

Equisetum hiemale L. found in Greenland

F.J.A. DANIËLS & C.M. VAN HERK

Department of Plant Ecology, Utrecht

ABSTRACT: *Equisetum hiemale* L. is recorded as new to Greenland, where it was found in 1981 in the coastal part of the Angmagssalik District, Southeast Greenland. Its habitat is described and the occurrence of the species is discussed. The species is considered indigenous in Greenland and immigrated from Iceland.

Following previous phytosociological research in the Angmagssalik District, Southeast Greenland (cf DANIËLS 1975, 1982, MOLENAAR 1974, 1976, DANIËLS & MOLENAAR 1970) more detailed plant ecological studies were carried out in the summer of 1981 in the surroundings of the town of Angmagssalik. This Greenland expedition proved again that it is still possible nowadays to make interesting finds of vascular plants, even in such a relatively well known area (cf. also KRUISE 1912, BÖCHER 1933, 1938, 1956, ELSLEY & HALLIDAY 1971, KLIIM-NIELSEN 1971).

During one of our field trips we came across a locality with abundant *Equisetum hiemale* L., hitherto not known to occur in Greenland. The Flora of Greenland (BÖCHER et al. 1978) only mentions robust *Equisetum* plants in Qagssiarsuk, Igaliko Fjord, South Greenland, which look like *Equisetum hiemale* L. These plants have a relatively small central stem cavity and only 10-12 stem ribs and are possibly hybrids between *Equisetum variegatum* and *E. hiemale* L. The plants from the Angmagssalik District, however, definitely belong to *Equisetum hiemale* L. Specimens have been deposited in the herbaria of U. and C.

SOME CHARACTERISTICS OF THE PLANTS

The plants have a more or less tuft-like appearance. They have rhizomes from which 2-6 stems emerge close together. The stems are about 20 cm long, with 20 or so pronounced ribs with 2 rows of silica dots. Several stems have strobuli of about 1 cm length, but very few ripe sporangia were found. The ratio of stem cavity to stem diameter is well over 2/3. Most of the teeth of the stem sheaths are absent. We have compared the plants with those from

other areas and conclude that no significant differences exist between the Southeast Greenland plants and European plants of *E. hiemale*.

LOCALITY AND HABITAT

The species was found abundantly about 5 km WNW of Angmagssalik. It grows in an area of about 100 by 60 m on the lower part of the southern slope of the Æmangâq (Præstefjeld, 633 m) mountain ridge, between 150 and 200 m altitude. The precise location is 66°37.5'N., 37°42'W.

Although situated not far from the coast the locality has some continental features. It is sheltered against the moist southern sea winds by the southern outer mountain ridge of the Angmagssalik Island formed by the mountains Ungutoq (985 m), Ymer Bjerg (809 m) and Sømandsfjeldet (718 m). The Præstefjeld itself protects the locality against the cold northern winds. As a consequence the southern slopes of the Præstefjeld have a comparatively warm and dry mesoclimate.

The vegetation also shows some continental features. Both the *Rhododendro-Vaccinietum microphyllii* Daniëls 1982 and the *Sphagno-Salicetum callicarpaeae* Daniëls 1982, which are until now (almost) completely restricted to and common in the inland of the District (DANIËLS 1982) were found at the *Equisetum hiemale* locality. Unfortunately climatic data on the locality do not exist. Angmagssalik, a low arctic-oceanic station, has 981 mm precipitation per year and a mean July temperature of 7°C (1961-1965) (DANIËLS 1982). The bedrock in the southern part of the Angmagssalik Island consists mainly of charnokite (WRIGHT et al. 1973).

Equisetum hiemale thrives abundantly in both species-rich dwarf shrub communities on moist, peaty soil and in (open) low willow shrub vegetation on humus-poor, dry soil. The following 3 relevés give an impression of these community stands and their habitat. Nomenclature of species follows DANIËLS (1982). The plantsociological scale used is after HELD & HELD (1979).

Relevé nr. 1, d.d. 04-08-1981:

Vaccinium microphyllum - *Phyllodoce coerulea* dwarf shrub heath just beneath a rock wall over which water trickles down during most part of the vegetation season.

Sample plot surface 1 x 3.5 m; total cover % vegetation 70-75%; height 20 cm; exp. SW, slope 55°.

