

Carex arenaria and *C. disticha* are closely related species. The former is a plant 4 to 12 inches high, common in sandy ground by the sea, especially on sand dunes, all round the coast; it occurs inland locally in England. *C. disticha* is usually about twice as tall, and favours damp grassy places at any distance from the sea. Neither usually grows in flowing water. The characters mentioned in the second-last sentence of Mr. Slack's note are those by which *C. arenaria* is separated from *C. disticha*—*Compiler*.

Wood Fescue (*Festuca altissima*) in Lanarkshire

During the summer of 1962, while engaged in a survey of some of the Nature Conservancy Sites in the Clyde valley, I found this grass near the River Nethan (V.-c. 77). It grew on a steep slope, where loose and slippery clay soil overlaid limestone rock; it was associated with Great Woodrush (*Luzula sylvatica*) under beeches. The locality is, unfortunately, close to a rubbish dump, but later the same day I saw the plant again. This time the habitat was among limestone boulders; the second station is about half a mile upstream from the first and on the opposite bank. About a month later I saw Wood Fescue in the county again; this time it grew in damp, shallow soil overlying slightly calcareous rock (a sandstone) at the foot of a steep bank.

There are few records of this plant from the Clyde area. Hopkirk (*Flora Glottiana*, 1813) records it, as *F. calamintha*, from Kenmuir Bank (V.-c. 77) on the authority of a Dr. Brown. This record is quoted in the handbook prepared for the British Association's Glasgow Meeting in 1876, and also in the various editions of Henedy's *Clydesdale Flora*. It is not, however, mentioned by Patrick (*Plants of Lanarkshire*, 1831) or by Lee (*Flora of the Clyde Area*, 1933). In *Fauna, Flora and Geology of the Clyde Area*, 1901, published for the second British Association meeting in Glasgow, the grass is recorded for Ayrshire (V.-c. 75). In 1937 it was found near Rowardennan,

V.-c. 86 (*Glasg. Nat.* 17, 81), and more recently it has been recorded from some of the gorges on the west side of Loch Lomond (V.-c. 99). (See also page 457).

E. C. D. TODD

New plant localities in the Glasgow district

Eastern Rocket (*Sisymbrium orientale*): Found at Yorkhill Quay (Pointhouse Road, V.-c. 77) in 1963; identified by R. Mackechnie.

Bladder Campion (*Silene vulgaris*): Also at Yorkhill Quay where it grew on a heap of rubble. This plant is not uncommon on railway sidings in the Glasgow area, but seemed out of its normal environment here. Found in 1965.

Spotted Dead-nettle (*Lamium maculatum*): Growing vigorously at Craighall Dam (V.-c. 76); it doubled its area from 1964 to 1965.

J. D. MORTON

Correction. It is regretted that, through a misunderstanding for which Mr. Morton was not responsible, the word "Renfrewshire" was included in the title to his note in the last issue (*Glasg. Nat.* 18, 384). Most of the localities mentioned in the note are in Renfrewshire, but the following are outwith that county:—Colville-Clugston brickworks, Kittoch Water, Bothwell Castle and Yorkhill Basin are in Lanarkshire (V.-c. 77); Armadale, Skye, is in North Ebudes (V.-c. 104)—*Compiler.*

New Records for the Cambuslang-Carmyle area, 1965

(V.-c. 77, Grid square NS 65)

Rorippa sylvestris (Creeping yellow cress)

Sisymbrium altissimum (Tall rocket)

Silene vulgaris (Bladder campion)

S. dioica (Red campion)

S. alba (White campion)

Melilotus alba (White melilot). See Morton, J. D., 1964.

Glasg. Nat. 18, 38. This occurs in two other stations in the district; near Kenmuir Farm and adjoining the Clyde Ironworks.

Polygonum bistorta (Bistort)

Mentha × miliaca

Campanula latifolia (Giant bell flower)

Dipsacus fullonum (Teazel). The late Mrs. F. M. Elder informed me that one of her pupils found this growing on the river bank at Cambuslang.

Senecio fluviatilis (Broad-leaved ragwort)

Petasites albus (White butterbur)

Cicerbita macrophylla (Blue sow-thistle)

Alisma lanceolatum (Narrow water plantain)

Carex acutiformis (Lesser pond-sedge). This grows at what appears to be the site of *C. acuta* given in Lee, J. R., 1900. *Ann. Anderson. Nat. Soc.* 2, 8. There is now no trace of *C. acuta* in the stream near the edge, on the north side of the Clyde, about half-way between Kenmuir Bank and Carmyle.

Bromus ramosus (Hairy brome)

I first observed the Creeping yellow cress and the Tall rocket with Mr. R. Mackechnie and the Bistort and the Broad-leaved ragwort with Mr. J. White.

None of the species listed are recorded for this square in the *Atlas of the British Flora*.

ALFRED A. PERCY

Addenda

Wood Fescue (*Festuca altissima*) in Lanarkshire

On page 455, the "rubbish dump" was at NS 822467, the "limestone boulders" at NS 817465, and the "steep bank" at NS 903452.—*Editor*.

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY

14TH JANUARY, 1964

Mr. Basil W. Ribbons presided over a meeting held in the Department of Botany, University of Glasgow. About 70 were present.

One new member was elected: Miss E. Henry, 12 Stamperland Drive, Clarkston.

The President introduced Mr. R. Prasher who, in the name of the Society, presented a copy of *Cassell's New Atlas of the World* bound in leather and inscribed by Mrs. M. Palmar, to Emeritus Professor John Walton, to mark his retirement from the Regius Chair of Botany in the University of Glasgow.

The President delivered an address "Tea, St. James and Labrador" (see part 9).

Exhibits were shewn by Mrs. A. Cross and Mr. E. C. D. Todd.

11TH FEBRUARY, 1964

The thirty-fourth Annual General Meeting was held in the Glasgow Art Gallery and Museum, Kelvingrove. About 59 members were present and the President, Mr. Basil W. Ribbons, presided.

Those present stood in silence after passing two resolutions expressing sorrow at the deaths of Mrs. F. M. Elder and Miss J. C. D. Craig (see pages 386-387).

Reports of the activities during 1963 were read, new office-bearers were elected (see page 458) and appointments made by Council were announced. The Report of Council stated that the total membership was 250 (53 joined, 2 resigned and 5 were removed from the Roll); eleven meetings were held with an average attendance of 55; twenty-six excursions took place (3 general, 16 botanical, 4 zoological, 1 ornithological and 2 geological); the Council met four times and the Executive Committee eight times. Mr. Basil W. Ribbons presided at the Annual Dinner held on 12th December, 1963, in the University of Glasgow in honour of Mr. Richard Prasher, ex-Botanical Convener. The President and Council gave a party for new members on 12th February, 1963. Two issues of the Bulletin were sent to members during the year.

Three new members were elected: Henry M. Goodwin, B.A., 168 Killin Street, E.2; Geoffrey Hosie, B.Sc., 74 Brunton Street, S.4; and Miss Pearl Jephcott, M.A., 12 Bute Gardens, W.2.

One family member was elected: Mrs. Margaret Brian, Clauchlands, Charlotte Street, Helensburgh.

The film *The Living Pattern* was shewn.

10TH MARCH, 1964

Dr. Stephen A. Hutchinson presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 50 were present.

Three new members were elected: Mrs. Mary Mullen, B.Sc., 38 Courthill Avenue, S.4; Mrs. Elizabeth Stevenson, 3 Baillieston Road, E.2; and David A. Walkinshaw, B.Sc., Woodstock, Chryston.

One junior member was elected: David Boomer, 57 Edmund Street, E.1.

One school member was elected: Elizabeth Stevenson, 3 Baillieston Road, E.2.

Mr. G. S. Johnstone of H.M. Geological Survey, Edinburgh, gave an illustrated lecture entitled "Outline of the Geology of the Scottish Highlands and Islands".

Exhibits were shewn by Mr. G. Rodway and Mr. A. McG. Stirling (including *Ptilium crista-castrensis* from Maol Mhor, Loch Arklet, V.-c. 86) and Mr. E. C. D. Todd.

14TH APRIL, 1964

Dr. Blodwen Lloyd presided over a meeting held in the Royal College of Science and Technology, Glasgow. About 42 were present.

Four new members were elected: Miss Kathleen M. Calver, B.Sc., Ph.D., 43 Dungle Avenue, W.4; Bruce Ing, M.A., Kindrogan Field Centre, Enochdhu, Blairgowrie; Joseph T. MacConnell, B.Sc., Ph.D., M.I.Biol., 260 Nithsdale Road, S.1; and Miss Mary M. Mathisen, 1048 Cathcart Road, S.2.

One school member was elected: Judith M. Sharp, 74 Hilton Road, Bishopbriggs.

Members visited the Biology Department of the College and inspected numerous demonstrations which were displayed by Dr. Fletcher and his colleagues.

13TH MAY, 1964

Professor P. W. Brian and Dr. Stephen A. Hutchinson presided over a joint meeting with the Botanical Society of Edinburgh in the Department of Botany, University of Glasgow. About 70 were present.

Three new members were elected: J. W. Alger, 402 Carmunnock Road, S.4; John F. McKerron, B.Sc.(Agric.), 25 Crichton Road, Rothesay; David L. Reid, B.Sc., Bridge Cottage, Balfron Station, Stirlingshire.

One family member was elected: Mrs. Jean Sharp, 74 Hilton Road, Bishopbriggs.

Mr. N. W. Pirie, F.R.S., of Rothamsted, gave an illustrated lecture on Leaf Protein as a Human Food.

Exhibits were shewn by the lecturer and Mr. E. C. D. Todd.

9TH JUNE, 1964

Dr. Stephen A. Hutchinson presided over a meeting held in the Department of Botany, University of Glasgow. About 69 were present.

One new member was elected: William C. Hutchison, B.Sc., Ph.D., F.R.I.C., 34 Mitre Road, W.4.

Four school members were elected: Mary Dickson, 19 Williamwood Park, S.4; Catherine Donachie, 358 Kingspark Avenue, Rutherglen; Joanne Frew, 20 Lochbroom Drive, Newton Mearns; and Jennifer Russell, 60 Keir Street, S.1.

Mr. V. S. Summerhayes of the Royal Botanic Gardens, Kew, gave an illustrated lecture on Orchids.

Exhibits were shewn by Mr. A. H. Brown (*Argyroneta aquatica*, two specimens from Baldernock Pond), Mrs. E. A. Crowson (*Pisaura mirabilis*, a wolf spider from Coilsholm Wood, Failford), Mr. A. A. Percy (leech and two freshwater Planarians from Lochwinnoch), Mr. R. Prasher (an ammonoid), Mr. A. McG. Stirling (*Tetraplodon mnooides*—see page 437 and a possibly hybrid *Ajuga*) and Mr. E. C. D. Todd.

8TH SEPTEMBER, 1964

Mr. Thomas Robertson, on behalf of the President, held a Reception in the Glasgow Museum and Art Gallery, Kelvingrove. Eighteen members arranged exhibits.

Two members were elected: Miss Evelyn Corson, M.A., c/o Wilson, 7 Broomhill Avenue, W.1; and Mrs. Janet Scobie, 7 Balmuidy Drive, Bishopbriggs.

One school member was elected: Ronald McKnight, 130 Alderman Road, W.3.

13TH OCTOBER, 1964

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 50 were present.

Two new members were elected: Gordon B. Corbet, B.Sc., Ph.D., Department of Zoology, British Museum (Natural History), Cromwell Road, London, S.W.7, and Alan N. Johnson, "Beechgrove", Angus Place, Cupar, Fife.

A natural history brains trust composed of Mr. R. Mackechnie, Mr. K. Richmond, Dr. I Rolfe and Dr. A. Young, with the General Secretary as Question Master, discussed eighteen questions from members.

7TH NOVEMBER, 1964

A botanical exhibition, lecture and soirée were held in the University of Glasgow in conjunction with the Committee for the Study of the Scottish Flora. Dr. Stephen A. Hutchinson and Mr. Robert Mackechnie, Chairman of the C.S.S.F., presided. Ten exhibits and seven sets of colour slides were displayed (see *Proc. B.S.B.I.* 6, part 2 and *Trans. Bot. Soc. Edinb.* 40, part 2). Mr. B. W. Ribbons of the University of Glasgow at short notice, taking the place of Dr. H. F. Dovaston, gave an illustrated lecture entitled "Recent Plant Discoveries in Scotland".

8TH DECEMBER, 1964

Dr. Stephen A. Hutchinson presided over a meeting held in the Department of Botany, University of Glasgow. About 40 were present.

One new member was elected: Miss Lindsay W. Urquhart, 23 Keystone Quadrant, Milngavie.

One junior member was elected: William R. B. Ingram, 1B Burr Place, Paisley.

Mr. C. E. Palmar presided over a display of photographs and coloured slides from eleven members.

Mr. R. Mackechnie exhibited specimens of *Matteucia struthiopteris* from Dalguise (V.-c. 88), *Bupleurum rotundifolium* from Milngavie (V.-c. 86)—see page 451, and *Ambrosia psilostachya* from Seafield (V.-c. 75)—see page 452.

THE GLASGOW NATURALIST

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The Glasgow Naturalist

The Journal of the
ANDERSONIAN NATURALISTS OF GLASGOW

Volume XVIII, part 9, published December, 1967



Edited by B. W. RIBBONS

Assisted by

A. C. Crundwell, R. M. Dobson, R. Mackechnie

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THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month except during July and August, in the University of Strathclyde, the University of Glasgow or the Glasgow Art Gallery and Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are : for Ordinary Members, twenty shillings ; for Junior Members, ten shillings ; for Family Members, five shillings ; and for School Members, three shillings and sixpence. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary*—

Mr. ALFRED A. PERCY,
5 BUCKINGHAM DRIVE,
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THE GLASGOW NATURALIST

Contributions are invited, especially when they bear on the natural history of the West of Scotland. A note of information for contributors is available from the *Editor*.

Articles and communications on editorial matters should be sent to the *Editor*—

Mr. B. W. RIBBONS,
DEPARTMENT OF BOTANY,
THE UNIVERSITY,
GLASGOW, W.2.

An invitation : members and others having interesting information such as new stations (not necessarily new county records) for a species, unusual dates of flowering—early or late, rediscoveries of old records, occurrence of a species known to be rare in an area, note of an unusual colour form of a species, an interesting locality not usually visited by naturalists, ringed birds recovered, weather notes, additions to records in the *Atlas of the British Flora*, etc., etc., are asked to send this to the *Compiler* of SHORT NOTES—

Mr. R. MACKECHNIE,
9 SKIRVING STREET,
GLASGOW, S.1.

The nomenclature of vascular plants should be as in Clapham, Tutin and Warburg, *Flora of the British Isles*, 2nd edition, 1962. Where a number of notes on the same topic are received they may be put together in a single narrative but acknowledgement will be made to each individual contributor.

A limited number of advertisements can be accepted and enquiries should be sent to the *Editor*.

Back numbers available are listed on page iii of cover.

THE GLASGOW NATURALIST

The Journal of the

ANDERSONIAN NATURALISTS OF GLASGOW

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PRODUCTIVE NATURAL HISTORY

By S.A. HUTCHINSON

(Presidential Address delivered on 10 January, 1967)

These are some thoughts about what the Society's activities could or do contribute to human affairs; I have grouped them around the three themes of the functions of the Society, how the Society is meeting these functions, and a few points that don't fit conveniently into either of the first two.

THE FUNCTIONS OF THE SOCIETY

This is really a speculation about why societies like ours exist at all. What is it that starts us on the road to natural history, what need for personal expression does it fulfil, or what chance does it give us to develop useful capacities of the mind? Two obvious parts of the answer are because we see living things around us, and because we become curious about them; these two points are distinct from each other and I would like to develop each separately.

We are talking here of a very particular sort of 'seeing', not merely non-critical acceptance of any visual stimuli, but painstaking and precise recognition of the characteristic structure and behaviour of a particular living thing. This sort of ability dates far back into human history. In the caves at Altamira there are wall drawings of various animals made 27,000 years ago. These are amazingly accurate in some ways; for example the carriage of the head and the details of the antler structure of some of the deer strongly suggest that the drawings are based on perceptive observation of individual animals. There are many other indications of this sort of observation in the ancient world. What we have left of the work of Aristotle includes much meticulous record of living things, with some bias towards animals. It was left to his student Theophrastus to provide the most complete record of plant life which survives from Greek Civilization. The point I want to emphasise is that in these old Greeks you find continuously the ability to "see with an innocent eye", to see and to record nature as it really exists, and to distinguish between direct observations of reality and the concepts evoked by such observations. In this connection there are interesting differences between the records inherited from Greece and those

from the early Oriental civilizations. For example, in early Chinese records you see beautiful and meticulous pictures of flowers, animals and mythical beasts, but many of them are oddly different from the accurate Greek records. They are not so much life-like as larger than life. Some of these differences may be related to the idea expressed in Binyon's (1913) comparison of the story of Zeuxis and the grapes and the Chinese story of the temple dragon. This runs—" . . . Everyone knows the story of the Grapes of Zeuxis, which appeared so like real grapes that birds came to peck at the tempting clusters. The Chinese have parallel fables about famous masterpieces, but how different an order of ideas they attest. A great artist painted a dragon on a temple wall, and as he put the final touch to it the dragon, too instinct with life, soared crashing through the roof and left an empty space . . . the inner and informing spirit, not the outward semblance, is for all painters of the Asiatic tradition the aim with which they wrestle." You see here the difference between accurate recording of reality, and the recording of concepts which are evoked by observation, but strongly influenced by emotion, memories, and perhaps by predisposition to see some character whether it is present in reality or not.

As Western civilization developed, these interests in accurate factual observation became less prominent, while those in processes of thought and reason were maintained or increased. This was understandable in the Islamic culture, where opportunities for detailed observation and record were limited by religious rules, but we can see the same change of emphasis in Roman times and in mediaeval Europe. For example, it has been suggested that when Pliny looked at an egg he would be inclined to speculate about who was the first man to eat one, and why, rather than to seek what he could find out about that particular egg by his own observations. Yet Aristotle, 400 years before, had looked at eggs and by meticulous study of the particular he had seen the embryo, the yolk sac and other structures in it. I suggest that this difference of approach is one of the important distinctions between a "natural historian" and a "philosopher".

I believe that the development of this skill to distinguish between opinion based on one's own precise observation of reality, and that based on dogma or second-hand assertions, is one of the great values to be obtained by the study of natural history. *We* know that buttercups don't all have five petals, *not* because someone tells us so, *not* because we read it in a book, but because we have *looked* at buttercups and found that this is so.

I have discussed elsewhere (Hutchinson 1964) some of the very difficult problems of seeing what you are looking at. Anyone who develops this skill of knowing when his judge-

ment is based on evidence, and not merely on opinions, has a sure defence against unsound but persuasive arguments put forward by propagandists, salesmen or others who influence people in modern civilization.

Observation is only the first step in formation of a natural historian. The next is curiosity about what we see. Again this is an ability which is part of the make up of a natural historian, and which is developed in a useful way by its study. It is certainly better developed in man than in any other higher animals ; it is only that my wife is in the audience that prevents me from speculating about the significance of " fact " that the fall of man resulted from feminine curiosity about a phenomenon of natural history. But it is interesting to see how much different minds vary in their disposition to wonder why things happen, how something is made, what causes rainbows and so forth. This seems to be due as usual, to a combination of nature and nurture. We are born with a certain capacity, more in some than in others, but how much of this capacity is exercised or developed is very dependent on the experience of growing up. We all know the curiosity of childhood, and it is a sad thing that so much of our training seems to aim at destroying this excitement. We have all been guilty in this way—how often does a harassed parent say " It's because I say so—now go away and let me read the paper ". How often does an over-pressed teacher say " Don't go into that, Smith—its not in the syllabus—just make sure you learn what I tell you—that's what you've got to know ". Where learning is a matter of following well worn paths, in which all the likely questions have been answered by others, then unexercised curiosity withers and dies. This is not altogether the fault of teachers ; we have to obtain a certain learning to cope with life, and in many subjects it is very difficult to bring students to the frontiers of knowledge where the interesting questions can be asked. But the man who looks curiously at nature has unanswered problems all around him—problems of immediate interest ; and, more particularly, he can find problems which can be solved by his own investigations at his own level of ability and knowledge. I think that this point of the question being answered by one's own effort is important. Curiosity can die from frustration as well as from neglect, and this is likely to happen if all enquiries come to nothing because of limitations in one's training. On the other hand, finding answers by one's own effort produces great mental satisfaction and offers a stimulus to further enquiry.

I suggest that if any man or woman exercises native talents in this way then he is exercising and developing socially valuable talents. The man who has learnt that speculation can be harnessed as a stimulus to further enquiry, that answers are worth obtaining by one's own observation and

thought—that man can be a thoughtful and forward looking citizen who could advance other affairs of humanity.

I want to develop this topic of enquiry a bit further, by considering the ways in which Natural Historians learn to judge evidence. I don't want to go far with this, as it would develop into a misplaced exposition of the principles of logic and scientific method, but the enquiries which we make as natural historians do exercise us continually in making and testing hypotheses, and sometimes in experimentation. This exercise is given by simple situations which can be understood without elaborate previous training or knowledge of the special vocabularies of particular sciences. In this way the study of natural history seems to give us particularly valuable understanding of the scientific principles on which so much of modern civilization depends.

The successful result of enquiry is the establishment of some body of knowledge. The knowledge acquired from the study of living things seems very obviously useful to humanity. We can get from it knowledge of how one's body works, understanding of the function of food, reproduction, hygiene and so forth in efficient survival. But a more far reaching knowledge develops from our study of the interaction of living things in communities. For example, a recent lecturer to our Society described the catastrophic effects of the sudden exclusion of man from the environment of a certain African forest park. In this particular community the removal of the native hunters resulted very quickly in the reduction in density of other life in the area. This was brought about by uncontrolled increase in numbers of large mammals, which then destroyed the vegetation and so led to erosion. Improvident farming by man can also cause erosion, of course, but his activities are not always antagonistic to other life. For example, at the same time as the enormous erosion problems were developing in the "Mid-West", man was irrigating California and producing citrus groves, lettuces, and food for our hungry millions, from land which was desert fifty years before. Sentimental or other regard for the creatures of the desert should not blind us to the fact that there is far more life, and far more varied life, in the irrigated valleys of California than there was when they were desert. This applies not only to man and to the crops which he plants deliberately, but to other forms of macrobial and microbial life which have increased because of his activities. A natural historian soon learns to appreciate the fact that man is part of this complex community of life, and that his life depends on its ever changing interactions. I believe that this sort of knowledge can be a proper help in our struggles to adjust as communal animals. It certainly gives us useful ideas of the effects of competition, of symbiosis and of disease, death and decay, on the maintenance of the balance of living

things in the world. For some of us who are not believers in Religion there are also sources of comfort in the consciousness of being part of a great and continuous cycle of events, which was going on long before we arrived and will continue long after we have left the scene.

THE WORK OF THE SOCIETY

So far I have talked about some of the products which can be obtained from natural history, but the degree to which we actually obtain them depends on the way we set about the work. I suggest that we can be modestly satisfied with the way in which the Society does this. We are not, of course, basically a 'teaching' organisation. We are simply an association of like minded people who have banded together to develop mutual interests. The decision as to what to do, and what anyone gets out of it, is entirely one for the members. Certainly the balance of field trips and lecture meetings seems to give the right sort of opportunities for members to see and speculate about life. It may be, however, that we could sometimes arrange situations to foster speculation and enquiry a bit more than we do. For example, an excursion leader who continually emphasises the unknown, the unusual, the unanswered question, is more likely to foster enquiry than one who emphasises the identification of the known and neglects the magical questions. We must also allow for those members of the Society who are not always satisfied with the abstract rewards of the search for pure knowledge. Some of them are more inclined to work on things which have a more material and direct value to humanity. In this connection the recent development of our sub-committee on the Sites of Special Scientific Importance could act as a useful focal point for our field activities. Our new Education Section could also play a valuable part in the current exciting development of biological education in Glasgow.

And finally to my rag bag of thoughts in the third group. I've put these in because some people may feel that this analytical approach misses the most important things; it misses the magic and mystery and beauty of nature, to which so many of us turn for relaxation and refreshment. I confess I am quite unrepentant about the form of this talk. I do think that there are practical values in the study of our subject, and that interest in it might well be advanced if these were better recognised and supported. And I do think that the advancement of knowledge of the subject comes best from perceptive observation, from curiosity and from logical deduction from sound evidence. It was Bacon (1605) who said "Whosoever shall entertain high and vaporous imagination, instead of laborious and sober enquiry after truth, shall beget hopes and

beliefs of strange and impossible shapes". But life would be a dull thing without our hopes and beliefs in strange and impossible shapes; without

" Such sights as youthful poets dream
On Summer eve by haunted stream " (Milton 1632),

without our Forests of Arden, our " tongues in trees . . . and good in everything " (Shakespeare). Again it would take many other talks to explore how we have developed this sort of value, this appreciation and respect for beauty in natural form. It isn't a natural character of all countrymen's life; it's the gipsy who is one of worst defilers of camp sites with rubbish, and the farmer who looks at land as something to be tamed and cropped to give a living for his family. The site of a piece of untouched natural moorland isn't all that pleasing to a farmer with hungry children. I am very conscious of this. My grandfather was a farm labourer earning eight shillings a week when my father was born in 1874. By the time I was a small boy, grandfather had a farm himself, and I used to play on a moorland that formed part of it. But by the time I had become a biology student I could no longer play on that moor, and I certainly couldn't collect rare plants and animals on it; because by then grandfather had drained the moor, limed it, ploughed it and planted it and I was eating bread from the grain he had grown on the fertile soil where it had been. And I believe he was right to do so; it was because grandfather did this sort of thing efficiently that my father had the leisure and money to become a botanist and I have been able to follow in his footsteps. You need a full belly and some leisure before the aesthetics of nature make much impact.

Late in his life Wordsworth appeared at an enquiry about the building of a railway to Windermere, and in his evidence he said " The perception of what has acquired the name of picturesque and romantic scenery is so far from being intuitive that it can be produced only by a slow and gradual process of culture " (Hodge, 1957). Not all men have had the chance to develop this culture; many have been more concerned with the effort of producing our daily bread. And make no mistake, it is *our* daily bread we speak of. It would ill become us automatically to oppose the spread of their activities, yet still eat the bread they produce. At the same time it is right that we should express our own values, so that these can be judged dispassionately when decisions on land use have to be made. In these values I hope we have a place for respect for the scientist, for the farmer and the forester, for living things other than man, and for the perception of beauty in many forms. But our own place is characteristic. A scientist may for example be concerned with the effects of particular light wavelengths on living things. But while he is making his precise

measurements in the laboratory we hope the natural historian will be out in the field in natural sunshine. And there we'll leave him to see the beauty, and to seek the pot of gold, at the end of whatever biological rainbow takes his fancy.

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OBSERVATIONS ON CERTAIN DRAGONFLIES (ODONATA) IN CENTRAL SCOTLAND

By PETER S. MAITLAND

Department of Zoology, University of Glasgow

(Received 16 May, 1966)

Since they are amongst the largest and most conspicuous of the insects found in this country there are many previous records of Odonata from various parts of the British Isles, and the general distribution of most species is now fairly well known. In Scotland there have been many observations on the distribution and occurrence of various species (e.g. Morton, 1899; McLachlan, 1900; King, 1901; Lucas, 1910; Evans, 1911; Longfield, 1948; etc.), but these have dealt almost entirely with the adults, which are highly mobile and often collected far from their typical habitats. A great deal more information on the larvae is still required before the ecological requirements of each species can be assessed accurately; in many, if not most species, the distribution is controlled by the requirements of the immature stages and any information on the habitats occupied by larvae is clearly of importance.

The present account concerns observations and collections of Odonata made by the author during recent years in central Scotland, an area which is here meant to include the counties of Stirling (Vice-county 86), Perth (records included here are confined to Mid-Perth, Vice-county 88), and Dunbarton (Vice-county 99). Two areas were studied in some detail: the region around Pitlochry, Perthshire, and the Loch Lomond District (Maitland, 1966) as defined by Hunter, Slack & Hunter (1959). Many casual collections were made at other places.

The most recent revision of the known vice-county distribution of Odonata in the British Isles is that of Corbet, Longfield and Moore (1960). Surprisingly enough, among the counties in Scotland for which there are fewest records are two very close to the Glasgow area, Stirling (one species with certain status) and Dunbarton (two species with certain status). It is clear that several of the abundant and widespread British species (e.g. *Lestes sponsa*) must almost certainly occur here (cf. Lucas, 1900) and the present note shows this, in fact, to be the case. In addition, the presence of certain species whose status was previously doubtful (e.g. *Cordulegaster boltoni*) has now been confirmed in these two counties. Central Perthshire, on the other hand, has a rich dragonfly fauna (about 16 species) which has been known for some time.

METHODS

All the collections with which this account is concerned were made with hand-nets, one with a mesh of 16 threads per centimetre being used for larvae and another of 8 threads per centimetre for adults. Most adult Zygoptera are easy to capture if a suitable net is available, but this is not true of the Anisoptera, many of which (e.g. *Cordulegaster boltoni*) are extremely able flyers. It is, however, often possible to identify some of these large species without actually capturing them. As noted below, many specimens, especially of the rarer species, were released after capture and identification; of those specimens which were kept the larvae were preserved in 70% alcohol and the adults mounted and dried. In most cases in this account, the only records of adults which are included are of specimens taken in the vicinity of the larval habitat.

During collecting many observations were made regarding the habitats occupied by larvae, the common aquatic species associated with them, the occurrence and position of cast larval skins, the food of adults and the oviposition behaviour of adult females. In addition, certain larvae were brought back to the laboratory for rearing purposes and observations were made there on their feeding and emergence behaviour.

ODONATA

Of the 43 species of Odonata occurring in the British Isles (Corbet *et al.*, 1960), 25 have been recorded from Scotland. Some of these are rare (and may not be established as breeding species), whilst others, though not rare, are confined to the highland areas and form part of the typical sub-arctic element found there; the remainder are relatively common and probably widespread throughout the country. With one exception (*Coenagrion hastulatum*) the species discussed below fall into the last category, and it is probable that eventually they will all be recorded from every vice-county.

Lestes sponsa (Hansemann). As shown in Table 1, this species was recorded from two localities in Stirlingshire, three in central Perthshire and one in Dunbartonshire; it does not appear to have been recorded previously from either Stirlingshire or Dunbartonshire. All the larvae collected were found in similar conditions, in still or very slow-flowing water with a very thick weed growth growing over fine silt.

Ischnura elegans (Linden). This species was not found in Perthshire, but occurred at three places in Stirlingshire and one place in Dunbartonshire (Table 1). Recorded from Stirlingshire by Corbet *et al.* (1960) its status in central Perthshire is noted by them to be uncertain and no records are shown for Dunbartonshire, though the species was recorded from both these counties by Evans (1911). Most

Station	Locality	Vice-county	Situation	Dominant Flora	<i>Lesites sponza</i>	<i>Ischnura elegans</i>	<i>Pyrrhosoma nymphula</i>	<i>Coenagrion hastulatum</i>	<i>Enallagma cyathigerum</i>	<i>Cordulegaster boltoni</i>	<i>Aeshna juncea</i>	<i>Libellula quadrimaculata</i>	<i>Symphetrum danae</i>
1	Bog Pool, Dumbrook	86	Sheltered pool below loch	<i>Potamogeton, Utricularia</i>	—	—	—	—	—	—	×	—	—
2	Bog Pool, Ben Vrackie	88	Exposed peat pool	<i>Utricularia</i>	—	—	—	—	—	—	×	—	—
3	Bog Pool, Fonab Hill	88	Exposed peat pool	<i>Potamogeton, Utricularia</i>	—	—	—	—	—	—	×	—	—
4	Ox-bow Pond, River Endrick	86	Partly exposed, dense weed growth	<i>Nymphaea, Potamogeton</i>	×	×	×	—	×	—	—	—	—
5	Baldernock Pond, Milngavie	86	Sheltered, dense weed growth	<i>Nymphaea, Potamogeton</i>	×	—	—	—	—	—	×	—	—
6	Fonab Pond, Pitlochry	88	Sheltered, thick emergent weed growth	<i>Potamogeton, Utricularia</i>	×	—	—	—	×	—	×	—	×
7	Small Pond, Pitlochry	88	Partly exposed, dense weed growth	<i>Myriophyllum, Potamogeton</i>	×	—	×	×	×	—	×	×	×
8	Curling Pond, Faskally	88	Sheltered, dense weed growth	<i>Potamogeton, Elodea</i>	×	—	×	—	×	—	×	×	×
9	Dumbrook Loch, Muggdock	86	Exposed, artificial dam	<i>Isoetes, Potamogeton</i>	—	—	×	—	×	—	—	—	—
10	Loch Dunmore, Pitlochry	88	Sheltered, dense weed growth	<i>Nymphaea, Myriophyllum</i>	—	—	×	—	×	—	—	—	—
11	Tannoch Loch, Milngavie	86	Sheltered, moderate weed growth	<i>Elodea, Potamogeton</i>	—	—	×	—	×	—	—	—	—
12	Loch Lomond, Balmaha	86	Sheltered, dense weed growth	<i>Potamogeton, Nuphar</i>	—	—	×	—	×	—	—	—	—
13	Loch Lomond, Rosshdu	99	Exposed stony shore, few weeds	<i>Liitorella, Isoetes</i>	—	—	—	—	—	—	—	—	—
14	Fonab Burn, Pitlochry	88	Exposed, rapid current, sandy	Nil	—	—	—	—	—	×	—	—	—
15	Douglas Water, Inverbeg	99	Sheltered, rapid current, stony	<i>Fontinalis</i>	—	—	—	—	—	×	—	—	—
16	Dougalston Burn, Milngavie	86	Sheltered, moderate current, stony	<i>Glyceria, Callitriche</i>	—	—	—	—	—	—	—	—	—
17	River Allander, Milngavie	86	Sheltered, moderate current, stony	<i>Fontinalis</i>	—	—	—	—	—	—	—	—	—
18	River Endrick, Cringate	86	Exposed, rapid current, rocky	<i>Fontinalis</i>	—	—	—	—	—	—	—	—	—
19	River Endrick, Balfon	86	Sheltered, moderate current, stony	<i>Myriophyllum, Fontinalis</i>	—	—	—	—	—	—	—	—	—
20	River Endrick, Gartocharn	99	Partly exposed, slow current, weedy	<i>Potamogeton, Elodea</i>	×	×	×	—	×	—	—	—	—

Table 1. Habitat data for certain Odonata in central Scotland.

of the present larvae were collected among thick vegetation, and the species is very abundant in the lower reaches of the River Endrick (Maitland, 1966).

Pyrhosoma nymphula (Sulzer). This species is a very common one and occurred in all the vice-counties considered here; it was recorded from many places other than those listed in Table 1. Recorded by Corbet *et al.* (1960) from central Perthshire, its status in Stirlingshire and Dunbartonshire is regarded by them as uncertain, though it has previously been recorded in these counties by Evans (1911) and King (1901) respectively. Like the two previous species, *P. nymphula* was found to be most common among thick vegetation growing over silt in still or very slow-flowing water.

Coenagrion hastulatum (Charpentier). This species was found only in central Perthshire, where it was collected from the same locality as first recorded by Blackwood (1949). This species is one of the rarest in the British Isles and is known to occur only in a few counties in the Highlands of Scotland (Corbet *et al.*, 1960). Though several visits were made in the summer of 1957 to the Perthshire locality—a small marshy pond in hilly country—the species was not then observed. The following year, however, adults of both sexes were found to be common there in early July, and of the many captured all were released except 4 (2 of each sex). Mature larvae were also collected at this time among thick aquatic vegetation growing in silt. The population here is undoubtedly a well established one.

Enallagma cyathigerum (Charpentier). An exceedingly common species, this was recorded at several places in all three counties under consideration; only some of these are listed in Table 1. Recorded from nearly every county in the British Isles, the status of this species in Stirlingshire is regarded as uncertain by Corbet *et al.* (1960), though it has been previously recorded there by both King (1901) and Evans (1911). The larvae collected here were found mainly in still water where rich vegetation was present.

