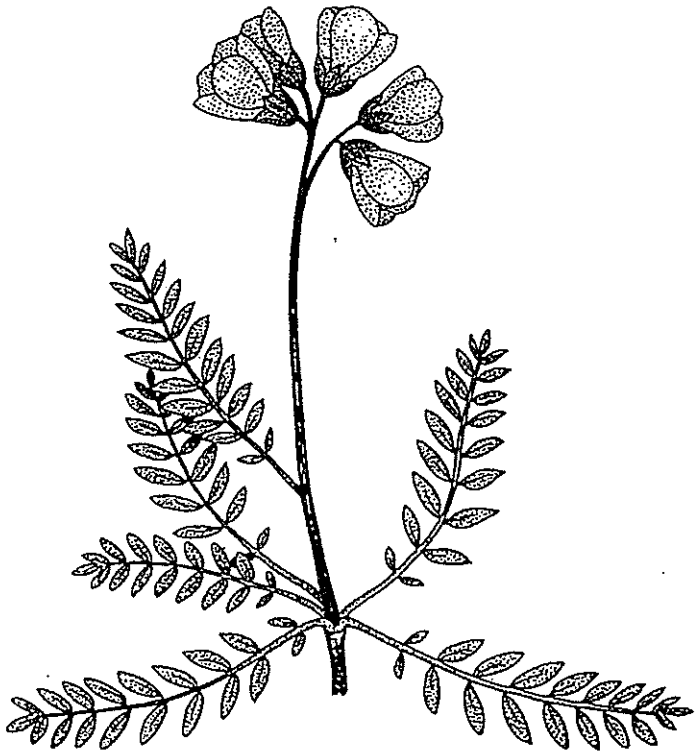
POLARFLOKKEN

TIDSSKRIFT OG MEDLEMSBLAD FOR
NORDNORSK AVDELING AV NORSK BOTANISK FORENING



Vol. (årg.) 24
No. 2 2000

ISSN 0332-9119

POLARFLOKKEN 24 (2) 2000

Utgitt av:
Nordnorsk botanisk forening
Postboks 1179
9262 Tromsø

Published by:
North Norwegian Botanical Association
PO Box 1179
N-9262 Tromsø, Norway

Internett-adresse: http://home.no.net/nbfnna/

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Redaksjonen av hefte 2/2000 avsluttet 22.12.2000.

Manuskripter sendes til redaktøren. Manuskriptfrister:
1. januar (vårheftet) 1. juli (høstheftet).

Opplag 2000: 400 eksemplarer.

Abonnementspris: kr. 105 pr. år (abonnement utenlands/*subscription price abroad: NOK 120*). Abonnement betales til NBF, Nord-norsk avdeling (adresse, se over), postgirokonto 0530 5433073. De fleste eldre hefter kan også skaffes; be om liste.

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Medlem med Blyttia (4 hefter pr. år) og Polarflokken:	kr. 335
Medlem med bare Polarflokken:	kr. 105

Medlemskontingent betales til NBF, Botanisk museum, NHM, postboks 1172 Blindern, 0318 Oslo; postgirokonto 0531 03723852.

POLARFLOKKEN

Polarflokken er tidsskrift og medlemsblad for Nord-norsk avdeling av Norsk botanisk forening. Det er blitt utgitt to til tre hefter pr. år siden 1977.

I tidsskriftet ønsker vi artikler og notiser om botaniske emner, i hovedsak med tilknytning til Nord-Norge. Ta kontakt med redaksjonen om du har noe du tror kan være av interesse. Vi kan også ta inn omfangsrike arbeider, men da er det en fordel om forfatterne gir beskjed i god tid. Forfatterne får ett ferdig eksemplar av Polarflokken og 25 gratis særtrykk av artiklene. Om du ønsker flere særtrykk, må de eventuelt bestilles på forhånd.

Navnet på tidsskriftet er hentet fra planten polarflokk (*Polemonium boreale*). Den eneste lokaliteten på det norske fastlandet er på Bugøynes i Sør-Varanger. På Svalbard er den langt vanligere. Omslagstegningen er laget av Olga Kvalheim.

Flora of North Norway: *Pinguicula villosa* L. (Lentibulariaceae)

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ABSTRACT

Alm, T. 2000: Flora of North Norway: Pinguicula villosa *L. (Lentibulariaceae). Polarflokken 24 (2): 193-205.*

Distribution, ecology, history and ethnobotany of Pinguicula villosa *L. in North Norway are summarized. The species has a distinctly eastern distribution in Fennoscandia, extending into Norway in the far north (Finnmark and interior Troms) and the easternmost part of Southern Norway. In North Norway, it is mainly found in the interior areas, growing on* Sphagnum *hummocks (usually* S. fuscum*) on oligotrophic mires, often palsa bogs; from near sea level to 564 m a.s.l.*

INTRODUCTION

This paper is the first in a series summarizing data on the flora of North Norway. *Pinguicula villosa* L. is by far the rarest of the three *Pinguicula* species found here.

TAXONOMY

Pinguicula villosa belongs to subgenus *Pinguicula*, which also includes the widespread *P. vulgaris* L. They are not closely related; *P. villosa* is the only member of section *Nana* (Casper 1962:41, 1966:41, 65, Schlauer 1986, Legendre 2000:84). *P. villosa* is probably one of the oldest members of the genus (Casper 1962:45, cf. Warming 1886:34).

