Vitenskapskomiteen for mat og miljø
Norwegian Scientific Committee for Food and Environment

Scientific assessment of risk to the population of *Rhodiola rosea* listed by CITES as a result of export from Norway

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Context

At the CITES CoP19, 14-25 November 2022, Prop. 45 was adopted. *Rhodiola rosea* and *Rhodiola crenulata* were listed in CITES Appendix II, in accordance with Article II, Paragraph 2 (a) of the Convention and satisfying Criteria B of Annex 2 a of Resolution Conf. 9.24 (Rev. CoP17). Additionally, all other species of the genus *Rhodiola* were listed in CITES Appendix II, because of their similarity to the mainly traded species, in accordance with Article II, paragraph 2 (b) of the Convention and Paragraph A of Annex 2 b of Resolution Conf. 9.24 (Rev. CoP17). Species on Appendix II include (a) all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation to avoid utilization incompatible with their survival; and (b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control (CITES Art. II.2). *Rhodiola rosea* and *Rhodiola crenulata* qualify under Art. II.2a, whereas all other species in the genus are listed under Art. II.2b to control trade in the aforementioned species. Norwegian CITES regulation Forskrift FOR - 2018-06-15-889 regulates the implementation of the CITES convention in Norway. *Rhodiola rosea* is the only species in the genus *Rhodiola* native to Norway, and although the species is common and not considered to be threatened (cf. CITES Art. XIV), Norway as a party to CITES will regulate its trade in line with other CITES Appendix II listed taxa. Export of CITES Appendix II listed taxa requires an export permit from the Party's CITES Management Authority (Res. Conf. 18.6), and such permit shall only be granted when the Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species; and a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora (CITES Art. IV.2; LOV-2009-06-19-100). In applying the CITES convention regarding *Rhodiola rosea*, the traditional use of the species in Norway by Norwegians and Sámi should be taken into account as well as the possible benefits that commercial trade may have on the conservation of the species and ecosystems where it occurs, as long as activity is carried out at levels that are not detrimental to the survival of the species in question (Conf. 8.3 (Rev. CoP13)). Furthermore, Res. Conf. 10.19 (Rev. CoP14) on traditional medicines, Res. Conf. 11.11 (Rev. CoP18) on trade in plants, Res. Conf. 13.2 (Rev. CoP14) on sustainable use of biodiversity, Res. Conf. 16.6 (Rev. CoP18) on livelihoods, and Res. Conf. 14.7 (Rev. CoP15) on export quotas, should be considered for trade in this species. This non-detriment finding for *Rhodiola rosea* was commissioned by the Norwegian CITES Management Authority from the Norwegian CITES Scientific Authority (cf. CITES Art. IV.2; Res. Conf. 10.3 par. 2c, 2g, 2h).

Assessment

a. Name, distribution, life history, habitat, role in ecosystem

Rhodiola is a genus of perennial plants in the Crassulaceae family, closely related to and often incorrectly included in *Sedum* (Mayuzumi & Ohba, 2004). *Rhodiola* includes approximately 70-90 species (Zhang et al., 2014; Flora of China, 2022), but its unresolved taxonomy makes it hard to make an accurate estimation of the number of species (Zhang et al., 2014). Species are native to arctic and alpine regions of the Northern Hemisphere with the highest number of species in Asia and a few species in Europe as well as North America (Lippert, 1995).

In Norway, *Rhodiola rosea* is the only native species in the genus (Bele & Norderhaug, 2022; Elven et al., 2022). *R. rosea*, commonly referred to as "Golden root", "Roseroot" or in Norwegian "Rosenrot" or "Kalverot", is widely distributed in arctic and alpine regions of Europe, Asia, and North America (Hultén and Fries, 1986). In Norway, *R. rosea* is a common species in the mountains and coastal districts, and occurs abundantly both on dry and wet coastal cliffs, stream edges and in alpine habitats, from sea level to 2280 m a.s.l. (Elven et al., 2022). Some authors recognise a separate species or subsp. *artica* (Boriss) A. Löve in Norway (Elven et al., 2022).