Cordulegaster boltoni (Donovan). Larvae of this species were found at only two places, one in central Perthshire, the other in Dunbartonshire (Table 1). Adults were recorded from both these vice-counties and also from Stirlingshire where it is almost certain that the species breeds (Maitland, 1966). Recorded by Corbet *et al.* from Central Perthshire, its status in Stirlingshire and Dunbartonshire is noted as uncertain—though the species had previously been recorded from the latter county by Evans (1911). All the larvae collected by the author have been from among fine silt in running water; this agrees exactly with the habitat described by Lucas (1930) for this species.

Aeshna juncea (L.). This species was found at two places in Stirlingshire, five in central Perthshire and one in Dunbar-

tonshire. Single adults were noted in many other localities—often far from water. This species is listed by Corbet *et al.* (1960) from central Perthshire, but not from either Stirlingshire or Dunbartonshire, though it has previously been recorded from both these counties by Evans (1911). The larvae occurred mainly in small bodies of water, especially bog pools on open moorland.

Libellula quadrimaculata L. This species was common at two places in central Perthshire (Table 1), where both larvae and adults were collected in 1958. Adults have been seen by the author in Stirlingshire but the larval habitat was not located, whilst none has ever been observed in Dunbartonshire. The species has been recorded previously for both Central Perthshire and Dunbartonshire (Corbet *et al.*, 1960) but apparently not from Stirlingshire. The Perthshire larvae found by the author were collected among fine silt both where vegetation was present and where it was absent.

Sympetrum danae (Sulzer). This species was found as larvae at only two places in central Perthshire where adults also were collected. Adults were also collected at one locality in Stirlingshire, but not in Dunbartonshire; the species has yet to be recorded from this county. Corbet *et al.* (1960) list this species from central Perthshire but not Stirlingshire, though it has been recorded there by both Lucas (1900) and Evans (1911). The present larvae were collected mainly among silt in shallow water.

HABITATS

Some of the most typical habitats and their dragonfly faunas have been listed in Table 1, though collections have been made at very many other places also. As a group, the Odonata occupy only certain types of freshwater habitat in this area, and, with the exception of *Cordulegaster boltoni*, are confined to places where the current is absent or extremely slow. *C. boltoni* was found only in running water where the current was strong, but occurred only in two streams out of many examined.

In large bodies of water (e.g. Loch Lomond) larvae are rare or absent on wave-washed shores, but may be abundant locally among thick weed beds in sheltered areas (e.g. in Loch Lomond near Luss or Balmaha). The smallest bodies of standing water examined were bog pools; characteristically these contained *Aeshna juncea*, alone at high altitudes where the exposure is great, but accompanied by other species in more sheltered areas. The majority of species appear to favour small bodies of water in sheltered spots, and Zygoptera, particularly, occurred abundantly only where there were thick growths of aquatic vegetation—usually including emergent species.

BEHAVIOUR

The food and feeding habits of immature *Aeshna juncea* afforded some interest. The larvae, as previously noted, were found most commonly in shallow bog pools with a limited flora and fauna. Late instar larvae of this species are large (4 cms) and are often thought to require fairly large animals as food; the presence of numerous larvae of the Palmate Newt, *Triturus helveticus* (Razoumoski) together with the absence of other suitably sized organisms seemed to indicate that these were the main food supply. Tests in the laboratory showed that whilst the larvae readily ate large animals such as newt and frog larvae, earthworms, etc., when these were not available they ate large numbers of Cladocera (*Daphnia hyalina* Leydig). These they caught and ate individually. *Aeshna juncea* does not appear to be dangerous to fish, for large larvae placed in an aquarium with small Minnows *Phoxinus phoxinus* (L.) and no other food for 10 days failed to catch any. When large larvae were placed with small ones, cannibalism took place.

Food eaten by adult Odonata was verified on only two occasions, viz. *Sympetrum danae* feeding on *Pyrrhosoma nymphula* and *Pyrrhosoma nymphula* feeding on *Mystacides azurea* (L.).

Before emerging, the nymphs of several species are known to crawl for considerable distances on land. Cast skins of *Pyrrhosoma nymphula* and *Enallagma cyathigerum* were collected from the walls of a boathouse, some 2 metres (vertically) from the water. All were facing upwards. Cast skins of *Aeshna juncea* were collected at distances over 2 metres from the water on open *Sphagnum* moss. All of them were pointing directly away from the water. It is evident that though *Aeshna juncea* may emerge from a vertical position on a plant stem (as was noted in the laboratory) it can also do so from a horizontal position.

Only *Enallagma cyathigerum* and *Aeshna juncea* were reared in numbers in the laboratory. Their times of emergence were uncertain, but all those emerging indoors did so between 18.00 and 08.00 hours.

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THE WILD CAT (*FELIS SILVESTRIS*) IN BANFFSHIRE

By RAYMOND HEWSON

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(Revised to 22 February, 1967)

INTRODUCTION

In his survey of the wild cat in Scotland, Jenkins (1962) found that numbers had increased markedly in parts of Angus, Moray, and Nairn, but not in other places where factors such as myxomatosis (which deprived the wild cat of an important food) and the increase in woodlands, (which gave it shelter) might have been expected to produce similar effects. Banffshire lies to the north of Angus and to the east of Moray and Nairn, and has a similar climate and system of land management.

This paper presents additional data for Banffshire, compares the status of the wild cat in Banffshire, Angus, Moray, and Nairn, and re-assesses some of the replies to Jenkins' enquiry.

DISTRIBUTION IN BANFFSHIRE

PREVIOUS RECORDS

Harvie-Brown and Buckley (1892) considered that the wild cat was virtually extinct in Banffshire at the end of the 19th century, and was confined to the mountainous area in the south-west. In 1962 Jenkins concluded that "there seem to be few wild cats on the low ground in Banffshire but they may be fairly widespread in varying numbers over the higher ground". While this is in accord with the evidence he presents, one of the records for Drummuir (No. 44 or 45) is a duplicate and exaggerates the extent of low ground. From another, Glen Avon (No. 46), it is concluded that a decrease occurred when in fact trapping was discontinued. The correct interpretation is that wild cats first appeared on ground between 1000 and 1700 feet in Glen Avon in 1935 and were numerous in 1942 and 1943. Between 1935 and 1938 the number of cats killed annually increased from 1 to 15; 22 cats were killed in 1942 and 27 in 1943. Although the return is labelled Glen Avon, Ballindalloch, I have confirmed that it refers to Glen Avon, south of Tomintoul, (Fig. 1 : A).

ADDITIONAL RECORDS

The following additional records of wild cats killed were collected. With a few exceptions the localities concerned are

indicated in the following text and in Fig. 1 by reference letters.

1. Not less than 20 wild cats were trapped in Strath Avon (Fig. 1 :B) between 1958 and 1961. Some of these were sent to the Hancock Museum, Newcastle, where 10, including kittens, were received in 1960.
2. At least 11 wild cats were killed during 1963 on Forestry Commission ground at Morinsh at the head of Glen Rinnes (C).
3. About 30 wild cats were killed in the year ended February 1963 and about 46 the following year in and around Strath Avon, Glen Livet, Blairfindy and the Ladder Hills. While referring to a later period than Jenkins' enquiry and covering too wide an area to be shown accurately on Fig. 1 these records show a substantial population which was likely to have been there in some strength during the preceding two or three years. The area concerned lies to the south and east of reference B on Fig. 1.
4. Wild cats were trapped at Boat o' Brig in 1945, nearby at Sheriffhaugh (K) in 1962 and Curlusk in 1964 (H). A dead wild cat was found by the roadside in 1961 near Mulben (J). At least 5 wild cats were killed on the opposite bank of the Spey in this heavily wooded region from about 1961 onwards (L).
5. At Loch Park, near Dufftown, a wild cat was trapped in January 1966. Enquiries revealed that one had also been trapped there about 1955 (G).
6. A wild cat killed at Chapelford on the Moray/Banff border in September 1964 was the most northerly record in the area up to that time and within 4 miles of the coast (M).
7. In September 1965 a female wild cat was killed in a 2-3 year old plantation at 800 feet on the Hill of Inverkindling and 8 miles east of the Chapelford record. This is an extensive area of newly planted moorland or scrub, remote from known wild cat country (N).
8. About 10 adult wild cats and 4 litters of kittens were killed in Glen Fiddich and Blackwater forests (F) up to December 1966, and mostly from 1955 onwards.

EVIDENCE OF AN INCREASE IN RANGE

Examination of Jenkins' questionnaires, together with additional information listed above and obtained by personal enquiries, suggests an increase in range which might tentatively be split into four phases :

1. Wild cats spread into low ground in Glen Avon, between Tomintoul and the area around Birchfield to the south, about 1935. They were caught during trapping for rabbits which began in 1930. The increase in wild cats killed was

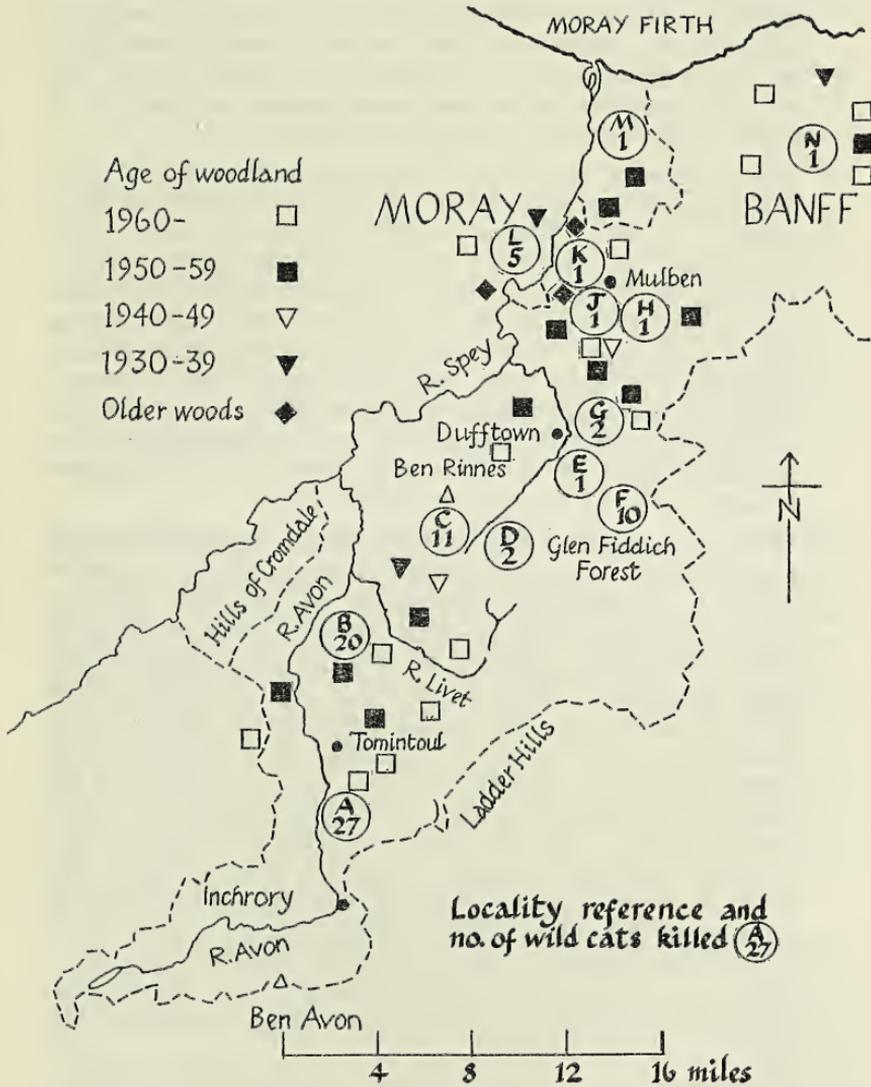


Fig. 1. Distribution of wild cats in Banffshire and age of main woodland areas.

rapid ; one in 1935 then 3, 10 and 15 in succeeding years. Trapping was discontinued for two years, and then 22 and 27 wild cats were killed in 1941 and 1942 respectively. Rabbit trapping was then discontinued. There are now fewer wild cats in this area (Return No. 47 and personal enquiry). Two points are of interest. The area concerned adjoins the mountainous south-westerly part of Banffshire, to which wild cats were confined at the end of the 19th century, and the wild cats were feeding on rabbits in grassy valley bottoms with birch woods.

2. Wild cats have occurred in Strath Avon since about 1914, but increased notably from 1957/58 (J. E. Dawson pers. comm.). Other information puts the increase about 1952 (C. Asher, pers. comm.) while G. Young (pers. comm.) trapped his first wild cat near Tomnavoulin in 1948. This was followed by a female with three kittens next spring, and a male later. Other gamekeepers then began to trap wild cats regularly until the annual estate total reached about 46 in the year ended February 1964. On the adjacent Glenlivet Estates the annual total of wild cats killed increased from 17 in 1951 to 30 in 1960, which agrees broadly with the increase in Strath Avon.
3. Wild cats appeared later in Glen Rinnes which lies north-east of Glen Livet and Strath Avon, with the extensive Forestry Commission plantations at Morinsh between them. The Glen Rinnes estate has long been in the same hands and earlier trapping of wild cats is unlikely to have gone un-noticed. The first record is 1953, and most of the wild cats killed occurred in the area between Morinsh and Ben Rinnes with the plantations offering a secluded route from Strath Avon and Glen Livet. On the east side of the glen two wild cats were killed at Wester Auchmore in 1957 and 1958 (D). The man who killed them said they were the first wild cats he had encountered since going to live there in 1914. Further down the east side of the glen one or more wild cats were killed at Allachlaggan, 4 miles south of Dufftown, in 1958. These, together with the 20 or more adult and young cats in Glen Fiddich and Blackwater, represent the present northerly limit of distribution in this area.
4. Wild cats killed at Boat o' Brig, Mulben, Curlusk and Sheriffhaugh may represent an extension of range from the area around Rothes in Moray, where at least 5 cats have been killed since 1961. The wild cat killed on the Banffshire/Moray border at Chapelford may be the forerunner of a spread from another direction, while that killed at the Hill of Inverkindling represents a notable extension of range across open or newly planted high moorland.

In Glen Avon during 1935-42 and in Strath Avon from about 1950 onwards wild cats increased rapidly. In Glen Rinnes the increase has been slow, but on Forestry Commission ground at Morinsh wild cats appear to be numerous. There has been a distinct and fairly rapid increase near the Spey Valley around Rothes in Moray and Mulben in Banffshire.

From 1935 onwards wild cats have been trapped at 600 to 1800 feet although estate boundaries reach 2700 feet. Of 6 wild cats killed in Glen Rinnes, 5 were between 900 and 1150 feet. At Morinsh 11 wild cats were killed between 900 and 1500 feet. These cats, and twenty or more in Strath Avon, were killed on moorland, birch scrub, or plantations near the fringe of cultivated land. Wild cats near Mulben were killed on the borders of cultivated land and conifer plantations and at Inverkindling in a young plantation, but a breeding den at 1800 feet on Ben Rinnes was in more remote country, and the Glen Rinnes records also refer to heather moorland. At Loch Park the first wild cat was killed, in 1955, in newly planted ground; the second, eleven years later, among the young trees.

COMPARISON WITH ANGUS, MORAY AND NAIRN

There were insufficient data in the replies to Jenkins' enquiry to attempt a comparison based on types of habitat, and it was difficult to compare numbers in different areas when the type of ground and the intensity of trapping were not known. Jenkins showed 31 estates which killed 10 or more wild cats in a year and 10 which killed more than 25 in a year. Of the latter, two were in Banffshire and two in Moray and Nairn. The greatest apparent densities (wild cats killed per 1,000 acres) occurred in Angus (one estate), Banffshire (1), Inverness (2), Moray (2) and Perth and Sutherland two each. The Banffshire total of 46 wild cats killed in the year ended February, 1964 was the second highest recorded.

The increases in Banffshire occurred earlier than in Angus, Moray and Nairn. In Strath Avon, Glen Livet, Morinsh, Blackwater and Glen Fiddich, they were rapid, in Glen Rinnes slow. In the Morinsh/Glen Livet area the increase began before myxomatosis, and might be associated with the additional area planted by the Forestry Commission, which increased from 2,500 acres in 1951 to 7,800 acres in 1963.

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PERTSHIRE SLIME MOULDS

by BRUCE ING

(Revised to 7 April, 1967)

INTRODUCTION

As in most other parts of Britain the study of myxomycetes in the large county of Perth has been sparse and sporadic. The first species noted in Perthshire were amongst the early fungus records of Buchanan White, who also contributed information to *Mycologia Scotica* (Stevenson, 1879, and White, 1880, 1882 and 1886). Two later members of the Perthshire Society for Natural Science took an interest in the group and published short notes (Lyell, 1908, and Menzies, 1923).

From then until 1964, when the present author came to live at Kindrogan Field Centre, the only records came from three mycological forays. The first was in the Dollar area, by the Cryptogamic Section of the Botanical Society of Edinburgh (Foister, 1951). The most important foray was that made by the British Mycological Society, based on Dunkeld, in September, 1953. Among the members present was H. J. Howard, an experienced myxomycologist, and some very useful myxomycete records were made. The following sites were visited: Stormont Loch, Blairgowrie; Black Wood of Rannoch; Murthly Castle Estate; Loch Craighlush plantations, Dunkeld; banks of the Tay, Dunkeld and the Ben Lawers area. Specimens from the foray are in the Herbaria at Kew and the British Museum. In these herbaria are a few more Perthshire specimens about which little is known. The last major foray was that associated with the Third European Mycological Congress held in Glasgow in September, 1964. Visits were made to Flanders Moss and the Black Wood of Rannoch; specimens are in the Herbarium of the Commonwealth Mycological Institute. Records made since February, 1964 are supported by specimens in the author's herbarium.

In recent years the writer has made extensive use of the moist chamber culture technique, as described by Gilbert and Martin (1933). The method involves the removal of small pieces of bark from living trees, with or without epiphytic vegetation, and keeping them in a covered petri dish with sufficient distilled water to maintain the saturation of the bark and the air in the chamber. The culture is examined at regular intervals for, perhaps, three months. In this way minute species of *Echinostelium*, *Licea*, *Paradiacheopsis* and *Perichaena* may be detected; they are rarely collected in the field. The dung of rabbit, hare and grouse may also be cultured by this method and may yield examples of the Acrasiales. Many of the species

listed here are new British records; these are also reported in Ing (1967b.)

ARRANGEMENT

The arrangement and nomenclature is as in Ing (1967a.)

The records are first listed under vice-counties: in Perthshire the boundaries of these are not always easy to define or find on the ground. V.-c. 87, West Perth with Clackmannan includes Clackmannanshire and some fragments of Stirlingshire, in particular the Wallace Monument on Abbey Craig. For details of the boundary here see Ribbons (1961). The boundary between V.-cs. 88 and 89 is frequently misrepresented. According to Watson (1859) it follows the Tay, Tummel and Garry rivers. This means that the boundary runs to Loch Garry and not, as in Druce's map (1932), to Rannoch Moor. Mr. B. W. Ribbons has confirmed that Druce is wrong.

Fig. 1 shows the distribution of records in the county. It is obvious that intensive collecting around Kindrogan is responsible for the large number of records; other areas might be as rich. Sources for the records are shown by the following

abbreviations:	BM	—	Herbarium, British Museum (Natural History).
	BMSF	—	British Mycological Society's Foray (Hora, 1954).
	K	—	Herbarium, Royal Botanic Gardens, Kew.

L — Lyell, 1908; W1, W2, W3, — White, 1880, 1882, 1886 respectively.

Where only a date and no abbreviation is given the record is that of the writer. Then follow the numbers of the 10 km. squares in the sequence NS, NN, NO, NT, in conformity with other local lists produced recently. It is hoped that distribution maps will be available for the group within five years.

PERTSHIRE MYXOMYCETES

Ceratiomyxaceae

Ceratiomyxa fruticulosa (Muell.) Macbr. Rotten wood of all kinds.

87. Kippenrait Glen, Dunblane, 1965.
88. Murthly Estate, BMSF; Aberfeldy, Moness Den, 1964; Rannoch, Black Wood, 1964.
89. Balinluig, W2; Blairgowrie, 1964; Kindrogan Field Centre, 1964; Moulin, 1964; Glen Tilt, 1965; Blair Castle, Blair Atholl, 1966.
79; 55, 84, 86, 95; 03, 06, 14.

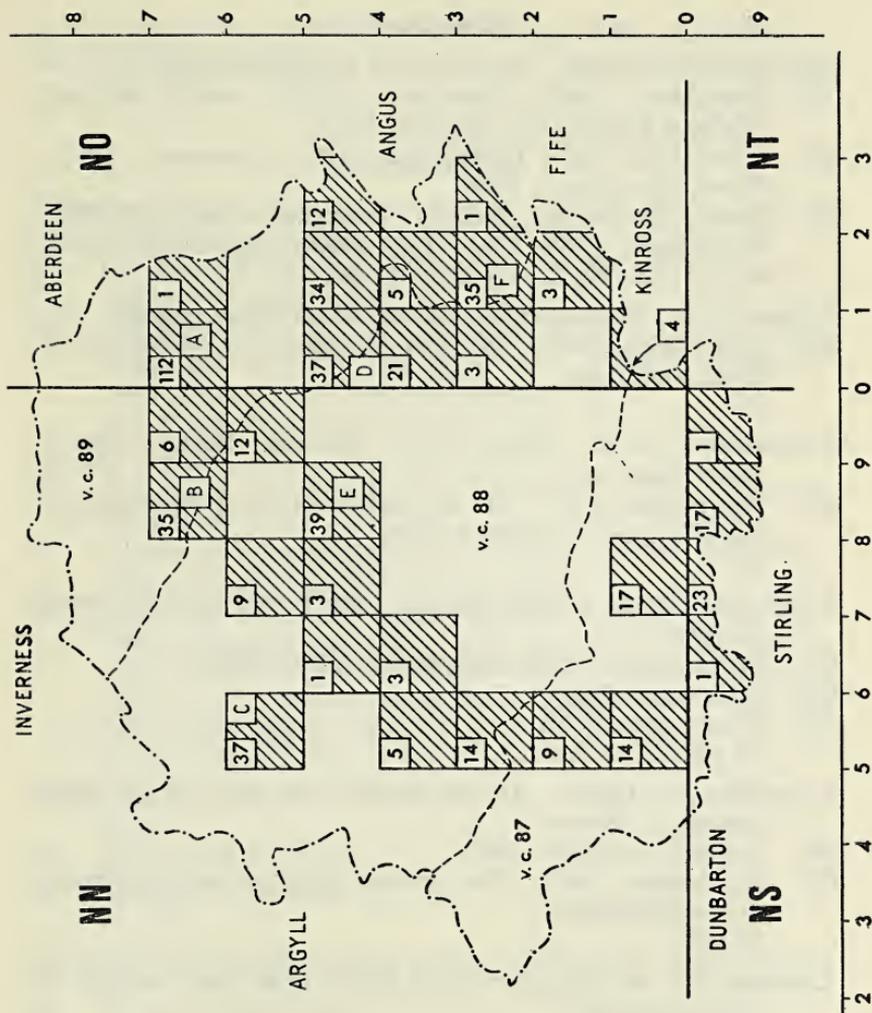


Fig. 1. Map of Perthshire showing the distribution of records by 10 km. squares. The number of records is marked within the respective square. The letters refer to the most fruitful areas:

A = Kindrogan area.

B = Glen Tilt and Blair Atholl.

C = Black Wood of Rannoch.

D = Dunkeld area.

E = Moness Den (Birks of Aberfeldy).

F = Kinnoull Hill and Kinfauns.

Liceaceae

Licea variabilis Schrad. Decorticated coniferous sticks.

- 87. Dunblane, 1965; Strathyre, 1965; woods around Wallace Monument, Stirling, 1965.
- 88. Aberfeldy, 1965; Dunalastair, 1965; Rannoch, 1965; Inver, Hermitage, 1966.
- 89. Loch Craiglush, BMSF; Stormont Loch, BMSF; Kindrogan, 1964; Glen Tilt, 1965; Hare Myre, 1966. 89; 51, 55, 70, 75, 84, 86; 04, 06, 14.

L. tenera Jahn. Sycamore bark in moist chamber culture.

- 89. Kindrogan, 1965. Known elsewhere in Britain from Essex and Bute. 06.

L. pedicellata (H. C. Gilbert) H. C. Gilbert. Bark of elm in moist chamber.

- 89. Kindrogan, 1966. The first British record; subsequently found on ash in Wester Ross. 06.

L. pusilla Schrad. Decaying pine wood and bark in moist chamber.

- 87. Balquhidder, 1965; Kippenrait Glen, 1965.
- 88. Rannoch, 1965.
- 89. Kindrogan, 1964. 79; 52, 55; 06.

L. castanea G. Lister. Inside of bark on trees or in moist chamber culture.

- 88. Lochan an Daim, 1965.
- 89. Kindrogan, 1965. This species appears to be confined to the Highlands. 75; 06.

L. minima Fr. Rotting pine wood and various bark samples in moist chamber.

- 87. Trossachs, 1965.
- 88. Murthly, BMSF; Dunalastair, 1965; Rannoch, 1965.
- 89. Kindrogan, 1964; Hare Myre, 1966. 50, 55, 75; 03, 06, 14.

L. kleistobolus Martin. Bark of grape vine in moist chamber.

- 89. Kindrogan, 1966. Second British record; previously found on rowan in Orkney. 06.

L. parasitica (Zukal) Martin. Bark of various tree species in moist chamber.

- 87. Kippenrait Glen, 1965; Trossachs, 1965.
- 88. Lochan an Daim, 1965.
- 89. Kindrogan, 1964; Dunkeld, 1966; Fungarth, 1966. 79; 50, 75; 04, 06.

- L. operculata* (Wing.) Martin. Oak bark in moist chamber.
89. Kindrogan, 1964.
06.

Reticulariaceae

- Tubifera ferruginosa* (Batsch) Gmel. Rotten coniferous logs.
87. Balquhidder, 1965.
88. Kenmore, W2 ; Killin, W2 ; Murthly, BMSF ; Rannoch, BMSF ; Aberfeldy, 1965.
89. Dunkeld, W2 ; Scone, W2 ; Kinnoull Hill, L ; Loch Craiglush, BMSF ; Stormont Loch, BMSF ; Dunkeld, 1964 ; Glen Tilt, 1964 ; Kindrogan, 1964.
52, 53, 55, 74, 84, 86 ; 03, 04, 06, 12, 14.
- Lycogala epidendrum* (L.) Fr. Rotten logs.
87. Rumbling Bridge, 1965 ; Trossachs, 1965 ; Wallace Monument, 1965.
88. Common, W2 ; Luncarty, L ; Logierait, 1964 ; Rannoch, 1964 ; Aberfeldy, 1965 ; Inver, 1965.
89. Common, W2 ; Glen Tilt, W1, 1964 ; Kinnoull Hill, W3, 1964 ; Kindrogan, 1964 ; Moulin, 1964 ; Craig Hall, 1965 ; Den o' Alyth, 1965 ; Glenshee, 1965 ; Kinfauns, 1965 ; Loch Clunie, 1965 ; Blair Castle, 1966 ; Dunkeld, 1966 ; Hare Myre, 1966.
89 ; 50, 55, 84, 86, 95 ; 00, 02, 04, 06, 12, 14, 16, 24.
- Dictydiaethalium plumbeum* (Schum.) Rost. Logs of beech and birch.
88. Moncrieffe Hill, W2.
89. Kinnoull Hill, W2, W3.
11, 12.
- Reticularia lobata* Lister. Base of pine stumps, often below the soil.
89. Kinnoull Hill, 1964.
12.
- R. jurana* Meylan. Fallen branches and sticks.
89. Kindrogan, 1964.
06.
- R. lycoperdon* Bull. Dead logs and dead standing trunks.
87. Dunblane, 1965.
88. Common, W2 ; Rannoch, 1964.
89. Common, W2 ; Kinnoull Hill, W3 ; Enochdhu, 1964 ; Kindrogan, 1964 ; Kirkmichael, 1964 ; Hare Myre, 1965.
55, 70 ; 06, 12, 14.
- R. olivacea* (Ehr.) Fr. Logs and stocks of ash and pine.
87. Dunblane, 1965.
89. Kinnoull Hill, W2 ; W3 ; Glen Tilt, 1965.
70, 86 ; 12.

Cribrariaceae

- Lindbladia effusa* (Ehr.) Rost. Sawdust and pine logs, rare.
89. Kinfauns, (Menziess, 1923). Overgrown by the hyphomycete *Stilbum orbiculare* B. & Br.
12.
- Cribraria argillacea* (Pers.) Pers. Coniferous stumps.
87. Balquhidder, 1965; Wallace Monument, 1965.
88. Aberfeldy, 1964; Rannoch, 1964; Inver, 1966.
89. Loch Craiglush, BMSF; Kindrogan, 1964; Glen Tilt, 1965.
89; 52, 55, 84, 86; 04, 06.
- C. intricata* Schrad. Coniferous sticks, rare.
88. Inver, 1966.
04.
- C. macrocarpa* Schrad. Coniferous logs, rare.
88. Rannoch, 1965.
89. Kindrogan, 1965; Blair Castle, 1966.
55, 86; 06.
- C. piriformis* Schrad. var. *notabilis* Rex. Coniferous stumps, uncommon.
88. Killin, (Lister, 1925); Rannoch, 1965.
89. Kindrogan, 1965.
53, 55; 06.
- C. rufa* (Roth) Rost. Coniferous logs.
88. Murthly, BMSF; Rannoch, BMSF, 1964.
89. Kindrogan, 1965; Dunkeld, 1966; Hare Myre, 1966.
55; 03, 04, 06, 14.
- C. aurantiaca* Schrad. Coniferous wood of all kinds, common.
87. Dunblane, 1965; Wallace Monument, 1965.
88. Rannoch, 1964; Aberfeldy, 1965; Inver, 1966.
98. Kinnoull Hill, L; Kindrogan, 1964; Moulin, 1964; Craig Hall, 1965.
89; 55, 70, 84, 95; 04, 06, 12, 14.
- C. vulgaris* Schrad. Cypress logs.
89. Kindrogan, 1965; collected by Mme. N. E. Nannenga-Bremekamp.
06.
- C. cancellata* (Batsch.) Nann-Brem. Stumps and logs of conifers and oak.
87. Kippenrait Glen, 1965; Strathyre, 1965.
88. Rannoch, BMSF, 1964; Aberfeldy, 1965; Inver, 1966.
89. Glen Tilt, 1964; Kindrogan, 1964; Kinfauns, 1965.
79; 51, 55, 84, 86; 04, 06, 12.

Dianemaceae

Calomyxa metallica (Berk.) Niewland. Sycamore bark in moist chamber.

89. Kindrogan, 1965.
06.

Dianema depressum (Lister) Lister. Rotten birch trunk.

89. Kindrogan, 1964.
06.

D. nivale (Meylan) G. Lister. Hazel sticks, rare.

88. Aberfeldy, October, 1966. This is only the second British gathering; it was previously known from Aberdeenshire.
84.

Trichiaceae

Perichaena chrysosperma (Currey) Lister. Bark of living trees.

89. Kindrogan, 1965; Glen Tilt, 1966.
86; 06.

P. vermicularis (Schw.) Rost. Bark of ash.

89. Kindrogan, 1966.
06.

P. depressa Libert. Fallen ash bark.

89. Blair Castle, 1966. This is a common southern species which is rare in Scotland.
86.

P. corticalis (Batsch) Rost. Fallen bark, especially ash.

87. Kippenrait Glen, 1965.
88. Aberfeldy, 1965; Ardradnaig, 1966.
89. Glen Tilt, 1965.
79; 74, 84, 86.

P. minor (G. Lister) Hagelet. Liverworts on bark of living trees.

88. Inver, 1967.
89. Den o' Alyth, 1965; Kindrogan, 1965; Dunkeld, 1966.
04, 06, 24.

Arcyria ferruginea Sauter. Dead wood, usually in winter.

88. Inver, 1966.
89. Kindrogan, 1964; Kinnoull Hill, 1964.
04, 06, 12.

A. incarnata (Pers.) Pers. Dead wood of all kinds.

87. Balquhiddier, 1965; Strathyre, 1965; Wallace Monument, 1965.
88. Rannoch, W2, 1964; Murthly, BMSF; Aberfeldy, 1966.
89. Glen Tilt, 1964; Kindrogan, 1964; Stormont Loch, 1965.
89; 51, 52, 55, 84, 86; 03, 06, 14.

A. oerstedtii Rost. Coniferous stumps.

89. Kindrogan, 1964.
06.

A. nutans (Bull.) Grev. Logs in summer.

87. Dunblane, 1965.
88. Kenmore, W2; Murthly, BMSF; Logierait, 1964;
Aberfeldy, 1966.
70, 74, 84, 86, 95; 03, 06.

A. cinerea (Bull.) Pers. Stumps, logs, and bark of living birch.

87. Kippenrait Glen, 1965.
88. Aberfeldy, 1965; Lochan an Daim, 1965.
89. Glen Tilt, 1964; Kindrogan, 1964; Craig Hall, 1965;
Killiecrankie, 1965; Kinfauns, 1965; Stormont Loch,
1965; Blair Castle, 1966; Fungarth, 1966.
79; 75, 84, 86, 96; 04, 06, 12, 14.

A. pomiformis (Leers) Rost. Fallen bark and sticks.

87. Dunblane, 1965.
88. Murthly, BMSF; Inver, 1966.
70; 03, 04.

A. denudata (L.) Wettst. Dead wood of all kinds.

87. Dunblane, 1965; Strathyre, 1965.
88. Moncrieffe Hill, W2; Murthly, BMSF; Aberfeldy, 1964.
89. Kinnoull Hill, W2, W3, 1964; Glen Tilt, 1964; Kindrogan,
1964; Moulin, 1964; Stormont Loch, 1965;
Blair Castle, 1966.
51, 70, 84, 86, 95; 03, 06, 11, 12, 14.

Hemitrichia abietina (Wig.) G. Lister. Bark of living oaks and sycamores.

89. Kindrogan, 1965.
06.

H. leiotricha (Lister) G. Lister. Heathland litter.

89. Kindrogan, 1965.
06.

H. clavata (Pers.) Rost. agg. Dead wood.

88. Rannoch, W2.
89. Dunkeld, W2; Kindrogan, 1965—the segregate species
stipitata (Masse) Macbr.
55; 04, 06.

Trichia varia (Pers.) Pers. Dead wood of all kinds.

87. Balquhidder, 1965; Dunblane, 1965; Kippenrait Glen,
1965; Rumbling Bridge, 1965; Trossachs, 1965; Wallace
Monument, 1965.
88. Murthly, BMSF; Rannoch, 1964; Aberfeldy, 1965.

