An overlooked boreal clubmoss *Lycopodium lagopus* (Laest. ex Hartm.) Zinserl. ex Kusen. (Lycopodiaceae) in Britain

F. J. RUMSEY*

Dept. of Botany, Natural History Museum, Cromwell Road, London SW7 5BD

ABSTRACT

Lycopodium lagopus (Laest. ex Hartm.) Zinserl. ex Kusen. (syn. *L. clavatum* L. subsp. *monostachyon* (Grev. & Hooker) Selander), a widespread circum-arctic taxon, is reported from Britain for the first time. First collected in the 19th century, it had been dismissed as *L. clavatum* and its significance not recognised. The appropriate taxonomic rank for this plant has long proved controversial but where sympatric with *L. clavatum* it apparently maintains its distinctions, supporting the view that it deserves specific rank. Its current status and British range are unclear but it is considered likely to be extremely localised and as an arctic disjunct element in our flora facing at least as great a threat as its declining lowland counterpart, not least through global warming and upland management practices.

KEYWORDS: *Lycopodium clavatum* subsp. *monostachyon*, Cairngorms, Arctic Stag's-horn Clubmoss, v.c. 96, v.c. 97.

INTRODUCTION

During routine study of herbarium material at **BM** associated with the production of a revised checklist of the Pteridophyte flora of the British Isles and Ireland (Rumsey, *in prep*.), and the B.S.B.I. hybrids project, two specimens of what were recognised as the boreal form of Stag's-horn Clubmoss (*Lycopodium clavatum* L. *sensu lato*) were detected. This plant was initially described as a variety of *L. clavatum* from Canada, under the name var. *monostachyon,* by Greville and Hooker (Hooker 1831) and independently from Scandinavia as var. *lagopus* by Laestadius (Hartman 1858); it was still treated at this rank by Rothmaler in the first edition of Flora Europaea (Tutin *et al*. 1964). More recently the consensus view has seen its elevation to subspecies, e.g. Jermy in Tutin *et al*. (1993), Øllgard & Tind (1993), Kukkonen in Jonsell (2000), but frequently with indications that specific rank might be more appropriate. However, amongst the recent major floras, only Wagner & Beitel (1993) in their account for the Flora of North America have accorded it specific status, a rank first published by Kuseneva (1953).

In spite of the massive historical interest in Pteridophytes in the British Isles, this taxon would seem to have gone un-noticed here. The club-mosses were certainly less regarded than the ferns during the Victorian fern craze, perhaps as they were less amenable to cultivation and were not treated in the majority of the fern works of the period. We thus have fewer descriptive accounts of minor morphological variants than with the true ferns, many of which have proved to be worthy of higher taxonomic rank, or have been shown to be of hybrid origin. Subsequently the failure to detect this taxon may, in part, be down to its controversial and lowly varietal status, inaccessibility of extra-British literature, and that common failing, our failure to look critically at apparently distinctive plants that require little effort to identify. In these respects it closely mirrors our treatment of another critical Boreal clubmoss *Huperzia selago* (L.) Bernh. ex Schrank & Mart. subsp. *arctica* (Grossh. ex Tolm.)Á. & D. Löve (Corner *et al.* 1998).

DISTRIBUTION

Lycopodium lagopus (Laest. ex Hartm.) Zinserl. ex Kusen. (Arctic Stags-horn Clubmoss) has an Arctic circum-polar distribution and is also recorded in the Swiss and Austrian Alps and in the High Tatras in the Carpathians (Dostál 1984). In the sub-arctic it is a common plant of well-drained base-poor tundra slopes in nutrient-poor dwarf-shrub heath, sub-alpine birch forest and rather dry coniferous woodland. In the Scandes it entirely replaces *L. clavatum* in the north, becoming less frequent as one proceeds south but extending to southern Norway (Aust-Agder) and as far south

*e-mail: F.Rumsey@nhm.ac.uk

as Dalarna province in central Sweden (Kukkonen 2000). It is frequent in Northern Finland south to Kainuu province and then extends at similar latitudes in a zone of fluctuating width of 2–5° on the meridian throughout the Soviet arctic (Griffiths & Packer 1995), along the Bering Coast of Alaska into North America and Canada. It is also present in S.W. Greenland. In North America it extends as far south as southern Michigan (Wagner & Beitel 1993), again replacing *L. clavatum* in the north and with only a limited zone of sympatry, as also noted for the Soviet Arctic. In these contact zones may be found transitional plants with peduncles longer than their solitary strobili.