<i>Equisetum hiemale</i>	2a.3 fl.	<i>Gymnocarpium dryopteris</i>	1.2 v.
(ca. 400 stems)		<i>Juncus trifidus</i>	1.2 fl.
<i>Vaccinium microphyllum</i>	3.3 v.	<i>Tofieldia pusilla</i>	1.2 fl.
<i>Phyllodoce coerulea</i>	2a.3 fl.	<i>Poa alpina</i> var. <i>vivipara</i>	1.2 fl.
<i>Salix callicarpaea</i>	2a.3 fr.	<i>Chamaenerion latifolium</i>	1.2 v.
<i>Alchemilla filicaulis</i>	2a.3 fl.	<i>Campanula gieseckiana</i>	1.1 fl.
<i>Thalictrum alpinum</i>	2m.2 fl.	<i>Pinguicula vulgaris</i>	1.2 fl.
<i>Carex scirpoidea</i>	2m.2 fl.	<i>Selaginella selaginoides</i>	1.1 v.
<i>Polygonum viviparum</i>	1.2 fl.	<i>Bartsia alpina</i>	+2 fl.
		<i>Empetrum hermaphroditum</i>	+1 v.

<i>Sedum rosea</i>	+2 fr.	<i>Veronica alpina</i>	r.1 fl.
<i>Erigeron uniflorus</i>	+1 fl.	<i>Harrimanella hypnoides</i>	r.1 fl.
<i>Silene acaulis</i>	+3 fl.	<i>Anthelia juratzkana</i>	1.3
<i>Sedum annuum</i>	+1 fl.	<i>Pohlia nutans</i>	+3
<i>Chamaenerion angustifolium</i>	+2 kn.	<i>Desmatodon latifolius</i>	r.3
<i>Veronica fruticans</i>	+1 fl.	<i>Meesia uliginosa</i>	r.3
<i>Saxifraga aizoides</i>	+1 kn.	<i>Bryum elegans</i>	r.3
<i>Saxifraga oppositifolia</i>	+3 fr.	<i>Bartramia ithyphylla</i>	r.3
<i>Salix herbacea</i>	+1 v.	<i>Lophozia alpestris</i>	r.2
<i>Viscaria alpina</i>	r.1 fl.	<i>Cladonia lepidota</i>	r.1
<i>Platanthera hyperborea</i>	r.1 fl.	<i>Pertusaria oculata</i>	r.3
<i>Taraxacum croceum</i>	r.1 fl.	<i>Stereocaulon alpinum</i>	r.1

This community is intermediate between the Phyllodoco-Myrtilion Nordh. 1943 and the Ranunculo-Oxyrion Nordh. 1943 em. Dahl 1957. The soil is moistured during most of the vegetation period and probably not very poor. The community is chionophytic and has a comparatively warm microclimate.

Relevé nr. 2, d.d. 04-08.1981:

A very open *Juncus trifidus* - *Salix callicarpaea* vegetation on a mobile scree.

Sample plot surface 1 x 1.5 m; total cover % vegetation 7; cover % gravel and stones 50; height of vegetation 15 cm; exposition SW; slope 45°.

<i>Equisetum hiemale</i>	2m.3 fl.	<i>Luzula spicata</i>	r.2 v.
(ca.100 stems)		<i>Pohlia spec.</i>	+1
<i>Juncus trifidus</i>	2m.3 fl.	<i>Stereocaulon spec.</i>	+1
<i>Salix callicarpaea</i>	1.3 fr.	<i>Cladonia bellidiflora</i>	r.2
<i>Poa arctica</i>	+2 fl.	microlichen	r.2
<i>Viscaria alpina</i>	+1 v.		

This community is very common on mobile screes with humus-poor and dry sand. With stabilization of the substrate the community develops into the Festuco-Salicetum callicarpaeae chamaenerietosum Daniels 1982.

Relevé nr. 3, d.d. 04-08-1981:

A relatively dense *Salix callicarpaea* dwarf shrub vegetation on a stable slope.

Sample plot surface 1 x 1.5 m; total cover % of vegetation 50; cover % litter 50; height of vegetation 20cm; exposition SW; slope 15°.

<i>Equisetum hiemale</i>	2m.3 fl.	<i>Poa alpina</i> var. <i>vivipara</i>	r.1 fl.
(ca. 200 stems)		<i>Carex bigelowii</i>	r.1 v.
<i>Salix callicarpaea</i>	3.3 fr.	<i>Desmatodon latifolius</i>	r.1
<i>Thymus drucei</i>	1.3 fl.	<i>Ceratodon purpureus</i>	r.1
<i>Poa arctica</i>	+2 fl.	<i>Stereocaulon alpinum</i>	r.1
<i>Campanula gieseckiana</i>	+2 kn.	<i>Peltigera malacea</i>	+1
<i>Salix herbacea</i>	+2 fr.	<i>Cladonia spec.</i>	r.1
<i>Chamaenerion angustifolium</i>	r.1 kn.		