89. Dunkeld, W2 ; Glen Tilt, 1964 ; Killiecrankie, 1964 ; Kindrogan, 1964 ; Kinnoull Hill, 1964 ; Moulin, 1964 ; Den o' Alyth, 1965 ; Enochdhu, 1965 ; Stormont Loch, 1965 ; Hare Myre, 1966.
79, 89 ; 50, 52, 55, 70, 84, 86, 95, 96 ; 00, 03, 04, 06, 12, 14, 24.
- T. contorta* (Ditm.) Rost. var. *contorta*. Sticks.
89. Glen Tilt, Kindrogan, 1964.
86 ; 06.
- T. contorta* var. *inconspicua* (Rost.) Lister. Heaps of twiggy refuse.
89. Kindrogan, 1964 ; Den o' Alyth, 1965.
06, 24.
- T. scabra* Rost. Logs, common in the south, rare in Scotland.
89. Kindrogan, 1964 ; Den o' Alyth, 1965.
06, 24.
- T. affinis* de Bary. Mossy stumps.
87. Pass of Leny, 1965.
88. Moncrieffe Hill, W2, as *chrysosperma* ; Rannoch, W2, 1964.
89. Dunkeld, W, as *chrysosperma* ; Kindrogan, 1964.
50, 55 ; 04, 06, 11.
- T. persimilis* Karst. Logs and sticks.
87. Kippenrait Glen, 1965.
88. Murthly, BMSF.
89. Glen Tilt, 1964 ; Kindrogan, 1964 ; Den o' Alyth, 1965 ; Enochdhu, 1965.
79 ; 86 ; 03, 06, 24.
- T. decipiens* (Pers.) Macbr. Dead wood of all kinds.
87. Balquhidder, 1965 ; Trossachs, 1965.
88. Ben Lawers area, BMSF ; Murthly, BMSF ; Killin, K ; Killiecrankie, 1964 ; Rannoch, 1964 ; Aberfeldy, 1965.
89. Dunkeld, W2 ; Loch Craiglush, BMSF ; Glen Tilt, 1964 ; Kindrogan, 1964 ; Kirkmichael, 1964 ; Stormont Loch, 1964 ; Den o' Alyth, 1965 ; Enochdhu, 1965 ; Kinfauns, 1965.
50, 52, 53, 55, 63, 84, 86, 95, 96 ; 03, 04, 06, 12, 14, 24.
- T. botrytis* (Gmel.) Pers. Sticks and logs, rarely on *Cladonia* spp. in moorland.
87. Balquhidder, 1965 ; Kippenrait Glen, 1965 ; Pass of Leny, 1965 ; Strathyre, 1965 ; Trossachs, 1965.
88. Rannoch, 1964 ; Aberfeldy, 1965 ; Dunalastair, 1965 ; Inver, 1966.
89. Glen Tilt, 1964 ; Kindrogan, 1964 ; Kinnoull Hill, 1964 ; Den o' Alyth, 1965 ; Enochdhu, 1965 ; Kinfauns, 1965 ; Hare Myre, 1966.
79 ; 50, 51, 52, 55, 75, 84, 86 ; 04, 06, 12, 14, 24.

T. flavicoma (Lister) B. Ing. Piles of dead leaves, rare.
89. Kindrogan, 1965.
06.

T. floriformis (Schw.) G. Lister. Logs, stumps and tree bases.
87. Kippenrait Glen, 1965.
88. Aberfeldy, 1966; Rannoch, 1964.
89. Kindrogan, 1964; Den o' Alyth, 1965; Loch Clunie,
1965; Blair Castle, 1966.
79; 55, 84, 86; 06, 14, 24.

Oligonema schweinitzii (Berk.) Martin. Sallow sticks at edge of loch.
89. Stormont Loch, 1964.
14.

Echinosteliaceae

Echinostelium minutum de Bary. Bark of living trees in moist chamber.

87. Kippenrait Glen, 1965; Trossachs, 1965.
88. Lochan an Daim, 1965; Rannoch, 1965.
89. Kindrogan, 1964; Hare Myre, 1966; Kinnoull Hill,
1966.
79; 50, 55, 75; 06, 12, 14.

E. roseum B. Ing. On *Orthotrichum lyellii* on sycamore bark in moist chamber.

89. Kindrogan, January 1965. This is the type locality (Ing, 1965); the species is also now known from Wester Ross, County Wicklow, Eire, and Germany.
06.

Stemonitaceae

Amaurochaete fuliginosa (Sow.) Macbr. Newly felled conifer stumps.

88. Rannoch, W2; Inver, 1966.
55; 04.

Brefeldia maxima (Fr.) Rost. Hollow stumps.

87. Balquhidder, 1965.
52.

Symphytocarpus flaccidus (Lister) B. Ing and Nann.-Brem. Exposed, dry pine logs.

88. Rannoch, 1964.
89. Glen Tilt, 1966.
55, 86.

S. impexus B. Ing and Nann.-Brem. Pine stumps.

88. Rannoch, 1964.
55.

S. amaurochaetoides Nann.-Brem. Beech logs.

89. Kinnoull Hill, 1964.
12.

Stemonitis fusca Roth. Logs and stumps.

87. Kippenrait Glen, 1965; Rumbling Bridge, 1965.
88. Logierait, 1964; Rannoch, 1964; Inver, 1966.
89. Glen Tilt, W1, W2, 1965; Killiecrankie, W2; Rait, W2;
Kinnoull Hill, W3, 1964; Scone Woods, L; Kindrogan,
1964; Moulin, 1964; Kinfauns, 1965; Stormont Loch,
1965; Blair Castle, 1966.
79; 55, 86, 95, 96; 00, 04, 06, 12, 14, 22.

S. virginensis Rex. Rotten sycamore log.

89. Kindrogan, 1965. This is the third British record of a
species now known from several sites throughout Britain.
06.

S. axifera (Bull.) Macbr. Logs and stumps.

87. Kippenrait Glen, 1965.
88. Stanley, 1966.
89. Kindrogan, 1964.
79; 06, 13.

S. flavogenita Jahn. Stumps and logs.

88. Stanley, 1966.
89. Kindrogan, 1964.
06, 13.

S. herbatica Peck. Herbaceous stalks and grass.

87. Kippenrait Glen, 1965.
88. Murthly, BMSF.
89. Kindrogan, 1966.
79; 03, 06.

Comatricha nigra (Pers.) Schroet. Sticks of all kinds.

87. Blair Drummond, 1964; Balquhidder, 1965; Dunblane,
1965; Pass of Leny, 1965; Strathyre, 1965; Wallace
Monument, 1965.
88. Murthly, BMSF; Inver, 1965; Rannoch, 1965; Aber-
feldy, 1966.
89. Glen Tilt, 1964; Killiecrankie, 1964; Kindrogan, 1964;
Kinnoull Hill, 1964, Kirkmichael, 1964; Pitlochry,
1964; Craig Hall, 1965; Den o' Alyth, 1965; Kinfauns,
1965; Stormont Loch, 1965; Blair Castle, 1966.
79, 89; 50, 51, 52, 55, 70, 84, 86, 95, 96; 03, 04, 06, 12,
14, 24.

C. elegans (Racib.) Lister. Coniferous twigs and sticks.

87. Strathyre, 1965.
88. Inver, 1965; Rannoch, 1965.
89. Glen Tilt, 1964; Kindrogan, 1965.
51, 55, 86; 04, 06.

C. laxa Rost. Oak sticks.

89. Kindrogan, 1965.
06.

C. subcaespitosa Peck. Wet sticks.

88. Rannoch, 1965. Third British record; also in Aberdeenshire and Northamptonshire.
55.

C. typhoides (Bull.) Rost. Well rotted logs.

87. Balquhidder, 1965.
88. Aberfeldy, 1964.
89. Kindrogan, 1964; Glen Tilt, 1965; Stormont Loch, 1965.
52, 84, 86; 06, 14.

C. hyperopta (Meylan) Nann.-Brem. Coniferous stumps.

88. Rannoch, 1964; Inver, 1966.
89. Blair Atholl, BM; Glen Tilt, 1965; Kindrogan, 1965; Stormont Loch, 1965.
55, 86; 04, 06, 14.

C. tenerrima (M. A. Curt.) G. Lister. Piles of wet sticks.

89. Kindrogan, 1964.
06.

C. pulchella (Bab.) Rost. Dead leaves and twigs.

88. Aberfeldy, 1965—var. *fusca* Lister.
89. Kinfauns, 1965.
84; 12.

C. alta Preuss. Stumps and logs.

89. Kindrogan, 1965.
06.

Enerthenema papillatum (Pers.) Rost. Sticks and fallen bark.

87. Balquhidder, 1965.
88. Rannoch, 1964; Aberfeldy, 1966; Inver, 1966.
89. Kindrogan, 1964; Glen Tilt, 1966.
52, 55, 84, 86; 04, 06.

Paradiacheopsis fimbriata (G. Lister and Cran) Hertel. Bark of living trees, especially pine.

88. Dunalastair, 1965; Rannoch, 1965.
89. Kindrogan, 1964; Hare Myre, 1966; Kinnoull Hill, 1966.
55, 75; 06, 12, 14.

P. solitaria (Nann.-Brem.) Nann.-Brem. Birch and oak bark in moist chamber.

88. Lochan an Daim, 1965.
89. Kindrogan, 1964. Outside Perthshire known only from Cambridge, Orkney and its type locality in Holland.
75; 06.

Macbrideola cornea (G. Lister and Cran) Alexopoulos. Mossy bark in moist chamber.

89. Kindrogan, 1965; Fungarth, 1966.
04, 06.

Collaria rubens (Lister) Nann.-Brem. Wet stumps and dead leaves.

89. Kindrogan, 1964.
06.

Lamproderma carestiae (Ces. and de Not) Rost. Coniferous litter.

89. Kinfauns, 1965; Normally regarded as an alpine species but of the three British gatherings only that from the Clova mountains is in alpine grassland. The third specimen, from Worcestershire, is on lowland litter.
12.

L. arcyrioides (Somm.) Rost. Leaf litter.

88. Aberfeldy, 1965.
89. Kindrogan, 1964.
84; 06.

L. sauteri Rost. Wet mosses.

89. Kindrogan, 1965. Another 'alpine' species which is occasionally found on mosses at low altitude in hill country.
06.

L. columbinum (Pers.) Rost. Wet mosses, including *Sphagnum*.

87. Kippenrait Glen, 1965.
88. Aberfeldy, 1965.
89. Kindrogan, 1964.
79; 84; 06.

L. scintillans (Berk. and Br.) Morg. Dead leaves and decaying fern fronds.

87. Dunblane, 1965; Wallace Monument, 1965.
88. Aberfeldy, 1965.
89. Kindrogan, 1964.
89; 70, 84; 06.

Diacheopsis insessa (G. Lister) B. Ing. Lichens on trees, very rare.

89. Kindrogan, 1964. Second known specimen; the species was described from Elgin. It has since been found in Argyll and British Columbia (see Ing, 1965 and 1967b.)
06.

Colloderma oculatum (Lipp.) G. Lister. Bark of living trees and rotten stumps.

88. Rannoch, 1965.
89. Kindrogan, 1964.
55; 06.

Diachea subsessilis Peck. Rotten sticks and plant litter.

88. Killin, BM.

89. Pitlochry (Lister, 1925) ; Kindrogan, 1965.
53, 95 ; 06.

Physaraceae

Fuligo muscorum Alb. and Schw. Moss and coniferous litter.

88. Inver, 1966.

89. Kindrogan, 1965 ; Kinfauns, 1965.
04, 06, 12.

F. septica (L.) Web. var. *flava* (Pers.) Morg. Stumps and logs.
'Flowers of Tan'.

87. Balquhidder, 1965 ; Dunblane, 1965 ; Kippenrait Glen,
1965 ; Rumbling Bridge, 1965 ; Trossachs, 1965.

88. Common, W2 ; Aberfeldy, 1964 ; Logierait, 1964 ;
Rannoch, 1964 ; Inver, 1966.

89. Common, W2 ; Glen Tilt, W1, 1964 ; Kinnoull Hill,
W3, 1964 ; Scone, L ; Killiecrankie, 1964 ; Kindrogan,
1964 ; Loch Clunie, 1964 ; Blairgowrie, 1965 ; Kinfauns
1965 ; Blair Castle, 1966.
79 ; 50, 52, 55, 70, 84, 86, 95, 96 ; 00, 04, 06, 12, 14.

F. septica var. *candida* (Pers.) R. E. Fr. Stumps and leaves.

88. Murthly, BMSF.
03.

Badhamia versicolor Lister. Moss on living trees.

87. Trossachs, 1965.

89. Kindrogan, 1965.
50 ; 06.

B. capsulifera (Bull.) Berk. Dead branches of beech.

89. Kindrogan, 1965.
06.

B. utricularis (Bull.) Berk. On *Stereum* spp. on beech logs.

88. Stanley, 1966.

89. Kinnoull Hill, W2, W3, 1966 ; Kindrogan, 1965.
06, 12, 13.

B. foliicola Lister. On *Metzgeria* on living beech.

88. Aberfeldy, 1966.
84.

B. alpina G. Lister. Birch log.

89. Kindrogan, August, 1965, collected by Mme. Nannenga-
Bremekamp. The only British record of an otherwise
alpine species.
06.

B. macrocarpa (Ces.) Rost. Beech branches.

89. Kinnoull Hill, 1966.
12.

B. panicea (Fr.) Rost. Beech logs.

87. Wallace Monument, 1965.

88. Aberfeldy, 1965.

89. Kindrogan, 1964.

89 ; 84 ; 06.

B. lilacina (Fr.) Rost. Grass and heather at edge of *Sphagnum* patches.

87. Flanders Moss, European Mycological Congress ; Lake of Menteith, 1966.

88. Killin, BM.

89. Kindrogan, 1966.

69 ; 50, 53 ; 06.

Physarum vernum Somm. ex Fr. Dead leaves.

88. Murthly, BMSF.

03.

P. cinereum (Batsch) Pers. Leaf litter and fallen bark.

89. Kindrogan, 1964.

06.

P. virescens Ditm. Terrestrial mosses, especially *Pseudoscleropodium purum*.

89. Glen Tilt, 1964 ; Kindrogan, 1965.

86 ; 06.

P. luteolum Peck. Terrestrial mosses, rare.

89. Kindrogan, 1965.

06.

P. auriscalpium Cooke. Rotten *Spiraea* stems in moist chamber.

89. Kindrogan, 1965.

06.

P. decipiens M. A. Curt. Bark of oak in moist chamber.

89. Glen Tilt, 1965 ; Kindrogan, 1966.

86 ; 06.

P. bivalve Pers. Herbaceous stalks and leaves.

87. Dunblane, 1965.

88. Murthly, BMSF ; Stanley, 1966.

89. Kindrogan, 1964.

70 ; 03, 06, 13.

P. bitectum G. Lister. Leaves and *Rubus* stems.

89. Stormont Loch, BMSF.

14.

P. mucosum Nann.-Brem. Cut stems of *Spiraea* in heap.

89. Kindrogan, August, 1965. First British record.

06.

P. penetrale Rex. Piles of beech leaves.

89. Kindrogan, 1965.

06.

P. crateriforme Petch. Bark in moist chamber.

89. Kindrogan, 1966.
06.

P. citrinum Schum. Spruce litter.

88. Inver, 1966.
89. Muirton Wood, Blairgowrie, 1957, D. M. Henderson ;
Kindrogan, 1964.
04, 06, 14.

P. leucophaeum Fr. Dead wood and moss.

87. Balquhidder, 1965 ; Kippenrait Glen, 1965.
88. Murthly, BMSF ; Aberfeldy, 1965.
89. Loch Craiglush, BMSF ; Glen Tilt, 1964 ; Kindrogan,
1964 ; Den o' Alyth, 1965 ; Enochdhu, 1965.
79 ; 50, 84, 86 ; 03, 04, 06, 24.

P. compressum Alb. and Schw. Wood and moss.

88. Aberfeldy, 1965.
89. Kindrogan, 1964 ; Enochdhu, 1965.
84 ; 06.

P. nutans Pers. Dead wood of all kinds.

87. Balquhidder, 1965 ; Dunblane, 1965 ; Kippenrait Glen,
1965 ; Pass of Leny, 1965 ; Strathyre, 1965 ; Trossachs,
1965.
88. Luncarty, L ; Ben Lawers, BMSF ; Murthly, BMSF ;
Aberfeldy, 1964 ; Logerait, 1964 ; Rannoch, 1964 ; Inver,
1966.
89. Scone, W2, L ; Loch Craiglush, BMSF ; Glen Tilt, 1964 ;
Kindrogan, 1964 ; Kinnoull Hill, L, 1965 ; Den o' Alyth,
1965 ; Enochdhu, 1965 ; Kinfauns, 1965 ; Stormont
Loch, 1965 ; Blair Castle, 1966.
79 ; 50, 51, 52, 55, 63, 70, 84, 86, 95 ; 02, 03, 04, 06, 12,
14, 24.

P. viride (Bull.) Pers. var. *viride*. Coniferous logs, twigs and
brashings.

87. Strathyre, 1965 ; Wallace Monument, 1965.
88. Rannoch, W2 ; Ben Lawers, BMSF ; Aberfeldy, 1965 ;
Inver, 1966.
89. Loch Clunie, 1964 ; Glen Tilt, 1965 ; Kindrogan, 1965 ;
Kinfauns, 1965 ; Blair Castle, 1966.
89 ; 51, 55, 63, 84, 86 ; 04, 06, 12, 14.

P. viride var. *incanum* Lister. Rotten stems of shrubs.

88. Ben Lawers, BMSF ; Aberfeldy, 1965.
89. Glen Tilt, 1965 ; Kinfauns, 1965.
63, 84, 86 ; 12.

- Craterium leucocephalum* (Pers.) Ditm. Dead leaves and moss,
 87. Dunblane, 1965.
 88. Aberfeldy, 1965.
 89. Kindrogan, 1965.
 70, 84; 06.
- C. aureum* (Schum.) Rost. Leaves and grass.
 87. Wallace Monument, 1965.
 89.
- C. minutum* (Leers) Fr. Leaves, moss and herbaceous stalks.
 87. Dunblane, 1965; Kippenrait Glen, 1965; Wallace
 Monument, 1965.
 88. Rannoch, W2; Luncarty, L; Aberfeldy, 1965; Inver,
 1966.
 89. Blair Atholl (Stevenson, 1879); Loch Craiglush, BMSF;
 Glen Tilt, 1964; Kindrogan, 1964; Kinnoull Hill, 1966.
 79, 89; 55, 75, 84, 86; 02, 04, 06, 12.
- Leocarpus fragilis* (Dicks.) Rost. Herbaceous stems and leaves.
 87. Kippenrait Glen, 1965; Wallace Monument, 1965.
 88. Murthly, BMSF.
 89. Dunkeld, W2; Stormont Loch, BMSF; Kindrogan,
 1964; Kinnoull Hill, 1964; Kinfauns, 1965.
 79, 89; 03, 04, 06, 12, 14.

Didymiaceae

- Diderma spumarioides* (Fr.) Fr. Dead leaves.
 88. Aberfeldy, 1965.
 89. Stormont Loch, BMSF.
 84; 14.
- D. effusum* (Schw.) Morg. Dead leaves, especially beech.
 89. Loch Craiglush, BMSF; Kindrogan, 1965.
 04, 06.
- D. chondrioderma* (de Bary and Rost.) G. Lister. Bark of rowan
 in moist chamber.
 89. Kindrogan, 1964. A rare bark species confined to
 Highland Britain.
 06.
- D. trevelyanii* (Grev.) Fr. Twigs and dead bracken, rare.
 89. Kindrogan, 1964.
 06.
- D. ochraceum* Hoffm. Wet mosses in north and west Britain.
 88. Inver, 1966.
 89. Glen Tilt, 1966.
 86; 04.
- D. asteroides* (A. and G. Lister) G. Lister. Moss on twigs in
 litter, rare.
 89. Kindrogan, 1964.
 06.

D. radiatum (L.) Morg. Rotten logs.

89. Kindrogan, 1964.
06.

Mucilago spongiosa (Leyss.) Morg. Grass and herbaceous stems.

87. Near Dollar (Foister, 1951).
88. Common, W2; Rannoch, European Mycological Congress.
89. Common, W2; Kinnoull Hill, W3; Kindrogan, 1964.
99; 55; 06, 12.

Didymium crustaceum Fr. On grass and litter, rare.

88. Murthly, BMSF.
89. Kindrogan, 1965.
03, 06.

D. clavus (Alb. and Schw.) Rabenh. Dead bracken fronds.

88. Aberfeldy, 1965.
84.

D. squamulosum (Alb. and Schw.) Fr. Dead leaves and fern fronds.

87. Kippenrait Glen, 1965; Wallace Monument, 1965.
88. Aberfeldy, 1965.
89. Kinnoull Hill, L; Kindrogan, 1964.
79, 89; 84; 06, 12.

D. laxifila G. Lister and Ross. Deep in leaf litter, rare.

89. Kindrogan, 1966. The first Scottish and fourth British record. The species is known outside Great Britain from a single gathering in North America.
06.

D. melanospermum (Pers.) Macbr. Litter in coniferous woodland.

87. Dunblane, 1965.
88. Murthly, BMSF; Aberfeldy, 1965; Inver, 1966.
89. Kindrogan, 1965; Kinfauns, 1965.
70, 84; 03, 04, 06, 12.

D. minus (Lister) Morg. Leaves and bark.

87. Wallace Monument, 1965.
89. Kindrogan, 1965.
89; 06.

D. nigripes (Link) Fr. Dead leaves, especially holly.

87. Dunblane, 1965; Wallace Monument, 1965.
88. Stanley, 1966.
89. Scone, W2; Kindrogan, 1965.
89; 70; 06, 12, 13.

D. iridis (Ditm.) Fr. Dead leaves and herbaceous debris.

87. Wallace Monument, 1965.
88. Aberfeldy, 1965; Inver, 1966.
89. Kindrogan, 1964.
89; 84; 04, 06.

D. megalosporum Berk. and Curt. Spruce litter.

89. Kindrogan, 1965.
06.

D. vaccinum (Dur. and Mont.) Buchet. Straw in compost heap.

89. Kindrogan, January 1965. First Scottish record.
06.

D. difforme (Pers.) S. F. Gray. Herbaceous debris of all kinds, especially nettle stems.

87. Dunblane, 1965 ; Kippenrait Glen, 1965.
88. Aberfeldy, 1965.
89. Kindrogan, 1964 ; Stormont Loch, 1964.
79 ; 70, 84 ; 06, 14.

Lepidoderma tigrinum (Schrad.) Rost. Wet moss and soggy coniferous wood.

87. Balquhidder, 1965.
88. Aberfeldy, 1965 ; Inver, 1966.
89. Kindrogan, 1965 ; Kinfauns, 1965.
52, 84 ; 04, 06, 12.

L. carestianum (Rab.) Rost. Grassland litter at edge of melting snow.

88. Yellow Corrie, Ben Lawers, June, 1947, collected by A. W. Stelfox. This is the only British record of this true alpine species.
64.

PERTSHIRE ACRASIOMYCETES

This little known group of aggregative organisms may be related to soil amoebae but show some fungal affinities and they are often called "cellular slime moulds". The Perthshire list is based on casual observations and could easily be enlarged.

Protostelium fimicola L. S. Olive. Grouse dung in moist chamber.

89. Kindrogan, October 1966. First European record of a newly discovered species (Olive, 1962). It is probably wide-spread on dung of herbivorous animals.
06.

Guttulina rosea Cienk. Bark of cypress, wellingtonia, pine and birch in moist chamber.

89. Kindrogan, February 1965 ; Hare Myre, 1966. First British record and only third known gathering since Cienkowski described it in 1873. Now also known from Wester Ross.
06, 12.

Dictyostelium mucoroides Bref. Dung of hare and grouse in moist chamber.

89. Kindrogan, August 1965. A widespread species of soil and dung.
06.

D. discoideum Raper. Rotting branches of bracken.

88. Rannoch, August 1965; Aberfeldy, October, 1966. Possibly a new British species, no published record or herbarium specimen has been seen.
55, 84.

Polysphondylium violaceum Bref. Hare dung in moist chamber.

89. Kindrogan, October, 1966. Known also from Fife.
06.

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PARASITES OF FRESHWATER FISH IN THE GLASGOW AREA. Part I.

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OBSERVATIONS ON THE OCCURRENCE OF THE PLEROCERCROID STAGE OF *LIGULA INTESTINALIS*

Ligula intestinalis is a tapeworm parasite found as an adult in the intestine of fish-eating birds. The eggs of the tapeworm pass out with the faeces of the bird and develop in water to produce small ciliated larvae. When these larvae are ingested by a copepod they penetrate into its body cavity and there form a larval stage called the proceroid. If a fish eats an infected copepod the proceroid is released. It bores through the wall of the gut and enters the body cavity of the fish where the next larval stage, the plerocercoid, develops. After developing for several months it becomes infective to the final host.

The species of fish infected with *Ligula intestinalis* were determined at two sites near Glasgow; Hogganfield Loch and Milngavie reservoir.

From Hogganfield Loch the following fish were removed and examined: 17 pike (*Esox lucius*); 52 three-spined sticklebacks (*Gasterosteus aculeatus*); 181 roach (*Rutilus rutilus*) and 16 perch (*Perca fluviatilis*). Plerocercoids of *Ligula* were found in roach only, three adults (at least four years old) being infected out of a total of 61 adult roach and 120 fry examined.

The fish removed from Milngavie reservoir were: 28 trout (*Salmo trutta*) and 177 minnows (*Phoxinus phoxinus*). *Ligula* plerocercoids occurred in the body cavity of the minnows only. Thirty fish, both fry and adult, were infected, out of a total of 177 examined.

Ligula plerocercoids can remain in the body cavity for as long as the fish lives. In Hogganfield Loch, only the older fish were infected and this indicates that the life cycle of the parasite is no longer being completed. In Milngavie reservoir, however, fry were infected, and it may be concluded that transmission to the fish is occurring.

Owen and Arme (1965) found that the plerocercoids of *Ligula intestinalis* were restricted to fish in Cyprinidae in Britain, such as the roach, rudd, dace and bream. However, Wardle (1932) found, in Canada, that members of the perch family (Percidae) and the sucker family (Catostomidae) become infected as well as the Cyprinidae. Both the minnow and the

roach are Cyprinids and therefore the records from the Glasgow area agree with those of Owen and Arme.

Other records of *Ligula intestinalis* in minnow are few. Gemmill (1909) has recorded *Ligula simplicissima*, regarded as a synonym of *L. intestinalis* (Cooper, 1918), from minnow in a small stream near Loch Thom at Greenock, and Hopkins (1966, personal communication) has used *Ligula intestinalis* from minnow caught at Loch Eck, for experimental work. Orr (1967) has shown the infection to exist in the cyprinids in the Northamptonshire district where minnows, though present, are uninfected. In this district minnows are characteristically inhabitants of fast-moving streams and are intolerant of the eutrophic conditions present in the local lakes. In the Glasgow area, however, minnows are found in lochs which by their salmonid fauna are characteristically oligotrophic (Slack, 1957). The life cycle of *Ligula* with a copepod intermediate host is favoured by still water with a high copepod density and this could explain why minnows in England do not become infected when inhabiting streams but become infected in lochs in the Glasgow area. The lack of other cyprinid host records of *Ligula* in Scotland is due to the paucity of cyprinids which are intolerant of the oligotrophic conditions present in many Scottish lochs (Slack, 1957).

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BARMUFFLOCK DAM MIRE. HISTORY AND PRESENT VEGETATION

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(Revised to 6 July, 1967)

INTRODUCTION

The mire known as Barmufflock Dam is situated $1\frac{1}{2}$ miles ($2\frac{1}{2}$ kilometres) west of Bridge of Weir in the parish of Kilbarchan, Renfrewshire, Scotland (National Grid Reference NS/368649). It was first visited by one of the authors (J.O.R.) while looking for sites containing *Carex limosa*. It is of great interest that a natural mire ecosystem of a type as yet undescribed for Scotland should still exist within the commuter belt between Glasgow and Greenock. The future of this mire is, however, threatened by urban development in its near vicinity, and it would be a great loss if such a valuable potential research and teaching site were destroyed. In order to draw attention to this problem, and as there is no existing account of this ecosystem, preliminary investigations were carried out and are presented here.

HISTORY

This mire is situated on land constituting the former farm steading of Barmufflock, since split into the farms Lochend and Donaldfield (Crawford, 1710). Present ownership is rather vague but as far as can be determined access is shared between the neighbouring farms of Lochend, Donaldfield and Barnbeth.

On consulting the county records for the area and by talking to the local tenants it was discovered that the dam had been built across the eastern end of the mire to provide water for the blanket mills established at Bridge of Weir during the Industrial Revolution. The date of construction of this dam must have been during the period 1790–1800 as the first mills were built on the banks of the River Gryfe at this time (Macartney, 1962; Metcalfe, 1905). It is almost certain that with the decline of the mills and their eventual closure towards the end of the nineteenth century the reservoir outlived its usefulness and was drained, the area reverting to mire development. In a regional geography account of the area published in 1912 (Mort, 1912) there is a map in which the reservoir appears undrained while the 25 inch to the mile Ordnance Survey map of 1913 shows the area drained and disused.

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The mire is of extreme ecological and botanical interest as the contemporary species-rich transition mire communities, (which contain a number of rare and uncommon plants), must have developed within the relatively short period of 60 years since the draining of the reservoir.

GEOLOGY

The Kilbarchan Hills belong to the lower carboniferous series (Anon., 1885) and are of igneous or volcanic origin. On these lie the lower beds of carboniferous limestone and these two in turn rest upon carboniferous sandstone, indicating long periods of volcanic activity. All over the district the beds may be observed very uniformly to slope upwards to the west terminating in bold escarpments on that side.

Many features of the Kilbarchan landscape are due to a glacier which flowed from north to south from Argyll to Renfrew across what is now the Clyde Valley. Somewhere near Duchal this glacier, or a branch of it, turned eastward so that as it passed through Kilbarchan its course was from west to east. Certain groovings or scratchings are said to have been observed on the rocks about Barmufflock, above Locher print field, near Glentyan, and at various other points. The generally smoothed and rounded form of the hill tops and exposed rocks on higher ground, the mounds and layers of till (clay containing ice-worn boulders) to be found in the upper regions are unmistakable evidence of ice rivers (Mackenzie, 1902). Such evidence is indicative that the basin in which the present mire is situated was gouged out by part of this glacier system.

THE MIRE SURFACE

The mire occupies the floor of a shallow valley and receives drainage water from a restricted catchment area; the main supply being a small stream which enters the western end of the system. The course of this water flowing through the mire is evident as a more or less open area of unstable vegetation surrounding a series of pools of varying size. This water track or soak dominated by *Menyanthes trifoliata*, *Carex limosa*, and the moss *Scorpidium scorpioides*, eventually drains into a large expanse of extremely unstable mire dominated by *Carex rostrata*, with *C. aquatilis* and *C. diandra* locally abundant. This latter community constitutes the "loch" which drains into an artificial channel leading to a sluice in the old dam wall.

Lateral to the water track are a series of more unstable communities dominated by *Sphagnum palustre*, *Betula pubescens* and *Salix* spp. The western side of the mire, most of which has been drained and planted with *Picea abies*, will not be discussed.

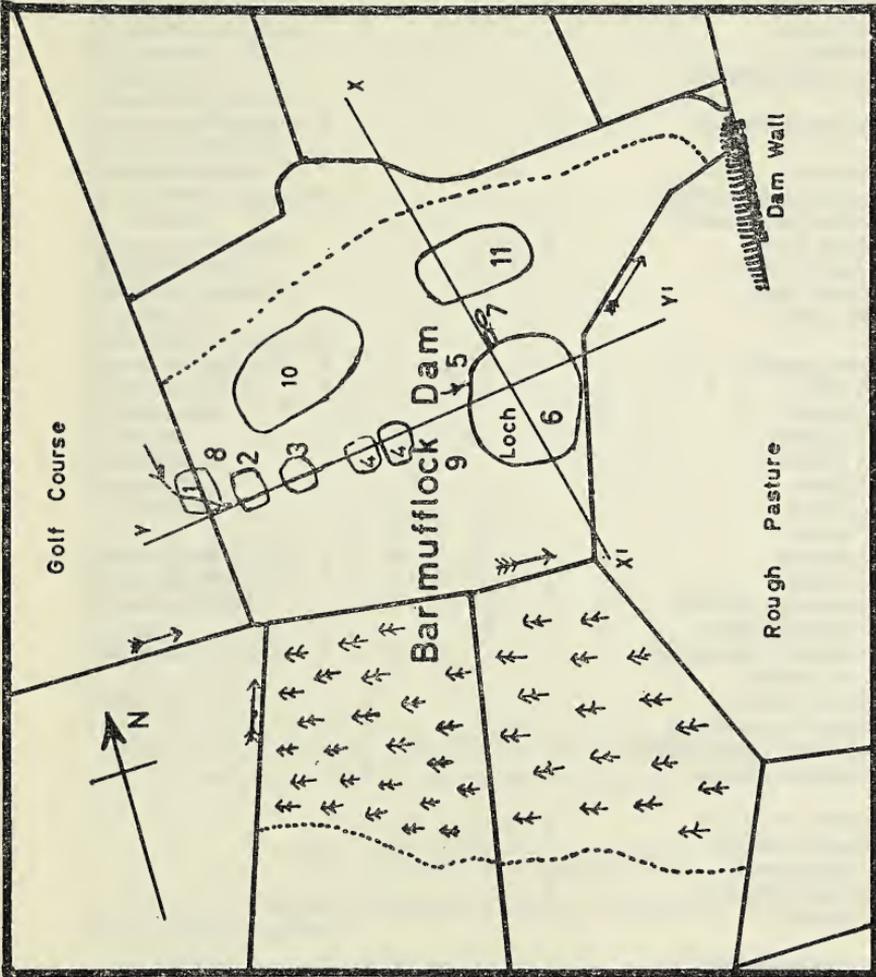


Fig. 1. Barmufflock Dam Mire showing position of the peat profile transects and the communities described in the text.

TABLE 1.

Species and cover index lists. (Cover index on Braun-Blanquet scale, species are grouped in blocks after the arrangement of McVean and Ratcliffe (1962).)

Community Nos. (see pages 509-510)													
	1a	1b	2	3	4a	4b	5	7	8a	8b	9	10	11
<i>Betula pubescens</i>	.	.	.	+	.	+	.	+	2	.	.	.	+
<i>Calluna vulgaris</i>	.	1	.	.	.	.	.	.	1	.	1	.	2
<i>Erica tetralix</i>	.	.	.	.	.	.	.	1	2	1	.	2	3
<i>Salix repens</i>	.	.	1	+	.	1	.	.	.	.	+	.	.
<i>Salix</i> sp.	.	.	.	.	.	.	.	.	2	.	.	.	.
<i>Vaccinium myrtillus</i>	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Equisetum fluviatile</i>	1	.	.	1	.	.	1	.	.	1	.	.	.
<i>Agrostis</i> sp.	.	+	.	.	.	.	.	.	.	.	+	.	.
<i>Anthoxanthum odoratum</i>	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Deschampsia flexuosa</i>	.	1	.	.	.	.	.	.	1	.	.	.	.
<i>Holcus lanatus</i>	1	+	.	.	.	.	.	.	.	.	.	.	.
<i>Molinia caerulea</i>	.	1	2	.	1	.	.	.	1	.	4	3	2
<i>Nardus stricta</i>	.	.	.	.	.	.	.	.	.	.	.	.	+
<i>Poa trivialis</i>	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carex aquatilis</i>	.	.	.	.	.	.	2	.	.	.	.	.	.
<i>C. curta</i>	.	+	.	.	.	+	+	.	.	.	.	.	.
<i>C. demissa</i>	.	.	1	1	1	+	.	1	.	.	.	.	.
<i>C. diandra</i>	1	.	+	1	.	+	.	.	.	.	.	.	.
<i>C. echinata</i>	.	.	.	.	+	+	.	.	.	1	1	1	+
<i>C. flacca</i>	.	1	.	.	.	.	.	.	.	.	.	.	.
<i>C. limosa</i>	.	.	.	.	4	3	.	.	.	.	.	.	.
<i>C. nigra</i>	.	+	+	1	+	+	.	+	.	.	.	.	.
<i>C. panicea</i>	.	.	2	2	+	+	.	+	.	1	1	.	+
<i>C. rostrata</i>	1	1	1	2	1	2	2	2	1	2	1	.	.
<i>Dactylorhiza maculata</i>	1	+	+	.	+	+	.	.	1	+	.	.	.
<i>Eleocharis palustris</i>	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>Eriophorum angustifolium</i>	.	+	.	+	+	.	1	.	.	.	1	1	1
<i>E. vaginatum</i>	.	.	.	.	.	.	.	.	.	.	.	1	.
<i>Juncus bulbosus</i>	.	.	.	.	.	.	.	+	.	.	.	.	.
<i>Narthecium ossifragum</i>	.	1	3	.	1	1	.	1	.	2	1	2	1
<i>Potamogeton polygonifolius</i>	.	.	.	.	.	.	.	1	.	.	.	.	.
<i>Triglochin palustris</i>	.	.	.	.	+	+	.	.	.	.	.	.	.
<i>Achillea ptarmica</i>	+	+	.	.	.	.	.	.	.	.	.	.	.
<i>Angelica sylvestris</i>	.	1	+	.	+	.	+	.	1	.	1	.	.
<i>Caltha palustris</i>	1	.	.	+	.	.	1	.	.	.	.	.	.
<i>Cardamine flexuosa</i>	1	.	.	.	.	.	.	.	.	.	.	.	.
<i>C. pratensis</i>	.	+	.	+	.	.	1	.	.	.	.	.	.
<i>Carum verticillatum</i>	.	.	1	+	+	+	.	.	.	.	+	.	.
<i>Cirsium palustre</i>	+	.	.	+	.	.	.	.	.	.	.	.	.
<i>Crepis paludosa</i>	1	+	.	.	.	+	.	.	.	.	1	.	.
<i>Drosera rotundifolia</i>	.	.	.	+	1	1	.	+	.	1	.	+	1
<i>Epilobium palustre</i>	+	1	.	.	.	.	+	.	.	.	.	.	.
<i>Filipendula ulmaria</i>	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>Galium palustre</i>	1	+	+	.	.	.	1	+	.	.	.	.	.
<i>Hydrocotyle vulgaris</i>	.	+	+	.	.	.	.	.	.	.	.	.	.
<i>Lychnis flos-cuculi</i>	1	.	.	.	.	.	+	.	.	.	.	.	.
<i>Mentha aquatica</i>	.	1	.	.	.	.	.	.	.	.	.	.	.
<i>Menyanthes trifoliata</i>	4	1	4	3	2	3	5	2	.	.	.	.	.