Many *Rhodiola* species, including *R. rosea*, are dioecious (Lippert, 1995). Rosenrot has several stems growing from a thick rootstock, unbranched stems densely clad with flat, fleshy leaves and a dense inflorescence with small, yellow or pink flowers. Above ground shoots die back in winter (Alm, 1994). In Norway, the flowering period of *R. rosea* is from June to August, which may vary depending on the altitude and location. Flowers are insect pollinated, whereas seeds are wind dispersed. The plant has a relatively long lifespan, and can live for over 50 years (Kubentayev et al., 2021).

b. Populations and trends

Rhodiola rosea is widely distributed in arctic and alpine regions of Europe, Asia, and North America (Hultén and Fries, 1986). Many populations outside Norway are likely in decline, such as in China where supply from several, morphologically similar *Rhodiola* species, currently is entirely based on wild collection, raising justifiable concerns about sustainability (Cunningham et al., 2020). In Norway, *R. rosea* is assessed as Least Concern in the Norwegian Red List (Solstad et al., 2021). *R. rosea* is a widespread species in Norway, and it is considered to be common in most of its distribution range. The species is also known from Bjørnøya (Engelskjøn & Schweitzer, 1970; Elven et al., 2022) as well as unconfirmed populations on Spitsbergen in the Svalbard Archipelago (Elven et al., 2011). The current population in Norway is >90% of the maximum population since 1900, 5-25% of the European population and < 1% of the global population of the species (Solstad et al., 2021).

c. Legal / illegal harvesting, and trade in Norway

R. rosea has a long history of use in Norway as well as many other places in its distribution range. Torbjørn Alm (2004) has reviewed the ethnobotany of the species in Norway. The main uses include prevention and treatment of scurvy in humans and

animals, as food, as hair wash, as well as a variety of lesser common medicinal uses (Holmboe, 1929). Its use as a plant on house roofs dates back to at least the 13th century (Nordhagen, 1934; Hjelmstad, 2002). In Russia, Sweden, and many other countries, it has been used for a range of conditions such as stress-induced depression and anxiety, fatigue, anaemia, impotence, infections (including colds and influenza), cancer, nervous system disorders and headache (Morgan and Bone, 2005; Ishaque et al., 2012). It is also regarded as a tonic and stimulant and used to increase physical endurance, stress resistance, attention span, memory and work productivity and resistance to high altitude sickness (Saratikov and Krasnov, 1974; Galambosi, 2012). The only systematic review of randomized clinical trials of the effectiveness and efficacy of *R. rosea* shows that it might have beneficial effects on physical performance, mental performance, and certain mental health conditions (Hung et al., 2011). However, the authors note that only 50% of the trials can be considered of acceptable quality.

In Norway, *R. rosea* is not commonly used today and forums for wild-crafting show no significant activity of use. Commercial wild-crafting is not common (Mette Thomsen, NIBIO, pers. comm. Feb. 2023). In 2004, the Norwegian Institute for Crop Research (Planteforsk Kise) - merged in 2006 into Norwegian Institute for Agricultural and Environmental Research (Bioforsk), and in 2015 into the Norwegian Institute of Bioeconomy Research (NIBIO), established a network for commercial cultivation of *R. rosea*, called "Nettverk Rosenrot". Small-scale farming trials with 20 farmers were supported by Research Council of Norway project 167899, 2005-2010, funded to Bioforsk. To date these initiatives have not led to commercial scale production from cultivation at a significant scale. Commercial scale supply from Norway is minimal to non-existent (Mette Thomsen, NIBIO, pers. comm. Feb. 2023). Earlier companies, Rosenrot Norge AS and Rhodiolafabrikken Fjeld AS have been removed from the Brønnøysund Register Centre.