P. villosa is easily recognized, and can hardly be confused with the two other species (*P. alpina* and *P. vulgaris*) found in Fennoscandia.

P. villosa shows little variation. White-flowered specimens (f. *albiflora*) may occur (Frödin 1915: 129), but have not been reported from North Norway; neither has a form with branched stem and two flowers, lus. *ramosa*, described by Casper (1962:44).

Warming (1886:27-37) carried out a detailed investigation of the morphology and floral biology of *P. villosa*, based on observations made at Alta, Finnmark. Figures based on the Alta

specimens are also reproduced in Heide (1912: 473-474).

The only chromosome count available for *P. villosa* in Norway (2n=12) derives from material collected at Dovre in SE Norway (Knaben 1950: 147).

PHYTOGEOGRAPHY

The total area of *P. villosa* is circumpolar and circumboreal, but with a large disjunction in W Siberia (Casper 1962:44, 1966:42, 45; Hultén & Fries 1986a:858, 1986b:1127). The species' three main areas of distribution cover northern Fennoscandia and adjacent NW Russia, E Siberia to Kamtchatka, and the arctic areas of N America. It is absent from Greenland and most other arctic islands.

Within Fennoscandia, *P. villosa* has an eastern to northeastern distribution (see maps in Lagerberg *et al.* 1957:186, Hultén 1971:412, Mossberg *et al.* 1992:420). Contrary to *P. alpina*, *P. villosa* is mostly restricted to the eastern side of the Scandinavian mountain chain (Lagerberg *et al.* 1957:186). The species is frequent in the northern parts of Finland and Sweden, extending northwestwards into the interior areas of Northern Norway, and southwestwards into the interior of SE Norway.

DISTRIBUTION IN NORTH NORWAY

In North Norway, *P. villosa* is only known from the two northernmost counties (Troms and Finnmark). It should be searched in Nordland, as some stations in northern Sweden approach the border (cf. Hultén 1971:412).

In Troms county, *P. villosa* is a rare species, so far reported from 14 stations, mostly along the Swedish border (Benum 1958:346 and map 490, Vorren 1977:13, Engelskjøn & Skifte 1995: 167). It is more frequent in Finnmark county, being recorded from numerous stations at the interior plateau (Finnmarksvidda), extending northwards to the fjord areas of Alta, Porsanger and Lebesby, and to the northern side of the Varanger fjord, East Finnmark.

The first record in North Norway is a collection made in "Varanger", East Finnmark by Chr. Weldingh, mentioned by Gunnerus (1772:71): "E Varangria missa a pl. V. D. Weldingh, rarissima"; cf. Dahl (1893:57). The specimen has not been preserved (cf. Krovoll & Nettelbladt 1985).

List of stations

The list includes herbarium specimens in **BG, H, O, TRH & TROM**, and stations mentioned in literature, plus some field notes. Material in other herbaria is only incorporated if details are given in literature sources, e.g. the lists of *specimina visa* in the monographs of Casper (1962, 1966).

TROMS

Bardu. Hávgavuopmi: Čoardajávri (31.07.1979, E.M. Engelskjøn & T. Engelskjøn, **TROM** 104902). Leinavatn NE: Ostováraš (27.07.1979, T. Engelskjøn, **TROM** 104898). Leinavatn E: Čoalbmevádda, 500 m a.s.l. (29.07.1979, T. Engelskjøn, **TROM** 104901); Gaskaordaluokta, 500 m a.s.l. (29.07.1979, E.M. Engelskjøn & T. Engelskjøn, **TROM** 104903). For further details on the stations in Bardu, see Engelskjøn (1984:129-130).

Målselv. Målselva: Beinelvdalen, Juttulstad (22.07. 1865, J.M. Norman, **O & TROM** 104899); on the south side of Beinelva according to Norman (1900:865). Ruten (1865, J.M. Norman, **O**), at the foot of the mountain according to Norman (1868:296, 1900: 865).

Øvre Dividal national park: mire a little above Divifoss, W side of Divielva (27.06.1973, K.-D. Vorren, T. Engelskjøn & S. Spjelkavik, **TROM** 104900).

Storfjord. Signaldalen: Mannfjellet, NW part, ca. 500 m a.s.l. (R. Ruotsalo 10.08.1958, H). Skiboln: mire 0.5 km SE of the crossroads to Olderelv camping (03.07.1973, T. Engelskjøn & S. Spjelkavik, **TROM** 104906). Skibotndalen: Helligskogen: Dápmoláttu, 355 m a.s.l. (08.07.1995, T. Engelskjøn, H.B. Gjærum, O. Skifte, B. Yurtsev & M. Aasen, **TROM** 42652); above Helligskogen, at the path to the Ditnujávri area (22.07.1957, S. Sivertsen, **TROM** 104905); mires W of Gálggojávri (11.08.1936, P. Benum, **TROM** 104904).

Nordreisa. Njallaávži: below Gieddeoaivi (06.08. 1984, H. Sætra/Bot. exc., **TROM** 45830); probably identical to the station given as Hoakkanjávri in the excursion reports (Sætra 1984:176, 1988:190).

Kvænangen. Brennbukt, 213 m a s.l. (15.08.1882, J.M. Norman, see Norman 1900:865).