<i>Myosotis secunda</i>	+	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Pedicularis palustris</i>	+	.	.	+	.	+	2	.	.	.	.	.	.	.
<i>Potentilla erecta</i>	.	1	.	.	.	+	.	.	1	.	1	2	1	.
<i>P. palustris</i>	2	2	1	1	1	1	.	1	.	1	.	.	.	.
<i>Ranunculus flammula</i>	+	.	+	1	+	.	.	+	.	.	.	.	.	.
<i>Rumex acetosa</i>	.	2	.	.	.	.	.	.	.	.	.	.	.	.
<i>Succisa pratensis</i>	1	1	1	+	1	1	.	.	.	.	.	1	1	.
<i>Utricularia minor</i>	.	.	.	.	1	1	.	1	.	.	.	.	.	.
<i>Viola palustris</i>	+	2	+	.	.	+	.	.	+	.	1	+	.	.
<i>Acrocladium cuspidatum</i>	.	+	2	+	.	.	.	+	.	.	+	.	.	.
<i>A. giganteum</i>	1	.	.	.	.	.	1	+	.	.	.	.	.	.
<i>A. stramineum</i>	+	.	.	.	.	+	.	.	.	+	.	.	.	.
<i>Aulacomnium palustre</i>	1	.	1	1	.	1	.	1	.	1	1	+	1	.
<i>Bryum pseudotriquetrum</i>	.	.	+	.	+	.	.	.	.	.	.	.	.	.
<i>Camphylium stellatum</i>	.	.	1	.	3	.	.	.	.	.	.	.	.	.
<i>Dicranum bonjeanii</i>	.	.	+	.	.	.	.	.	1	.	.	.	.	.
<i>Drepanocladus exannulatus</i>	.	.	.	.	.	.	.	+	.	.	.	.	.	.
<i>D. revolvens</i>	.	.	.	1	1	.	.	1	.	.	.	.	.	.
<i>Hypnum cupressiforme</i>	.	.	.	.	.	.	.	.	.	.	.	.	2	.
<i>Mnium punctatum</i>	2	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Polytrichum commune</i>	.	2	.	.	.	.	.	.	.	.	.	.	.	.
<i>P. strictum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	1
<i>Rhytidiadelphus squarrosus</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Scorpidium scorpioides</i>	.	.	.	5	1	.	.	3	.	.	.	.	.	.
<i>Sphagnum palustre</i>	.	5	1	.	.	+	.	.	5	2	1	2	5	.
<i>S. plumulosum</i>	.	.	1	.	1	2	.	.	.	2	2	1	.	.
<i>S. recurvum</i>	3	1	.	.	1	2	2	2	.	1	3	.	1	.
<i>S. rubellum</i>	.	.	.	.	.	.	.	.	1	.	.	.	.	.
<i>S. squarrosus</i>	2	.	.	.	.	+	2	.	.	.	.	.	.	1
<i>S. subsecundum</i>	.	.	.	.	.	.	.	1	.	.	.	.	.	.
<i>Odontoschisma sphagni</i>	.	.	.	.	.	.	+	.	.	.	.	.	.	.
<i>Pellia epiphylla</i>	1	.	+	.	.	.	.	.	.	.	.	.	.	.
<i>Riccardia multifida</i>	.	.	+	.	+	+	.	+	.	.	.	.	.	.
<i>R. pinguis</i>	.	.	+	+	+	+	.	.	.	.	.	.	.	.
<i>Calypogeia trichomanis</i>	.	.	.	.	.	.	.	.	.	.	.	+	.	.
<i>Chara delicatula</i>	.	.	.	.	.	.	.	3	.	.	.	.	.	.
Total No. of species (84)	29	30	29	24	27	31	19	25	14	14	23	14	17	

THE PRESENT VEGETATION

Eleven floristically distinct areas are recognised within the Barmufflock system :

A. Those affected by the main water flow through the system :

- (1) Swamp carr.
- (2) *Menyanthes* pools.
- (3) *Menyanthes*/*Scorpidium* pools.
- (4) *Carex limosa* pools.
- (5) Inflow to loch.
- (6) Loch.
- (7) *Chara* pools.

- B. Those lying lateral to the main drainage axis :
- (8) Open carpet of *Sphagnum*.
 - (9) *Molinia* under *Betula*.
 - (10) Open *Molinia*.
 - (11) Wet heath.

The positions of each of these communities is shown in Figure 1, and the floristic composition of each is given in Table 1. Where large differences occurred in the vegetation within these major communities (1, 4 and 8) more than one species list is given. Species present on the mire (including the edge) but not appearing in this table are listed in Table 2. A list of diatoms recorded from several areas is given in Table 3.

TOPOGRAPHY OF THE MIRE BASIN AND PEAT DEPOSITS

Preliminary investigations were carried out using a full core peat borer to determine the topography of the mire basin. Borings were made along two transects XX' and YY' (Figs. 1 and 2), both of which passed across the loch; YY' being taken down the line of pools and XX' approximately at right angles to it. The transverse section XX' showed a fairly uniform increase in depth from one side of the mire reaching a depth of 10 metres at the edge of the loch and rising again on the opposite side. The longitudinal section YY', however, revealed two shallow depressions of depth 3.25 and 3.75 metres corresponding to the position of the pools containing *Menyanthes trifoliata* with *Scorpidium scorpioides* and *Carex limosa* respectively. This transect showed the greatest depth of peat, 12 metres, at the edge of the loch. No borings could be made across the centre of the loch because of the unstable nature of the surface.

No detailed stratigraphical analysis was carried out but analysis of the pollen from a bottom sample taken from the deepest part of the profile revealed that peat development had commenced in the basin during Zone VIIa (Godwin, 1940), some 6000 years ago.

DEVELOPMENT OF THE MIRE

The pollen dating shows that the mire was in existence long before the construction of Barmufflock Dam. Flooding of the area in the late eighteenth century must have destroyed the existing vegetation, bringing mire development in the basin to an abrupt end. The continued existence of the more aquatic members of the mire flora along the edge of the reservoir seems feasible. After disuse and drainage of the reservoir these could have formed an 'inoculum' for new development producing in only 60 years a diverse mire flora harbouring a number of rare and restricted species, including *Carex aquatilis*, *C. limosa*,

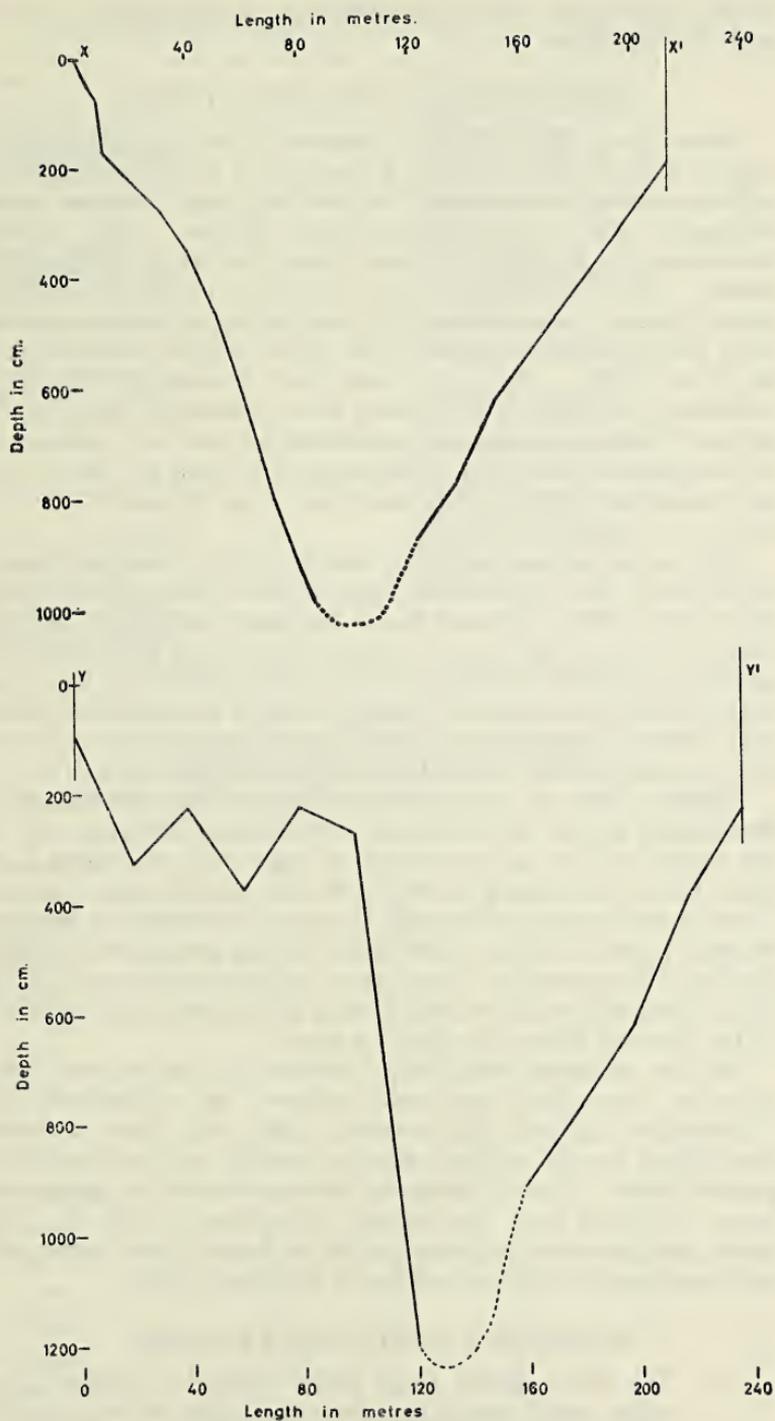


Fig. 2. Profile of mire basin
 XX'—transverse section.
 YY'—longitudinal section.

Carum verticillatum, *Scorpidium scorpioides*, *Drepanocladus revolvens* and *D. exannulatus*.

ECOLOGICAL CONSIDERATIONS

Barmufflock Dam Mire is a mixture of two classic morphological mire types: (1) Valley Bog, mires formed in shallow valleys showing a zonation of vegetation parallel to the main drainage axis. (2) Schwingmoore (Bulow, 1929), mires developing as floating mats over water in deeper steep-sided basins. The vegetation of the central track bears striking resemblances to some of the communities listed from the classic New Forest valley bogs and their East Anglian counterparts by Rose (1953). Some of these have developed over consolidated peats, others as floating mats. Similarly, some of the lateral *Sphagnum*-dominated communities are very similar to schwingmoore associations, although here they are developed on consolidated peat. This study shows the difficulty of using these two terms ecologically.

The investigation, however, indicates that the main factor influencing the vegetational types within Barmufflock Dam Mire is the effect of ground water draining through the system. From the area of the catchment and the size and position of the inflow and outflow streams it seems safe to infer that this is an intermittent phenomenon directly related to periods of rainfall. (Proof is needed for this and could be obtained by a simple but long term study of the hydrology of the system.)

Whether flow is intermittent or not, those communities developing within the influence of the main drainage axis of the system will be subject to more rapid and prolonged flow than those developing laterally to the central water track. These lateral communities will, however, be subject to influent seepage from the edge of the basin during periods of rainfall. Similarly communities developing as schwingmoore will be less influenced by any water flow in the region as it will tend to be directed below the floating mat.

On the evidence available, it seems that the eleven communities described are best referred to collectively as "Transition Mire" (Kulczynski, 1949) and form a series paralleling the decreasing effect of mobile nutrient-enriched ground water. This is borne out to some extent by analysis of water collected from the various mire areas (Table 4). All water samples were collected within an hour of each other and were analysed by the techniques in Gorham (1956).

SUMMARY AND CONCLUSIONS

- (1) The Barmufflock Dam Mire system as studied is a valley head transition mire comprising at least eleven ecologically distinct vegetational types.

TABLE 2.

Additional species recorded from the mire, including the edge.

<i>Alnus glutinosa</i>	<i>Dicranum scoparium</i>
<i>Callitriche stagnalis</i>	<i>Dicranoweisia cirrata</i>
<i>Carex pulicaris</i>	<i>Mnium hornum</i>
<i>Deschampsia cespitosa</i>	<i>M. pseudopunctatum</i>
<i>Glyceria declinata</i>	<i>Philonotis fontana</i>
<i>Juncus articulatus</i>	<i>Plagiothecium undulatum</i>
<i>J. effusus</i>	<i>Pleurozium schreberi</i>
<i>Luzula multiflora</i>	<i>Pohlia nutans</i>
<i>Myosotis scorpioides</i>	<i>Sphagnum fimbriatum</i>
<i>Polygala serpyllifolia</i>	<i>S. papillosum</i>
<i>Potamogeton natans</i>	<i>S. tenellum</i>
<i>Ranunculus hederaceus</i>	<i>Thuidium tamariscinum</i>
<i>Senecio aquaticus</i>	
<i>Sparganium erectum</i>	<i>Calyptogeia sphagnicola</i>
<i>Stellaria alsine</i>	<i>Cephalozia connivens</i>
<i>Urtica dioica</i>	<i>Chiloscyphus polyanthos</i>
	<i>Cladopodiella fluitans</i>
<i>Pinus sylvestris</i>	<i>Lepidozia reptans</i>
	<i>Lophozia ventricosa</i>
<i>Athyrium filix-femina</i>	<i>Marchantia polymorpha</i>
<i>Dryopteris dilatata</i>	<i>Mylia anomala</i>
<i>D. filix-mas</i>	<i>Pellia fabbroniana</i>
<i>Equisetum sylvaticum</i>	
<i>Lycopodium selago</i>	

TABLE 3.

Diatoms recorded from the mire surface.

Community No. (see pages 509-510)	2	3	4	9	11
<i>Achnanthes</i>	+	+	+	.	+
<i>Caloneis</i>	+	+	.	.	+
<i>Cocconeis</i>	.	+	.	.	.
<i>Cyclotella</i>	+	+	.	+	+
<i>Cymbella</i>	+	+	+	.	+
<i>Diatoma</i>	+
<i>Epithemia</i>	+	+	.	.	.
<i>Eunotia</i>	+	+	+	+	+
<i>Fragilaria</i>	.	+	+	.	.
<i>Frustulia</i>	+	.	+	.	+
<i>Gomphonema</i>	+	+	+	.	.
<i>Melosira</i>	+	+	.	.	.
<i>Navicula</i>	+	+	+	+	+
<i>Nitzschia</i>	+	+	+	.	+
<i>Pinnularia</i>	+	+	+	+	+
<i>Stauroneis</i>	+	.	.	.	+
<i>Synedra</i>	.	+	+	.	.
<i>Tabellaria</i>	+	+	+	+	.

- (2) The mire is of great interest as a reservoir of plant, and possibly of animal, communities in an area rapidly becoming built-up and close to large centres of industry and population.
- (3) It is important as an outdoor laboratory for research and for the teaching of ecology and natural history.
- (4) Conservation and management of the system to this end is important.
- (5) It is hoped that this account will stimulate the necessary measures to ensure the continued existence of the Barmufflock Mire ecosystem for future study, enjoyment and education. A short appendix on these aspects is included at the end.

ACKNOWLEDGEMENTS

Thanks are due to Mr. G. Millington for dating the peat sample, Miss M. Dalpra for identifying the diatoms and Mrs. A. Graham of Lochend Farm for useful information on the area. One of the authors (J.R.) was in possession of a N.E.R.C. research studentship during the period of this research.

BARMUFFLOCK AS A TEACHING RESERVE

The recommendation of any natural ecosystem containing rare and restricted species as an educational reserve is always a moot point. With the urban development in the region of Barmufflock Dam and the increased public usage of the area, the likelihood of the continued existence of the mire in an undamaged state, unless actively conserved, is extremely remote.

The only way to ensure its future is to make the whole system a nature reserve, and this will cost money. This expenditure can be amply justified on the purely theoretical grounds of the logic of conservation. However, if the area were created an educational reserve the benefits of this expenditure would be directly evident. Implicit in the concept of conservation is the idea of sensible utilisation—here is a case where this can be put into practice. The two uses are not incompatible, and the expenditure would not be too great. The continued existence of the mire depends on the water regime of the area and there is already a dam and a system of artificial drains by which this could be manipulated.

General teaching could be carried out from the high vantage points on the east of the mire, from which all of the most important features are easily visible, and by means of a duck-boarded nature trail. The whole concept of a rich natural ecosystem, the development of which can be related to the glacial morpho-

logy of the region and to the recent history of land use in the area is challenging and could be developed at a number of levels.

Access to the more vulnerable centre sections of the mire would have to be strictly limited as would collection of all but

TABLE 4.

pH and water analysis data for communities 1, 3, 4, 6, 7, 10 and 11 (water data in milli equiv/litre).

No.	pH	Na ⁺	K ⁺	Mg ⁺⁺	Ca ⁺⁺	HCO ₃ ⁻
1	6.2	0.33	0.01	0.07	0.30	0.62
3	6.6	0.31	0.02	0.08	0.23	0.43
4	6.2	0.28	0.01	0.03	0.16	0.22
6	5.7	0.24	0.02	0.05	0.15	0.23
7	5.9	0.35	0.02	0.03	0.18	0.18
10	5.8	0.34	0.01	0.06	0.15	0.14
11	4.4	0.23	0.05	0.01	0.08	—

the commonest species. Access to the most important sample sites for studying the water chemistry of the system could easily be arranged and a demonstration of all the important species could be provided in a small field museum nearby.

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SHORT NOTES

Compiled by R. MACKECHNIE

INVERTEBRATES

An Occurrence of the Yellow Tail Moth

Early in July 1966, while buying plants at the Cardwell Bay Nursery in Gourrock, I picked up a caterpillar new to me. It was almost fully grown, and span a cocoon a few days later. On 28 July a male of the Yellow Tail Moth (*Porthesia similis* Fuessly) emerged.

The only record I can find of this species in the Clyde Area is in the *Fauna, flora and geology of the Clyde Area*, 1901, where it is recorded as "rare, Monkton, Ayrshire (J.P.D.)". In South's *Moths of the British Isles* it is referred to as "very rarely seen in Scotland".

At Gourrock the insect may be an importation, as many of the shrubs in these nurseries are bought in, not grown locally. If it is otherwise, further specimens may be anticipated.

ALAN M. MACLAURIN

Writing on "Butterflies and Moths of the Solway Area" in *Trans. J. Proc. Dumfries. Galloway Nat. Hist. Antiq. Soc.* 25, 72, D. Cunningham refers to this insect as "a very rare moth in Scotland", and lists what he believed to be the only occurrences known at that time; these were Rockcliffe in Kirkcudbrightshire (Buchanan White, 1870), Aberdeen (Traill, 1872), South Ayrshire (Duncan, 1900), Southwick and Mainsriddle (Smith, 1946) and Isle of Whithorn (Cunningham, 1947).—*Compiler*.

Correction. The Keeper of the Royal Scottish Museum has informed me that the Fresh-water Mussel (*Anodonta cygnea*(L.)), which I recorded from Ryat Reservoir in 1960 (*Glasg. Nat.* 18, 376) has now been identified as the Swan Mussel (*Anodonta anatina*(L.))—J. D. MORTON.

MAMMALS

Roe Deer near Glasgow

A request for records of the occurrence of these animals in the vicinity of Glasgow, made some time ago to members of the Society, brought the following results:

"One seen at Waulkmill Reservoir, 12 August 1962; one at Cadder Wilderness, 23 June 1964".—*D. Norden*.

"One in field adjoining the cross-roads at Shilford on 25 March 1965."—*J. D. Morton*.

“A buck was seen in early December 1965 at a small pocket of wet moorland and plantation a mile north-west of Steps; the city boundary crosses the western part of the area. Roe Deer are regularly seen by duck shooters in sallow-birch thicket on the south side of Frankfield Loch, Steps”—*J. Mitchell.*

A small herd of these deer has its headquarters in Pollok Estate, on the south side of the city; early in 1967 the herd numbered at least seven, of which one or two were fawns born in 1966. A solitary animal, believed to be a doe, arrived in a walled field in the Newlands area late in 1966; it was reported in the press of 20 March 1967 as having been seen in the roadway on several occasions and was then still in the district. It is possible that this animal was the one killed by a car on Barrhead Road on 3 June 1967, leaving twin week-old fawns; this road lies between Newlands and the Pollok woods.

I shall welcome further records.—*Compiler.*

FLOWERLESS PLANTS

Fissidens celticus Paton in Scotland.

This moss, one of the smaller species of the genus, was first described by Mrs. J. A. Paton (*Trans. Br. bryol. Soc.* 4, 780–784, 1965) from specimens collected in Cornwall in August 1963. It has since been discovered in southern Ireland (E.R.B. Little, *Ir. Nat. J.* 15, 271, 1967), in the south and west of England and in west Wales and it was to be expected that inspection of suitable ground would lead to its discovery in Scotland.

On 18 March 1967, when examining the ravine of the Inverneil Burn, near Stronachullin, Ardrishaig, V.-c. 101, Mr. A. G. Kenneth and I found *Fissidens celticus* growing over a few square feet of vertical damp soil—a typical habitat for the species. Microscopical examination clearly showed the strong, bent nerve and the crenulate, unbordered leaves which are among the distinguishing features of this species.

In May 1967 we discovered a quantity of *F. celticus* on the bank of a small stream near Ardanstur, Loch Melfort, Argyll, V.-c. 98. The situation was again quite typical.

Fissidens celticus may prove to be frequent in the west of Scotland if looked for in suitable places.

A. McG. STIRLING

Hedwigia integrifolia P. Beauv. in Ayrshire

I found this rare moss on serpentine rock on the Byne Hill, Girvan, V.-c. 75 in August 1964. (See page 520.)

HUGH A. McALLISTER

Bryophytes of a drained reservoir

During the latter half of January 1967, at the Waulkmill Glen Reservoir, one of the Glasgow Corporation reservoirs near Balgray, Barrhead, Renfrewshire, a number of interesting bryophytes were found on the sides, on partially dried mud which had been exposed by the artificial lowering of the water level, presumably for maintenance purposes.

The most abundant species was *Pseudephemerum nitidum* (Hedw.) Reim. Also present in considerable quantity was **Physcomitrium sphaericum* (Schkuhr) Brid., a species whose only previously reported Scottish locality is in Fife, V.-c. 85. Other moss species present were **Leptobryum pyriforme* (Hedw.) Wils., *Pottia truncata* (Hedw.) Furnr., **Physcomitrella patens* (Hedw.) B., S. and G., **Ephemerum serratum* (Hedw.) Hampe var. *serratum* and **Bryum klinggraeffii* Schimp. In a small part of the area was the liverwort **Riccia crystallina* L. The only other known British localities for this species are in the Isles of Scilly, other records, so far as they have been checked, referring to an allied species, *R. cavernosa* Hoffm. Mrs. J. A. Paton has published a full account of these two species in Britain in *Trans. Br. bryol. Soc.* 5, 222-225, 1967.

Physcomitrium sphaericum, *Physcomitrella patens* and *Riccia crystallina* may be commoner than the fewness of their records suggests, for they are almost confined to this type of habitat, and it is largely a matter of chance a bryologist being there at the right time. The other species are also found in other habitats, such as arable fields, where there is damp soil and relative freedom from competition.

The species marked with an asterisk have not previously been recorded from Renfrewshire, V.-c. 76.

A. C. CRUNDWELL & A. McG. STIRLING

Bracken (*Pteridium aquilinum*) sporeling regeneration in West Sutherland

In Scotland, under our normal acid conditions, bracken sporelings are uncommon, so I wish to record that in 1963, in a recently exposed cutting on the north side (near the summit) of the road from Bettyhill to Borgie Bridge, V.-c. 108, I found three tiny colonies of bracken. I considered that there was no doubt that two of these at least had developed from sporelings and as there is basic soil in the locality, this appeared to be quite likely. I had hoped, in the intervening years, to have checked the soil acidity, but, unfortunately, I have not been in the district. Previously I had noted older colonies near Durness, which seem to have started in sink-holes in the limestone.

K. W. BRAID

Dryopteris assimilis on Beinn Narnain

In 1961 I found two fern rhizomes (subsequently identified as *Dryopteris assimilis*) lying more or less loose on a rock ledge at an altitude of about 3,000 feet, above the scree on Beinn Narnain, V.-c. 98. Although it was late May the rhizomes shewed no signs of developing fronds. They were subsequently potted up, but only one lived.

Since 1961 this plant has been growing beside a typical *D. dilatata* plant taken from a bog above Lochgoilhead. The Beinn Narnain plant has always been quite distinct, having a neat shuttlecock shape (the frond tips are erect, not drooping as in *D. dilatata*), a flatter, narrower, more membranous, paler green frond, and scales with a smaller central dark area. A further difference is that the fronds of the Beinn Narnain plant always died down completely, shortly after the first severe frosts of the winter, whereas at least some of the *D. dilatata* fronds remained green throughout the winter. It was not till 1965 that the Beinn Narnain plant was identified as *D. assimilis* by means of the spore and pinnule length characters (pale brown perispore with smaller (*c.* 1 micron), more widely spaced acute spinules—compared with *D. dilatata*, and the basal pinnule on the lower side of the lowest pinna usually at least twice as long as that on the upper side). The identification has been confirmed at the British Museum, and a specimen is in the Herbarium, Department of Botany, University of Glasgow.

Some spores were sown on sterilised (boiled) peat in a saucer in a polythene bag in November 1965, but did not germinate until May 1966. However, when spores were sown in May, germination occurred in less than four weeks—this suggests that a long day length may be required for spore germination. These sporelings, kept on a shady windowsill, have developed in seven months to fully grown prothalli bearing young fern plants.

HUGH A. McALLISTER

The fern *Dryopteris assimilis* is closely related to *D. dilatata*, the familiar woodland Buckler Fern. It has recently been recognised as a distinct species in Britain, known so far only from mountain localities in Scotland.

The 1962 edition of Clapham, Tutin and Warburg's *Flora of the British Isles*, refers to *D. assimilis* as "only certainly known from Ben Lawers, but probably occurring elsewhere". While preparing these notes I heard from Mr. E. C. Wallace that *Dryopteris* gatherings, which he and I had made on Cairn Toul, V.-c. 92, on 5 July 1934, on Meall a Chrasgaidh, Fannich Forest, V.-c. 105, on 22 July 1948, and on Bidean nam Bian, Glencoe, V.-c. 98, on 1 August 1949, had been examined by

Mr. A. C. Jermy at the British Museum, and identified as *D. assimilis*. Mr. Jermy has also put to the same species, material collected by Mr. Wallace on Beinn Mhor, Loch Eck, V.-c. 98 and on Carn Eige, Glen Cannich, V.-cs. 96 and 105, and by myself on Ben Lomond, V.-c. 86, on 20 August 1932 and on Ben Alder, V.-c. 97, on 10 July 1946. Specimens collected on 9 October 1965 by Mr. J. H. Penson on Meall nan Tarmachan, Killin, V.-c. 88, have been examined by Mr. Jermy, who listed several characters which suggest *D. assimilis*, but mature spores were lacking.—*Compiler*.

**Adder's Tongue (*Ophioglossum vulgatum*)
in Lanarkshire**

In the report of the C.S.S.F. excursion to the upper reaches of the Mouse Water, V.-c. 77, in June 1965, Mr. W. A. Scott records the discovery of a colony of this fern, a new record for the district.—*Compiler*.

FLOWERING PLANTS

***Minuartia verna* in Ayrshire**

During a visit in August 1964 to the serpentine grassland vegetation on the landward side of the Byne Hill near Girvan, V.-c. 75, I collected two flowering specimens of *Minuartia verna*. These were sent to Kew, and the identification confirmed, but unfortunately the specimens have been mislaid, and, despite subsequent visits to the site, the plant has not been refound. The dominant species in the surrounding grassland are Sheep's Fescue (*Festuca ovina*), *Koeleria cristata*, *Helictotrichon pratense*, Heather (*Calluna vulgaris*) and Thyme (*Thymus drucei*). Noteworthy species found in the grassland and not seen anywhere else in the surrounding vegetation include Cat's-foot (*Antennaria dioica*) and *Gentianella campestris*, while Parsley Fern (*Cryptogramma crispa*) and Juniper (*Juniperus communis*) were found growing on the serpentine rocks.

HUGH A. McALLISTER

**Scotch Laburnum (*Laburnum alpinum* Presl.) at
Loch Lomond**

Scotch Laburnum was so named because it was said to be grown in the more fertile parts of Scotland, and particularly to flourish there; indeed, it was at one time claimed as indigenous in this country on account of its great abundance in Fife and Angus. But these trees were derived from gardens; the species, like Common Laburnum (*L. anagyroides*) is a native of Central Europe, and *L. alpinum* is not even included in Dandy's

List of British Vascular Plants (1958). The two species hybridise to produce *L. × watereri* Dippel ("*L. Vossii*").

A tree of *L. alpinum* grows just west of the rock garden in the Royal Botanic Garden, Edinburgh, and displays the characters which distinguish the species from *L. anagyroides*. One may note its general hairlessness when mature, the darker and often relatively broader leaflets, the smaller flowers opening 2–3 weeks later, and the much thicker, stubbier ridges on its broader-looking pods. Its racemes are said to be longer, and the flowers more fragrant. There is an excellent description and drawing in Hadfield, M., 1957. *British Trees, a Guide for Everyman*, London, 353–354. (See also Bartrum, D., 1959. *Lilac and Laburnum*. London, 130–133.)

I have kept a look-out for this plant in the wild in Scotland for some years, but it is seldom seen away from gardens. Until 1965 I had encountered it only once, on a side road (which I have since failed to re-find) near Jedburgh. However, in early August 1965 Mr. Mackechnie and I saw two trees by Loch Lomond near Ross Priory, Gartocharn, V.-c. 99. Has *L. anagyroides* greatly increased and *L. alpinum* decreased in recent years? Observations would be welcome.

DAVID McCLINTOCK

Vicia orobus near Falls of Clyde

Mr. W. A. Scott records finding a single plant of this species near Falls of Clyde, V.-c. 77, on the occasion of the C.S.S.F. excursion which he led to the area in June 1965.

This is a welcome rediscovery of a species first recorded for that district over 150 years ago, but not reported from there for many years.—*Compiler*.

A Russian Lady's Mantle at Campsie

This plant I found in June 1965, during an evening visit to the Campsie district, V.-c. 86, with Mr. D. McClintock and Mr. A. McG. Stirling; it grew, in considerable quantity, on a railway embankment.

A specimen submitted to Dr. S. M. Walters was named *Alchemilla tythantha* and is now in the herbarium of Mr. J. E. Lousley.

A. tythantha is native in the Crimea; it is a robust, softly hairy lady's mantle, with small flowers. It was recorded (*Watsonia* 4, 281) by Dr. Walters and Dr. M. E. Bradshaw, as an established introduction of uncertain origin, at Bowhill, near Selkirk, V.-c. 79; it has since been reported near Duns, Berwickshire, V.-c. 81.

R. MACKECHNIE

***Sanguisorba canadensis* at Castle Semple Loch**

A small group of plants of *Sanguisorba canadensis* was found at Castle Semple Loch, V.-c. 76, during the first week of September 1965 and was visited again at the same time in the following year. The site is in a thicket on marshy ground at the edge of the Loch and is difficult of access, but may be found by passing through the wood north of Lochside station. The plants are in flower during the latter part of August and early September, and the long spikes of minute white flowers are striking. Lee's *Flora of the Clyde Area* records it (as *Poterium canadense*) as very rare, and refers to its having been found on the banks of the River Kelvin at Killermont, and also at Arrochar in 1922. Is this a new record for Renfrewshire?

J. M. LENNIE

Members who attended the excursion with the C.S.S.F. at Perth on 6 September 1964 will recollect seeing this species well established in the Tay marshes just below the city; so far as I know Mr. Lennie's is the only Renfrewshire record.—*Compiler.*

Mr. A. C. Crundwell saw plants of *Sanguisorba* sp. in what appears to be the same place as Mr. Lennie's in the early 1950s. When seen, early in the season, it was not possible to determine the species.—*Editor.*

Another New Zealand Willow Herb

In the autumn of 1965 Mr. W. A. Scott sent me dried material of an *Epilobium* which had appeared casually in his garden in Lanark, V.-c. 77. The plant had the habit of the species we now know as *E. nerterioides*, but differed, as Mr. Scott pointed out, in characters of leaf and capsule. The material was referred to Kew, where Mr. C. C. Townsend identified it as *E. inormatum* Melville.

E. inormatum differs from the now-familiar *E. nerterioides* in having smaller leaves, markedly rugose on the lower surface, and relatively short, sparingly puberulous capsules containing smooth seeds. In *E. nerterioides* the leaves are larger and not rugose beneath; the capsules are longer, glabrous and contain smooth seeds. Both species are natives of New Zealand.

It is not unlikely that *E. inormatum* occurs elsewhere in the Clyde Area, and colonies of presumed *E. nerterioides* should be checked.—*Compiler.*

***Astrantia major* in a new locality**

In May 1966 I discovered a colony of this plant, well established, on the roadside at Kennishead, V.-c. 76.

A. D. CHISHOLM

***Arctous alpinus* in Argyll**

In the British Isles *Arctous alpinus* is typically a plant of the north-west highlands of Scotland where it is a component of a plant community which includes *Salix herbacea*, Crowberry (*Empetrum hermaphroditum*), *Loiseleuria procumbens* and the moss, *Rhacomitrium lanuginosum*, usually on rather bare rocky ground at an altitude of between 1,800 and 2,000 feet.

Although occurring on the mountains of the Lochaber and Glen Spean districts *Arctous alpinus* had not been recorded from further south until found by Mr. A. G. Kenneth, Dr. P. McPherson and I on 28 August 1966 at an altitude of about 1,800 feet on Meall a'Bhuiridh, Glencoe, V.-c. 98.

This is not only the first record of this species for Argyll, but also the most southerly station of its British range so far recorded.

A. McG. STIRLING

***Veronica fruticans* in West Perth**

The discovery of this species on Beinn Dubhcaraig, West Perth, V.-c. 87, on 17 July 1966 confirms the record given by F. Buchanan White for "rocks above Loch Oss" in *Flora of Perthshire*, p. 231, and subsequently repeated by J. R. Lee in *Flora of the Clyde Area*, p. 242 (as *V. saxatilis*). This is the only known station for the species in the Clyde drainage area; the plants seen were restricted to a small exposure of 'sugar' on metamorphic limestone.

