THE OCCURRENCE OF *Empetrum rubrum* Vahl ex Willd. ON SOUTH GEORGIA

By R. I. L. SMITH

ABSTRACT. The occurrence is reported of a single plant of *Empetrum rubrum* growing in the wild state on Hestesletten, South Georgia. The plant is described and its age and origin are discussed.

ON 17 February 1971, a single large well-established plant of red crowberry or "diddle-dee", *Empetrum rubrum* Vahl ex Willd., was found on Hestesletten, *c.* 3·5 km. south-east of the former whaling station at Grytviken, Cumberland East Bay, South Georgia (lat. 54°18′S., long. 36°31′W.). The discovery is noteworthy as it represents the first wild occurrence of this evergreen heath-like species in the sub-Antarctic botanical zone and is also the first shrub known to have survived for a period of years on South Georgia.

The location of the site on the 5 km. grid for South Georgia is GR 133 121, and it lies about 75 m. west of the western margin of Zenker Ridge, a vegetated lateral moraine on the eastern side of Hestesletten. Hestesletten is a fluvio-glacial plain about 5–8 m. a.s.l. and is susceptible to violent catabatic winds blowing from the 2,000–2,500 m. high Allardyce Range to the south-west. The plant occurred on fairly dry loamy soil overlying stones on the edge of an undulating network of low hummocks and hollows dominated by short *Festuca erecta* and various bryophytes, particularly *Chorisodontium aciphyllum*, *Conostomum pentastichum* and *Polytrichum alpinum*, and lichens, mainly *Cladonia rangiferina* var. *vicaria* and other species of *Cladonia*.

Although the centre of the *Empetrum* bush (Fig. 1) had partially died out, its margins were actively growing over the surface of neighbouring vegetation. *Acaena decumbens*, *Festuca erecta*, *Rostkovia magellanica* and *Polytrichum alpinum* were growing sparsely within the

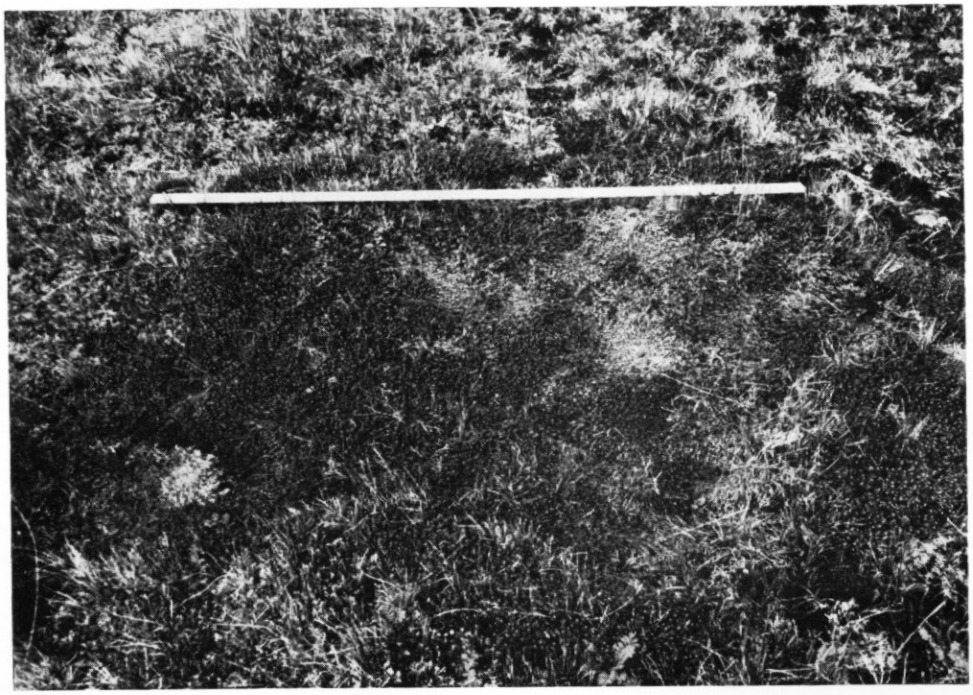

Fig. 1. The entire colony of *Empetrum rubrum* on Hestesletten, illustrating its procumbent growth form. The scale object is 1 m. in length.

colony (Fig. 2) while these species together with *Acaena tenera*, *Phleum alpinum*, *Cladonia furcata*, *C. rangiferina* var. *vicaria*, *Pseudocyphellaria freycinetii* and *Stereocaulon alpinum* together with *Conostomum pentastichum* and *Psilopilum antarcticum* occurred around its periphery. Three soil samples taken from beneath the *Empetrum* had a pH range of 4·7–4·9 and a field moisture content of 54–85 per cent.