FINNMARK

Alta. Kåfjord (1841, M.N. Blytt, **O**; undated [1841?], anonymous [M.N. Blytt?], **BG**; Lund 1842:107, Blytt 1874:816, Norman 1900:865, Dahl 1934:396); same area, "on the mountains" (1841, N. Lund, **TRH**).

Bossekop (1821, J.W. Zetterstedt, **LD**; 08.07.1885, B. Strøm, **TROM** 127458; 09.07.1885, S. Møller, **O**; Warming 1886:28, Heide 1912:473-474, Dahl 1934: 396).

Altaelva: Raipas (19.07.1878?, J.M. Norman, **TRH**; undated, J.M. Norman, **O**; 27.07.1900, R.E. Fridtz, **O**; 19.07.1903, O. Dahl, **O**); to 400 m a.s.l. according to Dahl 1934:396). Lille Raipas (27.07.1900, R.E. Fridtz, **O**). Øvre Raipas (19.07.1878, J.M. Norman, **BG & O**; 27.07.1878, J.M. Norman, **TRH**; Dahl 1934: 396); according to Norman (1900:865) also recorded 17.07.1878, at two stations, 115 and 211 m a.s.l.

Peska (1852, J.M. Norman, **BG**; undated, J.M. Norman, **BG & O**; Dahl 1934:396), according to Norman (1868:296, 1900:865) above the tree-line.

Eibydalen: Rávttašvárri/Helletoppen (17.07.1913, O. Dahl, **O**); below Rávttašvárri/Helletoppen (06.08. 1968, H.B. Gjærum, **TROM** 48584; Dahl 1934:396); Vuolušvárri (25.07.1913, O. Dahl, **O**).

Gargia: Stillelva 3 km N of Gargia fjellstue, N side (25.07.1955, A. Danielsen, **BG**); Stillelva, 1 km W of Gargia fjellstue, 150 m a.s.l. (29.07.1955, J. Lid, **O**); Stillelva, S side, ca. 3 km from Gargia fjellstue, slope below Midtfjellet (25.07.1955, O.I. Rønning, **TROM** 127713); gorge 2 km N of Gargia fjellstue, 200 m a.s.l. (29.07.1955, J. Lid, **O**); Gargiadalen, 125 m a.s.l. (undated, J.M. Norman, not., see Norman 1900:865, Dahl 1934:396); 1 km W of Gargia fjellstue, at Grønnåsen/Ruonánjunni (26.07.1955, O.I. Rønning, **TROM** 127712); at Joatkkajohka (17.07.1982, L. Mølster & O. Skifte, **TROM** 127723).

Tverrelvdalen: Borras (07.07.1913, O. Dahl, **O**).

"Alten" (1841, M.N. Blytt, **O**; 1841, N. Lund, not., see Lund 1842:107; undated, J.M. Norman, **BG & O**; Brooke 1827:151); "Altenfiord" area (Martins 1848: 99, 135).

Guovdageaidnu/Kautokeino. Beaskkádas: southern part towards Látnetjávri (1821, J.W. Zetterstedt, not., Zetterstedt 1822:159, Blytt 1874:816, Norman 1900: 865); Ákšoluoppal, 475 m a.s.l. (27.07.1955, J. Lid, **O**).

Suolovuopmi: at the mountain lodge (29.07.1955, A. Danielsen & K. Fægri, **BG**); Unna Suolojávraš, mire below Borri (31.07.1968, S. Sivertsen, **TROM** 127720).

Guovdageaineatnu/Kautokeinoelva: at Virdnejávri (08.07.1974, O. Gjærevoll, **TRH**).

Čabardasjohka: Junttejávri (26.07.1955, J. Lid, **O**).

Guovdageaidnu/Kautokeino: Labbessuolu, 2 km north of the village, 320 m a.s.l. (27.07.1955, J. Lid, **O**), mire 1 km north of the village (26.07.1955, J. Lid, **O**); "Kautokeinofjellet" (27.07.1955, O. Gjærevoll, **O**).

Láhpojohka: Vuottašjávri, Mohkkejávri and Láhpojávri (10.-11.08.1900, O. Dahl, **O**; cf. Dahl 1934:396).

Anárjohka: Suttesvuopmi (08.07.1969, S. Sivertsen, **TROM** 127719); Bosmmiidjávrrit, lower lake (04.07. 1969, S. Sivertsen, **TROM** 127718). Skiehččanjohka: outlet of Njuolasjohka (25.07.1969, S. Sivertsen, **TROM** 127717).

Øvre Anarjokka/bajit Anárjohka national park, frequent (Sivertsen 1976:34 & 51), found in UTM grid squares MS 01, 02, 03, 04, 11, 12, 13, 14, 21, 22, and 23.

Porsanger. Stabbursdalen national park (Ryvarden 1972b:80); Stabbursfossen (07.1935, C. Platou, O 96829); Stabbursnes (05.07.1898, A. Landmark, **O**; Dahl 1934:396).

Vesterboln (30.07.1900, O. Dahl, **O**); Oldereidet (30.07.1900, O. Dahl, **O & TRH**; Dahl 1934:396).

Lakselva: below Meardevárri, opposite Revfossnes (11.07.1901, O. Dahl, **O**; 05.07.1916, O. Dahl, **O**; Dahl 1934:396); Luoftevárri (08.07.1916, O. Dahl, **O**); Lakselva area (Mølster 1981:29).