J. MITCHELL

**Star-of-Bethlehem (*Ornithogalum umbellatum*)
in Renfrewshire**

Miss A. Laird reports this species established on the north side of the old road from Bishopston to Greenock, V.-c. 76, near the Kilmacolm right-of-way.

J. D. MORTON

Noteworthy plants at Taynuilt, Argyll

In October 1965 I discovered a colony of what appeared to be *Alisma lanceolatum* growing in a shady backwater where the road from Taynuilt to Bonawe Ferry crosses the river Nant, Argyll, V.-c. 98.

In 1966, Mr. A. McG. Stirling and I revisited the locality to check the identification, and were surprised to find an unusual assemblage of uncommon plants, including *Mycelis muralis*, *Pimpinella saxifraga*, *Leontodon hispidus* and what appeared to be a hybrid Fescue grass, *Festuca arundinacea* × *F. gigantea*, all growing in the immediate vicinity.

We had no difficulty in confirming the provisional identification of *Alisma lanceolatum* which is growing in great luxuriance. The area might well repay further investigation.

A. G. KENNETH

Re-discoveries on Ben Lomond

On 20 July 1966 we went to Ben Lomond, V.-c. 86, with the object of confirming some old plant records which exist in literature and collections. One of the more basic rock faces examined proved to be the long-lost locality for *Potentilla crantzii*, *Minuartia verna* and Holly Fern, (*Polystichum lonchitis*). These plants were first recorded for the mountain in 1875, and specimens were subsequently exhibited at a meeting of the Natural History Society of Glasgow. *Salix lapponum*, which was also re-found, was collected there in 1895 by Robert Kidston; the specimen is in the herbarium of the Department of Botany, University of Glasgow.

J. MITCHELL & E. T. IDLE

Plants of Cara, Kintyre

In the course of a visit to the Isle of Cara, V.-c. 101, in June 1966, the following plants were noted:—*Spergularia rupicola*, Hemlock (*Conium maculatum*), Garden Lovage, (*Levisticum officinale*) a relic of cultivation in an old garden, *Salix repens* ssp. *argentea*, *Dactylorhiza incarnata* ssp. *coccinea*, *Carex paniculata*, and *Carex disticha*. The occurrence of Small Nettle (*Urtica urens*) as a strand plant is perhaps worthy of mention.

Botanically, the island is disappointing. I made 162 records; a true total would probably not exceed 200.

A. G. KENNETH

OBITUARY

SAMUEL PARKINSON

Samuel Parkinson, who died on 14 June 1966, was born in Bolton, Lancashire some eighty years ago where, on leaving school, he attended evening classes at Bolton Technical College. Meanwhile he served his apprenticeship as an engineer, qualifying as a fitter at the early age of 20. He eventually came to Glasgow as a time-study engineer, becoming later a production engineer. At the time of his retirement he was Works' Manager at Harland and Wolff, Finnieston.

As a young man Mr. Parkinson was keenly interested in natural history and was a member of his local society. His interests were wide; in his earlier days botany took first place, and it was only in later years that geology supplanted it as his main interest. He did not permit his mind to "rust", and year after year he was to be found attending Extra-Mural courses in a wide variety of subjects.

Mr. Parkinson joined the Society in 1941, and in 1959 he became Geological Convener, an office he retained until his death. He was a regular attendee at indoor meetings, seldom being absent, and he appeared at numerous excursions. He was also a member of the Geological Society of Glasgow, on the Council of which he served a term of office.

Sam Parkinson was a man of great personal integrity, most unassuming, and although very decided in his opinions his friendly disposition and sense of humour ensured the affection of those who knew him.

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY 1965-66

12TH JANUARY, 1965

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 60 were present.

Two new members were elected: Miss Elizabeth J. Dimelow, B.A., B.Sc., Ph.D., Department of Extra Mural-education, The University, W.2; and Miss Jennifer Young, D.A., 66 Highburgh Road, W.2.

One family member was elected: Mrs. M. M. Way, 3 Woodlands Terrace, C.3.

Dr. R. M. Dobson of the University of Glasgow gave an illustrated lecture on natural history in South Uist.

9TH FEBRUARY, 1965

The thirty-fifth Annual General Meeting was held in the Department of Botany, University of Glasgow. About 76 members were present and the President, Dr. Stephen A. Hutchinson, presided.

Reports of the activities during 1964 were read, new office-bearers were elected (See page 526) and appointments made by Council were announced. The Report of Council stated that the total membership was 255 (31 joined, 17 resigned and 9 were removed from the Roll); ten meetings were held with an average attendance of 57; thirty-three excursions took place (2 general, 13 botanical, 8 zoological, 6 ornithological, 3 geological and 1 joint botanical and geological); the council met three times and the Executive Committee eight times. Dr. Stephen A. Hutchinson presided at the Annual Dinner held on 10 December 1964, in the University of Glasgow in honour of Mr. Basil W. Ribbons, B.Sc., M.I. Biol., F.L.S., Ex-President. Professor M. G. P. Stoker delivered the Young Person's lecture on 28 May—Viruses and the Nature of Life. The President and Council gave a party for new members on 11 February, 1964. One issue of the Bulletin was sent to members during the year.

Six new members were elected: Miss Elizabeth I. Anderson, M.A., L.G.S.M., "Balgownie", 289 Merry Street, Motherwell; E. T. Idle, B.Sc., 22 Muirpark Way, Drymen; S. A. J. Oldham, N.D.H., Auldhouse Cottage, Thornliebank Road, S.3; W. D. Ian Rolfe, B.Sc., Ph.D., F.G.S., Department of Geology, The University, W.2; Findlay L. Swinton, B.Sc., Ph.D., 9 Norfolk Crescent, Bishopbriggs; and Miss Zora I. C. Third, 15 Collylin Road, Bearsden.

One junior member was elected: G. Neilsen Hunter, 21 Lindsay Drive, W.2.

The film, *Highland Heronry*, was shewn.

9TH MARCH, 1965

Dr. Stephen A. Hutchinson presided over a meeting held in the Glasgow Museum and Art Gallery, Kelvingrove. About 64 were present.

Five new members were elected: Brian R. Davies, 40 Burnside Avenue, Brookfield, nr. Johnstone; Miss Margaret MacKellar, M.A., 5 Dudley Drive, W.2; John C. Smyth, B.Sc., Ph.D., Glenpark, Johnstone; L. C. Archibald, 91 Balcarres Avenue, W.2; and John Mitchell, Craigendmuir, Steps.

One school member was elected: Gavin Steel, 30 Ripon Drive, W.2.

Dr. S. M. K. Henderson, Director of Museums and Art Galleries, Glasgow, gave a lecture illustrated with films and slides on the National Parks of Western Canada.

An exhibit was shewn by Mr. E. C. D. Todd.

13TH APRIL, 1965

Dr Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 45 were present.

Three new members were elected: Graham Hayward, c/o Coia, 26 Carnarvon Street, C.3; Mrs. Margaret Preston, Wychwood, Helensburgh; and G. Norman Stallard, 6 Lindsay Place, W.2.

One junior member was elected; Donald J. Scobie, 7 Balmuilty Road, Bishopbriggs.

Two school members were elected: David A. and Ian N. Scobie, 7 Balmuilty Road, Bishopbriggs.

Mr. R. Mackechnie, Mr. B. W. Ribbons and Mr. R. A. J. Weston lectured with coloured illustrations on the natural history of Shetland.

Exhibits were shewn by Mr. A. McG. Stirling (agates from Craig Hill, Straiton, Ayrshire), Mrs. M. Little, Mr. R. Prasher, and Mr. E. C. D. Todd.

11TH MAY, 1965

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 60 were present.

Eight new members were elected: Miss E. Alston c/o Macgregor, 21 Granville Street, C.3; Alex. M. M. Berrie, B.Sc., Ph.D., Department of Botany, The University, W.2; D. N. Butcher, B.Sc., Ph.D., Department of Botany, The University, W.2; Miss Anne K. Hetherington, B.Sc., Ed.B. (Dip.), c/o Mrs. White, 37 Kersland Street, W.2; Mrs. Doris H. Hinchcliffe, M.R.C.V.S., Mill Cottage, Drumbeg Loan, Killearn; Mrs. Helen M. L. Logan, B.Sc., 21 Ashton Road, W.2; Miss C. F. Munro, 48 Greenwood Road, Clarkston; and Roy A. J. Weston, B.Sc., 20 Hamilton Drive, W.2.

One family member was elected: D. D. Clarke, B.Sc., Ph.D., 15 Spey Road, Bearsden.

Dr. A. C. McLean of the University of Glasgow gave a lecture entitled "The Origin of the Firth of Clyde".

There was an exhibit from Mr. R. Prasher.

8TH JUNE, 1965

Dr. Stephen A. Hutchinson presided over a meeting held in the Department of Botany, University of Glasgow. About 60 were present.

One new member was elected: Sister Marie Josephine, S.N.D., Notre Dame College of Education, Dowanhill, W.2.

One junior member was elected: Alan S. Thomson, 2 Claremont Drive, Milngavie.

One family member was elected: Mrs. Isobel C. Brown, 144 Woodlands Road, C.3.

Dr. P. Spencer Davies of the University of Glasgow lectured on underwater exploration in the Maldive Islands.

14TH SEPTEMBER, 1965

Mr. A. A. P. Slack, on behalf of the President, held a Reception in the Glasgow Museum and Art Gallery, Kelvingrove. Eighty members attended and twenty members arranged exhibits.

Four new members were elected: D. R. Burkel, B.Sc., Ph.D., Museum and Art Gallery, Kelvingrove, C.3; G. B. Esslemont, C.B.E., M.A., LL.B., C.A., 285 George Street, C.1; Miss Joan E. Howie, Gweek, Dalry, Ayrshire; and Mrs. Joyce K. Whittick, 10 Westbourne Crescent, Bearsden.

12TH OCTOBER, 1965

Mr. A. A. P. Slack presided over a meeting held in the University of Strathclyde. About 63 were present.

One new member was elected: Richard Hunter, 30 Learmont Place, Milngavie.

Mr. Bruce Ing, Warden of Kindrogan Field Centre, gave an illustrated lecture entitled "A Naturalist in the Highlands".

Exhibits were shewn by Mr. A. McG. Stirling and Mr. E. C. D. Todd.

9TH NOVEMBER, 1965

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 63 were present.

One new member was elected: Andrew M. Lupton, B.Sc., 41 Magnus Crescent, S.4.

Mr. J. Grant Roger of the Nature Conservancy, Edinburgh gave an illustrated lecture on man's influence on the Scottish landscape and flora.

1ST DECEMBER, 1965

Dr. Stephen A. Hutchinson presided over a meeting held in the Department of Botany, University of Glasgow. About 50 were present.

Mr. John Calthrop, Co-ordinator for National Nature Week 1966 gave an illustrated talk on National Nature Week, 1966 and shewed the film *Wildlife in Trust*.

14TH DECEMBER, 1965

Dr. Stephen A. Hutchinson and Mr. Basil W. Ribbons presided over a joint meeting with the Botanical Society of Edinburgh in the Department of Botany, University of Glasgow. About 34 were present.

Professor J. N. Black of the University of Edinburgh gave a lecture entitled "The Dilemma of Conservation".

11TH JANUARY, 1966

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 34 were present.

Two new members were elected: The Misses D. W. and G. S. Smith, The Croft, 168 Garscadden Road, W.5.

Mrs. E. A. Crowson gave an illustrated lecture on spiders and other things.

8TH FEBRUARY, 1966

The thirty-sixth Annual General Meeting was held in the Department of Botany, University of Glasgow. About 47 members were present and the President, Dr. Stephen A. Hutchinson, presided.

Reports of the activities during 1965 were read, new office-bearers were elected (see page 527) and appointments made by Council were announced. The Report of Council stated that the total membership was 267 (40 joined, 19 resigned and 9 were removed from the Roll); eleven meetings were held with an average attendance of 60; thirty-seven excursions took place (1 general, 20 botanical, 6 zoological, 6 ornithological, 3 geological and 1 joint botanical and geological); one meeting of the educational section was held; the Council met three times and the Executive Committee six times. Dr. Stephen A. Hutchinson presided at the Annual Dinner held on 16 December 1965, in the University of Glasgow in honour of Professor P. W. Brian, F.R.S. Dr. W. W. Fletcher delivered the Schools' lecture on 3 June—Some Exciting Developments in Biology. The President and Council gave a party for new members on 9 February, 1965. One issue of the Bulletin was sent to members during the year.

Three new members were elected: David Briggs, B.Sc., M.A., Ph.D., Department of Botany, the University, W.2; John B. Gray, 68 Garriochmill Road, N.W; and Miss Phyllis D. McCloskey, M.A., 30 Athole Gardens, W.2. The film *An Expedition to North Borneo* was shewn.

8TH MARCH, 1966

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 34 were present.

Mr. S. A. Barnett of the University of Glasgow gave an illustrated lecture on social stress in wild rats.

An exhibit was shown by Mr. R. Mackechnie.

12TH APRIL, 1966

Dr. Stephen A. Hutchinson presided over a meeting held in the Department of Botany, University of Glasgow. About 24 were present.

Three new members were elected: Mrs. M. W. Drysdale, 60 Graffham Avenue, Giffnock; Mrs. Elizabeth Hughes, 12 Clouston Street, N.W.; and John McLaurin, 45 Greenwood Road, Clarkston.

One family member was elected: Mrs. Irene McLaurin, 45 Greenwood Road, Clarkston.

Two school members were elected: Jane Mary Hughes, 12 Clouston Street, N.W.; and Kenneth Taylor, 12 Burnside Avenue, Kirkintilloch.

Mr. A. A. Percy presided over a display of coloured slides from six members.

NATIONAL NATURE WEEK, 23-30 APRIL, 1966

As in the previous National Nature week, the Andersonian Naturalists of Glasgow organised a number of events in the Glasgow Area which are included in the following list: Wildlife and Natural History Art Exhibition in the Museum and Art Gallery, Kelvingrove (26,251); Discovering Nature Exhibition in the Kibble Palace, Botanic Gardens; Scottish Opening Ceremony by the Lord Provost of Glasgow (300); Lecture by Christopher Mylne on Life on Some Remoter Scottish Islands (153); Excursions to the Botanic Gardens, Linn Park Nature Trail, Cadder (15), Loch Lomond and Islands (52), and Lanark and the Falls of Clyde (36). The figures in brackets give the numbers attending.

18TH MAY, 1966

Dr. Stephen A. Hutchinson and Mr. A. A. Percy presided over a joint meeting with the Botanical Society of Edinburgh in the University of Strathclyde. About 31 were present.

Two new members were elected: John Biggar, 3 Westcliffe Street, S.1; and Miss Jean Primrose, 23 Thorncliffe Gardens, S.1.

Dr. G. Hadley of the University of Aberdeen lectured on fungi and other plants.

14TH JUNE, 1966

Dr. William W. Fletcher presided over a meeting held in the University of Strathclyde. About 30 were present.

Five new members were elected: Mrs. Barbara Fisher, 36 Westbourne Crescent, Bearsden; Miss Charlotte H. Irving, 53 Bentinck Street, C.3; Ian McKnight, 18 Campsie Road, Wishaw; Miss Marjorie Baird, 38 Park Road, C.4; and James M. Roy, Upper Clunaline, Moncrieff Avenue, Lenzie.

One junior member was elected: Graeme D. Hall, 13 Clarence Drive, W.2.

One family member was elected: Mrs. Muriel J. B. Roy, Upper Clunaline, Moncrieff Avenue, Lenzie.

Dr. David Martin of Glasgow gave a lecture on bracken.

13TH SEPTEMBER, 1966

Dr. Stephen A. Hutchinson presided over a meeting held in the Department of Botany, University of Glasgow. About 40 were present.

Two new members were elected: Andrew H. Burnside, M.A., 1919 Great Western Road, W.3; and Miss Phyllis Walker, 12A Kirklee Circus, W.2.

One family member was elected: Peter T. Fisher, B.Sc., 36 Westbourne Crescent, Bearsden.

Two school members were elected: Paul D. and Wendy B. Fisher, 36 Westbourne Crescent, Bearsden.

Dr. W. D. Ian Rolfe of the University of Glasgow lectured on the folklore of fossils.

Exhibits were shown by Mr. A. McG. Stirling and Mr. R. Prasher.

11TH OCTOBER, 1966

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 32 were present.

One new member was elected: Miss Mary Lunney, 44 Ardnahoe Avenue, S.2.

Dr. P. S. Maitland of the University of Glasgow gave a lecture entitled "Loch Lomond and its fishes".

Mr. A. A. Percy exhibited a large piece of red and yellow banded Jasper (now in the Glasgow Museum, Kelvingrove), from the Campsie Fells.

12TH NOVEMBER, 1966

A botanical exhibition, lecture and soirée were held in the University of Glasgow in conjunction with the Committee for the Study of the Scottish Flora. Mr. A. A. P. Slack and Mr. Robert Mackechnie, Chairman of the C.S.S.F., presided. Seventeen exhibits and four sets of coloured slides were displayed (see *Proc. B.S.B.I.* 7, part 1 and *Trans. Proc. bot. Soc. Edinb.* 40, part 3). Mr. S. A. J. Oldham, Director of Parks in Glasgow, gave an illustrated lecture on Landscape Conservation. About 70 were present.

13TH DECEMBER, 1966

Dr. Stephen A. Hutchinson presided over a meeting held in the University of Strathclyde. About 40 were present.

Seven new members were elected: Miss Mary Conway, 80 Chancellor Street, W.1; Miss Margaret F. Frazer, 3 Clarence Drive, W.2; James G. Gilchrist, Kerse, Lesmahagow, Lanarkshire; A. G. Kenneth, Stronachullin, Ardrishaig, Argyll; William Halcrow, 96 Carlyle Drive, East Kilbride; Ian M. Young, 69 Kingsheath Avenue, Rutherglen; and Mrs. E. T. Whitelaw, 96 Gibson Street, W.2.

Dr. J. Morton Boyd of the Nature Conservancy, Edinburgh, gave an illustrated lecture entitled, "The Changing Image of the National Park".

ACKNOWLEDGEMENT

The Andersonian Naturalists of Glasgow is indebted to the University of Glasgow for a generous financial grant which has been used towards the cost of publishing this part of *The Glasgow Naturalist*.

THE GLASGOW NATURALIST

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The Glasgow Naturalist

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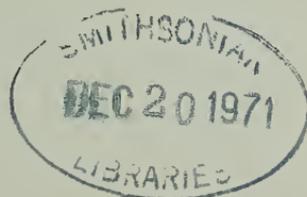
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THE ANDERSONIAN NATURALISTS OF GLASGOW

The Andersonian Naturalists of Glasgow meet at least once a month except during July and August, in the University of Strathclyde, the University of Glasgow or the Glasgow Art Gallery and Museum. The object of the Society is the encouragement of the study of natural history in all its branches, by meetings for reading and discussing papers and exhibiting specimens, and by excursions for field work.

The present rates of subscription per annum are: for Ordinary Members, one pound; for Junior Members, fifty new pence; for Family Members, twenty-five new pence; and for School Members, seventeen new pence. Further information regarding the Society's activities and nomination forms for membership are obtainable from the *General Secretary*—

Dr. J. D. SCOBIE,
7 BALMULDY ROAD,
BISHOPBRIGGS,
GLASGOW.

THE GLASGOW NATURALIST

Contributions are invited, especially when they bear on the natural history of the West of Scotland. A note of information for contributors is available from the *Editor*.

Articles and communications on editorial matters should be sent to the *Editor*—

Mr. B. W. RIBBONS,
DEPARTMENT OF BOTANY,
THE UNIVERSITY,
GLASGOW, W.2.

An invitation: members and others having interesting information such as new stations (not necessarily new county records) for a species, unusual dates of flowering—early or late, rediscoveries of old records, occurrence of a species known to be rare in an area, note of an unusual colour form of a species, an interesting locality not usually visited by naturalists, ringed birds recovered, weather notes, additions to records in the *Atlas of the British Flora*, etc., etc., are asked to send this to the *Compiler* of SHORT NOTES—

Mr. R. MACKECHNIE,
9 SKIRVING STREET,
GLASGOW, S.1.

The nomenclature of vascular plants should be as in Clapham, Tutin and Warburg, *Flora of the British Isles*, 2nd edition, 1962. Where a number of notes on the same topic are received they may be put together in a single narrative but acknowledgement will be made to each individual contributor.

A limited number of advertisements can be accepted and enquiries should be sent to the *Editor*.

Back numbers available are listed on page iii of cover.

THE GLASGOW NATURALIST

The Journal of the

ANDERSONIAN NATURALISTS OF GLASGOW

Vol. XVIII. Part 10

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THE DISTRIBUTION OF LEECHES (HIRUDINEA) IN THE RIVER CLYDE, LANARKSHIRE, WITH NOTES ON THEIR ECOLOGY

By FIONA M. MACPHEE

Department of Zoology, University of Glasgow

(Received August 1968)

The known distribution of freshwater leeches in Scotland has been described by Warwick & Mann (1960), Warwick (1961), Williams (1961) and Maitland (1966).

The present paper records the leeches found in the lower reaches of the River Clyde and includes short notes on their ecology. Special reference is made to the presence of an amphibious leech only once previously recorded for Scotland.

The leeches were collected with a 60 mesh/in. hand net from 17 sampling stations along the river. Three types of habitat—fast-flowing riffle, stones in pools and weed beds were sampled at each station, in August and December 1965 and June 1966. The sampling technique was standardised by netting for 10 mins. at each collecting point (Macan 1957).

RESULTS

Table 1 lists the number of leeches found in three sets of collections at the 17 stations.

Table 2 shows the numbers of leeches found in the different habitats sampled.

Glossiphonia complanata (L.) is of widespread occurrence in the River Clyde, and considerable colour variation can be seen among the populations. Bennike (1943) describes two easily recognisable sub-species but Mann (1953) has shown that they are linked by intermediate types. There is a marked preference for a stony substratum, this agreeing with the results of Williams (1961).

Glossiphonia heteroclita (L.) was found only at two stations. It was abundant only at station 16 where there is a high density of the freshwater snail *Limnaea pereger* (Müller). *G. heteroclita* is known to suck the body fluids of gastropods

(Mann and Watson 1954). It is more common in stagnant than in running waters (Brown, 1935). Bennike (1943) found that in running water *G. heteroclita* is almost always in the vegetation along the banks and certainly this is the case in the River Clyde.

TABLE 1.

Numbers of leeches found at the sampling stations in three sets of collections.

STATION	Species of leech						
	<i>G. comp.</i>	<i>G. het.</i>	<i>H. stag.</i>	<i>T. tess.</i>	<i>D. lin.</i>	<i>E. oct.</i>	<i>T. subv.</i>
1 Gana	0	0	0	0	0	0	0
2 Potrail	0	0	0	0	0	0	0
3 Fingland	0	0	0	0	0	0	0
4 Crookedstone	0	0	0	0	0	0	0
5 Elvanfoot	1	0	0	0	0	0	0
6 Kirkton	1	0	0	0	0	0	0
7 Burnfoot	5	0	6	0	0	0	0
8 Wolfclyde	0	0	0	0	0	0	0
9 Medwin	3	0	10	0	0	92	0
10 Hyndfordbridge	16	0	5	2	0	66	0
11 Kirkfieldbank	36	0	2	0	0	25	0
12 Rosebank	39	0	21	0	0	58	0
13 Cambusnethan	33	0	4	0	0	13	1
14 Motherwell	10	0	1	0	0	34	2
15 Blantyre	0	0	0	0	2	0	0
16 Cambuslang	6	103	1	0	0	6	0
17 Glasgow Green	0	12	0	0	0	0	0

TABLE 2.

Numbers of leeches found in the different habitats sampled.

SPECIES	RIFFLE	POOL	WEED
<i>Glossiphonia complanata</i>	24	99	27
<i>Glossiphonia heteroclita</i>	15	78	22
<i>Helobdella stagnalis</i>	10	34	6
<i>Theromyzon tessulatum</i>	0	0	2
<i>Dina lineata</i>	0	2	0
<i>Erpobdella octoculata</i>	69	167	58
<i>Trocheta subviridis</i>	3	0	0
TOTALS	121	380	115

Helobdella stagnalis (L.) was found at eight stations but was abundant only at station 12 just above which a sewage effluent is discharged. Williams (1961) found that it was abundant on stones in lochs and ponds in the Glasgow area.

Theromyzon tessulatum (Müller) is recorded by Warwick (1961) as rare in running water. This species is known to be a parasite of the nasal tract of water fowl; the area of the river where two specimens were collected from a weed bed is slow-flowing and one where there are many water birds present at certain times of the year.

Mann (1955) suggests that this species has become more abundant in recent years.

Dina lineata (Müller). Only two specimens were found, both at station 15 on stones near the bank. Pawlowski (1936) records it from temporary ponds while Bennike (1943) and Williams (1961) found it mainly in running water.

Erpobdella octoculata (L.) was the most abundant species collected. It was most common on stones in fairly fast-flowing water. Mann (1954) observes that high population densities of this species are associated with moderate organic pollution.

Trocheta subviridis (Dutrochet) is an amphibious leech locally common in parts of England (Brown, 1935) but only once previously recorded in Scotland (Warwick & Mann, 1960). This record was of a specimen found in clay soil in a garden at Ashburton Road, Glasgow in 1953.

The life history of *T. subviridis*, usually found in clay soil in gardens and in sewers (Mann and Watson, 1954) as well as in rivers, has been worked out by Hartley (1962). He found that the young leeches appear in the late summer and remain in the stream for one year as juveniles. The majority mature at the end of the second summer and many leave the stream. The immature leeches that fail to mature after one year remain as juveniles until the next summer. The adults have amphibious tendencies and as shown by Mann & Watson (1954) spend part of the year foraging in moist soil in search of earthworms. They return to the stream to breed.

The Clyde specimens were collected on 25 August 1965 from two habitats, from stones in riffle in the river near Motherwell Bridge and from stones in riffle about 6 kms. upstream from this. At both stations sewers enter the river within 50 m. of the stones on which the leeches were found. Unfortunately, the nature of the station at Motherwell Bridge has been destroyed due to the formation of an amenities lake, so that no further collecting could be done there. A search was made upstream but no further specimens of *T. subviridis* were found.

In the autumn of 1966, however, about 5 specimens of *T. subviridis* were collected by Mr. J. Gray from the River Kelvin at Maryhill, and in November 1966 eight specimens were collected by Mr. W. Burton in the River Kelvin, about 1 km. below Balmore Bridge. This river is a much polluted tributary of the River Clyde. Also, Mr. J. D. Hamilton has reported (pers. comm.) the occurrence of one specimen in the River Gryfe, another tributary of the Clyde, at Bridge of Weir, in August 1959 and three specimens there in May 1965. This suggests that *Trocheta subviridis* may be of fairly wide distribution in the lower Clyde river system and further sampling will be necessary to elucidate its distribution pattern.

ACKNOWLEDGEMENTS

I would like to thank Dr. P. S. Maitland for his help in the preparation of this account. Dr. K. H. Mann kindly verified the identification of *T. subviridis* and Mr. A. R. Waterston allowed the use of some data on leech distribution. My thanks are due also to Mr. J. D. Hamilton for the River Gryfe records and to Messrs. Gray and Burton for material provided.

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SOME ASPECTS OF THE BIOLOGY OF FERAL MINK *MUSTELA VISON* SCHREBER IN BANFFSHIRE

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(Revised to 26 October, 1968)

DISTRIBUTION

During 1963 feral mink, presumed to have escaped from fur farms, were reported along various rivers and streams in Banffshire and there is evidence that they bred on the River Deveron on the common boundary of Banffshire and Aberdeenshire near Huntly in 1962. The first reports were of mink within a few miles of fur farms; later, mink spread more widely. When mink were reported to the Department of Agriculture for Scotland they were trapped by the Pests Officer, who found that trapping over a short period eliminated them in the area concerned.

Three or four mink were also trapped by a gamekeeper at Boat o' Brig in 1964, having presumably travelled about 28 miles down the Avon and Spey from the nearest fur farm, or about 10 miles over watersheds from a fur farm near Elgin. (There are circumstantial indications of mink having travelled over watersheds to make this as likely a source (J. H. Cuthbert *in litt.*)). Other mink, not all reported to the Pests Officer, were seen in Glenrinnies and near Dufftown. Tracks of mink in snow were found by Dr. R. Richter and the author in January 1968 at various points on the River Isla about 4 miles south-west of Keith. They were of a large mink, presumably male, but no tracks were found later in the year.

The places at which mink were trapped or seen in Banffshire between December 1963 and January 1968 are shown in Fig. 1. Despite their large size and apparent boldness mink may be elusive and their tracks and droppings difficult to find, so that the present distribution cannot be accurately assessed.

Mink were removed from the fur farm at Blairfindy about May 1965, and other mink farms were discontinued before this date.

Mink trapped after May 1965 in the Glenlivet region and along the River Fiddich and its tributary streams could be assumed to be truly feral and not recent escapes. A juvenile mink, probably bred in the wild, was trapped in July 1965 on the River Deveron near Banff and in August 2 more were trapped on the Rivers Fiddich and Dullan, with a recently lactating female in the same area in early September, so that there is strong evidence of feral mink breeding successfully in 1965.

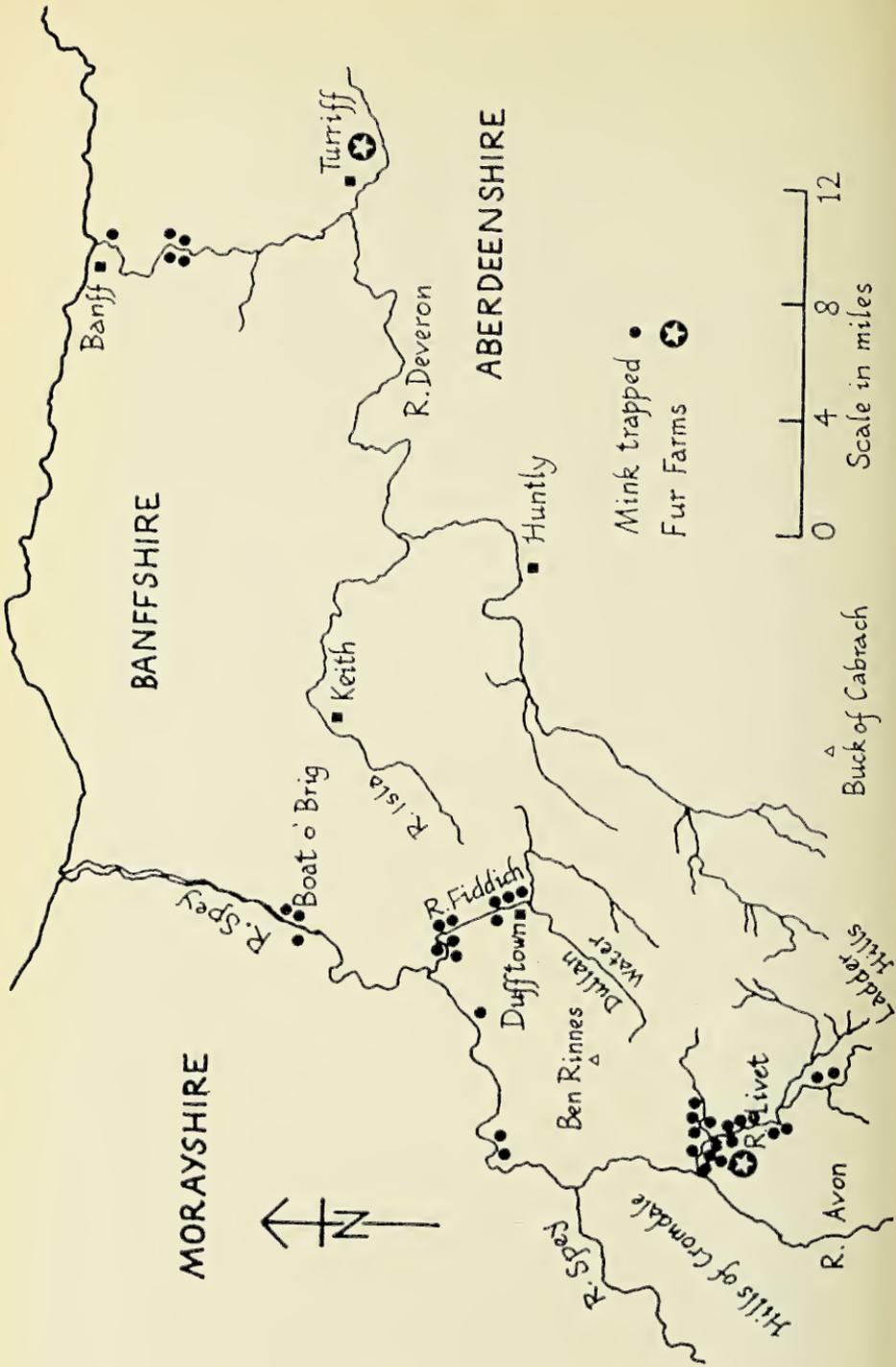


Fig. 1. Mink trapped in Banffshire, December 1963—January 1968

HABITAT

The habitat of European mink *Mustela lutreola* (L.) has been described as "small, hidden, heavily littered forest lowlands where streams abound. It is rarely encountered along large taiga rivers, but in southern parts of range it prefers large ponds with vegetation along shores. In the Caucasus mountains it lives on rivers and lakes in forests". (Novikov, 1956). *M. vison* is a native of Canada, except the north-central area, and most of the United States, except parts of the south-west. It has been introduced into Iceland, Norway, Sweden, Finland, Denmark, and Britain as a domestic fur bearing animal confined to ranches or farms, but has escaped in all these countries and established itself in the wild. In Iceland it is now common over much of the country especially in certain coastal areas and along rivers and lakesides (Thompson, 1964).

Replies to a questionnaire circulated to its observers by the State Game Research Institute in Finland showed a preference for rivers, brooks and lakes by *M. vison*, with native (but declining) *M. lutreola* thriving especially near brooks, rivers, ditches and ponds, larger watercourses being less important. *M. vison* lived oftener near settled areas, and newly escaped mink at first kept close to fur farms and were therefore more easily observed (Westman, 1968). This was also the pattern in Banffshire.

Mink first bred in Britain on the River Teign in Devon in 1957, and subsequently appeared in Hampshire, Dorset and in Wales. More recently Thompson (1967) reported that mink had been caught in 26 English and 4 Welsh counties, extending as far northwards as Northumberland and Cumberland.

In Upper Banffshire mink were found along upland rivers, wide, relatively shallow and fast flowing, or large burns, usually with birch and alder along their banks and with grassland beyond. Cover was usually meagre, with the banks accessible to cattle and sheep, in contrast to the habitat of European mink described above. Mink were not found along the smaller watercourses with treeless banks or on streams and rivers flowing through heather moorland. Females were trapped at greater altitudes than males but the sample is too small for this to be significant (Table 1).

TABLE 1.

Numbers of mink trapped at various altitudes (feet above sea level) in Upper Banffshire.

Altitude	400- 499	500- 599	600- 699	700- 799	800- 899	900- 999	1000- 1099	1100
males	4	1	2	6	0	0	0	0
females	6	0	1	4	2	0	1	1

In Lower Banffshire four mink were trapped on the River Deveron at altitudes below 100 ft. This is a larger river, flowing through arable land with beech and other trees, and is tidal to a point above where the mink were trapped.

Mink trails in snow showed that the animals kept close to the water's edge, although there were reports of raids on poultry at farms at a distance from the water. Among likely prey animals, water voles *Arvicola amphibius* (L.), field voles *Microtus agrestis* (L.), bank voles *Clethrionomys glareolus* Schr. and rabbits *Oryctolagus cuniculus* (L.) occur along the upland streams and rivers, extending (except possibly for bank voles) to smaller and higher streams where mink have not yet been found. In Finland the prey of *M. vison* included waterfowl, wildfowl, hares and muskrats (Westman, 1968) and the first three of these would also be available to mink in Banffshire.