IDENTIFICATION

The two taxa most noticeably differ when fruiting: *L. clavatum*, the widespread lowland plant has a long main fruiting axis, or peduncle which is >2·5 cm at maturity. It usually bears two, or more, strobili, each on short branches (pedicels) at the apex of the peduncle. In contrast, *Lycopodium lagopus* (Laest. ex Hartm.) Zinserl. ex Kusen. has strobili that are borne singly, and are sessile, or on a short peduncle (usually in British material <1cm long).In very rare instances when two cones are formed, these are borne directly on the peduncle apex, i.e. are non-pedicellate. Wagner & Beitel (1993) also comment that the sporophylls of *L. lagopus* are less abruptly contracted to a point than are those of *L. clavatum*. The growth forms of both taxa are broadly similar but the boreal taxon has a more congested habit, its branches upright and less obliquely spreading and with more marked annual growth zones. The foliage of the boreal plant is also more appressed or incurved and not loosely spreading. The microphylls are shorter, narrower and with less prominent hair tips, which may be more caducous and thus similar to *L. annotinum,* with which it often grows. Wagner & Beitel (1993) suggest that the microphylls of *L. lagopus* are more toothed than the generally entire microphylls of *L. clavatum* but a random selection of Scottish examples of *clavatum* was indistinguishable from the British *lagopus* in this respect, all showing some minute denticulation. Many of these characters, however, are somewhat plastic and under a degree of environmental control, e.g. with greater exposure in montane environments *L. clavatum* shows dwarfing generally and greater microphyll appression and the yellower colour typical of the boreal plant. Similar plasticity of *lagopus* towards the *clavatum* expression might be expected in its warmest, most mesic environments. As the modifying influence of the environment remains unstudied, the taxonomic status of the boreal plant continues to prove controversial and must still remain to an extent unresolved awaiting genetic and other research. It is reported that the morphological distinctions appear less than clear-cut in some parts of its broad zone of sympatry in the Scandes, particularly the more oceanic areas (Kukkonen 2000). Intermediates (with longer peduncles but single coned) are most frequent in this zone of sympatry at the southern extremity of the Scandinavian range of *L. lagopus*; whether these plants represent hybrids, the fertility of which is unknown, or perhaps, in some cases, extreme environmentally-induced expressions of the boreal taxon, is unclear. All authors, however, agree that these "races" maintain their distinctions where growing together under uniform conditions and this is our most compelling evidence to suggest that they should be regarded as distinct species.

TABLE 1. CHARACTERS DISTINGUISHING *LYCOPODIUM LAGOPUS* AND *L. CLAVATUM* (BASED ON BRITISH MATERIAL)

Character	*L. lagopus*	*L. clavatum*
Strobilus number	1(–2)	(1–)2–3(–5)
Peduncle length	0–12 mm	25–)30–70(–130) mm
Microphyll length (minus hair point)	3–5 mm long	4–6 mm long
Microphyll posture	ascending to incurved appressed	spreading to ascending
Lateral branching	± upright	oblique, spreading

The presence of a single strobilus alone should not be taken as sufficient confirmatory evidence, as *L. clavatum* may also produce occasional single strobili (although generally other fertile branches will show the more normal number); only where this character is coupled with the very short, or absent peduncle can one be certain. Single coned plants should however be treated with interest, as well as caution, and their spores should be examined for signs of abortion, indicative of hybridisation.

LYCOPODIUM LAGOPUS IN BRITAIN

L. lagopus was apparently first collected in the British Isles by E. S. Marshall in 1896. (Garbh Bheinn, Fersit Forest – at 2,800 ft, v.c. 97 W. Inverness 24/7/1896 **BM**) Unfortunately this is one of several mountains of this name, however, the addition of the phrase Fersit Forest by Marshall would seem to indicate that the peak at NN3571 is intended. The specimen is without information as to habitat, or associates, but from the stated altitude must have been collected from close to the summit (858 m alt.). The material has more the appearance of *L. annotinum* with its sessile strobili (peduncles 0–12 mm, mean 4 mm) and in the texture of its foliage, the characteristic hair points of which have largely been lost from all but the newest growth. This caducous character is also demonstrated by *L. clavatum s. stricto* in Western North America, where it is regarded as characteristic of what has been called var. *integrifolium* Goldie.

The second site for *L. lagopus* was detected more recently (v.c.. 96 Easterness, E. Side of Geal Carn, Glen Feshie (Cairngorms NNR) NGR. NH888008, 2,800 ft. AC J[*ermy*] 10801. [*1st Aug.*] 1974 **BM**). Geal Carn was visited by Clive Jermy in1974 in an attempt to relocate *Diphasiastrum* × *issleri* (Rouy) J. Holub, collected here by Wheldon & Wilson in the 1890s (Jermy in Wigginton 1999). This was not located on the 1974 visit but was refound subsequently in 1991 at a slightly lower altitude (810 m) than that given for the *L. lagopus* specimen. Indeed if the grid reference cited is accurate then the specimen may be from closer to 880 m than the c. 853 m indicated on the label and again on gentle slopes close to a summit plateau. It was recorded as growing in *Calluna* (*Arctostaphylos-Empetrum*) heath with *Lycopodium annotinum* and *Diphasi*[astr]*um alpinum.* Significantly both sites fall above the 840 m alt. altitudinal limit of *Lycopodium clavatum* given in Preston *et al*. (2002).

Aside from the disjunct high Alpine and Carpathian localities reported for this species, the Scottish sites represent the most southerly occurrences of this essentially sub-arctic taxon, but phytogeographically similar disjunctions provide some of the most interesting and enigmatic plants of our montane flora. Most of these taxa have been detected comparatively recently, e.g. *Diapensia*, *Artemisia norvegica*, etc. and this is even more apparent with our bryophytes, e.g. *Marsupella arctica* (Long *et al*. 1990). Indeed it is perhaps more remarkable that similarly distributed plants, such as *Phyllodoce caerulea,* were detected so early. These plants have scattered locations on rather acidic and thus less well botanised Scottish mountain summits, which in spite of their comparatively low altitude support a surprisingly rich arctic flora because of their climatic severity.

It is probable that further sites for this taxon will be found in the Scottish highlands now that its distinguishing features have been demonstrated, but it is unlikely that it will prove to be anything other than rare. With continuing high levels of upland grazing, and poorly managed muir-burn, both of which strongly impact clubmosses in particular, and a general regression of our arctic flora through climatic change, it is likely that this species is under threat, but with our present state of knowledge we can only assign it an IUCN DD (Data deficient) category pending further research.

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