Skuvvanvárri/Skoganvarre: tarn in Čeavrrešjohka at Čeavrreščohkka (15.07.1961, S. Sivertsen, **TROM** 127724).

Brennelva: Rohččivuopmi (Svalastog 1995:34).

Kárášjohka/Karasjok. Idjajávri/Nattvatnet, S end (24.07.1958, O. Gjærevoll, **TRH**); Čáhppesjávrrit, NE of the road (23.07.1958, O. Gjærevoll, **TRH**).

Kárášjohka/Karasjok (19.07.1885, G. Balke, **BG & O**; 07.1885, G. Balke, **BG & TROM** 127714); 4 km S

of the settlement (18.06.1963, B. Malhiesen, **TROM** 127715).

Anárjohka: Iškorasjohka (28.07.1910, V. Ollila, H; 10.07.1953, S. Sivertsen, **TROM** 127716); same area, at the foot of Dilljavárri (30.06.1955, S. Sivertsen, BG).

Øvre Anarjokka/bajit Anárjohka national park, frequent (Sivertsen 1976:34 & 51), found in UTM grid squares MS 25 and 34.

Lebesby. Iljord, small mire at the fjord head (27.07. 1965, L. Ryvarden, **TROM** 127721; Ryvarden 1967: 60).

Deatnu/Tana: Deatnu/Tana river: Birkelund (01.08. 1857, T.M. Fries, O; Blytt 1874:816); Langnes (01.08. 1857, T.M. Fries, LD & O; 15.07.1855, C. Sommerfelt, O; 01.07.1858, C. Sommerfelt, O; 07.07.1858, C. Sommerfelt, O; Blytt 1874:816). Ruostefielbma: Langnesmyra (15.07.1855, C. Sommerfelt, O; Norman 1900: 865); Rássejohka (11.07.1859, C. Sommerfelt, O); see also Fries (1858:58, 1865:43).

Holmfjellet/Suolovárri, W side (10.08.1968, L. Ryvarden, O).

Leavvajohka: Sáráskáidi, at Leavvajohka (21.07. 1965, L. Ryvarden, H & O); same area, W side of Sáráskáidi near Leavvajohka (21.07.1965, L. Ryvarden, **TROM** 127748); W side of Sáráskáidi about 8 km W of the Leavvajohka mountain lodge, large mire ca. 300 m a.s.l. (17.07.1965, L. Ryvarden, **TROM** 127750); Rástligáisá (undated, P.V. Deinboll, O); below Rástligáisá (17.08.1965, P. Kallio & O. Skifte, **TROM** 72921); Geaidnojohka, small mire at the S side of the hill (on older maps given as 325 m a.s.l.) E of hill 282 m a.s.l., 3 km from the outlet in Leavvajohka (13.07. 1965, L. Ryvarden, **TROM** 127745); same area, small mire 2 km from the outlet in Leavvajohka (12.07.1965, L. Ryvarden, **TROM** 127746): Jorbaoaivi, E side, above Geaidnojohka, at a small mire, 200 m a.s.l. (11.07.1965, L. Ryvarden, **TROM** 127747). Dordnejohka, at the outlet in Deatnu/Tana (26.07.1964, L. Ryvarden, **TROM** 127751; 20.07.1965, L. Ryvarden, **TROM** 127749).

Buolbmát/Polmak: below Vuohppevárri (06.08.1917, O. Dahl, O; Dahl 1934:396).

Store Leirpollen: Hánájohka, lower course (18.07. 1968, L. Ryvarden, O).

"Tana" (undated, N. Lund, BG & O; Lund 1846:39).

Vadsø: Kiby: Kibymyra (22.07.1966, B. Vorren & K.-D. Vorren, **TROM** 127752).

Unjárga/Nesseby: Mortensnes (Blytt 1874:816, Dahl 1934:396), both probably referring to a find made "behind" Storfjellet by T.M. Fries and Chr. Sommerfelt (Norman 1900:865). Nyborg (Schübeler 1886:129); same site, mire (27.07.1965, L. Ryvarden, **TROM** 127722). Varangerbotn, "i største Mængde" ["in the greatest quantity"] (Sommerfelt 1799:119, cf. Blytt 1874:816, Norman 1900:865, Dahl 1934:396, Alm 1992:232-233).

Skjåholmen/Várjjavuonsuolu (A.A. Arhhenius 1880, not., see Alm & Pilrainen 1997:51 & 60).

Sør-Varanger: Neiden: Færdesmyra (23.07.1965, B. Vorren & K.-D. Vorren, **TROM** 127728; Vorren 1979b: 167, 177, Fremstad 1984:33).

Munkelva: hillside above Munkelv (05.08.1968, G. Bråthen & T. Engelskjøn, **TROM** 127736); at the lower course of Munkelva (undated, J.M. Norman, not., see Norman 1900:866, Dahl 1934:396).

Skogerøya: in the valley S of Skogerøytoppen, 50 m a.s.l. (03.08.1968, G. Bråthen & T. Engelskjøn, **TROM** 127739); at the tarn S of Skogerøytoppen, ca. 150 m a.s.l. (03.08.1968, G. Bråthen & T. Engelskjøn, **TROM** 127743); at Revholmen (03.08.1968, G. Bråthen & T. Engelskjøn, **TROM** 127740).

Kirkenes: Postmestervatn (02.07.1938, H. Holmsen, O).