In December 1963 Mr. G. Livingstone and the author examined about ten salmon which had died after spawning along a stretch of the River Livet and the Tervie Burn where mink were known to be present. None of the salmon showed signs of predation by mink, although the fish if healthy were probably too large for successful attack by mink.

Preliminary reports of mink prey suggest that it may not compete directly with the otter *Lutra lutra* (L.) which takes more fish (Stephens, 1957); but it may take prey (e.g. field voles and rabbits) favoured by the stoat *Mustela erminea* (L.). Stoats were often seen along the River Isla and several were caught in traps set for mink.

WEIGHTS AND MEASUREMENTS

Mink trapped during control operations were weighed and measured, the measurements being taken by the method described by Dr. G. B. Corbet in *The Handbook of British Mammals* (1964) (Tables 2 and 3). After skinning, the gut was removed for examination and a brief examination made of testes and uterus, and of both sides of the skin for evidence of moulting. The epiphyses were examined for ossification. While the amount of fat was not measured, it was noticed that some of the animals, probably most, were in very good condition with much fat around the kidneys, the intestines and subcutaneously around the hind belly.

The stomachs were usually empty, or nearly so. There was no overlap in the weights of adult males and females.

COLOUR AND MARKINGS

It is likely that the offspring of escaped mink, possibly of very different colours, would eventually revert to a fairly uniform pattern in any one locality, once the pressure of carefully selective breeding was removed. The most general

TABLE 2.

Measurements (mm) and weights (gm) of male mink trapped in Banffshire.

Date	Head and body	Tail	Hind Foot	Ear	Weight	Observations
Jan. 1964	380	203	54	24	1080	Fecund
Mar. 1964	369	185	62	23	990	Testes fully developed
Mar. 1964	355	187	61	22	905	Testes fully developed
Nov. 1964	379	163	63	22	920	Testes small, firm
Nov. 1964	397	194	65	24	1051	Testes scrotal
Nov. 1964	391	200	70	22	1278	Testes scrotal
Feb. 1965	388	210	62	22	1392	
Aug. 1965	405	204	65	24	937	Testes regressed
Sep. 1965	391	182	55	23	840	Juvenile
Oct. 1965	384	190	58	25	1022	Testes regressed
Dec. 1965	343	137	57	21	—	
Mar. 1966	408	180	67	22	1335	
means (juvenile excluded)	381.7	183.9	62.2	22.8	1091.0	
Range	343-408	163-210	54-70	21-25	905-1392	

TABLE 3.

Measurements (mm) and weights (gm) of female mink trapped in Banffshire.

Date	Head and body	Tail	Hind Foot	Ear	Weight	Observations
Jan. 1964	353	181	55	24	685	
Jan. 1964	324	171	53	24	690	
Mar. 1964	318	172	52	21	455	
Mar. 1964	329	169	53	21	520	
Mar. 1964	334	166	55	—	620	in oestrus
Apl. 1964	345	162	55	—	610	7 embryos
Nov. 1964	350	161	55	20	750	
May 1965	331	178	51	25	840	lactating
July 1965	305	129	57	19	390	juvenile
Aug. 1965	333	154	54	20	500	juvenile
Sep. 1965	364	188	53	25	700	recently or still lactating
Oct. 1965	344	183	54	21	680	
Jan. 1966	342	166	59	22	800	
Mar. 1966	328	154	56	22	650	
means (juveniles excluded)	338.5	171.3	54.3	22.5	671.8	
Range	318-364	154-188	51-59	20-25	455-840	

colouring of mink trapped in Banffshire was a dark chocolate brown, with darker guard hairs protruding through the pelage and grey or grey brown underfur. White spots and patches, often irregular in shape and sometimes reduced to a few white hairs, occurred at chin, throat, and on the ventral surface between front and hind legs. The frequency with which these markings were found (Table 4) shows no marked difference between males and females except for the more frequent presence of white between the hind legs of males.

TABLE 4.
Numbers of feral mink showing white markings in pelage.

	Chin	Throat	Between front legs	Between hind legs
males	11	8	7	5
females	14	9	8	11
both sexes	25	17	15	16

All the males examined were dark brown, with some variation in the underfur colour. Four out of 7 females examined in 1963 and 1964 were pale or mid-brown with pale grey fur. Seven females examined in 1965 and early 1966 were all dark brown, but the evidence is barely sufficient to show that a uniform type of pelage appeared in a feral population from 1965 onwards.

MOULTS

The sample of mink examined was small and was collected at irregular intervals, so that the progress of the moult could not be closely followed. All skins, male or female, were prime until the end of March, but a male trapped on 13 April showed early signs of a spring moult. The dorsal fur was kinked or slightly curled, a condition associated with imminent moulting (Hewson, 1963), but there was no pigmentation showing on the flesh side of the skin. Pigment is deposited at the hair roots before new growth begins and is a useful indicator of areas affected by moulting, before the new hair is visible among the pelage. In this case there was a fairly dense pigmentation at the ventral surface between the hind legs, continuing more thinly along the mid-line of the belly and heavier again between the forelegs. A female trapped four days later had heavy and continuous moult marks from the head to behind the shoulders, both dorsal and ventral, and also along the ventral mid-line and irregularly over back and flanks, heavier again at rump and hind legs. These two examples suggest a moult beginning in early April.

Adult mink were not available in summer. Two juveniles trapped in July and August 1965 were moulting, presumably to a winter coat.

There were too few specimens to provide adequate evidence of an autumn moult but the lactating female trapped in September was moulting, with new hair about 1 mm long growing in thickly along the back. Later skins appeared to be prime.

BREEDING

There appears to be no published account of the breeding season of feral mink in Britain. In captivity males become sexually active in February, and females have four oestrous cycles between late February and early April. Delayed implantation occurs with a "gestation" period between 39 and 76 days. The normal litter is 5-6 but up to 17 have been recorded (Southern, 1964).

In Banffshire four female mink examined between early January and mid-March were neither in oestrus nor obviously pregnant on gross examination. A female was in oestrus on 23 March and another contained 7 embryos, at a fairly early stage of development, on 17 April. On 12 May a lactating female was trapped, presumably having given birth to a litter before that date.

Three well-grown young, one in the adult weight range, were trapped in July and August, again indicating an early start to breeding. A female trapped at the beginning of September had been lactating shortly before.

Sperms were found in a testis smear from a male on 29 January and two other males had full sized testes in March. At the apparent end of the breeding season a male had testes which appeared regressed in August.

It is therefore possible that males were in breeding condition from January onwards (full testes size often coincides with fecundity in other mammals), and the first litters might be born about April or May.

Males with small firm testes in November might have been first winter animals; a male with regressed testes in October must have been in breeding condition earlier.

ACKNOWLEDGEMENTS

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**SOME RECORDS OF COLEOPTERA, OTHER
INSECTA AND ARACHNIDA FROM
ARDMORE POINT, DUNBARTONSHIRE**

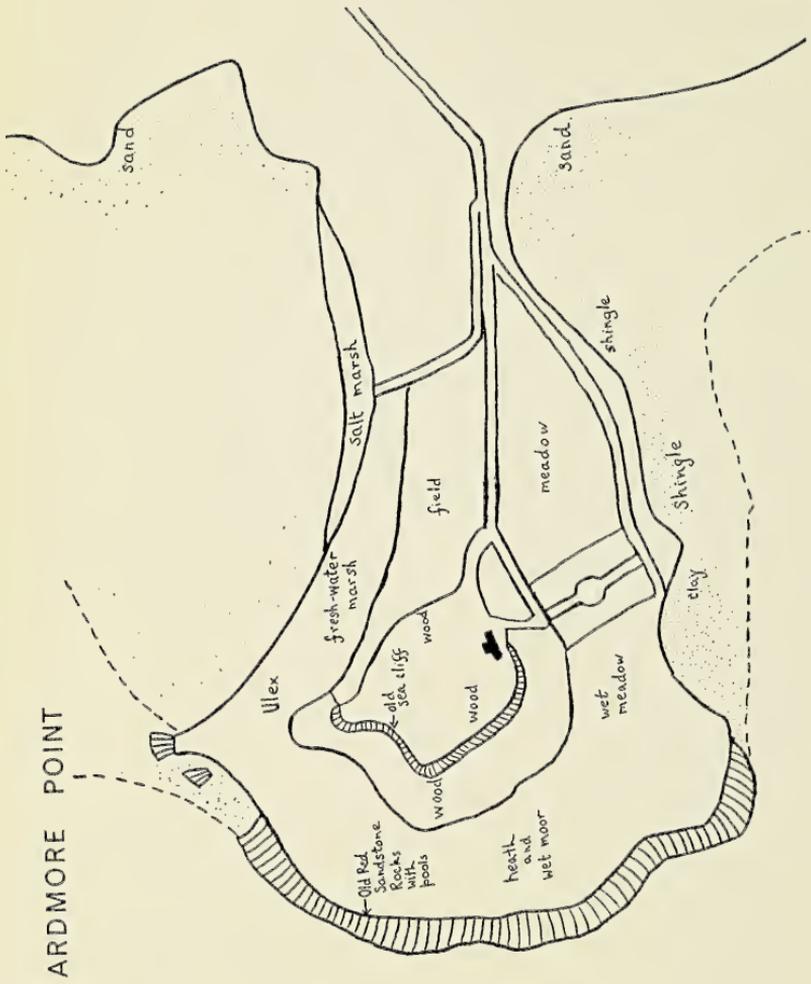
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(Revised to December, 1968)

The Ardmore Peninsula, projecting into the Clyde estuary from its north shore, between Cardross and Helensburgh, has been dedicated as a Nature Reserve by agreement between the owners and the Scottish Wildlife Trust. The locality has points of particular interest for geographers, geologists, botanists, marine zoologists, ornithologists and entomologists. At the time of the "Post-glacial climatic optimum" some 6,000 or more years ago, Ardmore was undoubtedly a rocky island, represented today by its raised central portion (see map), still partly surrounded by cliffs of Old Red Sandstone. In the dry recesses under these cliffs, there are accumulations of organic matter, and these have produced a number of interesting species of insects. The lower parts of the present peninsula, including the narrow isthmus linking it to the mainland, are composed of sand and gravel terraces; the better drained parts of these have been converted into pastures for cattle, but in the rather wet climate prevailing at Ardmore (average annual rainfall probably nearly 60 inches) much of it bears marshy moorland with accumulations of peat, with a flora including *Molinia caerulea*, *Eriophorum vaginatum*, *Narthecium ossifragum*, *Myrica gale*, *Drosera rotundifolia*, *Calluna vulgaris*, *Erica tetralix*, *Pinguicula vulgaris*, *Pedicularis sylvatica*. On the northern side is an area of less acid marsh, with a flora of *Phragmites communis*, *Iris pseudacorus*, *Juncus sp.*, *Mentha aquatica*, *Potentilla palustris* etc., and there are one or two small fresh water streams with much *Rorippa nasturtium-aquaticum* and *Myosotis sp.* The shore habitats include sandstone rocks with rock-pools, shingle beaches, sand, and salt marsh. Most of the raised central part is covered with planted mixed woodland, but its flanks have semi-natural scrub of oak, birch, alder, willow etc. The overall flora is remarkably rich in species for such a small area, providing samples of a number of plant communities. Our evidence suggests that Ardmore is relatively rich also in herbivorous insects.

Temperatures and humidity have been recorded on the peninsula since January 1968, with the assistance of Mr. C. Halstead of the Department of Geography, University of Glasgow. A preliminary analysis of the records for the first



half of 1968 has been carried out by Mr. R. McInnes of that Department, who came to the conclusion that "there can be no question that Ardmore Point is characterised by warmer nights, and to a lesser extent by warmer days in comparison with inland sites of the lower Clyde basin". This climatic singularity is indicated also by some of the plants grown in the gardens of Ardmore House; species like *Tricuspidaria lanceolata* being grown successfully out of doors, which is hardly practicable elsewhere in this district. Undoubtedly, some of the interesting insect records from Ardmore are related to this climatic peculiarity.

INTERESTING SPECIES RECORDED FROM ARDMORE

Coleoptera

1. *Amara curta* Dej. (CARABIDAE). Two specimens found in sandy turf, 10 October 1967, by Miss H. Stallard, were rather doubtfully attributed to this species; a clearly conspecific individual was collected by R. A. Crowson at Southernness, Kirkcudbrightshire. The species is not recorded from Scotland by Moore (1957).

2. *Acritus nigricornis* (Hoffm.) (HISTERIDAE). A specimen extracted from mixed leaf litter on 12 October 1967, by Miss H. Stallard. Joy (1932) did not record the species from Scotland, though there was a very old record from Dumfriesshire by Rev. W. Little (Murray, 1853). R. A. Crowson collected two specimens from Clyde flood drift at Garrion Bridge in Lanarkshire on 30 October 1954, and recently obtained another from the decayed interior of a hollow tree at Ballagan Glen, Strathblane, Stirlingshire.

3. *Colan brunneum* Latr. (ANISOTOMIDAE). Specimens of this were caught in a suction trap, the first on the week 24–31 July 1967, the second 5–12 August 1968. Fowler (1889) quoted a number of Scottish records of this species, but we know of no recent ones; the only one from the Clyde valley seems to have been by Morris Young, from near Paisley a century or more ago (Murray, 1853).

4. *Leptinus testaceus* Mull. (LEPTINIDAE). Adults in a leaf-litter sample, 4 November 1967. A parasite of small mammals, widespread in Scotland but rather local in this area.

5. *Neuraphes sparshalli* (Denny) (SCYDMAENIDAE). One specimen in grassy drift, 15 May 1965. Probably the first record of this local species from Dunbartonshire.

6. *Micropeplus tesseraula* Curt. (MICROPEPLIDAE). One specimen in oak litter, 4 March 1968. Widespread but generally uncommon in southern Scotland.

7. *Stenus ater* Mannerh. (STAPHYLINIDAE). A male and a female by sweeping, 23 July 1968. Not previously recorded from Dunbartonshire, but we have specimens from Inverkip, Renfrewshire.

8. *Philonthus nigriventris* Thoms. (STAPHYLINIDAE). Two specimens from compost heap, 11 March 1968. Apparently not previously recorded from the Clyde area.

9. *Callicerus obscurus* Grav. (STAPHYLINIDAE). One specimen in suction trap, 9–16 April 1968. Previously recorded from Bothwell Castle, Lanarkshire (Crowson, 1961) but apparently not otherwise from the Clyde area.

10. *Falagria obscura* Grav. (STAPHYLINIDAE). One in grassy shore herbage, 15 May 1965. There are old records of this species from Paisley and Cambuslang (Murray, 1853), but our only recent Scottish records are from the Solway and Ayrshire coasts.

11. *Aphodius obliteratedus* Panz. (SCARABAEIDAE). A specimen in the suction trap, 23–30 September 1968. A local and mainly woodland species here, recorded also from Lanarkshire and Ayrshire.

12. *Calyptomerus dubius* (Marsh.) (CLAMBIDAE). In relatively dry organic debris under cliff, 4 November 1968. Apparently not previously recorded out-of-doors in Dunbartonshire.

13. *Tipnus unicolor* (Pill. & Mitt.) (PTINIDAE). Found in dry organic debris under the cliffs on several occasions. We have found the species in similar habitats at Cadzow Castle, Hamilton, Lanarkshire, and in a hollow tree at Bemersyde, Melrose, Roxburghshire.

14. *Cateretes rufilabris* Latr. (NITIDULIDAE). Several specimens by sweeping in marsh, 10 June 1968. Believed to breed in flowers of *Juncus* sp. Local in this area, apparently not previously recorded for Dunbartonshire.

15. *Monotoma longicollis* Gyll. (RHIZOPHAGIDAE). Specimens from a thick mat of dead grass, 9 April 1968. In this area, the usual breeding habitats of this seem to be artificial ones, e.g. compost heaps and hay stacks. It occurs in a compost heap at Ardmore.

16. *Monotoma picipes* Herbst (RHIZOPHAGIDAE). One specimen in the suction trap, 22–29 August 1967. Very local in this area, habits more or less as in preceding species.

17. *Henoticus serratus* (Gyll.) (CRYPTOPHAGIDAE). One specimen in the suction trap, 1–8 July 1968. Fergusson (1912) records this rare species also from Arrochar (Dunbartonshire) and Shewalton (Ayrshire). The remaining Scottish records are mainly from the eastern Highlands.

18. *Cryptophagus bicolor* Sturm (CRYPTOPHAGIDAE). Two specimens in dry organic debris under overhanging cliffs, 4 November 1967. Fergusson (1912) recorded the species from a stable at Lanark, but we have seen no outdoor records of it from the Clyde area.

19. *Antherophagus nigricornis* (F.) (CRYPTOPHAGIDAE). One specimen swept from marsh herbage, 23 July 1968. Widespread but local in southern Scotland; develops in nests of *Bombus* bees.
20. *Orthoperus mundus* Matth. (CORYLOPHIDAE). Two specimens from dry organic debris under cliffs, 4 November 1967. Probably the first record of the species from Dunbartonshire. We have found it in similar habitats in Ayrshire and Lanarkshire.
21. *Subcoccinella 24-punctata* (L.) (COCCINELLIDAE). Adults and larvae found on *Silene maritima* on many occasions. Apparently the northernmost British locality for this species, the next being at Ailsa Craig; the species is apparently absent on the Ayrshire mainland, but occurs commonly along the Solway coast.
22. *Anthicus scoticus* Rye (ANTHICIDAE). Found on many occasions at roots of herbage on a shingle bank. The species, known mainly from NW England and SW Scotland, occurs also on the Ayrshire coast and on sandy shores of Loch Lomond.
23. *Tetratoma fungorum* F. (TETRATOMIDAE). This well-known species, rather local in the Clyde valley, occurs at Ardmore in its usual habitat, the bracket fungus *Polyporus betulinus*.
24. *Lochmaea capreae* (L.) (CHRYSOMELIDAE). Beaten from willows, 2 September 1967. A local species in the Clyde area.
25. *Chalcoides fulvicornis* (F.) (CHRYSOMELIDAE). Beaten from willows, 15 May 1965. Very local in the Clyde basin.
26. *Chaetocnema hortensis* (Geoffr. in Fourcr.) (CHRYSOMELIDAE). Adult from sandy turf, 4 November 1967. Other Clyde area records of this species are from the Ayrshire and Arran coasts.
27. *Apteropeda orbiculata* (Marsh.) (CHRYSOMELIDAE). One specimen from woodland litter, 27 January 1968. Food-plant locally is probably a labiate. Local in the Clyde area.
28. *Longitarsus jacobaeae* (Waterh.) (CHRYSOMELIDAE). In turf near shore line, 12 October 1967. The normal food-plant of this species is ragwort, *Senecio jacobaea*; our other western Scottish records of it are from the coasts of Ayrshire, Arran and Argyll.
29. *Apion miniatum* Germ. (APIONIDAE). Adults on *Rumex* sp., 10 June 1968; larvae and pupae in *Rumex* stems, also adults, 15 July 1968. We have found this species on more than one occasion on the Solway coast, but it seems not to have been recorded elsewhere in western Scotland.
30. *Apion ononis* Kirby (APIONIDAE). This species occurs fairly commonly on *Ononis repens* on the Ayrshire and Solway coasts, but seems not to have been recorded previously from Renfrewshire or Dunbartonshire. It was found on 15 September 1968. *Ononis repens* occurs in small quantity at Ardmore.
31. *Poophagus sisymbrii* (F.) (CURCULIONIDAE). Adults found on *Rorippa nasturtium-aquaticum* on 23 July 1968; pupae, young larvae and teneral adults in stems of the same species on 22 August 1968, by Professor M. de Viedma of Madrid.

There are few previous Scottish records, and none from the Clyde area (cf. Fowler, 1891; Fowler & Donisthorpe, 1913; Joy, 1932).

32. *Ceuthorhynchus rugulosus* (Herbst) (CURCULIONIDAE). Swept from shore herbage, 2 September 1967. Food plant *Matricaria maritima*; a local species in this area.

33. *Mesites tardii* (Curtis) (CURCULIONIDAE). Abundant in dead wood of almost any species at Ardmore. The adults have wings but appear rarely if ever to fly; none have been caught in a suction trap operating in the vicinity through the summer of 1967, and most of 1968. The species occurs also at a few points along the coasts of Ayrshire and Argyll, and at one point on the shore of Loch Lomond near Inversnaid, where the loch is deep and never freezes. The species is an "Atlantic" one whose distribution seems to be limited by winter temperatures.

Hymenoptera

1. *Abia candens* Konow (CIMBICIDAE). Beaten from birch on 23 July 1967, by J. Brock. We have seen no other records of the species from the Clyde area.

2. *Gastracanthus pulcherrimus* Westw. (PTEROMALIDAE). This large chalcid wasp seems to be fairly common at Ardmore, and has been found more than once in the burrows of *Mesites*, on which it may be parasitic. We have seen no other records of it from the Clyde area.

Lepidoptera

1. *Callophrys rubi* (L.) (LYCAENIDAE). The Green Hairstreak butterfly is rather local in the Clyde area, but occurs at Ardmore.

Neuroptera

1. *Micromus variegatus* (F.) (HEMEROBIIDAE). Adults and larvae in shore herbage, 23 July 1968. Very local in Scotland and confined to the south.

Psocoptera

1. *Ectopsocus briggsi* McLach. (PERIPSOCIDAE). In dry organic matter under cliffs on many occasions. Adults caught in suction trap in summer on many occasions. First record from the Clyde area.

2. *Mesopsocus immunis* (Steph.) (MESOPSOCIDAE). Caught in suction trap, 17-24 June 1968. Apparently a new record for the Clyde area.

3. *Holoneura laticeps* (Kolbe) (MESOPSOCIDAE). Caught in suction trap, 26 August-2 September 1968. Apparently a new record for the Clyde area.

4. *Elipsocus abietis* Kolbe (MESOPSOCIDAE). From suction trap, 20–27 May 1968. A previous record of the species, from Carluke (Lanarkshire) by King (1910).

Chilopoda

1. *Lithobius lapidicola* Meinert. (LITHOBIIDAE). One specimen in decayed log, 9 April 1968. Apparently uncommon in the Clyde area, but recorded from Dunbartonshire by Eason (1964).

Arachnida (ARANEAE)

1. *Araeoncus crassiceps* (Westring) (LINYPHIIDAE). A male and female were taken in drift at high water mark on 15 May 1965. This species has few Scottish records and is rare. It is typical of wet swampy areas and has been recorded from Brodick and the Western Isles (Bristowe, 1939; Evans, 1901). This is the first record from the Clyde area since 1895.

2. *Erigone arctica* (White) (LINYPHIIDAE). This species has been taken several times in the high water mark drift at Ardmore which is the farthest upstream locality from which it has been recorded. The British form of this species is var. *maritima* and it occurs on the Ayrshire coast usually in drifted seaweed. There are no published records for the Clyde area.

3. *Erigone longipalpis* (Sundevall) (LINYPHIIDAE). Males and females of this uncommon species were taken on the salt marsh at Ardmore on 15 September 1968. It has been recorded from Renfrewshire, Bute and Arran in the Clyde estuary (Bristowe, 1939; Evans, 1901). Specimens have been taken by us also at Portencross in Ayrshire on 11 August 1954, and on the salt marsh at Erskine, Renfrewshire on 18 February 1962.

4. *Halarotes reprobus* (O. P.-Cambridge) (LINYPHIIDAE). This rare species was taken in high water mark drift on 12 October 1967. There are several published records of this species in Scotland (Bristowe, 1939) but the only one for the west coast is for Argyll (Evans 1901). It is considered a salt marsh species but at Ardmore and several localities on the Kirkcudbrightshire coast it seems to be associated with seaweed drift on shingle shores.

5. *Mengea scopigera* (Grube) (LINYPHIIDAE). A male of this species was taken on the salt marsh on 15 September 1968. The only published record for the Clyde area is from a fresh-water marsh at Elvanfoot in Lanarkshire (Evans, 1901). It has also been found by us on the river-bank at Dalsarf, Lanarkshire, in October 1958, and on the salt marsh at Erskine, Renfrewshire on 18 August 1962.

6. *Silometopus curtus* (Simon) (LINYPHIIDAE). This species has been found several times in drift at high water mark at Ardmore. It is typical of such habitats but has few Scottish records, the only published record from the Clyde estuary being from Arran (Bristowe, 1939). It has been taken by us at

Inverkip in Renfrewshire on 20 October 1961, and at Monkton in Ayrshire where it was taken in company with the rarer species *S. incurvatus* (O.P.-Cambridge) on 16 October 1960.

7. *Gnathonarium dentatum* (Wider) (Linyphiidae). This species was taken from the freshwater marsh at Ardmore on 10 June 1968 and from shore herbage on 15 September 1968. It is typical of marshy habitats but there are only two published records for the Clyde area (Evans, 1901), one from Arran and one from Cleghorn Glen in Lanarkshire. It has been taken by us in the marsh at Lochwinnoch in Renfrewshire on 1 November 1958 and 2 October 1961, and from flood-drift from the River Endrick in January 1960.

8. *Hypomma bituberculatum* (Wider) (Linyphiidae). This species has several Scottish records but seems to be less common here than in England. Published records for the Clyde area (Evans, 1901) are from Cleghorn in Lanarkshire, Paisley in Renfrewshire, and Bowling in Dunbartonshire. It was taken by us at Ardmore in marsh herbage on 10 June 1968.

9. *Lophomma punctatum* (Blackwall) (Linyphiidae). There is only one published record of this species from the Clyde area from "near Paisley" where it was taken by Morris Young (Evans, 1901). It has also been found by us at Rossthdu in Dunbartonshire in May 1960, and at Cambusnethan Priory, Lanarkshire, on 14 March 1962. A female was taken in the salt marsh at Ardmore on 15 September 1968.

10. *Minyrioloides trifrons* (O.P.-Cambridge) (Linyphiidae). This species has few Scottish records (Bristowe, 1939) and has not previously been recorded from the Clyde area. It was found on marsh herbage at Ardmore on 10 June 1968, and has also been found by us at Gartness in Stirlingshire on 13 May 1961. It is probable that it will prove to be more common than the records indicate and has been overlooked because of its small size.

11. *Trachynella nudipalpis* (Westring) (Linyphiidae). The only published record for this species in the Clyde area is from Blackstone near Paisley (Evans, 1901). It has been taken by us on Mugdock Moor, Dunbartonshire, in July 1959, Rossthdu, Dunbartonshire in May 1960, and Tyndrum, Perthshire, in June 1961. A male was taken at Ardmore on a gravel ridge on 10 June 1968.

12. *Gongylidiellum vivum* (O.P.-Cambridge) (Linyphiidae). The published records of this species for Scotland (Bristowe, 1939) are from Perthshire, Inverness-shire, Stirlingshire and Moray. We have taken it at Kenmure Castle and Garroch, both in Kirkcudbrightshire, on 28 May 1961 and 30 May 1961, and from flood-drift from the River Ayr on 5 December 1960. At Ardmore it has been found in shore drift on 15 May 1965, in turf from the shore on 4 November 1967, and at the roots of shore herbage on 11 March 1968.

13. *Lophocarenum parallelum* (Wider) (LINYPHIIDAE). This species was taken at the roots of shore herbage on 2 September 1967. The only published Scottish records (Bristow, 1939) are from Fife, Haddington, Edinburgh and Moray, and it is rare in England. Locket and Millidge (1953) give its habitat as "amongst moss and detritus, in woods, under turfs and stones etc".

14. *Oedothorax agrestis* (Blackwall) (LINYPHIIDAE). This species is relatively rare in Scotland, the only Clyde area record is from Brodick where it was taken by William Evans in 1895. (Evans, 1901). It may be more common than is recognised as it can only be distinguished with certainty from *O. fuscus* (Blackwall) by the characters of the male. At Ardmore a male was found by us at the roots of shore herbage on 2 September 1967.

15. *Oedothorax fuscus* (Blackwall) (LINYPHIIDAE). *O. fuscus* is more common than *O. agrestis*. In the Clyde area it has been recorded from Renfrewshire and Dunbartonshire (Evans, 1901). Most of our records are coastal, from Turnberry and Gables on the Ayrshire coast on 23 August 1961 and 29 October 1961, and Inverkip in Renfrewshire on 22 October 1961, but it also occurs inland at Cambusnethan Priory in Lanarkshire and several stations outwith the Clyde area. At Ardmore as at the Ayrshire coast localities it is common in high water mark drift.

16. *Aulacocyba subitanea* (O.P.-Cambridge) (LINYPHIIDAE). There is only one published Scottish record of this species (Bristowe, 1939) and it is from the county of Midlothian. Its habitat is haystacks and debris of straw and grass. We have taken it in a sample from the base of haystacks at Boghall Farm at Broomhouse in Lanarkshire. On 27 January 1968, the species was found in a grass sample from Ardmore.

17. *Bathyphantes pullatus* (O.P.-Cambridge) (LINYPHIIDAE). The only published record of this species from Scotland is from the county of Inverness (Bristowe, 1939). We have taken it from Loch Davain in Inverness-shire on 6 June 1965. It has also been found by us at three sites in Kirkcudbrightshire, Loch Minnoch on 1 July 1962, Rascarrel Bay on 3 July 1962 and Moss of Cree on 6 April 1964. At Ardmore a female was found in high water mark drift on 12 October 1967, but this is an atypical habitat, and a breeding colony is more likely to occur on the wet moorland part of the reserve.

18. *Maro minutus* (O.P.-Cambridge) (LINYPHIIDAE). This species has not previously been recorded from Scotland although we have a specimen which was taken by hand collecting at Flanders Moss in Perthshire on 13 September 1959. The second Scottish specimen, a female, emerged from a sample of relatively dry organic matter from a cave under the cliff at Ardmore on 4 November 1967. No males have yet been taken in Scotland.

RELICT SPECIES IN THE ARDMORE FAUNA

Perhaps the most interesting of the species we have so far recorded from Ardmore Peninsula are two herbivorous beetles—the Coccinellid *Subcoccinella 24-punctata* and the weevil *Apion miniatum*. Neither, as far as we know, has been recorded elsewhere in the Clyde drainage basin, though the food-plants of both are common and widespread. *Subcoccinella*, feeding on *Silene maritima*, is fairly abundant along the Solway coast, and has been recorded also from Ailsa Craig, off the south Ayrshire coast, but despite frequent searching of the food-plant we have never found it on the Ayrshire mainland. All the many Scottish specimens we have examined of this species are wingless, and it seems that the species is likely to be a very "sedentary" one, whose colonies will tend to persist for a long time in one spot with very little tendency to spread or shift their location. Much the same may be true of *Apion miniatum*, of which our specimens are also wingless. It, too, has been found at several points along the Solway coast but nowhere in Ayrshire.

Both species may well be survivors from the "post-glacial climatic optimum" of six or seven thousand years ago, when their ranges probably extended considerably north of their general limits today. At this time Ardmore would have been a rocky island, with the *Silene maritima* doubtless growing on the cliffs and the *Rumex* species on the flatter parts with deeper soil. With the subsequent deterioration of the climate, both species probably died out in most of the Clyde basin, but were able to persist at Ardmore because of a somewhat more favoured climate than in surrounding areas and because the food-plants persisted there. The *Silene maritima* presumably shifted from the cliffs as these became overshadowed with woody vegetation and colonised the shingle ridges, on which it (and *Subcoccinella*) occur today.

If the Ardmore populations of these two species have been isolated as long as this theory suggests—i.e. for 5,000 years or more—they might be expected to show genetical abnormalities. In the case of the *Subcoccinella* these might well be manifest in details of the spotting pattern, as has been shown in other Coccinellidae. A comparison of adequate samples of the species from Ardmore, the Solway coast, and southern England might yield interesting data. The species should be fairly easy to rear in the laboratory if breeding tests prove to be desirable.

DRY ORGANIC MATTER AS A HABITAT FOR INSECTS

Natural accumulations of organic matter, particularly in the climate of western Scotland, are liable to become water-logged for considerable periods, and this factor probably limits the

distribution of many species. Where natural accumulations of decaying organic matter are protected from being soaked by rain, special faunas are found; the recesses under the sandstone cliffs of Ardmore provide this type of habitat in some quantity. Species occurring at Ardmore and particularly associated with this type of habitat include *Calyptomerus dubius*, *Tipnus unicolor*, *Cryptophagus bicolor*, *C. pilosus* Gyll., *Orthoperus mundus*, and the introduced New Zealand Lathridiid *Metopthalmus serripennis* Broun, also the Psocopteran *Ectopsocus briggsi*.

THE SIGNIFICANCE OF ABSENCES IN THE ARDMORE FAUNA

The Ardmore fauna is notably poor in Cerambycidae and in other groups of Coleoptera associated with dead trees, also in foliage insects specific to oak. It seems likely that the peninsula never possessed a well-developed natural tree cover in post-glacial times—a circumstance which may have contributed to the survival there of *Subcoccinella 24-punctata* and *Apion miniatum*. Insects of birch and willow are relatively well represented, suggesting that these species have been on Ardmore in some quantity for considerably longer than oak. The presence of the *Mesites tardii* may, however, suggest that at least some more or less woody plants have been there since the post-glacial climatic optimum; the species might have bred for a time in drifted logs, or in plants like elder and gorse.

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THE FRESHWATER LEECHES (HIRUDINEA) OF ORKNEY

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Many islands off the coast of Scotland have been the subject of ecological surveys over the last century, and a number of studies are available, usually concerned, however, with one section of the flora or fauna e.g. Grimshaw, 1906; Hunter, 1953. The inland waters of such islands, often of potential interest, have been rather neglected by ecologists, though a few comprehensive surveys are available, e.g. Bertram, 1939; Hamilton, 1963; Maitland, 1968. Due to the limited capacity for dispersal of many aquatic species the fauna of such islands merits more study and may help further to elucidate geographical relationships within the British Isles.

The 49 islands comprising Orkney lie off the north-east tip of the Scottish mainland and are likely to be interesting faunistically. Little information concerning their aquatic fauna has been published; that which has, consists mainly of various short notes on organisms or groups. Prior to the present data (mentioned briefly by Maitland, 1966) there have been no records of any species of freshwater leech (Hirudinea) from Orkney (vice-county 111).

Geologically, Orkney is underlain mainly by sandstones of various types. Surface water draining from the peat-covered uplands is naturally soft and often stained, in contrast to the numerous springs of the flagstone districts which are very clear and hard. The pH and alkalinity of water bodies arising from a mixture of surface and spring waters vary considerably according to rainfall. In most areas salt from blown spray is present, becoming an important constituent of waters near exposed coasts.

Systematic collections of Orkney freshwater fauna were made from July 1964 to October 1965; a number of specimens were also supplied by the Orkney Field Club. Collections were made using methods appropriate to the substrates in question; for Hirudinea these consisted mainly of the hand-picking of animals from stones and vegetation and the use of a small hand-net (10 meshes per cm.) in softer substrates. Animals were sorted alive, preserved in 4% formaldehyde and later identified and counted in the laboratory.

A large number of freshwater habitats of different types were examined during this survey. However, for various reasons,

several important waters were not visited, notably the hill lochs of Hoy and Rousay and waters in the sand dune areas of the North Isles. No systematic collecting was carried out in waters which were obviously very brackish. The survey is considered, however, to include most of the common species of freshwater invertebrates and to be sufficient to indicate some of the ecological relationships relevant to these animals in Orkney. The present account is concerned solely with the Hirudinea of the area, but full details of all localities examined and their fauna will be lodged with the Stromness Museum, Orkney.

HIRUDINEA

Theromyzon tessulatum (Müller). The present ecological data (Table 2) indicate that, as observed in other parts of Scotland (Warwick and Mann, 1960; Warwick, 1961; Williams, 1961; Maitland, 1966), this species is rarely found in running water and no specimens were ever found in this habitat in Orkney. It is common, however, in many lochs in the area, thus confirming the suggestion that it is one of the most widespread of British forms. A parasite of waterfowl, it has great opportunities for dispersal and is probably much less dependent on the trophic conditions of its environment than other species. Adult leeches were found carrying eggs in July and young in October, thus agreeing with what is known about the reproductive habits of the species elsewhere in the British Isles (Mann, 1951).

