Cyclosorus interruptus (Thelypteridaceae): new to Victoria

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Abstract

A new fern, *Cyclosorus interruptus*, is reported for Victoria. Information is provided as to how this species can be distinguished from closely-related Victorian ferns. Its Victorian distribution is discussed, along with its habitat, the threats to its persistence and its conservation significance in Victoria.

Key words: Ferns, *Cyclosorus*, identification, ecology, Australia.

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Introduction

During recent botanical survey work in south-western Victoria (Sinclair and Sutter 2008), a fern not referrable to any species recorded previously in Victoria was encountered (Fig. 1). Examination of the material confirmed the identity of the species as *Cyclosorus interruptus* (Willd.) H.Ito (Thelypteridaceae). This species occurs in the tropics and sub-tropics of all continents as well as New Zealand (Bostock 1998). In Australia, prior to the current discovery, it was known to occur in tropical central Australia, and southward along the margins of the continent about as far south as Sydney and Perth.

In Victoria the family Thelypteridaceae is represented by four species in four genera: *Christella dentata* (Forssk.) Brownsey & Jermy, *Cyclosorus interruptus* (Willd.) H.Ito (here reported), *Pneumatopteris pennigera* (G.Forst.) Holttum, and *Thelypteris confluens* (Thunb.) C.V.Morton. *Cyclosorus interruptus* can be distinguished from *Christella dentata* and *Pneumatopteris pennigera* by the presence of scattered, papery, broad, flat scales on the pinnae midribs on the lower surface of mature fronds (Fig. 2a), which are absent in *Christella* and *Pneumatopteris;* similar scales are present in *Thelypteris confluens*, and pale brown ovate scales are sometimes present on the lower surface of young fronds in *Pneumatoperis pennigera*. The upper surfaces of the pinnae in *Cyclosorus interruptus* are virtually hairless (occasional, minute, pointed hairs on veins present), whereas in *Christella dentata* the upper surface of pinnae have many short, pointed hairs. *Cyclosorus interruptus* also has stalkless, spherical orange or orange-red glands on the veins on the lower surface of the fronds, which are absent in *Christella dentata* and *Pneumatopteris pennigera* (Fig. 2b). The texture of the fronds of *Cyclosorus interruptus* is harsh, whereas the fronds of *Pneumatopteris pennigera* are softer-textured. When sori are present, *Cyclosorus interruptus* is easily distinguished from *Pneumatopteris pennigera* by its indusiate (i.e. protected) sori; the sori of *P. pennigera* lack indusia. The absence of sori

on the lowermost 1 (–2) of the basal pair of veins (the pair that unite below the sinus) is also diagnostic. The sori are usually present in the corresponding position in *Christella dentata* and *Pneumatopteris pennigera*. *Cyclosorus interruptus* differs from *Thelypteris* in that the pinnae are lobed for about one-half to one-third of the distance to the pinnae midribs, with the basal veins in adjacent pinnae lobes always branching to produce a long excurrent vein passing to the sinus membrane, whereas in *Thelypteris* the pinnae are lobed almost to the pinnae midribs, and all veins are free (Bostock 1998) (Fig. 2c).

Many ferns are readily dispersible and popular in cultivation, making it potentially difficult to determine whether some species are historically indigenous to a given area (e.g *Pteris umbrosa* at sites such as Yellingbo, Victoria, distant from its conventionally recognised distribution in eastern Victoria, Stajsic

Figure 1. *Cyclosorus interruptus* in situ.