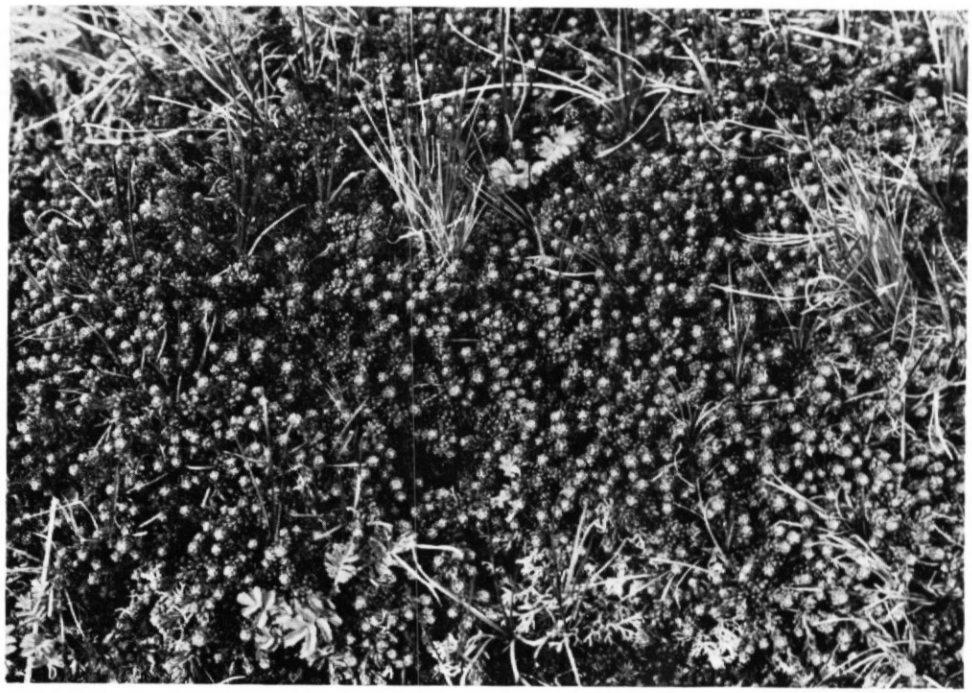

Fig. 2. Species associated with *Empetrum rubrum* on Hestesletten, including *Acaena decumbens* (pinnate leaves), *Festuca erecta* (light erect leaves), *Rostkovia magellanica* (dark erect leaves) and *Cladonia rangiferina* var. *vicaria* (whitish finely branched thalli).

The single plant had a procumbent growth form with a dense mat of intertwined branches which radiated from the central stem to give an overall diameter of 125 cm. to the almost circular bush. Many of the branches, which had produced roots at intervals along their length, were ascending towards their apices to a height of *c.* 7 cm. The diameter of the thickest stem was only 4·4 mm. The South Georgian plant differs from the description of the species on the Falkland Islands given by Moore (1968), in being a slightly yellower green with rather less tomentose leaves and stems with shorter (*c.* 3–4 mm.) and narrower (*c.* 1·3–1·5 mm.) leaves. It resembles most closely the form described by Good (1927) as being "of open semi-procumbent habit" and "confined to the island group of Tristan da Cunha and Gough Island", a form first described by Carmichael (1818) as *Empetrum medium*.

E. rubrum is usually dioecious but polygamous, monoecious and hermaphrodite plants have been reported, particularly in the Tristan da Cunha island group (Good, 1927; Moore and others, 1970). When the South Georgian plant was examined by the author in February and March 1971 and by J. R. Tallowin (personal communication) in March 1972, only female flowers and berries were seen. Clusters of immature green berries were abundant but these had not ripened by the end of the summer. The occurrence of fruit suggested that fertilization had taken place and yet there was no evidence of male flowers on the plant. Several theories may be proposed regarding the reproductive status of the plant, although none is completely satisfactory:

i. The plant possesses only female flowers but another plant bearing male flowers may

occur nearby. However, a thorough search over a wide area did not reveal another plant of *Empetrum rubrum*.

ii. The flowers could have been hermaphrodite but there was no evidence of stamens at the base of the berries.

iii. The berries could have developed by some form of apomixis, although this condition is unknown in the Empetraceae (personal communication from D. M. Moore).

iv. The berries may have been a developmental reaction to foreign pollination (personal communication from D. M. Moore). However, there are no species remotely related to *Empetrum rubrum* known on South Georgia and the suitability of pollen from any of the island's flora is considered very unlikely.

v. Pollination may have resulted from the long-distance transfer by wind of fertile pollen from the Falkland Islands. Although *E. rubrum* is wind pollinated, it is most unlikely that pollination of a single plant could be effected over such a distance.