Glossiphonia complanata (L.). This too is a widespread British leech and in Orkney occurs in a variety of waters, mostly on stones in shallow water. As observed by Mann (1955) it is commoner in standing than in running water (Table 2). Adults were found with eggs in June, well within the breeding season recorded by Mann (1957a) in the south of England. *Glossiphonia complanata* is known to suck the body fluids of various Mollusca and on different occasions several species of Gastropoda were collected with it.

Haemopsis sanguisuga (L.) This leech is one of the less common of the Orkney species and was rarely abundant there. All specimens were collected among stones in shallow standing water. No observations were made on the breeding season of this species, which is a macrophagous carnivore feeding on small Oligochaeta, etc.

Dina lineata (Müller). Recorded only for the first time in the British Isles by Mann (1952) this leech is now known to occur in many parts of the country. It was found in several places on Orkney (Table 1), though never in fast running water. Egg cocoons were collected from stones during the summer months in several of the lochs examined. This species is also

TABLE 1.

Numbers of leeches in collections of freshwater fauna from Orkney (positive localities only).

Station	Locality	Grid Reference	Date	<i>Theromyzon tessulatum</i>	<i>Glossiphonia complanata</i>	<i>Helobdella stagnatis</i>	<i>Haemaphys sanguisuga</i>	<i>Dina lineata</i>	Total
1a	Pond at north end of North Fara	HY 528378	6. 9.64	2				1	3
1b	Ditch at cemetery, North Fara	HY 528367	6. 9.64			12			12
4	Quarry pond at school, Eday	HY 563308	25. 7.65			1			1
6	Loch of Scockness, Rousay	HY 450330	15. 8.64	6					6
7a	Loch of North Tofts, Egilsay	HY 467305	15. 8.64	1	2				3
7b	Ditch between Kirbist and school-house, Egilsay	HY 470295	30. 4.64					1	1
9a	Stream in former mill dam, Shapinsay	HY 485172	20. 6.65		1	4			5
10	Outlet of Loch of Boardhouse	HY 256271	10. 6.65		2				2
11	Loch of Boardhouse	HY 273249	9. 6.64		14			2	16
12	Burn of Kirbister	HY 285254	13.10.64		1	2			3
13	Loch of Hundland	HY 291269	19. 6.65					1	1
14a	Loch of Swannay at Lochside	HY 304283	13.10.64		6		4	3	13
14b	Loch of Swannay at Southend	HY 319273	11. 6.65		4				4
15	Peerie Water, Evie	HY 335272	5.10.65		1				1
16b	Lowries Water, Evie	HY 345257	2. 2.65	1					1
19	Loch of Vastray, Evie	HY 399254	24. 7.64	12	2				14
24	Loch of Sabiston	HY 293225	10.10.65	3	1			1	5
25	Loch of Bosquoy	HY 304187	15. 6.64		2			2	4
28a	Loch of Brockan, Rendall	HY 393189	6.10.64	1					1

34b	Loch of Harray at Ring of Brodger	HY 294137	25. 4.65			7	1	8	
36	Loch of Harray at Stoneybrae Camp	HY 310139	5. 6.64			4		4	
38	Quarry Pond, Hillview, Harray	HY 337140	15. 7.64				1	1	
39	Loch of Wasdale, Firth	HY 342150	1. 9.64			2	3	5	
53b	Dam at Gyre, Orphir	HY 341047	24. 4.65		4	4	11	19	
56	Loch of Kirbister	HY 370080	28. 2.65			6	1	8	
57	Burn of Swarta back, Orphir	HY 380075	15. 7.64				1	1	
63b	Orquill Burn above bridge on A964	HY 431093	15. 6.64			6		6	
65b	Quarry pond, Craigiefield Farm, St. Ola	HY 462122	29. 4.65				7	7	
67	Burn 300 m. east of Tongue of Gangsta, Holm	HY 457035	28. 4.64			1		1	
72a	Graemeshall Loch, Holm	HY 489020	8. 9.64	1		1		2	
74a	Loch of Tankerness	HY 514097	7. 2.65	1		1	2	4	
78	Burn of Ore, below bridge on B9047	ND 304939	12. 7.64				1	1	
80	Quarry ponds, Kirk Point, Lamb Holm	HY 485000	26.10.64			19		19	
82	Echnaloch, Burray	ND 473967	6. 7.65	5				5	
83	Burn, near mouth, Sandwick, South Ronaldsay	ND 437892	26.10.64			2		2	
88	Ponds, 400 m. west of Old Head, South Ronaldsay	ND 466835	7. 7.65	2			1	3	
Total				39		69	9	14	192

TABLE 2.

Frequency of positive occurrence of Orkney leeches in different types of habitat expressed as a percentage of each habitat type sampled.

Habitat	<i>Theromyzon tessulatum</i>	<i>Glossiphonia complanata</i>	<i>Helobdella stagnalis</i>	<i>Haemopsis sanguisuga</i>	<i>Dina lineata</i>
Pond	6	0	9	6	3
Loch	38	50	11	11	26
Ditch	0	7	15	0	7
Burn	0	16	8	0	0

a macrophagous carnivore feeding especially on Oligochaeta and Chironomidae, both of which were common in similar habitats in Orkney.

DISCUSSION

The feeding habits of the species of leech found on Orkney have been mentioned briefly above, where it was pointed out that invertebrate organisms collected with the 4 predacious species were often known food items of these leeches. The widespread occurrence of *Theromyzon tessulatum* would indicate that wildfowl are likely to be common in Orkney; this is amply confirmed by the observations of one of the present authors and various published records. Thus Boyd (1963) noted that there are considerable numbers of ducks and swans found on lochs on the island and records show maximum winter numbers of 579 and 4,792 for the lochs of Kirbister (14.11.65) and Harray (17.12.61) respectively.

With the discovery of *Piscicola geometra* (L.) in the River Tweed (Mills, 1967) a 12th species was added to the Scottish list noted by Maitland (1966). Thus of the 13 species known to occur in the British Isles only one—*Eryobdella testacea* (Savigny 1820)—has not been recorded from Scotland. The results of the present study of Orkney indicate that though leeches are common there, only 5 species are represented.

The general paucity of invertebrate species on an island or group of islands appears to be a common feature of the islands round Scotland in relation to the mainland (Hamilton, 1963; Maitland, 1968). The situation with regard to the Orkney islands, however, is less extreme than with some others. Hamilton (1963), referring to the low number of aquatic species occurring on St. Kilda suggests that this is partly due to isolation. The number of aquatic species recorded from the Isle of May (Maitland, 1968) is even less than St. Kilda, but here the probable cause is thought to be the temporary nature of the waters rather than isolation. The proximity of the Orkney islands to the mainland and the varied nature of the aquatic habitats there (which include many permanent water bodies) mean that both these factors are less important than elsewhere.

The variety and numbers of waters which were examined during this study make it probable that the present list is a complete one or almost so for Orkney Hirudinea. As with many other groups of hololimnic animals in the British Isles there appears to have been a gradual movement northwards since the last Ice Age and many species have not yet reached the north of Scotland (cf. freshwater fish, Maitland, 1969). Thus of the Scottish species, *Piscicola geometra*, *Trocheta subviridis* (Dutrochet) and *Trocheta bykowskii* (Gedroyc) have not yet been recorded north of the Midland Valley. Only 6 species have been recorded from Caithness (Mann, 1964), the nearest mainland area to Orkney; these are the 5 species noted from Orkney during the present study and *Batracobdella paludosa* (Carena). This may well be the next leech to be recorded from these islands.

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Addendum p. 559

Helobdella stagnalis (L.). Tolerating a wide range of conditions, this species was observed in a variety of habitats (Table 2). Young were noted in June (cf. Mann, 1957b); this leech sucks the body fluids of various invertebrates.

**A POPULATION OF COLOURED GOLDFISH,
CARASSIUS AURATUS IN THE FORTH AND CLYDE
CANAL**

By PETER S. MAITLAND

The Nature Conservancy, Edinburgh

(Received 24 January, 1969)

The Goldfish, *Carassius auratus* (L.), was introduced to Europe from the Far East several hundred years ago and has been known in the British Isles since at least 1665 (Wells, 1941). Imported originally as an ornamental aquarium and pond fish, the species has been introduced into a variety of waters in this country and has become well established in many of them. Like the closely related Crucian Carp, *Carassius carassius* (L.) (Marlborough, 1966) it would appear to have been much more successful in the southern half of England than elsewhere. It is probable that this has resulted from the more favourable climate there.

The popularity of the Goldfish as a domesticated species is probably due to two factors: firstly, the great plasticity which it shows in both form and colour; and secondly, its tolerance of poor conditions (e.g. crowding and low oxygen levels) which would prove inimical to most other species. *Carassius auratus* is native to eastern Asia, where fish in wild populations are dark in colour, normally a dull olive-green on the back lightening to bronze-grey on the sides and white on the belly. The red and yellow colours seen among domestic forms have been obtained by selective breeding from mutants, but even after many generations of such breeding these colour varieties still have a high percentage of wild type colouration among their young. Successful populations in the wild in this country are normally characterised by two features: firstly, the whole population very rapidly reverts to the original wild uncoloured type; secondly, the water body in which the population has developed is favourably situated as far as its temperature regime is concerned—i.e. in the southern half of England, or in favourably exposed areas only in other parts of the British Isles. In breeding and rearing this species in captivity in this country it is normal practice to keep the young, for their first few months at least, in artificially heated conditions, normally between 20°C and 25°C. Only with such warmth do they appear able to grow fast enough to reach an adequate size to withstand overwintering conditions outside—viz ca. 5 cm. A similar situation appears to exist with the Common

Carp, *Cyprinus carpio* (L.) (Maitland, 1964) and some other species (Varley, 1967).

In view of the above, and the absence of records of this species in the area since those of Scott and Brown (1901), it was felt to be worthwhile recording the existence of a large population of coloured *Carassius auratus* in the Forth and Clyde Canal in the Clydebank (Kilbowie) area. Here, in a stretch which is at least 1000 m in length, very large numbers of this species are present in densities estimated at an average of some 5 fish per square metre in shallow water, with maximum densities of more than 250 fish per square metre where numbers are congregating round a food source. Other species of fish known to be present in this stretch of the canal and collected recently with the Goldfish are Roach, *Rutilus rutilus* (L.) and Three-spined Sticklebacks, *Gasterosteus aculeatus* L.

Two visits were paid to this stretch of the canal—on 18 and 19 January 1969. Four methods of capture were used—small trawl, gill net, hand net and angling (using dough as bait). The last was undoubtedly the most successful method under the conditions prevailing at the time, especially as far as the larger specimens were concerned. In all, during the 2 days, over 100 specimens were examined and several were taken alive for subsequent observation.

The most striking feature of this population is the very large proportion of coloured fish present. Of all the fish captured and seen more than 95% were fully coloured. The most common colour form was orange-red (occasionally with black or silver markings) but lemon-yellow and white types were also present in considerable numbers. All such fish were of course clearly visible against the muddy substrate of the canal, and, in shallow water at least, it was possible to gain some idea of the numbers present by direct counts.

Most of the fish in shallow water were from 3–8 cm. in fork length with an average of some 5.5 cm. Much larger specimens occurred in deeper water but were less readily seen or caught. The largest fish caught so far was an orange-red specimen 18 cm. in fork length. Determination of the age of these fish is extremely difficult because of the relatively constant temperature involved (see below) and the consequent absence of variation in the annular formation of their scales or other bony parts. Based on knowledge of fish reared in captivity it would appear likely that most of the fish in shallow water were 0+ years old and those in deeper water 1+ years and occasionally older. Abnormalities of finnage, etc., are common among broods of domestic Goldfish, but the only two deformed fish noted among fish collected from this population were one with telescopic eyes and another with only one eye, the left eye being completely absent.

In view of the unusual nature of this population of *Carassius auratus* it is relevant to record here some of the important features of the canal at this point. The maximum width is about 25 m, the maximum depth some 3 m along the middle. The substrate is mainly small stones and mud at the edge, changing to bare mud further out. The dominant influence on the canal at this point, and almost certainly the reason for the success of *Carassius auratus* there, is a large effluent of heated water discharged from a factory near the centre of the stretch concerned. On the 19 January 1969 several readings of the water temperature were taken at various points along the canal here, at about 1300 hrs. The results were as follows: (a) 2000 m east of heated effluent, 9.5°C. (b) 200 m east of effluent, 12.5°C. (c) Opposite effluent, 16.5°C. (d) 200 m west of effluent, 12.5°C. (e) 500 m west of effluent, 12.0°C. The air temperature at the time was 8°C while many small ponds in the area had temperatures of 0°C with partial ice cover resulting from a hard frost on the night of 17 January.

It can be seen that this effluent had a considerable influence on the temperature of the canal, apparently for considerable distances. Contrary to what might be expected of a population of Cyprinidae at this time of year the entire population of *Carassius auratus* was extremely active and feeding constantly. The unusually high temperatures were reflected in the aquatic macrophytes not only by the luxuriant growth of the native *Myriophyllum alterniflorum*, which is common in other parts of the canal and in various waters throughout the country, but also by several very fine stands of the North American *Cabomba caroliniana*. This species is commonly grown under tropical conditions by aquarists in this country but appears not to have been previously recorded in the wild.

The origin of this population of *Carassius auratus* is uncertain but, like the water plant *Cabomba caroliniana* Gray it is likely to have been introduced recently by Man. The population was certainly present in 1967 when many specimens were caught in August and in December by Dr. D. Burkell (personal communication). Surprisingly, most of these specimens were uncoloured. Thus, contrary to the normal situation (Wheeler, 1958) it would appear that the percentage of coloured forms in this population is increasing. The most likely predator of fish in the Forth and Clyde Canal in this area is the Pike, *Esox lucius* (L.) which certainly occurs in stretches nearby, though it has not yet been seen in the Kilbowie area. Assuming continuity of the present high temperature regime it seems highly probable that the population described here will continue to thrive. The relationships between the coloured and uncoloured components of the species would seem to be uncertain, however, and will be watched with interest.

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FLEEMING JENKIN AND DARWIN'S ON THE ORIGIN OF SPECIES

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(Received 20 March 1969)

A number of recent books on genetics and evolution mention the celebrated review of Darwin's *On the Origin of Species* by Jenkin. For example, in Lewis and John (1964, p. 195) we read: "In the middle of the nineteenth century, Jenkin, *an engineer from Glasgow* (my italics) pointed out that if genetic differences did blend then new variations would be progressively diluted by crossing with the original type. Consequently, a new type could arise only if genetic changes in the same direction occurred repeatedly and frequently." And again, in Stebbins (1966, p. 11), "One of Darwin's severest critics, Fleeming Jenkin, pointed out that selection could not sort out superior fluids from a mixture". Reading these two rather differently worded statements it is perhaps interesting to discover the identity of "the engineer from Glasgow" and to examine the text of his review.

Henry Charles Fleeming Jenkin, far from being an engineer from Glasgow, was a famous Professor of Engineering at Edinburgh University. Born in Kent in 1833, he received his early education in Edinburgh, and later in Frankfurt and Paris. In 1850 he graduated as a Master of Arts at the University of Genoa; then followed a year in the locomotive workshops of that city. Returning to Britain in 1851, he worked in Manchester and later in Birkenhead, where he became chief of the engineering and electrical staff in a firm which manufactured submarine cables. For a number of years he was in engineering practice but later became Professor of Engineering at University College, London. His appointment as Professor of Engineering at Edinburgh dated from 1868. Distinguished in many fields of engineering, especially in telegraphy (he was made F.R.S. in 1865) Fleeming Jenkin had wide interests. For instance, he wrote a play, campaigned for better sanitary conditions in houses and improvements in technical education. He died in 1885. Further details of his life are available in a collection of his papers (edited by Colvin and Ewing, 1887) bound with a memoir by Robert Louis Stevenson. There is also an obituary, initialled W. T. (presumably Sir William Thomson), in the Proceedings of the Royal Society for 1885.

Fleeming Jenkin's review of *The Origin* was published anonymously in *The North British Review* for June, 1867. It is a

substantial work of some 42 pages. Two numbers of the *Review*, March and June, bound as Vol. XLVI (New Series Vol. VII) in the Glasgow University Library, contain a wide range of articles on Trade Union Policy, The Bengal Famine of 1866, Reform of the University of Oxford, Religious works and Education in Scotland, etc. From Stevenson's memoir it is clear that Jenkin's review was written in London about four years before publication for, on page LXVIII we read, "His paper on Darwin, which had the merit of convincing on one point the philosopher himself, had indeed been written before this in London lodgings . . .". Reference to the context of this quotation shows that the review was written before 1863, in which year he moved, with his family, to a cottage at Claygate, (Esher) in Surrey.

This lengthy review, with its detailed discussion of many issues is extremely interesting, not least because it considers Darwin's theory untenable. Particularly important is the section referred to by Lewis and John (1964) and Stebbins (1966). Darwin argued in *The Origin* that favoured individuals would be selected by Natural Selection. The way in which these favoured variants could breed and pass on their advantage to their offspring, was not fully explored. With Mendel's work still to be discovered by biologists, the most firmly held ideas about inheritance were that blending of the characters of the parents occurred in the offspring. Fleeming Jenkin pointed out cogently the difficulties of explaining the persistence of favoured variants—"sports" as he called the most conspicuous of them—under a system of blending inheritance. He was also aware of the importance of chance events in evolution. Jenkin's insight into the importance of chance on the survival of organisms does not appear to have been appreciated by recent authors who discuss his review (e.g. Fothergill 1952, Vorzimmer 1963). There is still much argument as to the precise effects of chance upon the evolution of plants and animals. Mayr (1963) may be consulted for reference to the work of Sewall Wright and other population geneticists.

In the following quotation on the persistence of "selected" variants, Jenkin's views are made clear on the two major issues. First he discusses the effect of chance and then the consequences of blending inheritance. (It is illuminating to compare Jenkin's own words with those quoted at the beginning of this article.) "It is very difficult to see how this [persistence] can be accomplished, even when the sport is very eminently favourable indeed; and still more difficult when the advantage gained is very slight, as must generally be the case. The advantage, whatever it may be, is utterly out-balanced by numerical inferiority. A million creatures are born; ten thousand survive to produce offspring. One of the million has twice as good a chance as any other of surviving; but the

chances are fifty to one against the gifted individuals being one of the hundred survivors. No doubt, the chances are twice as great against any one other individual, but this does not prevent their being enormously in favour of *some* average individual. However slight the advantage may be, if it is shared by half the individuals produced, it will probably be present in at least fifty-one of the survivors, and in a larger proportion of their offspring; but the chances are against the preservation of any one "sport" in a numerous tribe. The vague use of an imperfectly understood doctrine of chance has led Darwinian supporters . . . to imagine that a very slight balance in favour of some individual sport must lead to its perpetuation . . . Let us consider what will be its influence on the main stock when preserved. It will breed and have a progeny of say 100; now this progeny will, on the whole, be intermediate between the average individual and the sport. The odds in favour of one of this generation of new breed will be, say $1\frac{1}{2}$ to 1, as compared with the average individual; the odds in their favour will therefore be less than that of their parent; but owing to their greater number, the chances are that about $1\frac{1}{2}$ of them will survive. Unless these breed together, a most improbable event, their progeny would again approach the average individual; there would be 150 of them, and their superiority would be say in the ratio $1\frac{1}{4}$ to 1; the probability would now be that nearly two of them would survive, and have 200 children, with an eighth superiority. Rather more than two of these would survive; but the superiority would again dwindle, until after a few generations it would no longer be observed . . ."

What effect did Jenkin's review have on Darwin's ideas? It is clear from a number of Darwin's letters that he was extremely interested in its criticism. In a letter dated January 16 [1869] he wrote to J. D. Hooker "Fleeming Jenkins (sic) has given me much trouble, but has been of more real use to me than any other essay or review" (Darwin, F., 1903. Vol. II, p. 379).

Fothergill (1952) and a number of other authors, including Hardin (1959), have suggested that the serious problems raised in the *North British Review* forced Darwin to a reassessment of the power of natural selection. Evidence for this reappraisal was seen in the major rewriting of the text for the 5th edition (1869) of *The Origin*. (All additions are clearly exhibited in a variorum text of *On the Origin of Species* by Peckham 1959.) There appear to be strong grounds for suspecting a marked change in Darwin's thought, as he added to the section on natural selection, "Until reading an able and valuable article in the *North British Review* (1867), I did not appreciate how rarely single variations, whether slight or strongly marked, could be perpetuated".

In a recently published essay, Vorzimmer (1963) challenges the idea of an abrupt change in Darwin's views. On the basis of a thorough study of Darwin's papers and reprints in the University Library, Cambridge, Vorzimmer argues that Darwin was aware of the problems posed by blending inheritance as early as 1842. Moreover, he shows that other reviewers mention problems of blending inheritance, an early example being an essay by Dr. Francis Bowen, Professor of Philosophy at Harvard University, published in 1860 in the *American Journal of Science and Arts*. Nevertheless, Jenkin's contribution should not be underestimated, especially in view of the published views of Darwin's son, Francis. In editorial comment in *The Life and Letters of Charles Darwin* (1888 Vol. III, p. 109), F. Darwin writes "It is not a little remarkable that the criticisms which my father, as I believe, felt to be the most valuable ever made on his views should have come, not from a professed naturalist, but from a Professor of Engineering".

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SHORT NOTES

(See page 376)

Compiled by R. MACKECHNIE

INVERTEBRATES

Death's-head Hawk Moth in Kilsyth

A specimen of this insect, found alive on a pavement in Kilsyth, was sent to the Glasgow Museum by Mr. James Duncan, editor of the *Kilsyth Chronicle*, about 28 September 1967; Mr. C. E. Palmar has kindly made the record available.

This is the largest British moth, and is a rare insect in the Clyde valley. Prior to the beginning of this century there were fourteen recorded occurrences (*Fauna, flora and geology of the Clyde Area*, 1901); since then I know of only one; a single insect, picked up in a Glasgow street, was brought to me in late September 1954.

Mr. A. M. Maclaurin writes: "most recent records of this moth are probably of immigrant insects; one might expect occurrences to be more frequent, as the main food plant of the larva is the potato, but modern methods of cultivation include spraying, which could destroy the caterpillars".—*Compiler*.

Transparent Burnet Moth in Kintyre

On 22 June 1968, on the west coast of Kintyre a few miles north of the Mull, I collected four specimens of a burnet moth which appeared to be the Transparent Burnet, *Zygaena purpuralis* (Bruen.), a species which I had seen a few years previously in the west of Ireland. This identification was confirmed by Mr. W. G. Tremewan and by Mr. A. M. Maclaurin.

Z. purpuralis has been recorded from a small number of scattered localities in the west of Scotland, both on the isles of the Hebrides and on the adjacent mainland. It is otherwise known only from the west of Ireland (Galway and Clare) and from one locality in north Wales. The Kintyre locality is the most southerly Scottish station so far recorded for the species.

Scottish *Z. purpuralis* differs slightly but significantly from the Irish and Welsh forms, and has been named subspecies *caledonensis*. The moth should be looked for on sunny slopes close to the sea on the western Scottish seaboard, especially where the food plant, thyme, is plentiful. It is often accompanied by the much more common Six-spot Burnet, *Z. filipendulae* (L.).

A. McG. STIRLING

FISH

Records from the Clyde sea area

The following have been extracted from the Glasgow Museum's register of specimens received:

- Sebastes marinus* (L.), Norway Haddock, Ailsa Craig, 6 May 1964.
- Lophius piscatorius* (L.), Angler Fish, off Ayr, 6 May 1964 and 7 May 1969.
- Morone labrax* (L.), Bass, Ailsa Craig, 15 March 1964 and 7 December 1964.
- Urophycis blennioides* (Brunn.), Greater Fork-beard, Ailsa Craig, 26 April 1965.
- Labrus bergylta* (Ascam.), Ballan Wrasse, Ailsa Craig, 30 April 1965 and 27 September 1967.
- Myoxocephalus scorpius* (L.), Father Lasher, Dunure, 12 June 1966.
- Belone belone* (L.), Gar-pike, Saltcoats, 13 June 1967.
- Trachinus draco* (L.), Greater Weaver, Loch Long, 26 August 1967.
- Gaidropsarus vulgaris* (Yarrell), Three-bearded Rockling, Loch Long, 23 September 1968.
- Alosa alosa* (L.), Allis Shad, Ailsa Craig, 15 March 1964 and 2 May 1969
- A. falax* (Lacep.), Twaite Shad, Ailsa Craig, 6 May 1969.
- Germo alalunga* (Bonn.), Long-finned Tunny, Furnace, Loch Fyne, 28 February 1968.

The two species of Shad resemble each other closely, differing in the number of gill-rakers and in the keel scale count. *A. falax* is much the rarer of the two. The Tunny was taken by an aqua-lung diver; the skin, with head and fins, was donated to the Museum. The specimen, which was obtained in shallow water, was approximately 110 cm. long and weighed about 30 lb. The pectoral fin was long (26 cm.) and narrow, reaching the base of the first dorsal fin; the latter had 13 rays. This may be the first record of the species from the Clyde area; it is not recorded in Bagenal, T. B., 1965. *Fauna of the Clyde Sea Area*, Millport.

D. L. BURKEL

Introduction of fish to new water

Tench, *Tinca tinca* (L.): In May 1967 at Milngavie, Dunbartonshire 17 were introduced into Lady Pond, Dougalston and 100 were introduced into Dougalston Loch, Dougalston. In May 1968 at Bearsden, Dunbartonshire 130 were introduced into St Germain's Loch, Canniesburn. The average weight of the specimens was about 1 lb. (range 4 oz. to 2½ lbs.) and the proportion of sexes was one male to two females.

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Carp, *Cyprinus carpio* (L.): In August 1968 near Kilsyth, Stirlingshire 24 were introduced into the Forth and Clyde Canal at Banknock. The average weight of the specimens was 2 lbs. (range 12 oz. to 4 lbs.).

D. L. BURKEL

Clingfish from Loch Fyne

In 1961 a single specimen of the Clingfish, *Apletodon microcephalus* (Brook), was recorded from Bute by B. B. Rae and J. M. Lamont (*Scott. Nat.* **71**, 1964). A second specimen has been collected by me on 18 April 1967 from the shore at Dundarave Castle, a few miles north of Inveraray on Loch Fyne, Argyllshire. The fish, a juvenile male, was found clinging to the damp undersurface of a flat stone a little above the low water neap tide mark. The shore below Dundarave Castle is sheltered, heavily weeded and largely composed of deep drifts of overlapping schistose slabs and fragments, most of which can be moved by hand.

This record is interesting in two respects: (1) The majority of specimens have been collected inshore in British waters. In the Isle of Man, where this species is listed as common in Port Erin Bay, a few specimens have been recorded intertidally and those from the lowest levels on the shore (Bruce, J. R., Colman, J. S. and Jones, N. S., 1963. *Marine fauna of the Isle of Man and its surrounding seas*, Liverpool). The gut contents of the present specimen, however, suggest that it had been feeding for some time in the zone where it was found. The stomach and intestine contained two species of invertebrate, a mite and specimens of the small isopod, *Jaera albifrons* Leach., a characteristically intertidal, crevice-inhabiting form. (2) Although the present record and that of 1961 are the only two records of *A. microcephalus* for the Clyde sea area this century, G. Brook (*Proc. R. phys. Soc. Edinb.* **10**, 1891) collected his new *Lepadogaster microcephalus* (= *Apletodon microcephalus*, see Briggs, J. C., 1955. *A monograph of the Clingfishes (Order Xenopterygii)*, Stanford, California) at low water in the same two areas, Loch Fyne and Bute. Unfortunately, Brook's inadequate description of the species and the confusion in the early records of this form with the rather similar species, *Diplecogaster bimaculata* (Bonnaterre), has left an unreliable picture of the distribution of *A. microcephalus* in the west of Scotland. Indeed, a review of the British distribution is required.

My specimen was pale apple green in colour, its total length 26 mm., standard length 22 mm., head length 5 mm., trunk length 17 mm., orbital diameter 1.7 mm., interorbital distance 1.6 mm.; it had 30 vertebrae, 5 rays in the dorsal

fin, 6 rays in the anal fin and $\frac{6 \mid 4}{6 \mid 4} = 20$ rays in the caudal fin; the dorsal fin originated immediately above the second ray of the anal fin.

JOHN J. AITKEN

BIRDS

Death-feigning by Starling

A Starling, *Sturnus vulgaris* (L.), picked up in a Glasgow street showed no sign of injury, but could not fly. When brought home and given the freedom of the living-room, it took refuge among the furniture by day, making sallies into the open to snatch food scraps put down for it. In the evenings it was always unwilling to be put to bed in a box and had to be stalked. When manoeuvred into a corner from which it could not escape, it lay down and rolled over, feet in the air, shamming death.

W. K. STOVE

This behaviour is interesting, but not particularly rare. I have had a similar experience with an adult Wren, which subsequently flew off and sang loudly. Bird-ringers, when handling birds for fixing the rings, frequently find that the birds "sham death".—*C. E. Palmar.*

Finches and nuts

The fondness of Titmice for nuts is well known. For many years we have maintained a bird-feeding device suspended in a window; the usual bait is split peanuts. Both Blue and Great Tits are regular, and Coal Tits occasional, visitors. Chaffinches and, more recently, Greenfinches have joined the nut-queue. Both finches are now so addicted to a nut-diet that they refuse all other types of food when nuts are available.

W. K. STOVE

Under the artificial conditions existing when food is put out in a garden, it is not unusual to find species which normally have quite different diets competing for similar food-items.—*C. E. Palmar.*

Waxwings in Shawlands, Glasgow

Mr. John Biggar reports a small party of about a dozen Waxwings, *Bombycilla garrulus* (L.), on 27 and 28 January 1968. The birds were feeding on *Cotoneaster* fruits in a garden at Westclyffe Street, Minard Road; they roosted

over-night on the horizontal bar of a street light standard, and the following morning resumed work on the cotoneasters. During that day the fruits were finished; the birds disappeared and were not seen again.

The Waxwing is a stoutly-built, crested bird, about the size of a Starling; it breeds in the forests of northern Europe, and is a regular winter visitor to Britain.—*Compiler*.

Hen Harrier in Glasgow

This bird was observed at Auchinairn, adjacent to Western Auchengeich Farm on 10 October 1966; the locality is just inside the city boundary at its nearest point to Lenzie Loch. It was seen at a distance of about 50 yards, flying languorously some 10 feet above the ground, and eventually disappeared over some high ground. The manner of flight suggested that the bird was a harrier; it was about 20 inches long, uniformly grey on the back, with a conspicuously white rump. These characters indicated an adult male Hen Harrier, *Circus cyaneus* (L.).

J. D. & J. C. SCOBIE

I know of no record of a Hen Harrier in Glasgow, though it does not surprise me to hear of one, since the bird is commonly seen in autumn, as it disperses southwards, as near the city as, for example, the southern end of Loch Lomond.—*A. T. Macmillan, editor of Scottish Birds*.

Corncrake in North Lanarkshire

During early May 1963 I heard the Corncrake, *Crex crex* (L.) in a field of Cocksfoot hay adjoining the Clyde Ironworks at Carmyle. In the same month in 1968 I again heard its characteristic, harsh, rasping rattle, but attempts on both occasions to find the bird were unsuccessful; this is not unusual. It is interesting that one of the shyest of birds, seen by so few people at close quarters and becoming increasingly scarce, should venture so close to man and his works.

ALFRED A. PERCY

MAMMALS

Foxes in Glasgow

During the early months of 1969 an adult fox was seen several times by Mr. R. Mackechnie and others, in open ground just north of Pollok Estate woodland; on most of these occasions the animal was making its way towards the wood, and did not appear to be making any effort to avoid being seen. The death of one of a pair of swans in circumstances indicating that a fox was responsible at Hogganfield Loch, Glasgow, was reported in the press on 9 November 1969.

Mr. C. E. Palmar informs me that the register of animals received at the Glasgow Museum records adult foxes from Pollok Estate on 30 January 1964, 21 April 1965 and 27 May 1965; one adult shot at Linn Park 15 May 1968; and one cub found in a dying condition at Crookston, 14 May 1964.

Mr. G. Rodway tells me that a fox was sighted in Glasgow Botanic Gardens by three persons on three separate occasions during August and September 1969.—*Compiler*.

FLOWERLESS PLANTS

Two rare *Riccia* species from Kirk Dam, Rothesay

The unusually dry summer of 1968 had the effect of considerably reducing the water level in the Kirk Dam, Rothesay, V.-c. 100, exposing a considerable area of almost flat, muddy shore. The mud, on drying out, developed a network of cracks, in and around which there was an abundant growth of a hepatic with a narrow thallus. I thought this was the terrestrial form of *Riccia fluitans*, but Mrs. J. A. Paton determined it as *R. huebenerana* Lindenb., a species not previously recorded in Scotland. Another species of the same genus, *R. warnstorfi* Limpr. was found in small quantity on similar ground at the same locality. This hepatic has been recorded only from a few localities in Scotland. *R. huebenerana* seems to be yet another example of a species whose presence is only readily detected when the normally submerged habitat becomes exposed by lowering of the water level. See also pages 518 and 582.

A. McG. STIRLING

Bazzania trilobata in Ayrshire

This liverwort, *Bazzania trilobata* (L.) Gray was found commonly in the woodlands of the River Ayr gorge near Failford, V.-c. 75, in October 1967. The identification has been confirmed by Mrs. J. A. Paton. The species is characteristic of *Quercus petraea* woods of the north and west (Watson, E. V., 1968. *British mosses and liverworts*, Cambridge). It has previously been recorded from all the western counties of Scotland except Ayr and Renfrew—so that it should be looked for in the latter.

A. J. KERR

Bryophyte records from Shielhill Glen, Inverkip

Shielhill Glen is a steep-sided, wooded defile extending for some two miles between Loch Thom and Dunrod, where its stream joins the Kip Water about a mile and a half north-east of Inverkip, Renfrewshire. The rocks through which the stream

has cut are mainly sandstones of the Calciferos Sandstone Series having a high base status, and this, coupled with the prevailing permanently damp conditions, has provided optimum conditions for the development of a varied and, in places, rich bryophyte flora. Shielhill Glen also has a most interesting flora of higher plants.

The following bryophyte records new to V.-c. 76, Renfrew, were made in March 1967. The hepatic *Tritomaria exsectiformis* (Breidl.) Schiffn. was found in small quantity on a rotting log, the typical habitat. The moss *Seligeria recurvata* (Hedw.) B., S. & G. was abundant on the damp vertical faces of the sandstone, often growing with the small moss *Gyroweisia tenuis* (Hedw.) Schimp. Both are typical of such a habitat. *Amblystegiella sprucei* (Bruch.) Loeske, one of the smallest and most delicate of the pleurocarpous mosses, was the best find in the Glen. A patch, of only a few square inches, grew in a fissure of the calcareous rock. This species is rare and is indicative of highly calcareous conditions.

Though not a new vice-county record, the occurrence of the moss *Orthothecium intricatum* (Hartm.) B., S. & G. in one place in some abundance was worth noting. This species is a strict calcicole and is rare in the vice-county.

A. McG. STIRLING

Four "Mediterranean-Atlantic" Bryophytes new to Scotland

The bryophyte flora of two limestone outcrops, south of Tayvallich, Kintyre, V.-c. 101, close to the Tayvallich-Keills road, which were visited several times in 1968, includes four species, one liverwort and three mosses, new to Scotland. On the northernmost of the two outcrops the hepatic *Cephaloziella turneri* (Hook.) K. Müll. was found in limited quantity on damp soil below slight overhangs of the rock. The small moss *Epipterygium tozeri* (Grev.) Lindb., which only a few months previously had been added to the Scottish flora from slightly further north near Loch Craignish, occurred in similar situations but in greater abundance. At the second outcrop, just to the north of Keills, the two mosses, *Pottia crinita* Wils. ex B., S. & G. var. *viridifolia* (Mitt.) Mönk. and *Tortula canescens* Bruch ex Mont. were fruiting and grew in very small quantity on rather dry, exposed ledges of the limestone.