Pasvik: between the inner end of Langvannet and Svanvik (23.07.1908, A. Landmark, O), same area, frequent along the road (Norman 1900:866); W of Svanvik (13.07.1890, A. Landmark, O); Svanvik (1864?, J.M. Norman, O; 23.07.1908, A. Landmark, O; 14.07.1917, O. Dahl, O); S of Svanvik on the large mire expanses towards Skogøya/Menikasaari (29.08. 1864, J.M. Norman, not.; Norman 1868:296, 1900: 866); on the mire opposite Skogøya/Menikasaari (08.1864, J.M. Norman, O); Bjørnsund (10.07.1875, J.M. Norman, O; Norman 1900:866); Strand - Bjørnsund (05.08.1919, P. Benum, **TROM** 127735).

Waterfall at Fuglebukta/Goalsejávri (28.08.1868, J.M. Norman, O); between Fuglebukta/Goalsejávri and Langvannet/Boršejávri (Norman 1868:296, 1900: 866).

W of Skogfoss, tarn NW of hill 140 (29.07.1958, I. Kaasa & J. Kaasa, **TROM** 127339). 1 km SSW of Skogfoss, mire just N of Solgløttvann (25.07.1958, I. Kaasa & J. Kaasa, **TROM** 127331); mire at the Pasvikelva river at border post No. 109 (28.07.1958, I. Kaasa & J. Kaasa, **TROM** 127330); at border post No. 110 (25.07.1958, I. Kaasa & J. Kaasa, **TROM** 127332).

Kobbfoss, near the farm 800 m N of the former tourist station (27.07.1958, I. Kaasa & J. Kaasa, **TROM** 127729).

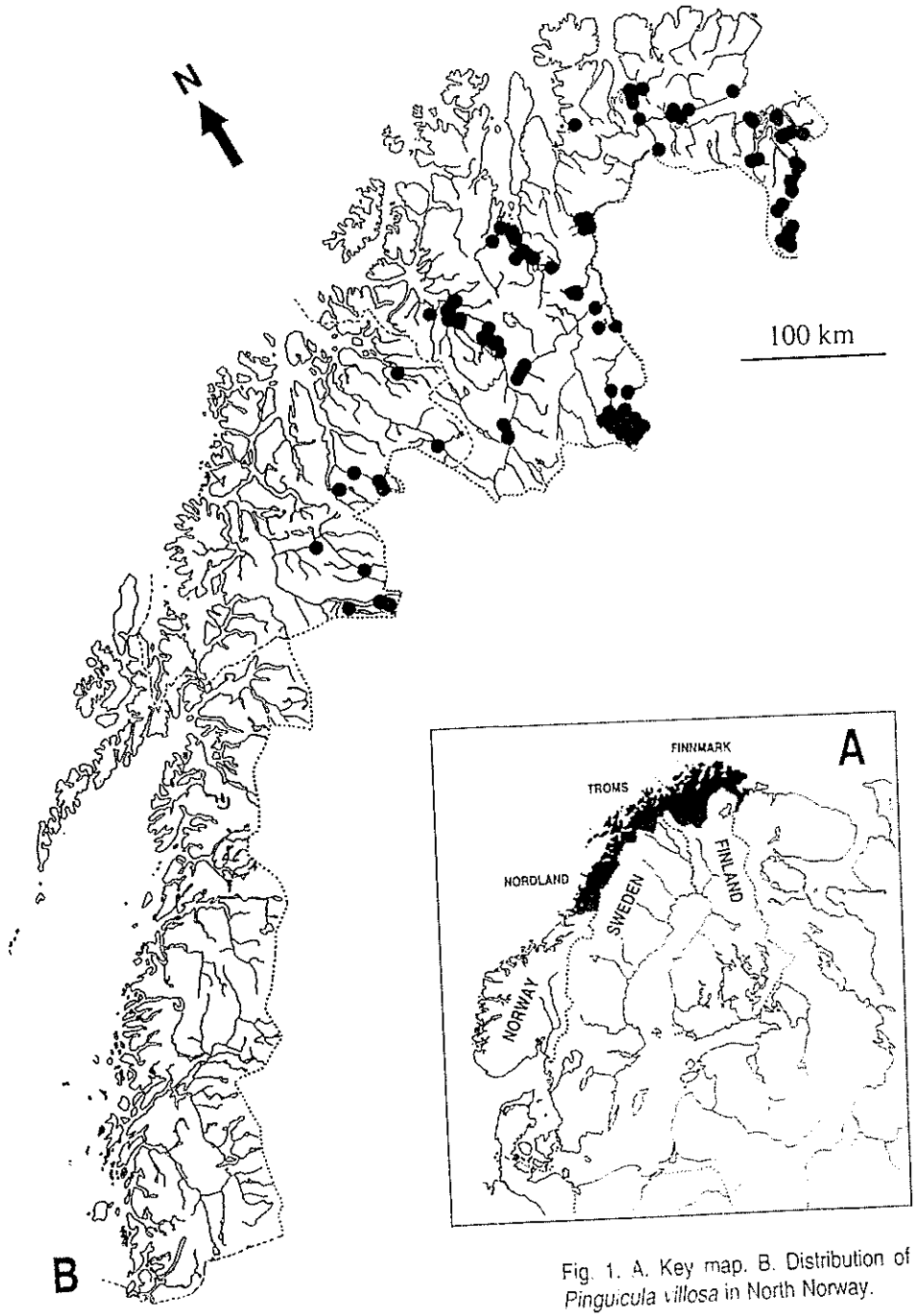

Fig. 1. A. Key map. B. Distribution of *Pinguicula villosa* in North Norway.

