Corybas sulcatus

grooved helmet-orchid

TASMANIAN THREATENED SPECIES LISTING STATEMENT

Image by Noel Carmichael

Scientific name: ***Corybas sulcatus*** (M.A.Clem. & D.L.Jones) G.N.Backh., *Vict. Naturalist* 127: 56 (2010)

Common name: grooved helmet-orchid (Wapstra et al. 2005)

Group: vascular plant, monocotyledon, family **Orchidaceae**

Name history: *Nematoceras sulcatum*

Status: *Threatened Species Protection Act 1995*: **endangered**

Environment Protection and Biodiversity Conservation Act 1999: **Critically Endangered**

Distribution: Endemic status: **Endemic to Macquarie Island**

Tasmanian NRM Regions: **South**

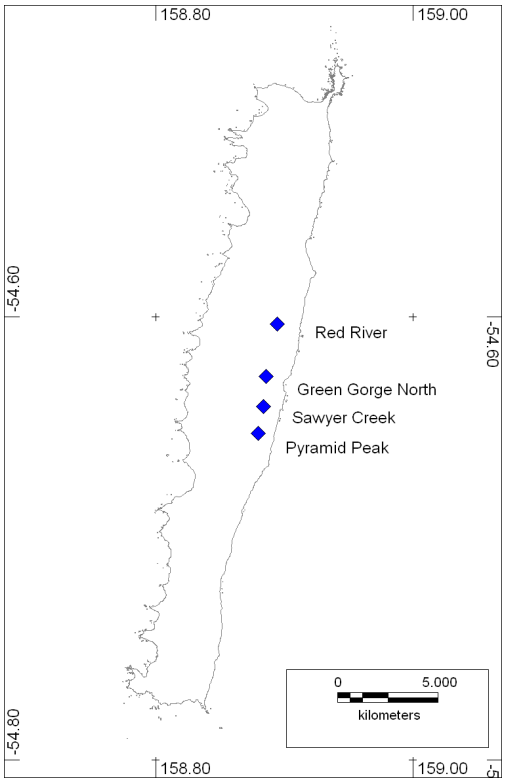

Figure 1. The distribution of *Corybas sulcatus* on Macquarie Island

Plate 1. *Corybas sulcatus* showing flower and leaf (image from Clements et al. 2007)

IDENTIFICATION AND ECOLOGY

Corybas sulcatus belongs to a group of terrestrial orchids loosely referred to as the 'helmet orchid alliance' (Jones 2006). *Corybas sulcatus* was previously included in the genus *Nematoceras* whose members are sometimes called spidery helmet-orchids, an allusion to the long lateral sepals and petals that are much more conspicuous than in other helmet-orchids (Jones 2006). *Nematoceras* is no longer recognised as a genus distinct from the helmet-orchid genus *Corybas* (Backhouse 2010). The spidery helmet-orchids form sparse to dense vegetative colonies. Flowering plants have a single ovate leaf and a solitary hooded flower. The flowers, which are produced in the leaf base or held away from the leaf on a stalk, are mostly greenish with red or purple markings. The dorsal sepal and labellum are large and the long thin lateral sepals and the petals are conspicuous and often held erect (giving the illusion of a spider). The tubular labellum sometimes has a tailed apex and also has two short broad open-ended auricles at the base (Jones 2006).

About 20 spidery helmet-orchids were recognised, most occurring in New Zealand and its subantarctic oceanic islands. Two species occur in Australia, *Corybas dienemus* and *Corybas sulcatus*. Both are apparently endemic to the subantarctic Macquarie Island, which is administered by Tasmania.

Vegetative reproduction, through production of daughter root-tubers on lateral, underground and elongate stolons (stems), is the most common form of reproduction in the spidery helmet-orchids and all species are capable of growing from stolon, stem and root-tuber fragments (Clements et al. 2007).

The ecological role of *Corybas dienemus* and its association with most other species has not been examined and is at present unknown. Like most orchid species, it has been reported to form a mycorrhizal association within its roots (Laursen et al. 1997).

Corybas sulcatus flowers in late spring (November) through to early summer (December) (Shaw 2005, Clements & Jones 2007), and surveys are best conducted when the species is flowering. The species is deciduous, so surveys are not recommended between late autumn and early spring.