These four species all belong to the "Mediterranean-Atlantic" group of bryophytes whose distribution in the British Isles is distinctly southern and western, implying a preference for warm, often dry districts. Two other members of this group, the moss *Tortella nitida* (Lindb.) Broth. and the thallose hepatic *Targonia hypophylla* L. occur on the Keills outcrop; the latter species being present in considerable quantity.

M. F. V. CORLEY, A. G. KENNETH & A. McG. STIRLING

Royal Fern in West Perth

The Royal Fern, *Osmunda regalis*, is first mentioned for the Parish of Aberfoyle, V.-c. 87, by the Rev. Patrick Graham in the *Old Statistical Account* of 1796. Later in his *Perthshire Sketches*, Graham remarks of its profusion from Loch Ard to Loch Chon. Several writers subsequently record the gradual extermination of this fern in west Scotland by land drainage, horticultural demand for osmunda fibre and the depredations of collectors. By 1908 it was noted in the *Trans. Proc. Perthsh. Soc. nat. Sci.*, there was scarcely a plant left in this particular locality. The record in the *Atlas of the British Flora* (1962) is based on a single specimen in the herbarium of the Department of Botany, University of Glasgow collected by Peter Ewing in 1870. On 21 September 1967 a short search was made in the area and although only one tuft of fronds was seen, it can be recorded that the Royal Fern is still to be found in its old haunts.

JOHN MITCHELL

Green Spleenwort in Arran

In April 1967 the Green Spleenwort, *Asplenium viride*, was found on rocks alongside a tributary of the main stream flowing through Gleann Dubh, Arran (V.-c. 100; 10 km. grid square NR 986331). The *Atlas of the British flora* (1962) contains a pre-1930 record for this square which may be based on Bryce's *Arran and the other Clyde Isles*, 4th edition, 1872. Bryce gives as one locality for the species; "on rocks at the head of Glen Cloy, sparingly". These two glens are the same, the former being the Ordnance Survey designation for an area which could well be described as the head of Glen Cloy.

T. HUXLEY & A. J. KERR

The source of the record in the *Atlas of the British flora* is J. H. Balfour, *Trans. bot. Soc. Edinb.*, **10**, 1870: "Glen Cloy, a fine mountain valley and corry near Brodick . . . The rocks are covered with ferns, such as . . . *Asplenium viride*". ". . . Glen Benlister, near Lamlash, where . . . *Asplenium viride* also occurs sparingly. The station for the latter has been sadly robbed of late".—*Editor*.

Polystichum setiferum in the Clyde area

In May 1967 Mr. K. Thompson found a single plant of this fern growing under a rock in the dense, shrubby vegetation below the cliffs alongside the Marine Station, Keppel, Isle of Great Cumbrae, V.-c. 100. In May 1968 Mr. H. A. McAllister found several plants in a small wood immediately behind the Marine Station. This wood shows evidence of former culti-

vation since it contains several plants (e.g. saxifrages) which must certainly be introduced. *Polystichum setiferum* is not recorded in Fletcher and Martin's *Flora of Great Cumbrae Island* in *Trans. Proc. bot. Soc. Edinb.* **39**. Lee's record of "rare" and "Clyde Isles" in his *Flora of the Clyde Area* (1933) is not specific enough since the *Atlas of the British Flora* (1962) gives it for 10 km. square NS 05 (Bute) "before 1930" but not at all for square NS 15 (Great Cumbrae). However, Henedy's *Clydesdale Flora* of 1891 records the species as "(presumably) native on Bute, Arran, Great Cumbrae and 'glens around Largs'". If the fern is not introduced to Great Cumbrae more recently it has been overlooked for some 70 years. It is now well established and can justifiably be recorded as "at least naturalised".

K. THOMPSON & H. A. McALLISTER

Mr. B. W. Ribbons has shown me a frond of this species found in 1964 growing in woodland at Pollok Castle, V.-c. 76, and I have myself in 1968 seen a plant near Lagg, Isle of Arran, V.-c. 100.—*Compiler*.

Moonwort in Renfrewshire

On 19 June 1968 Miss K. M. Calver, Mr. J. D. Morton, Mrs. M. Little, Mr. J. Watt and I found numerous plants of Moonwort, *Botrychium lunaria*, one to three inches in height, scattered over an area of some 20–30 square yards, at an altitude of 300 feet, on the north-east side of Tower Hill, formerly known as Drumshantie Hill, above Craigmuschet Quarry, Gourrock, Renfrewshire, V.-c. 76. These plants were growing in a dry, well drained area, much trodden by visitors to the hill, and the following species were present in the same area: *Ranunculus acris*, *Cerastium vulgatum*, *Trifolium repens*, *T. pratense*, *Conopodium majus*, *Rumex acetosella*, *Euphrasia officinalis* agg., *Plantago lanceolata*, *Bellis perennis*, *Hypochaeris radicata*, *Leontodon autumnalis*, *Taraxacum* agg., *Festuca rubra*, *F. ovina*, *Dactylis glomerata*, *Cynosurus cristatus*, and *Holcus lanatus*.

On 23 July 1969 Miss K. M. Calver in the company of Mr. R. Mackechnie, Mr. J. Watt and myself, found a single plant of *Botrychium lunaria* in rough pasture near Lilybank at an altitude of 450 feet about a mile west of Port Glasgow and about four and a half miles east of Tower Hill, Gourrock.

Miss E. R. T. Conacher tells me that in July 1937 her late father, Mr. H. R. J. Conacher, showed her *Botrychium lunaria* growing on the Ranfurly Castle Golf Course, Bridge of Weir about one third of a mile east of East Torrs and at an altitude of 350 feet. He saw it also on Whinnaston Braes (10 km. grid square NS 3863) in June 1940 and in May 1944. Miss Conacher, Mr. Mackechnie, Miss A. Laird, Miss A. R.

Miller, Mr. Watt and I after searching for an hour, failed to find it there on 2 July 1969.

On 13 June 1970 Miss Conacher, Mr. P. J. Wanstall, Mr. Watt and I found one plant of *Botrychium lunaria* in turf beside the footpath on the north bank of the aqueduct known as "The Cut" above the former Ravenscraig railway station and about a mile and half south of Tower Hill, Gourrock; and on 16 June 1970 with Miss Conacher and Mr. Watt I found a few plants of *Botrychium lunaria* growing in heathy moorland at an altitude of 570 feet, west of Netherwood and some three and a half miles south-east of the Lilybank locality.

This fern is recorded for Neilston Pad and Gourrock in *A contribution towards a complete list of the fauna and flora of Clydesdale and the west of Scotland* compiled under the auspices of the Society of Field Naturalists, Glasgow (1876) and this is the source of the "before 1930" record for national grid square NS 27 in the *Atlas of the British flora* (1962). Other references are in Hennedy, *The Clydesdale flora* (1878): "hills above Gourrock near the tower"; in Wood, *Annals of the Andersonian Naturalists' Society* (1893): "all the district . . . from Corkindale Law here, over by the Pad, to Hairlaw Dam, abounds both in adder's-tongue and moonwort ferns"; in the list of Renfrewshire plants in the *Transactions of the Paisley Naturalists' Society* (1915) where *Botrychium lunaria* is listed without locality and is not marked "rare"; and in Lee, *The flora of the Clyde area* (1933): "moors above the coast from Gourrock southwards".

Herbarium specimens of *Botrychium lunaria* are in the Art Gallery and Museum, Paisley: Ferneze Braes, June 1894; and the Department of Botany, University of Glasgow: Pilmuir Dam, 7 July 1878, Neilston Pad, A. Hill, June 1890, Commore Dam, R. & T. Wilkie, 23 July 1892 and Misty Law Moor, D. Ferguson, July 1919. Further information would be welcome.

B. W. RIBBONS

FLOWERING PLANTS

Elatine hydropiper, new to Scotland, at Loch Lomond

The summer of 1968 was unusually dry in the west of Scotland and extensive areas of normally inundated muddy ground were, for lengthy periods, exposed near the mouth of the River Endrick, Loch Lomond. In July we found a small plant of *Elatine hydropiper*, the rarer of the two species native in Britain, and not previously recorded from Scotland, growing on this bare mud near Wards, Gartocharn (V.-c. 99). Examination of similar areas near the loch shore between Gartocharn and Balmaha (V.-cs. 86 and 99) revealed further occurrences of *E. hydropiper*, sometimes accompanied by the less rare *E. hexandra*.

It is probable that the apparent rarity of both species in the west of Scotland is due to the infrequency of dry summers which produce the prolonged reduced water levels essential for the proper growth and maturation of *Elatine*, and which enable such small plants to be seen easily.

E. T. IDLE, J. MITCHELL & A. McG. STIRLING

All-seed at Carmyle

In the late autumn of 1968 I found about twenty plants of All-seed, *Chenopodium polyspermum*, growing in a small sand-pit beside a railway at the Clyde Ironworks, Carmyle (V.-c. 77; 10 km. square NS 66) in which the flora was very sparsely distributed. Amongst associated species were *Fumaria officinalis*, the only plant covering the ground, and the remains of a number of poppies, believed to be *Papaver dubium*. In Scotland *Chenopodium polyspermum* is recorded only for a few sites in the south-east coastal area, but it is probably much more plentiful than the records indicate. This is a new vice-county record.

A. A. PERCY

Alder Buckthorn in the upper Forth Valley

Professor G. Bond, in July 1967, saw some trees, 10–15 feet in height, of Alder Buckthorn, *Frangula alnus*, growing on the east verge of the Glasgow to Aberfoyle road a little to the north of Ward Toll. There are five trees spaced at intervals in a thicket of oak and birch, bordering the road for about one hundred yards, alongside a ditch with water in it. This is in Stirlingshire, V.-c. 86, at the extreme western end of Flanders Moss, at an altitude of about 60 feet. Professor K. W. Braid writes that he has no knowledge of *Frangula alnus* occurring in this place.

On 20 August 1967, Mr. John Watt noticed three plants of *Frangula alnus*, the largest being a young bush about eight feet in height, all bearing fruits in the red condition, in the depression of Flanders Moss, Perthshire, V.-c. 87, at an altitude of about 48 feet, through which flows the stream High Moss Pow. The two most distant plants were not more than 50 yards apart. They were growing amongst tussocks of *Molinia caerulea* and *Deschampsia caespitosa*, together with scattered bushes of *Myrica gale* and an occasional plant of *Potentilla erecta* and of *Dryopteris dilatata*. The area is approximately six miles east of the Glasgow–Aberfoyle road.

On 24 July 1968 Professor Bond examined some of the roots of these plants growing in Flanders Moss. They apparently bore no root nodules. Subsequent tests on two samples of soil in which the roots were growing showed the pH to be 3.5.

Clapham, Tutin and Warburg, *Flora of the British Isles* (1962), say *Frangula alnus* is "absent from Scotland". The *Atlas of the British flora* (1962) gives the following records for the 10 km. squares indicated: *Before* 1930: NO 04 (Dunkeld), NS 57 (Milngavie), NX 66 (Woodhall Loch), NX 89 (Thornhill); *1930 onwards*: NH 45 (Contin), NX 46 (Newton Stewart), NX 97 (Dumfries); *Introductions*: NH 95 (Auldearn), NY 38 (Langholm).

The species is not mentioned in Henedy, *The Clydesdale flora* (1878) but other references are in Hooker, *Flora Scotica* (1821): "Callum-wood near Auchincruive, Ayrshire, Mr. Smith"; in Buchanan-White, *Flora of Perthshire* (1898): "*Rhamnus frangula* L., although omitted in Dr. White's MS., was recorded by him as found, on 30 July 1887, near Dunkeld in (89) E. Perth (Proc. P.S.N.S., p. xxiii)"; in the *Glasgow catalogue of native and established plants* (1899): "75 Ayr?, 86 Stirling-Ewing, 98 Argyle-Ewing"; in Sowerby, *English Botany*, (1913): "In Scotland it is known only in Ayrshire and Moray"; in Druce, the *Comital flora* (1932) it is listed for the Scottish vice-counties 72, 73, 75, 78, 86, 89, 91-93, 95, 106!, 107?; and in Lee *The flora of the Clyde area* (1933): "Woods and thickets, very rare. Banks of Avon; Mugdock; Milngavie".

Herbarium specimens are in the Department of Botany, University of Glasgow: Banks of Avon, near Fairholm, 21 August 1926, J. R. Lee (V.-c. 77); Mugdock, Stirlingshire, 16 June 1887, P. Ewing (V.-c. 86); Milngavie, June 1915, D. Patton, *And. Nat. Bot. Excursion* (V.-c. 86?); Clober, Milngavie, 16 June 1915, J. R. Lee (V.-c. 86?); Milngavie, 16 August 1919, J. R. Lee (V.-c. 86?); and marshy ground with *Salix* sp., Loch Achilty, Dingwall, E. Ross, A. M. Stirling (V.-c. 106). This last specimen is presumably the source of the record for 10 km. square NH 45 in the *Atlas of the British flora*.

B. W. RIBBONS

Epilobium alsinifolium in Stirlingshire

On 7 July 1968 I noted a small colony of this alpine plant in a basic flush below the cliffs of the Corrie of Balglass, Campsie Fells, V.-c. 86. As a "Clyde" species it has previously been recorded only in the mountainous north-west region.

J. MITCHELL

New localities for *Bartsia alpina*

In July 1968 Mr. J. Mitchell found several plants of this semi-parasitic alpine species growing on grassy ledges at an altitude of about 2,800 feet on the south side of Beinn Dubhchraig (V.-c. 87). This is a new vice-county record and an addition to the "Clyde" flora.

Late in 1967 Mr. G. Rodway accompanied a group of horticultural students to Ben Lawers in order to introduce them to the nature trail. Reasonable weather encouraged them higher up the hill, where on Lawers proper they found a few plants of *Bartsia alpina*, which Mr. Rodway could not recall having seen there before. This species is said to be "very rare (if not extinct) on Ben Lawers" in Buchanan-White's *Flora of Perthshire* (1898). The Curator of Perth Art Gallery and Museum has kindly searched the herbarium there; it contains no specimen of the plant from the mountain. Mr. A. W. Robson writes that he can find no record of the occurrence of the species on Ben Lawers in the *Trans. Proc. Perthsh. Soc. nat. Sci.* It thus seems certain that Mr. Rodway's record is at least the first for Ben Lawers during the present century.—*Compiler.*

The Bead plant on Clydeside

Some years ago, in company with Mr. David McClintock, I saw this plant, *Nertera granadensis* Druce, for the first time, in the garden of a house (Glenoran) in Rhu (V.-c. 99), where it was a well-established weed. The Bead plant is a small-leaved, mat-forming perennial; in late summer it is profusely covered with orange-coloured fruits, each the size of a pea. It is native in South America, New Zealand and Tasmania, and elsewhere is cultivated in gardens for its showy fruits.

A few years later the same plant was reported from a fairway of the Kelburne golf-course, south of Largs (V.-c. 75). Here we found it, in some quantity, near the edge of a green; it had become a source of annoyance to the ground staff, and had resisted attempts to eradicate it. The greenkeepers were unanimous in denying that it could be a deliberate introduction, but could not suggest how it might have arrived; they recalled that, during the war, American servicemen billeted in the area had been offered the courtesy of the course.

There was no further news of the Bead plant until 1966, when Professor P. W. Brian mentioned to Mr. B. W. Ribbons that it grew on "a number of lawns in Helensburgh", including his own; at the suggestion of the latter I got in touch with Mrs. E. Taggart, of Clyde Bank, Kilcreggan, who very kindly supplied the information which follows. Some 60 years ago the plant (known to her as Coral Berry Moss) grew freely in the grounds of the house Taybank, in Helensburgh. There are now several houses on this site, including the one in which Professor Brian lived, but formerly the *Nertera* was at the opposite corner of the 2-acre feu, and not near the Brians' garden. She had also seen quantities of the plant under the weeds on a disused tennis court, used for growing

vegetables during the war, at Glenoran, Rhu, and in several places at the edge of woodland in the same locality. It is abundantly established in the gardens of two houses (Stanley Lodge and Edendene) at Cove, and from there it was introduced to her own garden at Kilcreggan. She believes that formerly there was "quite an established colony" at Coulport, but recent developments there make investigation difficult.

All the localities named by Mrs. Taggart are in V.-c. 99.

R. MACKECHNIE

Localities for Pyrenean valerian

On 22 June 1967 two pupils of Mrs. M. Hodge, of Eastwood High School, Newton Mearns brought a specimen of Pyrenean valerian, *Valeriana pyrenaica*, to Mr. B. W. Ribbons for identification. They had found it growing on the bank of the burn which flows just outside the wall of Capelrig Estate, Newton Mearns, Renfrewshire (V.-c. 76; 10 km. grid square NS 5457) near to what was the main entrance to Capelrig House, and is now the entrance to Eastwood High School. Some 35 years ago a plant of this species grew by the side of the Patterton-Newton Mearns road (now Capelrig Road); a visit, with Mr. Ribbons, to that locality confirmed that it is in fact the one from which the schoolboys brought their specimen, and that there is now a considerable colony of the plant there.

Mr. A. D. Chisholm found *Valeriana pyrenaica* growing with Wood Stitchwort, *Stellaria nemorum*, near Drumtian Bridge, Killearn, Stirlingshire (V.-c. 86) in 1967 and reports that it was also there in 1968 and 1969.—*Compiler*.

Gallant Soldier in Stirlingshire

On 27 October 1968 Mr. F. G. Rodway and I observed a luxuriant growth of Gallant Soldier, *Galinsoga parviflora*, in fallow nursery ground by the Carronbridge road just north of Kilsyth. The plants were up to a foot tall and still in flower, covering an area of several square yards.

This introduced species is of comparatively rare occurrence in Scotland, though not uncommon as a garden weed in the south of England. It seems likely that the Kilsyth plants resulted from the introduction of seed in the soil accompanying imported bedding plants.

A. McG. STIRLING

Groundsel with ray florets

During 1958, near Kilwinning railway station sidings (V.-c. 75) I observed some unusual specimens of groundsel,

Senecio vulgaris, with ray florets round the edge of each capitulum. On presenting two of these plants to the Royal Botanic Gardens, Edinburgh, I was informed that they were *S. vulgaris* var. *radiatus*.

Recently, while collecting material for the flower table at the Glasgow Museum, I found the same variety in abundance at Glengarnock railway sidings in the same vice-county; here it was well-established, and apparently spreading rapidly. Elsewhere I have seen this plant at Easter Road, Edinburgh (V.-c. 83).

R. PRASHER

In *Watsonia*, 6, 280, Mr. D. E. Allen distinguishes two radiate varieties of groundsel. One, which differs from the common garden weed in stem and leaf characters, and in hairiness, as well as in the possession of ray florets, is confined to a few maritime habitats (dunes, cliffs and sandy fields) in England; this is var. *denticulatus* (O.F. Müell.) Hyland. The other, var. *hibernicus* Syme, is separable from the common plant only by its ray florets, and is a plant of disturbed ground and waste places in inland localities. Mr. Prasher agrees that his Ayrshire and Edinburgh specimens belong to the latter variety. More recently, in *Watsonia*, 8, 47, Messrs. P. Crisp and B. M. G. Jones remark that var. *hibernicus* tends to occur only after *S. squalidus*, the Oxford Ragwort, has been recorded in the same locality.—*Compiler*.

The Lochside Michaelmas daisy

Aster macrophyllus has been recorded in, at least, *Rep. bota Soc. Exch. Club Br. Isl.*, 9, 712, Lee: *The flora of the Clyde arel* (1933) and *Flora of the British Isles* (1952 & 1962), from Renfrewshire (V.-c. 76). This is based on the discovery of a well-established patch, 20 feet square, on a bank at Lochside railway station. It was found on an excursion of the Andersonian Naturalists' Society in August 1922 which Robert Grierson, the Irish specialist in aliens, attended. The plant was subsequently named *A. macrophyllus* at Kew, but the specimen is not now to be found there.

In the company of Messrs. R. Prasher and R. Mackechnie I collected some material from the site on 15 October 1964 and on 31 July 1965, sent it for drawing to Miss K. Hollick. In the course of examining her drawing, and of growing plants, I noticed that this species had whitish-grey florets and eglandular inflorescences. This seemed to put it to *A. schreberi* Nees, *A. macrophyllus* having purple rays and normally glandular inflorescences. Dr. P. Yeo at Cambridge agreed, and Mr. C. Jeffrey at Kew reached the same conclusion. I am grateful to both of them for their assistance.

Mr. Jeffrey told me of a specimen at Kew labelled: "Parkwood, Swanley, Kent. Naturalised and spreading; coll. F. R. Browning, 14. viii. 1964"—this from V.-c. 16. He wrote that this plant was glandular and appeared to be true *A. macrophyllus*. Mr. Browning (*in litt.*) told me it grew on the way through to Farningham Woods, but his notes gave no more precise information. On 6 August 1967, by kind permission of the Principal, I searched the grounds at Parkwood, but saw no sign of any Michaelmas daisy.

Both these species are natives of North America. *A. macrophyllus* is included in the Royal Horticultural Society's *Dictionary of Gardening* (1951), but I personally have never seen or heard of either in cultivation nowadays. They are, however, not unattractive, and have the advantage of colouring the difficult "August gap".

How good a wild plant this Michaelmas daisy is in its single station at Lochside, is a matter of opinion, but its name is not. It should be *A. schreberi* Nees, and *A. macrophyllus* needs deleting from the British list, at least until such time as it is rediscovered at Swanley, or found elsewhere, in a naturalised state.

D. McCLINTOCK

There is a specimen in the herbarium of the Department of Botany, University of Glasgow, from Lochside, 26 June 1933, probably collected by J. R. Lee. It has an eglandular inflorescence.—*Editor*.

***Leontodon taraxacoides* in man-made habitats**

Leontodon taraxacoides is a comparatively uncommon plant in Scotland, occurring as a native in light soils, usually near the sea. It is therefore of interest that during the past seven years I have on three occasions observed it in widely separated localities growing on ground which had comparatively recently been disturbed in the course of civil engineering works, twice on the sites of hydro-electric dams, and once on bare, disturbed ground resulting from a road-widening scheme. The dam sites were at Loch Sloy, Dunbartonshire (V.-c. 99), and at Cluanie Dam, Inverness-shire (V.-c. 96). The roadside site was near Fasnakyle, Glen Affric (also V.-c. 96). The number of plants observed at each site varied from less than a dozen in Glen Affric to several hundreds at Cluanie. It seems probable that the introduction of seeds, either through the agency of vehicle wheels or, more likely, materials (e.g. sand) imported to the sites, was responsible for the establishment of the plant in these locations.

A. McG. STIRLING

Blue-eyed grass in the Clyde area

In early June 1968, Mr. A. A. Percy found some seventy plants of Blue-eyed grass, *Sisyrinchium bermudiana*, growing amongst grass alongside a path through waste land adjoining the Clyde Ironworks at Carmyle (V.-c. 77; 10 km. grid square NS 66). There are a few records of this species in Scotland and it has already been recorded for an adjacent square. Mr. Percy thinks these plants have not previously been noticed due to their inconspicuousness when not in fruit or flower as the winged flower stalk resembles a grass blade and, at a casual glance, would not easily be distinguished from the surrounding grass.

One or two small groups of this plant were found by Mrs. M. C. Palmar in flower near Carradale, Kintyre (V.-c. 101) during the first fortnight of June 1953. The habitat was damp grassland close to the shore, at a point approximately 100–200 yards north of Port Righ.

I found a small colony on 18 June 1940, in a marshy area near Clarkston, Renfrewshire (V.-c. 76), and know of no records from the Clyde area other than those published here.—*Compiler.*

An orchid new to Scotland

On 26 June 1967 I found a colony of a puzzling marsh orchid, two specimens of which I sent to Kew, where they were determined by Mr. P. F. Hunt as *Dactylorhiza traunsteineri* (Sauter) Soó. The plant grows in some quantity in base-rich grassland intersected with flushes, at an altitude of about 500 feet, the locality being on the south bank of the River Lussa, Achnamara, Knapdale, Argyll (V.-c. 101). Associated species include *Selaginella selaginoides*, *Eriophorum latifolium*, *Schoenus nigricans*, and *Saxifraga aizoides*.

This orchid has a general resemblance to a form of *Dactylorhiza incarnata* with dull purple flowers, but is easily distinguished by the strongly ring-marked leaves. It is somewhat rare in Britain, occurring in base-rich fens in Berkshire, West Norfolk, Caernarvon, Anglesey, Clare, Kildare, Wicklow and West Meath. This appears to be the first reported occurrence of the species in Scotland.

A. G. KENNETH

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DIGEST OF THE PROCEEDINGS OF THE SOCIETY 1967-1969

10TH JANUARY, 1967

Mr. R. H. Johnstone presided over a meeting held in the University of Strathclyde. About 42 were present.

One new member was elected: W. Rankin, M.B., F.R.C.S., 25 Kingsborough Gardens, W.2.

The President delivered an address "Productive natural history" (see page 463).

14TH FEBRUARY, 1967

The thirty-seventh Annual General Meeting was held in the Department of Botany, University of Glasgow. About 48 members were present and the President, Dr. Stephen A. Hutchinson, presided.

Reports of the activities during 1966 were read, new office-bearers were elected (see page 590) and appointments made by Council were announced. The Report of Council stated that the total membership was 257 (33 joined, 29 resigned and 14 were removed from the Roll); ten meetings were held with an average attendance of 38; thirty excursions took place (11 botanical, 6 zoological, 10 ornithological and 3 geological); the Botanical Section held one meeting jointly with the Botanical Society of Edinburgh, the Glasgow University Botanical Society and the University of Strathclyde Biology Club on 9 December when Professor E. J. H. Corner of the University of Cambridge, lectured on the fig leaf; two meetings of the educational section were held; the Council met three times and the Executive Committee seven times. Dr. Stephen A. Hutchinson presided at the Annual Dinner held on 15 December 1966, in the University of Glasgow in honour of Dr. S. M. K. Henderson, Director of Museums and Art Galleries, Glasgow. Dr. T. D. M. Roberts delivered the Schools' lecture on 2 June—How animals move. The President and Council gave a party for new members on 8 February, 1966. No issue of the Bulletin appeared during the year.

One new member was elected: J. D. Scobie, F.F.A. R.C.S., 7 Balmuildy Road, Bishopbriggs.

14TH MARCH, 1967

Dr. Elsie Conway presided over a meeting held in the University of Strathclyde. About 37 were present.

Mr. R. Mackechnie and Mr. A. McG. Stirling lectured with coloured illustrations on the C.S.S.F. field meeting held in Norway in 1963.

An exhibit was shown by Mr. R. Prasher.

11TH APRIL, 1967

Mr. C. E. Palmar presided over a meeting held in the Department of Botany, University of Glasgow. About 40 were present.

Five members shewed coloured slides, Mr. E. C. D. Todd shewed a film and the Chairman played recordings of bird songs.

9TH MAY, 1967

Dr. Elsie Conway presided over a meeting held in the Department of Botany, University of Glasgow. About 24 were present.

One new member was elected: Mrs. Margaret C. McGarva, 70 Grant Street, C.3.

Dr. J. W. H. Lawson of the University of Glasgow gave a lecture entitled "Insects at home."

15TH JUNE, 1967

Dr. Roy A. Crowson presided over a meeting held in the University of Strathclyde. About 30 were present.

One new member was elected: Peter Macpherson, L.R.C.P.S., D.T.C.D., 15 Lubnaig Road, S.3.

Mr. D. Gray of Glasgow lectured on filming small mammals and shewed four short films.

12TH SEPTEMBER, 1967

Mr. A. A. P. Slack, on behalf of the President, held a Reception in the Glasgow Museum and Art Gallery, Kelvingrove. About 50 were present and 14 members arranged exhibits.

10TH OCTOBER, 1967

Dr. Elsie Conway presided over a meeting held in the University of Strathclyde. About 42 were present.

One new member was elected: Miss Janet Laing, 51 Stamperland Gardens, Clarkston.

One family member was elected: Mrs. Agnes C. Macpherson, 15 Lubnaig Road, Newlands.

Four school members were elected: Barbara C. M., Elspeth L. S., Gillian A. C. and Lorna M. D., Macpherson, 15 Lubnaig Road, Newlands.

Mr. A. A. Percy, General Secretary, lectured on grass, man and brain.

14TH NOVEMBER, 1967

Dr. Elsie Conway and Mr. B. Preston presided over a joint meeting with the Clyde Area Branch of the Scottish Wild Life Trust held in the University of Strathclyde. About 60 were present.

Five new members were elected: Mrs. June Hunter, 66 Tannadice Avenue, S.W.2.; Mrs. Shona J. Paton, 43 Moulin Road, S.W.2.; John M. Scott, 10 Hartfield Gardens, Dumbarton; J. Wilson and Mrs. J. Wilson, 146 Terregles Avenue, S.1.

Mr. J. I. Waddington, Director of the Clyde River Purification Board gave a lecture entitled: "The Clyde at present and in the future".

12TH DECEMBER, 1967

Dr. Elsie Conway presided over a meeting held in the University of Strathclyde. About 50 were present.

One new member was elected: Miss J. F. Wilson, 44 Oronsay Crescent, Bearsden.

Mr. R. Mackechnie, Mr. B. W. Ribbons and Mr. A. McG. Stirling lectured with coloured illustrations on the Pyrenees.

9TH JANUARY, 1968

Dr. Elsie Conway presided over a meeting held in the Department of Botany, University of Glasgow. About 29 were present.

Two junior members were elected; Robert R. Mill, 2 Courtrai Avenue, Helensburgh; and David J. Henderson, 32 George Street, Helensburgh.

Dr. A. Hopkins of the University of Glasgow lectured on the parasites of freshwater fish in the Glasgow area.

13TH FEBRUARY, 1968

The thirty-eighth Annual General Meeting was held in the Department of Botany, University of Glasgow. About 39 members were present and the President, Dr. Elsie Conway, presided.

Reports of the activities during 1967 were read, new office-bearers were elected (see page 591) and appointments made by Council were announced. The report of Council stated that the total membership was 245 (16 joined, 21 resigned, and 7 were removed from the Roll); ten meetings were held with an average attendance of 42; thirty-six excursions took place (2 general, 11 botanical, 7 zoological, 6 geological, 9 ornithological and 1 joint botanical and zoological); the Botanical Section held two meetings jointly with The Botanical Society of Edinburgh, the Glasgow University Botanical Society and the University of Strathclyde Biology Club (on 15 March when Dr. F. H. Whitehead of the University of London lectured on the role of morpho-regulators in plant adaptation and their importance to agriculture; and on 15 November when Professor J. G. Hawkes of the University of Birmingham lectured on Botanical explorations in Argentina); one meeting of the educational section was held; the Council met three times and the Executive Committee six times. Dr. Elsie Conway presided at the Annual Dinner held on 14 December, 1967, in the University of Glasgow in honour of Dr. Stephen A. Hutchinson, T.D., B.Sc., Ph.D., F.R.S.E., Ex-President. Professor P. W. Brian delivered the Schools' lecture on 1 June—Health and disease in plants. The President and Council gave a party for new members on 14 February 1967. One issue of the Bulletin was sent to members during the year.

Three new members were elected: Miss Wilma W. Fernie, R.G.M., S.C.M., R.M.N., 90 Marlborough Avenue, W.1; Mrs. S. G. Hoey, 115 Balshagray Avenue, W.1; and Mrs. Florence W. Williams, B.Sc., 27 Lindsay Place, W.2.

The films *Water in biology* and *The living environment* were shown.

12TH MARCH, 1968

Dr. Elsie Conway presided over a meeting held in the Department of Botany, University of Glasgow. About 42 were present.

Five new members were elected: Douglas and Mrs. Grace C. Clement, 56 Stamperland Drive, Clarkston; J. R. and Mrs. J. R. Neilson, 151 Whitehill Street, E.1; and Mrs. Angela Watson, c/o McKay, 1070 Maryhill Road, N.W.

Dr. Joy Tivy of the University of Glasgow lectured on aspects of land use in the U.S.A.

9TH APRIL, 1968

Dr. Elsie Conway presided over a meeting held in the University of Strathclyde. About 45 were present.

Three new members were elected; J. M. Ayerst, 28 Invercargill, Westwood, East Kilbride; and W. and Mrs. W. Irvine, 409 Great Western Road, C.4.

Mr. R. Mackechnie presided over a display of coloured slides from ten members.

7TH MAY, 1968

Dr. Elsie Conway presided over a meeting held in the Department of Botany, University of Glasgow. About 48 were present.

One new member was elected: Frank Bennett, B.Sc., Planning Department, Renfrew County Council, 9 Glen Street, Paisley.

Dr. F. H. Perring, Director of the Biological Records Centre, lectured on the work of the Centre.

17TH SEPTEMBER, 1968

Dr. Elsie Conway held a Reception in the Glasgow Museum and Art Gallery, Kelvingrove. About 75 were present and 14 members and others arranged exhibits.

16TH OCTOBER, 1968

Dr. Elsie Conway and Mr. R. G. Frame presided over a joint meeting with The Botanical Society of Edinburgh, the Glasgow University Botanical Society and the University of Strathclyde Biology Club in the Department of Botany, University of Glasgow. About 55 were present.

Dr. W. T. Stearn of the British Museum (Natural History) lectured on Linnaeus and his botanical opponents.

9TH NOVEMBER, 1968

A botanical exhibition, lecture and soirée were held in the University of Glasgow in conjunction with the Committee for the Study of the Scottish Flora. Dr. Elsie Conway and Mr. R. Mackechnie, Chairman of the C.S.S.F., presided. Twelve exhibits and a number of sets of coloured slides were displayed (see *Watsonia*, **8**, part 1). Mr. J. F. M. Cannon and Mr. E. B. Bangerter of the British Museum (Natural History) gave an illustrated account of the survey of the flora and vegetation of Mull being carried out by the British Museum. About 100 were present.

Six new members were elected: A. G. Borland, Invercloy, 2a Stirling Drive, Bearsden; Mrs. Rose Greaves, 216 Woodlands Road, C.3; Miss Hellen M. Mackenzie, 90 Colchester Drive, W.2; Miss M. B. F. Small, 525 Alexandra Parade, E.1; Miss C. J. O'Sullivan, 295 Crow Road, W.1; and Miss L. J. Stewart, 54 Underwood Road, Burnside, Rutherglen.

3RD DECEMBER, 1968

Dr. Elsie Conway presided over a meeting held in the University of Strathclyde. About 55 were present.

One new member was elected: M. J. Leech, 57 Cornwall Street, S.1.

Dr. J. T. MacConnell of the Paisley College of Technology gave an illustrated lecture entitled "Sisal, ruins and Mayas in Yucatan".

ACKNOWLEDGEMENT

The Andersonian Naturalists of Glasgow is indebted to the University of Glasgow for a generous financial grant which has been used towards the cost of publishing this part of *The Glasgow Naturalist*.

ROLL OF THE ANDERSONIAN NATURALISTS OF GLASGOW

(As at 31 December, 1969; any errors should be reported to the Treasurer)

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NOTES

1. With the exception of the contributions marked * on pages iii-vi, titles and authors' names only are, in general, indexed, although records of species are, as far as possible, referred to the appropriate Watsonian Vice-county, grouped—where they are numerous—under the headings: amphibians, birds, fish, flowering plants, flowerless plants, invertebrates, mammals, reptiles.

2. The index includes the names of places, persons and species contained in the contributions marked * on pages iii-vi, save that in the *Proceedings* the names of new members are omitted.

3. Organisms are indexed by their scientific names only except where these are not in the text.

4. Watsonian Vice-county names are in capital letters.

5. Figures in brackets are Watsonian Vice-county numbers and these are given wherever appropriate.

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