This stand belongs to the Festuco-Salicetum callicarpaeae chamaerietosum Daniëls 1982.

DISTRIBUTION

The total range of *Equisetum hiemale* L. is mapped by HULTÉN (1964, map 174; 1968, p. 34). In Europe and in western and central Asia it is a moderately variable species but in eastern Asia and especially in America it forms a complex not yet properly understood (HULTÉN 1964, see also SCOGGAN 1978). The complex as a whole could be characterized as circumboreal-temperate in distribution. It is absent in the northern and eastern part of the North American Continent.

Its distribution in Europe is mapped by JALAS & SUOMINEN (1972, p. 32, map 30). It is common all over West, North and Middle Europe, but scarce or absent in most of the mediterranean region. According to WALTER & STRAKA (1970) it belongs to the subboreal geoelement.

It occurs in different habitats. HEGI (1906) reports it from sandy, shadow-rich slopes, from woodlands and pastures, up to 2600 m. From northern Europe it is reported (LID 1963) on sandy substrates in woodlands and in the mountains. LÖVE (1970) reports it from Iceland from sandy and gravelly soil in heather and birch scrub.

DISCUSSION

We can only speculate on the origin of the isolated occurrence of the species in Southeast Greenland. Is the species introduced or indigenous in Greenland?

Introduction seems out of question. A possible introduction must have taken place after the foundation of Angmagssalik in 1895 since before that time the contact between the District and other parts of the world where *Equisetum hiemale* occurs was negligible. After the World War II the contact between Angmagssalik and Europe increased strongly, but it seems unlikely that such a big population could be build up in say 40 years, taking into account its dispersal (to be mainly vegetative; we found very few ripe sporangia). If introduced, however, we would expect to find the species (also) in Angmagssalik itself or its close surroundings, or in or nearby other settlements, in more or less disturbed environments where neophytes are most likely to occur. And also in the other parts of Greenland, especially in the south and west, which have been in contact with Europe for a long time, and where suitable habitats certainly occur (cf. also PEDERSEN 1972). The question remains whether the occurrence of the species is of preglacial, interglacial or postglacial age in Southeast Greenland.

BÖCHER (1956) drew attention to the rich and interesting flora around and east and west of Kong Oscars Havn, the small fjord along which the town of Angmagssalik is situated, and the geomorphology of the landscape in the southern part of the Angmagssalik Island (cf. also DANIËLS & MOLENAAR 1970). The existence of this

rich flora with plants of isolated occurrence in the District may relate to the geomorphological history, but survival of such a "southern" species as *Equisetum hiemale* during the glacial period seems definitely out of question.

Irrespective of the time of immigration, *Equisetum hiemale* must have reached the Angmagssalik District from Iceland, where by far the nearest populations of the species occur. Postglacial arrival in the District by migratory birds from Iceland might be possible (see also DANIËLS & MOLENAAR 1970, KLIIM-NIELSEN 1971, HALLIDAY et al. 1974). A vast lake and mire system, which is certainly visited by migratory aquatic birds, stretches at the foot of the southern slope of the Præstefjeld mountain ridge. This aquatic system is at a very short distance from the *Equisetum hiemale* population on the lower part of the slope. But its southern distribution, its isolated occurrence on a warm southern slope, its somewhat reduced vitality (short stems, few ripe sporangia found) and the diaspore characteristics (very small and light) are in favour of the view that *Equisetum hiemale* is an hypsithermal immigrant from Iceland (immigrant of the post glacial heat period; cf. SEIDENFADEN & SØRENSEN, 1937).

For the moment *Equisetum hiemale* L. can be classified as an indigenous species in Greenland, belonging to the boreal suboceanic floraelement (cf. BÖCHER 1956).

ACKNOWLEDGEMENTS

We like to thank Dr. B. Fredskild, Copenhagen for comments on the manuscript, Dr. I. C. Prentice, Uppsala for correction of the English text and Mrs. Regina Jaegermann for typing the manuscript.