Little is known about the pollination mechanisms of the two *Corybas* species that occur on Macquarie Island. Clements et al. (2007) discuss the two pollination syndromes thought to occur in *Nematoceras*: autogamy (self-pollination) and insect pollination by deceit (scent, mimicry, food reward). Seed capsules on individuals of *Corybas sulcatus* have not been observed. Although no evidence of pollination has been observed in *Corybas sulcatus*, the flower characteristics of this species are consistent with the insect pollination syndrome. The absence of hybridisation between the two Macquarie Island species indicates separate pollinators or one or both species being autogamous. An endemic black fungus gnat *Bradysia watsoni* Colless (Sciaridae: Diptera) (Greenslade 1990) has been suggested as a potential pollinator of either of the species (Clements et al. 2007). *Bradysia watsoni* has only been found between sea level and 100 m elevation and usually occurs in *Stilbocarpa polaris* vegetation and herbfield (Davies & Melbourne 1999). It should be noted that this distribution is not wholly coincident with that of *Corybas sulcatus*.

Description

Corybas sulcatus is a small (less than 5 cm tall at flowering), deciduous, tuberous terrestrial orchid, forming small clonal colonies. The leaves are solitary and orbicular (lamina 12 to 20 mm diameter), flat to shallowly concave. The leaf is light green above, silvery green beneath, with a moderately thick-textured lamina and fleshy petiole, which is 12 to 16 mm long. The flowers are held erect, supported on a fleshy green pedicel that is 5 to 7 mm long. The flowers are 25 to 30 mm long and 10 to 14 mm wide, and mostly dark red.

The dorsal sepal is spathulate, 22 to 25 mm long and 4 to 5 mm wide, strongly hooding the labellum, with a blunt apex (giving the classic 'helmet' appearance of the alliance). The lateral sepals are red with a pale base, 23 to 28 mm

long and 0.6 mm wide, and held erect or spreading above the dorsal sepal. The petals are also red with a pale base, 11 to 15 mm long and 0.5 mm wide, and held erect or spreading. The labellum base is tubular, then expanded, and 9 to 11 mm long and 6 to 9 mm wide. The boss of the labellum is cream to yellowish with a deep central groove. The margins of the labellum are incurved with a few small teeth.

[description from Clements & Jones 2007]

Confusing species

Two species of *Corybas* occur on Macquarie Island and have been confused prior to the recognition of two distinct entities (Clements & Jones 2007). *Corybas dienemus* may be distinguished from the allied species *Corybas sulcatus* by '... its green flowers with purplish-red markings, oblong dorsal sepal that is shallowly incurved with a recurved acute to acuminate apex with involute margins and an ovate labellum with an inconspicuous purplish-red boss' (Clements & Jones 2007). The two *Corybas* species on Macquarie Island have different leaf shapes and thus can be identified in the field when not in flower.

DISTRIBUTION AND HABITAT

Corybas sulcatus is endemic to Macquarie Island (Clements et al. 2007). It is known to occur in loose colonies at four locations on the eastern side of the plateau in the central part of the island, at elevations between 80–150 m above sea level (Table 1, Figure 1). The linear range of the species is 5.6 km, with individual sites separated by at least 1.4 km and arranged in a more-or-less linear fashion, and the area of occupancy is less than 0.3 ha (Skotnicki et al. 2009).

Corybas sulcatus grows in wet grassy seepage areas beside drainage lines, e.g., the eastern side of the Sawyer Creek Valley (Plate 2). The water table is close to the surface at all four sites, the vegetation consisting of short herbfield-grassland dominated by *Festuca contracta*, *Agrostis magellanica* and *Luzula crinita,* with a mixture of bryophytes (Skotnicki et al. 2009).

Plate 2. *Corybas sulcatus* habitat near Pyramid Peak (image by Helen Achurch)

POPULATION ESTIMATE

The clonal nature of *Corybas sulcatus* makes any estimate of plant numbers problematic. Instead the number of leaves recorded at the four known locations on Macquarie Island is cited, varying from 300 to more than 10000, with a total of 12000–13000 (Table 1, based on Skotnicki et al. 2009).

Corybas sulcatus was first collected from Macquarie Island in 1980, but has only recently been described as a new species with the collection of additional samples in 2004 from the same localities (Clements & Jones 2007). The species has been subject to a considerable survey effort in the period since, with vegetation surveys conducted on the island during most summers. During 2007–2008 there have been regular island-wide surveys by expeditioners and rangers with the Tasmanian Parks and Wildlife Service (Bryant & Shaw 2007, Skotnicki et al. 2009). Three of the four sites were visited in January 2011 (Red River, Sawyer Creek and Pyramid Creek), at which time they were described as being 'healthy and intact' (J. Shaw, pers. comm.).