The main trade of *R. rosea* in Norway today is of processed imported dietary supplements as well as tinctures from wild harvested material at a low level (Mette Thomsen, NIBIO, pers. comm. Feb. 2023) Health food chains like Sunkost, Life, Farmateket AS, pharmacies and grocery stores stock and sell a variety of *Rhodiola* products (e.g., Solaray GPH Super Rosenrot, Rawpowder Rosenrot, Life Rosenrot, Rosenrot forte). These products are imported and, as far as we could find out at the time of this report, not made with raw materials sourced in Norway.

d. Assessment of the threat(s) posed by trade (export from Norway)

Trade does not pose a threat to the survival of the species in Norway at the moment – this includes both domestically harvested material and existing re-export from Norway. However, the life history strategy of *R.rosea* poses similar challenges to those of other slow-growing, long-lived species of which the roots or rhizomes are harvested for use, e.g., terrestrial orchids tubers for salep (Ghorbani et al. 2014; Kreziou et al., 2016; Ghorbani et al. 2017; de Boer et al., 2017) or chikanda (Veldman et al., 2014; Veldman et al., 2017; Veldman et al., 2018). Harvesting the rhizome involves usually destructive harvesting of the whole plant (Cunningham et al., 2020). Destructive harvesting depletes populations if harvesting intensity outpaces regrowth, a balance that is quickly negative in slow growing species. Plants in their natural habitat seem to enter their mature generative phase with strong rhizome growth only at an age of over 20 years

(Kubentayev et al., 2021) making commercial growing unattractive. Extractive destructive wild-crafting of *R. rosea* from Norway populations at commercial scale would likely impact populations in terms of age structure and population size. However, the plants can be grown in Norway from cuttings and seeds are readily available. In cultivation, harvest seems possible after 4-5 years (Galambosi, 2006). Additionally, cultivation trails at NIBIO suggest that a harvest cycle of cultivated material could be about five years (Mette Thomsen, NIBIO, pers. comm. Feb., 2023). If trade of wild harvesting of material in Norway were to increase a national permit system with rolling time restrictions could prevent local population declines with detrimental effects on genetic diversity of *Rhodiola rosea*.

e. Brief summary of other threats and conservation status

R. rosea is assessed as Least Concern in the Norwegian Red List (Solstad et al., 2021). The species is widespread and common in Norway, and its population trend is stable. There are no major threats or other developments that affect its conservation status in Norway. In some areas outside Norway the species is likely threatened by non-sustainable wild-harvesting.

f. Brief summary of population monitoring programs in Norway

R. rosea is widespread and common in Norway. Its population trend is stable, and no specific population monitoring programs exist.

g. Overall assessment of data quality

Data on historic use, biology (with exception of life-history traits distribution), abundance, conservation status, populations and trends are very good. Data on modern use are good. Data on cultivation, life-history such as rhizome development, wild-crafting (*sanking*) and trade are limited, either due to an apparent decrease in commercial interest in local cultivation and/or due to a lack of interest among wild-crafters in the species. The source of *R. rosea* raw material imported and processed as dietary supplements commercialized in Norway is not known, but the majority of commercial material is likely wild-sourced.

Answer to the terms of reference

A scientific assessment of the biology, distribution, status, use, trade and conservation of *Rhodiola rosea* in Norway concludes that the species is slow-growing and sensitive to harvesting, while also concluding that the species is common and not threatened by harvesting for use and trade. The species has a number of traditional uses in Norwegian and Sámi culture, although most of these uses are historical, and its current popularity for wild-crafting is low. Experimental small-scale cultivation has been active in Norway for about 20 years, but the objective of this production is mostly domestic production of finished products packaged and ready for retail trade. Determination of detriment should consider the source of the material for export. Cultivated material and commercially harvested material from private land does not pose a significant risk of detriment. However, commercial harvest of material from public lands is likely to cause detriment due to the slow growth of the species. Commercial harvest would breach LOV-2021-05-07-34 § 5, but this should be assessed by the CITES Management

Authority as part of the legal acquisition finding (CITES Art IV.2b). Based on the current status and trade of *Rhodiola rosea* in Norway, VKM assesses that export is not detrimental to survival of the species in the wild, however the risk assessment should be updated if domestic harvest and/or export levels increase in the future.

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