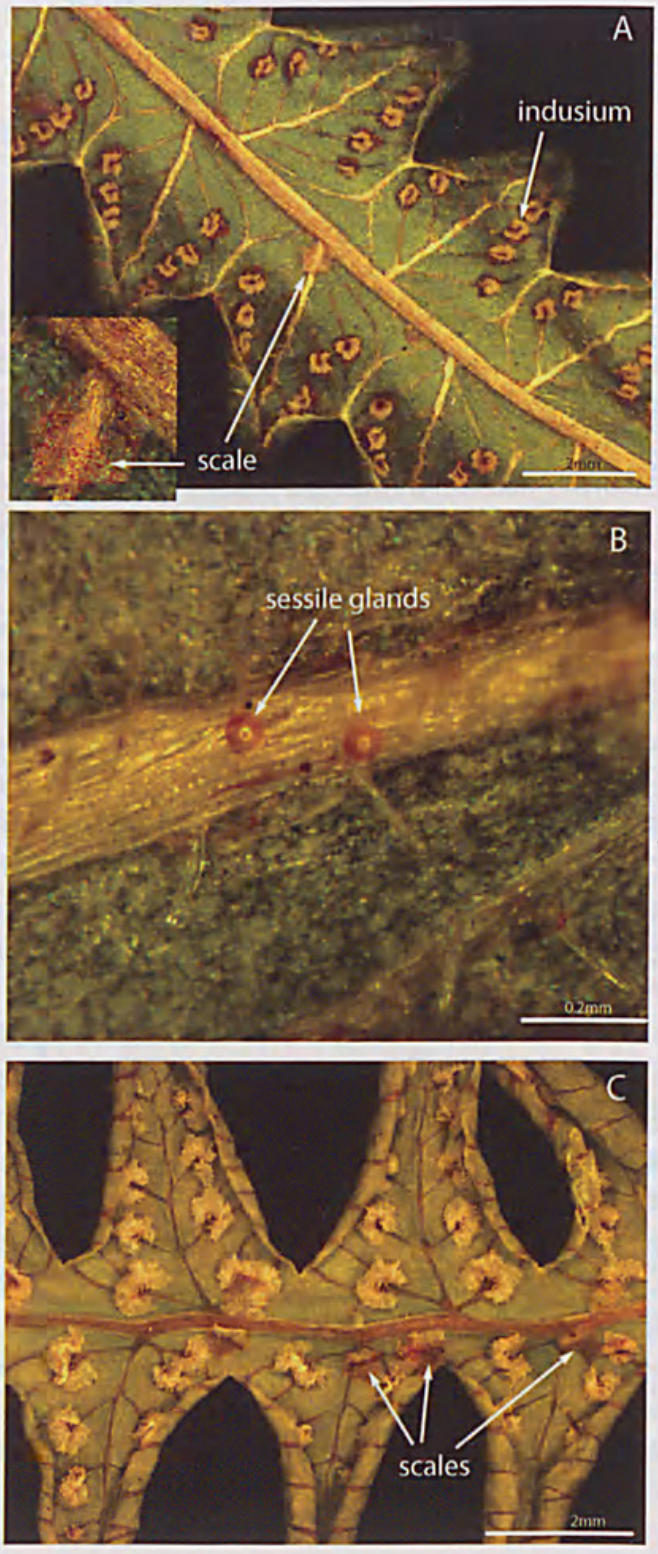

Figure 2. Frond under-surfaces, showing diagnostic features. A: *Cyclosorus interruptus*, with the broad scales indicated (absent in *Pneumatopteris* and *Christella*), and the pinnae division clearly evident; B: *C. interruptus* with the sessile glands highlighted; C: *Thelypteris confluens*, showing the absence of glands, the presence of scales and the relatively deeper pinnae division.

pers. obs.). We consider *Cyclosorus interruptus* to be indigenous in Victoria, since the species is apparently very rarely (although easily) cultivated (on the basis of internet searches and published literature, e.g. Jones & Clemesha 1993), the individual plants appear long-established, and the area of occurrence is sparsely inhabited (although two farmhouses are within 1 km). The site is unfenced and the possibility that it may have been introduced with stock, although remote, cannot be discounted. However, given the remarkable disjunct Australian occurrence of *Thelypteris confluens* in north-eastern Victoria, otherwise known with certainty only in south-eastern Queensland, the occurrence of *Cyclosorus interruptus* in south-western Victoria is perhaps less surprising given the far greater natural range of this species in Australia. As is often the case with *Cyclosorus interruptus*, *Thelypteris confluens* has a preference for swampy habitats (Wilson 1990; Bostock 1998).

Figure 3. The Victorian habitat of *Cyclosorus interruptus* when A. dry; and B. inundated.

Table 1. Species associated with *Cyclosorus interruptus* in Victoria, taken from two quadrats (D0076200, D0076300). The abundance values are consistent with the Victorian Flora Site Database (2007), where the information from these quadrats is stored. The species are listed by their abundance, then alphabetically. The nomenclature for botanical names follows Walsh & Stajsic (2007). Vernacular names follow the Victorian Flora Site Database.