Given the species' diminutive nature it is possible that targeted surveys will detect new sites, although it should be noted that based on past experience any new subpopulations are likely to be very localised.

Table 1. Population summary for *Corybas sulcatus* in Tasmania (Skotnicki et al. 2009)

	Location	Tenure	NRM region	1:25000 mapsheet	Year last (first) seen	Area of occupancy (ha)	Number of plants *
1	Red River	MINR	South	n.a.	2011 (2006)	0.01	300
2	Green Gorge North Basin	MINR	South	n.a.	2009 (1984)	0.20	1300+
3	Sawyer Creek	MINR	South	n.a.	2011 (1980)	0.004	1000
4	Pyramid Peak	MINR	South	n.a.	2011 (1980)	0.025	10000+

MINR = Macquarie Island Nature Reserve; NRM region = Natural Resource Management region

* Numbers of plants refer to distinct emergent leaves; note that due to the ability of *Corybas sulcatus* to propagate clonally, the leaf numbers do not necessarily represent genetically distinct individuals. Leaf densities as high as 1100/m² have been recorded (Skotnicki et al. 2009).

RESERVATION STATUS

Corybas sulcatus is endemic to Macquarie Island. The island is entirely dedicated as the Macquarie Island Nature Reserve (under the Tasmanian *Nature Conservation Act 2002*). Macquarie Island is also a World Heritage Site and a UNESCO Biosphere Reserve. The island is also listed on the Register of Critical Habitat and National Heritage List (under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*), and on the Register of the National Estate, until February 2012 (under the Australian *Heritage Commission Act 1975*).

CONSERVATION STATUS

Corybas sulcatus was listed in 2009 as endangered on the Tasmanian *Threatened Species Protection Act 1995*, meeting criterion B (extent of occurrence estimated to be less than 5,000 km^2 or area of occupancy estimated to be less than 0.1 km^2), specifically B1 (known to exist at no more than 5 locations) and B2 (continuing decline projected in the area, extent and/or quality of habitat, and number of mature individuals), and criterion D (total population estimated to number fewer than 250 mature individuals).

THREATS, LIMITING FACTORS & MANAGEMENT ISSUES

Corybas sulcatus is endemic to Macquarie Island and has a fragmented and disjunct distribution, and localised occurrences. The extent and quality of *Corybas sulcatus* habitat is in decline due to feral rabbit activity. Several other factors also potentially impact deleteriously on the species.

Impact of rabbits: Rabbits (*Oryctolagus cuniculus*) were introduced to Macquarie Island in the 19th century as a food resource for sealers (Scott 1988), and have had a major impact on elements of the island's flora (Copson 1984).

Rabbit numbers on the island have fluctuated considerably over the last 100 years, undergoing a decline in the late 1970s and 1980s due to the introduction of the myxoma virus in 1978 (Scott 1988). However, the rabbit population has expanded significantly in recent years (Scott & Kirkpatrick 2008). The increase has been attributed to a complex suite of factors, including a decrease in the effectiveness of myxomatosis, the eradication of cats, and a changing climate that has permitted rabbits to produce more offspring per year. The threat of rabbits will continue until the rabbit population either collapses or rabbits are eradicated from the island as planned (PWS & BCB 2007).

Rabbits are widespread across the island, including in short herb vegetation and grassland, where they dig and scratch at the vegetation surface. Studies have shown that rabbit activity (grazing and burrowing) alters vegetation structure and composition (Copson & Whinam 1998). In mire communities where rabbit activity is high *Marchantia* (a liverwort) and *Poa annua* (introduced grass) are more abundant (greater cover). Both these species have the ability to out compete surrounding small species (such as *Corybas sulcatus*).

Plate 3. Rabbit damage at Bauer Bay

(only *Nematoceras dienemum* occurs at this site but the type of damage caused by rabbits is similar to that in habitat of *Corybas sulcatus*): note diggings, surface disturbance and piles of rabbit faeces (image by Justine Shaw

The rabbits' digging action may have a deleterious impact upon a species such as *Corybas sulcatus* (Bryant & Shaw 2007), as individuals may be dug up and then die on the soil surface (Shaw 2005). Apart from causing direct damage to individual plants or small colonies, this physical action of digging compromises the stability of the peat soils leading to the degradation or destruction of habitat. In addition, where rabbits are active they may deposit large (50 x 50 cm) piles of faeces (Plate 3). The impact of nutrient deposition from scats has not been quantified but it is likely that over time the release of nitrogen from scats will alter soil nutrient processes. Decomposition processes are slow in the subantarctic (Tweedie 2000) and piles of scats can smother individuals or small colonies leading to plant mortality (J. Shaw pers. obs.).