Gjeddevann/Havgjärvi drainage area (02.08.1965, B. Vorren & K.-D. Vorren, **TROM** 127726).

Pasvikelva: Gjøkbukta SW of Noatun (28.07.1994, T. Alm, K.A. Bråthen & A. Often, **TROM** 47496).

Gaukvann, E side (24.07.1949, N. Hauge, O); S of Gaukvann, lake SW of Fiskevann (04.07.1962, S. Murak, O).

Ødevannsbekken, 80 m a.s.l. (16.08.1984, H. Edvardsen & B. Moe, **TROM** 127742); at the path to Ødevasskoia, N of Røyskattjørna, 110 m a.s.l. (05.07. 1983, K.M. Sarre & K. Høiland, **TROM** 127741). Ellenvatn, N end (13.07.1968, L. Ryvarden & S. Sivertsen, **TROM** 127727); W side of Ødevann (07.07. 1965, L. Ryvarden, **TROM** 127334); Pasvik national park (Ryvarden 1972a:38).

Elvenes: at the road towards Skalferhullet (30.07. 1968, G. Bråthen & T. Engelskjøn, **TROM** 127744); at border cairn 360 (24.07.1903, R.E. Fridtz, O).

Bøkfjorden: Svartaksla (13.07.1938, A. Hogstvedt, O). Ropelv (04.07.1965, K.-E. Sibblund, O 235524); Myrvoll (21.07.1968, G. Bråthen & T. Engelskjøn, **TROM** 127737); hill above Indre Ropelv (07.1968, L. Borgen, G. Bråthen & T. Engelskjøn, **TROM** 127725); Nedre Ropelvvatn (27.07.1903, R.E. Fridtz, O); Øretoppvannet/Bealjaidjávrrit (19.07.1977, K.-E. Sibblund, O 97063).

Storskog: Storskogtjern [= lake SE of Botnfjellet] (24.07.1903, R.E. Fridtz, O; 24.07.1968, G. Bråthen & T. Engelskjøn, **TROM** 127738); Storslåttfjell (26.07. 1903, R.E. Fridtz, O).

Jarfjorden: between Pandornes and Karpelv (23.07. 1903, R.E. Fridtz, O); Karpedalen (12.07.1875, J.M. Norman, O), at Suoidnejávri according to Norman (1900:865). Jarfjorden (undated [1864], S. Henschen, not.; Fries 1865:49, Blytt 1874:816).

Other records: Varanger (18th century, C. Weldingh, see Gunnerus 1772:71, Wahlenberg 1812:180 and Dahl 1893:57). "in Varangria Finm. orient" (undated [early 19th century], P.V. Deinboll, TRH; see Dahl 1892:88). "Finmarken" (undated [1841 or 1842], N. Lund, **TROM** 127456; undated [19th century], J.M. Norman, **BG**; undated [19th century], J.D.S. Landmark, **TROM** 127457).

The map (fig. 1) gives a fairly good picture of *P. villosa*'s distribution in North Norway. It should be noted, however, that the species is frequently overlooked (Dahl 1934:386, Engelskjøn 1984:129), and will probably turn up at many as yet undetected stations, at least in Finnmark.

The northernmost stations, near the outlet of the Deatnu/Tana river in East Finnmark, are situated at about 70°29' N (Norman 1901:467, Dahl 1934:396).

The map in Hultén & Fries (1986a:858) shows several other stations at about the same latitude in Siberia and North America.

ECOLOGY

Like other members of the genus, *P. villosa* grows in moist habitats; a necessity for plants using water for their fluid, insect-trapping secretions (Casper 1966:38 & 40, Legendre 2000:91); but *P. villosa* is much more vulnerable to dessication than the other Nordic species, i.e. *P. alpina* and *P. vulgaris* (Heide 1912:470, Casper 1962:45).

In North Norway, *P. villosa* is mostly found on *Sphagnum* hummocks (Sommerfelt 1799:119, Wahlenberg 1812:180, Zetterstedt 1822:159, Warming 1886:28, Dahl 1934:386, Benum 1958: 346, Sivertsen 1976:34,. Alm & Piirainen 1997: 51 & 60), in particular on *Sphagnum fuscum* (Lagerberg *et al.* 1957:185, Bråthen 1973:80, Vorren 1979b:69, Engelskjøn 1984:129, Engelskjøn & Skifte 1995:167), but also associated with other *Sphagnum* species, e.g. *S. angustifolium* and *S. nemoreum* (Vorren 1979b:177). It is mainly found on ombrotophic mires. Palsa bogs are a preferred habitat (Vorren 1979b, Engelskjøn & Skifte 1995:167). pH is 'low; Vorren (1979b:92) found an average pH of 4 in water squeezed out of turf from ombrotrophic *Sphagnum fuscum* and *S. nemoreum* communities at Neiden (Færdesmyra) in Sør-Varanger, East Finnmark.

Seedlings and "stray" plants may occur in a wider variety of habitats (cf. Söyrinki 1939:363). Towards the coast, *P. villosa* may sometimes grow on intermediate to rich fens, but it is still usually associated with *Sphagnum* stands.