The status of *Empetrum rubrum* on South Georgia is an interesting problem. Its natural geographical distribution ranges from the southernmost locality in the Cape Horn islands at lat. 55°52′S. (Hooker, 1847), through Tierra del Fuego including Staten Island (Skottsberg, 1913), south and west Patagonia (Macloskie, 1905), Andean Patagonia to *c.* lat. 42°S. (Moore and others, 1970) northwards through the Chilean Andes including the Chiloé archipelago to near Laguna in the province of Talca in the Cordillera Linares at *c.* lat. 35°30′S. (Moore and others, 1970). *E. rubrum* is particularly abundant in the Falkland Islands (Moore, 1968) and the islands of Tristan da Cunha group (Wace and Dickson, 1965), and reaches its most northerly and westerly locality on the Chilean island of Masafuera in the Juan Fernandez group, at lat. 33°46′S., long. 80°46′W. (Skottsberg, 1953).

The mode of arrival of *E. rubrum* on South Georgia is thus of considerable interest. Since the seeds are produced in a berry, dissemination is almost certainly by biotic agents, particularly birds. The nearest land where *Empetrum rubrum* occurs is the Falkland Islands, about 1,600 km. to the west-north-west, where the berries are eaten by various birds. Besides accidental migrants, the only species of land bird which is thought to migrate to South Georgia (Jones, 1963) is the sheathbill (*Chionis alba*), but it is almost restricted to shore habitats and is seldom likely to eat berries despite its omnivorous feeding habits. The most probable means of ornithogenic dispersal would seem to be on the feet of sea birds such as Dominican gulls (*Larus dominicanus*), great skuas (*Catharacta skua*) and possibly Antarctic terns (*Sterna vittata*), all of which occur in the Falkland Islands and southern South America, and which are commonly seen and breed on Hestesletten and nearby Zenker Ridge. Although it is not certain whether the great skua eats *Empetrum* berries in the Falkland Islands, Ridley (1930) commented that "the northern skua, a bird allied to it [Antarctic great skua], has been seen feeding occasionally on the berries of *E. nigrum* in sub-Arctic regions".

There is also the possibility that the plant was introduced directly or indirectly by Man. Since the establishment of a shore station at Grytviken in 1905, horses, sheep and cattle were imported and grazed on Hestesletten (Allen, 1920; personal communication from K. S. Pierce-Butler). Horses survived for a number of years (Matthews, 1931), as did sheep sporadically during the summers until 1957, the last to be kept there numbering about 30 which were brought from the Falkland Islands in 1955–56 (personal communication from K. S. Pierce-Butler).

There is some evidence from a phytochemical analysis of the leaves that the source of the South Georgian plant was the Falkland Islands, as D. M. Moore (personal communication) has indicated that the material showed a flavonoid pattern very similar to material from the Falkland Islands and Tierra del Fuego, such as has been reported by Moore and others (1970).

It is known from transplant experiments (Edwards and Greene, 1973) that Falkland Islands material of *E. rubrum* is capable of surviving for short periods on South Georgia and Signy Island (lat. 60°43′S., long. 45°38′W.), South Orkney Islands, and in an earlier experiment Holdgate (1964) reported that I. M. Lamb grew plants of *E. rubrum* from the Falkland Islands on Goudier Island (lat. 64°50′S., long. 63°31′W.), where they produced berries and survived at least one winter. It is of interest to note that, due to the prolonged winters on South Georgia,

it is possible that the *Empetrum* plant could be under snow cover for up to 6 months of the year, suggesting that it tolerates considerably harsher conditions than the species experiences within its natural range.

No precise information is available regarding the age of the South Georgian plant. The growth increment for the summer of 1970–71 appeared to be up to 5 cm., and such an amount would indicate a minimum age of 12–15 years, although the increase is unlikely to have been constant, being liable to fluctuation from year to year depending on the climate. As some degree of die-back and regeneration of shoots appears to have occurred in the central part of the bush, it is possible that the plant is at least 20–25 years old. These ages would correlate with the introduction of sheep to the area so, although the single plant known from South Georgia is comparable to the situation on Masafuera, it seems better to treat it as an introduced species which has survived for many years but has not increased in number of plants or effectively displaced the native vegetation, i.e. as a persistent alien in the sense of Walton and Smith (1973).

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