Monitoring of known *Corybas sulcatus* sites has been undertaken by researchers with the Australian National University on an almost yearly basis over the past ten years (Skotnicki et al. 2009). It has been observed that the orchid leaves themselves do not appear to be grazed by rabbits.

The direct impact (at the subpopulation level) of rabbits on *Corybas sulcatus* has not been formally documented. However, if rabbit grazing were to continue, survival of *Corybas sulcatus* is considered unlikely. Rabbit eradication is proposed, which will remove this threat. The ability of *Corybas sulcatus* to recover from previous disturbance is unknown.

The threat to *Corybas sulcatus* from rabbits is great, as the entire range of the species is subject to rabbit grazing. For an island endemic species with so few subpopulations, any loss of individuals or colonies and a reduction in habitat quality threatens the species survival.

Browsing by the weka: Historically, the introduced weka, *Gallirallus australis* (a flightless bird from the rail family), was observed removing and eating root-tubers and stems of *Nematoceras* species (Brown et al. 1978). The past impact of this introduced bird on *Corybas sulcatus* is unknown. However, it could be assumed that removal of individuals was deleterious to small populations. The weka has since been eradicated (Copson & Whinam 2001).

Introduction of alien species: A new introduction of an alien species (plants, vertebrate, invertebrate or pathogen) could severely affect the species or its mycorrhizal symbiont.

Landslips: Landslips could eliminate subpopulations. However, it is unlikely that all localities would be affected at the same time.

Stochastic events: *Corybas sulcatus* has a fragmented and localised distribution on Macquarie Island, with subpopulations occupying relatively small areas, presenting a risk of extinction from stochastic events.

Climate change: Climate data shows warming of Macquarie Island of over half a degree in 50 years (Tweedie & Bergstrom 2000, Pendlebury & Barnes-Keoghan 2007). The influence of climate change on *Corybas sulcatus* is unknown, but it is likely that any drying associated with increased temperatures will negatively impact on the species, as it is currently confined to wet grassy seepage sites.

Low genetic diversity: *Corybas sulcatus* is currently known from only four locations and has a limited area of extent. Levels of genetic diversity in the population could be low due to low numbers of individuals recorded at each locality and because vegetative means of reproduction is most common in this genus. In addition, the small population size may lead to

inbreeding problems, possibly in combination with insufficient maintenance of populations of pollinating insects and associated mycorrhizal fungi, which in turn may be linked to other threatening factors such as the impacts of rabbits and climate change.

MANAGEMENT STRATEGY

What has been done?

Corybas sulcatus is included in the *Threatened Tasmanian Orchids Flora Recovery Plan* (Threatened Species Section 2017).

Botanical survey on Macquarie Island has been extensive over the last 50 years, with vegetation surveys conducted on the island during most summers. *Corybas sulcatus* has been specifically targeted by several researchers in recent years (Copson 1984, Clements et al. 2007, Skotnicki et al. 2009).

Rabbit-proof exclosure fences were erected at the Sawyer Creek and Pyramid Peak sites in 2007/2008, enclosing part of the colonies in each instance (Plate 2). The exclosures are an initiative of the Parks & Wildlife Service and the Biodiversity Conservation Branch (Department of Primary Industries, Parks, Water and Environment, Tasmania).

Implementation of the *Macquarie Island Rabbit and Rodent Eradication Plan* has already begun with on-ground activities proposed for 2009/2010.

Management objectives

- prevent the loss or degradation of known subpopulations;
- undertake active management, including monitoring, of subpopulations to ensure their long-term viability;
- identify new subpopulations of the species.

What is needed?

- establish a demographic monitoring program for all known and new found subpopulations, to report on health and recruitment, and gauge the response of the species to disturbance events (including rabbit control measures) as well as seasonal/annual conditions;
- fully implement the Macquarie Island pest eradication plan (PWS & BCB 2007);
- continue stringent biosecurity controls to prevent the introduction of alien species to Macquarie Island;
- undertake extension surveys of potential habitat on Macquarie Island;
- collect seed for long-term storage at the Tasmanian Seed Conservation Centre, contingent on locating the species again and sufficient fertile material being present;
- implement the threatened orchid recovery plan (Threatened Species Section 2017).

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