Thus, *P. villosa* typically grows in an extremely nutrient-poor environment. To some extent, the lack of nutrients in the substrate may be compensated by trapping small insects (cf. Casper 1966:37-38, Heslop-Harrison & Heslop-Harrison 1980, 1981, Heslop-Harrison & Knox 1971, Legendre 2000:86ff).

Studies of other *Pinguicula* species (including *P. vulgaris*) have clarified biochemical (Heslop-Harrison & Knox 1971, Heslop-Harrison & Heslop-Harrison 1980, 1981) and anatomical (Heslop-Harrison & Heslop-Harrison 1981) aspects of the insect trapping process. The prey is dissolved by a viscous fluid containing various acid hydrolases, including proteases, carbohydrases, esterases, nucleases and phosphatases (Heslop-Harrison & Knox 1971:192ff, Heslop-Harrison & Heslop-Harrison 1980:729). The enzymes are stored in lysosome-like vacuoles, and are abundantly present in the spongy wall of the gland cells (Heslop-Harrison & Knox 1971:209).

Enzyme secretion starts rapidly, within 40 minutes according to Darwin (1875), who used meat to trigger the process; somewhat later with natural prey (Heslop-Harrison & Knox 1971: 198). Digestion products are entering the leaf within 2 hours (Heslop-Harrison & Knox 1971: 189-190).

Trapping may not be very effective in *P. villosa*. Warming (1886:30) found only a few, small arthropods on the leaves of *P. villosa* in Alta, Finnmark; the catch was described as "very sparse", and much inferior to that of *P. alpina*. In addition, pollen (and perhaps other organic debris) may be dissolved and contribute to the nutrient supply (cf. Harder & Zemlin 1968, Legendre 2000:86).

Pollen could possibly be an important of nutrients for *P. villosa*. Pollen depositon rates on mires in North Norway vary considerably, depending on topography, surrounding vegetation and climate, with large year to year fluctuations

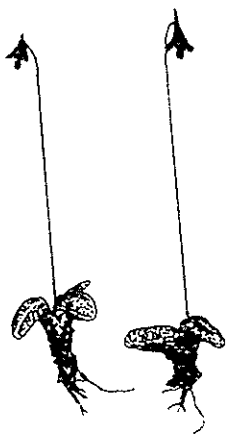

Fig. 2. Pinguicula villosa. *habitus; specimens from Alta (Gargia). Natural size.*

(Alm 1996, Alm *et al.* 1996, Vorren *et al.* 1996), but a minimum supply of at least 500 pollen/cm²/year is likely; deposition rates more than 20 times as high (exceeding 10000 pollen/cm²/year) may occur in inland areas during favourable years (Alm 1996, Alm *et al.* 1996, Vorren *et al.* 1996, Seppä 1996:35).

Altitude limit. In Troms, *P. villosa* is mainly found at middle altitudes. Most stations are in the subalpine areas of the interior mountains, 355 to 550 m a.s.l. The altitude limit for North Norway is 564 m a.s.l. at Čoardajávri in Bardu (Engelskjøn & Skifte 1995:167).

In Finnmark, *P. villosa* is mostly found at low to middle altitudes (Dahl 1934:386), reaching 475 m a.s.l. at the interior plateau, at Ákšoluoppal north of Suolovuopmi in Guovdageaidnu/Kautokeino (O).

In interior S Norway, *P. villosa* reaches 1050 m a.s.l. (Elven 1994:560) or perhaps 1100 m a.s.l. (Knaben 1950:147).

Climatic demands. Dahl (1998:210) found a correlation between the distribution of *P. villosa* and winter temperature; it is restricted to areas with a mean temperature during the coldest month of -10 °C or less (calulated for the highest point within 50 x 50 km grid squares).

In a classification of eastern mire plants in Troms, Vorren (1977:13-14) grouped *P. villosa* with *Eriophorum brachyanterum*, *E.* × *medium*, *E. russeolum*, *Rubus arcticus* and *Salix myrtilloides*. According to his view, their distribution is restricted by the following set of parameters: a July mean temperature of 12 °C or higher; a mean January temperature of -6 °C or less, a yearly mean temperature below 2 °C, a yearly mean precipitation of less than 600 mm, and a vegetation period (mean daily temperature 5 °C or more) of at least 120 days. *P. villosa* is certainly restricted to interior areas with a stable, cold winter, low precipitation and low annual mean temperatures, but the July mean indicated seems too high. In Finnmark, *P. villosa* thrives at a number of coastal stations with July mean temperatures of about 11 °C or lower, though hardly below 10 °C.

PHENOLOGY

Foliage/defoliation. The plants sprout in June (to early July) and wither in August-September; no detailed observations on dates are available from North Norway.

Warming (1886:27-37) studied the biology of *P. villosa* at Alta (Bossekop), Finnmark, and has given a detailed account. In spring, a fertile plant will produce a rosette with a few leaves, usually three (Warming 1886:27). If the growth rate of the surrounding *Sphagnum* moss carpet is high, the spring rosette may fail to develop (Heide 1912:471-472).

Towards the end of the summer, a hibernating bud is formed at the base of the flowering stalk (Heide 1912:471, Lagerberg *et al.* 1957:185). In this bud, the leaves are tightly packed like the scales of an onion (Warming 1886:28). The hibernating bud may be further protected by continued growth of the surrounding *Sphagnum* (Heide 1912:471).