Species	Common name	D0076200	D0076300
Leptospermum lanigerum	Woolly Tea-tree	2	3
Cyclosorus interruptus	Swamp Shield-fern	2	2
Ranunculus sp.	Buttercup	2	2
Rumex bidens	Mud Dock	2	2
Stellaria angustifolia	Swamp Starwort	2	2
Urtica incisa	Scrub Nettle	2	2
**Sonchus asper*	Rough Sow-thistle	3	+
Carex appressa	Tall Sedge	1	2
Crassula helmsii	Swamp Crassula	1	2
Eleocharis acuta	Common Spike-sedge	2	1
Hydrocotyle sibthorpioides	Shining Pennywort	1	2
Persicaria decipiens	Slender Knotweed	1	2
Triglochin alcockiae	Southern Water-ribbons	2	1
Hydrocotyle muscosa	Mossy Pennywort	2	+
**Paspalum distichum*	Water Couch	2	+
Glyceria australis	Australian Sweet-grass	1	1
**Nasturtium officinale*	Watercress		2
Poa labillardierei subsp. labillardierei	Common Tussock-grass	1	1
Juncus procerus	Tall Rush	1	+
Lachnagrostis filiformis	Common Blown-grass	1	+
Leptinella reptans	Creeping Cotula	1	+
**Aster subulatus*	Aster-weed	1	
Baumea articulata	Jointed Twig-sedge		1
Calystegia sepium subsp. roseata	Large Bindweed	1	
?Nasturtium microphyllum	Brown Watercress	1	
Carex fascicularis	Tassel Sedge		1
**Cuscuta suaveolens*	Fringed Dodder	1	
**Cynodon dactylon var. dactylon*	Couch		1
Lilaeopsis polyantha	Australian Lilaeopsis	1	
**Rumex conglomeratus*	Clustered Dock	1	
**Cirsium vulgare*	Spear Thistle	+	+
**Rumex crispus*	Curled Dock	+	+
Triglochin procera	Water Ribbons	+	+
Alternanthera denticulata	Lesser Joyweed		+
Asperula conferta	Common Woodruff	+	
Carex gaudichaudiana	Fen Sedge		+
Dichondra repens	Kidney-weed		+
Lobelia pedunculata	Matted Pratia		+
**Solanum nigrum*	Black Nightshade		+
Solanum sp.	Kangaroo Apple		+

Habitat and threats

The Victorian plants grow along the flats of Darlot Creek, near Tyrendarra. Interestingly, the Tyrendarra population of *Cyclosorus* occurs within a distance of ca. 11 km from the similarly rare and restricted *Pneumatopteris pennigera*. The surrounding landscape at the site consists of weathered calcareous dunes, however *Cyclosorus* grows on alluvial deposits of silt/clay. The habitat is open, with occasional patches of *Leptospermum lanigerum* (nearby but not directly associated), and on some occasions is subject to partial shallow inundation (Fig. 3). Two floristic quadrats were taken around patches of *Cyclosorus*, in order to characterise its habitat (Table 1).

Cyclosorus is long-rhizomatous, and it is difficult to determine the number of individual plants that make up the Victorian population without genetic analysis. We counted 42 fairly distinct clumps, some of which cover several square metres. These are distributed along ca. 400 m of creek-line.

Livestock presumably pose a long-term threat to this species. The streamside habitat is unfenced and accessible to stock (currently sheep). It appears, however, that this species has tolerated stock for many years, and is probably secure in the immediate-short term in Victoria if the current management doesn't change.

Given that the plants grow about 2 km from the coast (less than 5 m above sea level) with obviously estuarine elements nearby (e.g. *Juncus kraussii* occurs in extensive beds shortly downstream), the Victorian population of *Cyclosorus* is potentially at risk from rising sea levels which may occur as a result of climate change. We do not have direct evidence for the tolerance of *Cyclosorus* of saline conditions; however it would seem that this species is tolerant of brackish conditions. Vegetation studies from other states show that *Cyclosorus interruptus* frequently occurs in brackish-saline, estuarine or near-coastal areas, often in paperbark swamps (e.g., *Melaleuca quinquenervia*, Kingston *et al.* 2004). In New Zealand it grows near thermal springs (Bostock 1998). Unpublished data from salinity tests over several seasons show that Darlot Creek, including waters in the vicinity of the *Cyclosorus* plants, is generally slightly brackish (often EC ca 2 dS/m) and of neutral pH (in the range 6.5–7.5) (J. Macdonald, Arthur Rylah Institute, pers. comm.). Measurements on two soil samples (ca 5–15 cm depth) and a surface water sample taken from among the *Cyclosorus* plants in May 2008 support this (pH 6.5–7.7; EC 0.6–1.2 dS/m). It remains to be seen how much salinity *Cyclosorus* can tolerate.

Weed invasion may also present a threat to *Cyclosorus*, but probably not in the immediate future. Currently, the abundance of weeds is relatively low in the area where *Cyclosorus* occurs. Furthermore, the long-lived, strongly rhizomatous habit of the plant might make established plants resilient to the effects of some competition. Weeds may, however, in future alter the site to the extent that the germination of new plants is suppressed.

It would seem that the most pressing threat to the persistence of *Cyclosorus* is its very small population size and area of occupation, making it highly vulnerable to extinction from chance events. Presumably, the small and isolated Victorian population has low genetic diversity, reducing its ability to adapt, and increasing its vulnerability to environmental change.

Assuming that the species is indigenous to Victoria (which we assume to be the case), we recommend that it be assigned a Victorian conservation status of Critically Endangered, using IUCN criteria. In the standard notation of the IUCN Red List (IUCN, 2001): CR B1ab(i,ii,iii,v)+2ab(i,ii,iii,v); C1+2a(i,ii); D. The National Herbarium of Victoria recently classified the species as 'endangered' in Victoria (Walsh & Stajsic 2007).

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