REFERENCES

- BÖCHER, T.W. 1933. Studies on the vegetation of the east coast of Greenland. Meddr. Grønland 104(5): 56 pp.
- BÖCHER, T.W. 1938. Biological distributional types in the flora of Greenland. Ibid. 106(2): 339 pp.
- BÖCHER, T.W. 1956. Area-limits and isolations of plants in relation to the physiography of the southern parts of Greenland. Ibid. 124(8): 40 pp.
- BÖCHER, T.W., B. FREDSKILD, K. HOLMEN & K. JAKOBSEN. 1978. Grønlands Flora. Haase & Sons Forlag, København. 326 pp.
- DANIËLS, F.J.A. 1975. Vegetation of the Angmagssalik District, Southeast Greenland III. Meddr. Grønland 198(3): 32 pp.
- DANIËLS, F.J.A. 1982. Vegetation of the Angmagssalik District, Southeast Greenland IV. Meddr. Grønland, Bioscience 10: 78 pp.
- DANIËLS, F.J.A. & J.G. de MOLENAAR. 1970. Rare plants from the Angmagssalik District, Southeast Greenland. Botanisk Tidsskr. 65: 252-263.
- ELSLEY, J.E. & G. HALLIDAY. 1971. Some plant records from Southeast Greenland. Meddr. Grønland 178(8): 15 pp.
- HALLIDAY, G., L. KLIIM-NIELSEN & I.H.M. SMART. 1974. Studies on the flora of the north Blossville kyst and the hot springs of Greenland. Meddr. Grønland 199(2): 49 pp.

- HEGI, G. 1906. *Illustrierte Flora von Mittel-Europa* Bd. 1. Lehmanns, München. CLVIII, 402 pp.
- HELD, J.J. den & A.J. den HELD. 1979. *Beknopte handleiding voor vegetatiekundig onderzoek*. Wet. Med. KNNV 97. KNNV Hoogwoud. 40 pp.
- HULTÉN, E. 1964. *The circumpolar plants*. 1. KVA Handl. 8, nr. 5.
- HULTÉN, E. 1968. *Flora of Alaska and neighboring territories*. Stanford University Press, Stanford, California. 1008 pp.
- JALAS, J. & J. SUOMINEN. 1972. *Atlas Florae Europaeae. Distribution of vascular plants in Europe*. 1. Pteridophyta (Psilothaceae to Azollaceae). *Comm. Mapping Flora of Europe and Soc. Biol. Fenn. Vanamo, Helsinki*. 121 pp.
- KLIIM-NIELSEN, L. 1971. *Corallorhiza trifida* in Greenland. *Bot. Tidsskr.* 66 (1/2): 69-75.
- KRUUSE, C. 1912. *Rejser og botaniske undersøgelser i Østgrønland samt Angmagssalikegnens Vegetation*. *Meddr. Grønland* 49: 304 pp.
- LID, J. 1963. *Norsk og Svensk Flora*. *Det Norske Samlaget, Oslo*. 800 pp.
- LÖVE, Á. 1970. *Íslenzk Ferðaflóra*. *Almenna bókafélagið, Reykjavík*. 428 pp.
- MOLENAAR, J.G. de. 1974. *Vegetation of the Angmagssalik District, Southeast Greenland*. I. *Meddr. Grønland* 198(1): 79 pp.
- MOLENAAR, J.G. de. 1976. *Vegetation of the Angmagssalik District, Southeast Greenland*. II. *Ibid.* 198(2): 265 pp.
- PEDERSEN, A. 1972. *Adventitious Plants and Cultivated plants in Greenland*. *Meddr. Grønland* 178(7): 99 pp.
- SCOGGAN, H.J. 1978. *The flora of Canada. Part 2. Pteridophyta, Gymnospermae et Monocotyledonae*. *Nat. Mus. of Nat. Sciences. Nat. Mus. of Canada, Botany* 7(2): 545 pp.
- SEIDENFADEN, G. & T. SØRENSEN. 1937. *The vascular plants of Northeast Greenland from 74°30' to 79°00' N. Lat.* *Meddr. Grønland* 101(4):215 pp.
- WALTER, H. & H. STRAKA. 1970. *Arealkunde*. Verlag Eugen Ulmer, Stuttgart. 478 pp.
- WRIGHT, A.E., J. TARNEY, K.F. PALMER, B.S.P. MOORLOCK & A.C. SKINNER. 1973. *The geology of the Angmagssalik area, East Greenland and possible relationships with the Lewisian of Scotland*. In: PARK R.G. & J. TARNEY, eds. *The Early Precambrian of Scotland and related rocks of Greenland*. University of Keele, New Castle: 157-177.