Within the genus *Pinguicula*, there are two main life cycles, a tropical-subtropical growth type, and a temperate growth type (Heide 1912:464 & 474, Casper 1962:9, 1966:11ff, Legendre 2000:81). The latter is similiar to the growth cycle of *P. villosa* outlined above, except that species growing in areas with a longer growth season will usually also form an autumn rosette, before the hibernating bud is formed.

Thus, Heide (1912:472) added an arctic growth cycle to the general scheme, characterized by the absence of an autumn rosette. It is found both in *P. villosa* and in northern biotypes of some other species, e.g. *P. vulgaris* (Heide 1912:472).

Due to their small size, the leaves of *P. villosa* are more concave than in *P. alpina* and *P. vulgaris*, and the access to the leaf's upper side may be restricted to a narrow slit (Warming 1886:29, Heide 1912:472, Casper 1962:43).

Flowering. *P. villosa* may start flowering in mid-June in the interior areas of Troms and Finnmark, and has been collected in full flower at Kárášjohka/Karasjok on 18 June 1963 (B. Mathiesen, **TROM**). The main flowering is in July throughout the area (cf. Schübeler 1886:129), lasting into the first days of August (to 11 August according to herbarium specimens). Söyrinki (1939:363) reported similar dates from Pechenga (Russia), just E of Finnmark, i.e. a main flowering period in July, lasting into mid-August in subalpine sites.

Flowering has been recorded at almost all known stations in North Norway. Sterile specimens may occur in unfavourable habitats. Söyrinki (1939:363) reported abundant flowering in adjacent Pechenga. Still, each plant produces only a single flowering stem (Warming 1886:28), whereas e.g. *P. vulgaris* may have numerous stems.

No data on pollination are available from Fennoscandia. Warming (1886:31) supposed *P. villosa* to be largely self-pollinated (see also Heide 1912:475). Contrary to the flowers of *P. alpina* and *P. vulgaris*, the structure of the flower in *P. villosa* does not preclude self-pollination (Warming 1886:30, Heide 1912:474, Casper 1966:40). According to Lagerberg *et al.* (1957:185), the flowers attract some small flies (Diptera), which may pollinate them.

The pollen is very viable, and pollen tubes may form in any part of the flower (Warming 1886:5, Heide 1912:74).

Fruiting. Capsules develop from the last days of July (27 July) onwards. Capsules and seeds ripen towards the end of August (28 August). This is in accordance with the observations made by Söyrinki (1939:363) in the Pechenga area (Russia) just E of Finnmark, where the time from the end of flowering to ripe seeds was found to be about 33 days.

Seeds will probably ripen in most years in both Troms and Finnmark, as was also the case in Pechenga (Söyrinki 1939:363).

Dispersal. Dispersal is by seeds only; vegetative reproduction is not known in *P. villosa* (Warming 1886:28, Söyrinki 1939:364).

Size. Norman (1900:467) recorded specimens ranging from 5.5 to 9 cm in North Norway, but the herbarium specimens in **TROM** show a greater range, from 2.8 to 10.8 cm for flowering specimens; most specimens measure between 3.5 and 7.0 cm.

HISTORY

There is hardly any solid evidence of the history of *P. villosa* in North Norway. Pollen of the insect-pollinated *Pinguicula* species rarely turn up as more than single, "stray" grains in pollen analysis, and can only be identified to genus level. No macrofossils have been reported, although the typical growth site of *P. villosa* might favour preservation e.g. of the dried-out stalks.

The areas now inhabited by *P. villosa* in North Norway were deglaciated during the last part of the Late Weichselian and the early Holocene. Suitable habitats may have been available in the early Holocene (cf. Vorren 1972, Vorren & Vorren 1976, Göttlich *et al.* 1983, Alm *et al.* 1996, Moe *et al.* 1996, Vorren *et al.* 1996).

On present phytogeographical grounds, *P. villosa* is likely to have immigrated to Fennoscandia from the northeast (Lagerberg *et al.* 1957:186); probably during the early Holocene.

ETHNOBOTANY

Throughout Norway, *Pinguicula vulgaris* (and probably, to some extent, *P. alpina*) has been frequently used for making *tettemelk*, i.e. a thickened, usually sour milk (Lagerberg *et al.* 1957:182, Wendelbo 1961, Høeg 1974:489). This practice has been particularly widespread in North Norway (see e.g. Strompdal 1938:73, Rønning 1956:16, Blix 1971:218-219, Alm 1983:392-393). A similar tradition is also known from the other Scandinavian countries (Brøndegaard 1961, 1971, Loyd 1995, 1996). *P. villosa* is too tiny to be of much use in this respect.

The effect may partly be due to bacteria rather than any chemical constituents in *Pinguicula* (Christen 1961, Casper 1966:58, Brøndegaard 1971), though if warm milk is sieved through fresh leaves, a jelly-like substance is instantly formed.

OTHER ASPECTS

Pinguicula species are threatened throughout much of their range (Legendre 2000). In North Norway, the situation is much better. Both *P. alpina* and *P. vulgaris* occur abundantly, and even the less frequent *P. villosa* is hardly under any foreseeable threat, not least due to its preference for wet palsa bogs - hardly an attractive habitat for human use, and one where the actual habitats (the hummocks) may be rather inaccessible.

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