



## *Haplopteris yakushimensis* (Pteridaceae, Vittarioideae), a new species from Yakushima Island, Japan

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### Abstract

A new species of vittarioid ferns (Pteridaceae) that has long been regarded as *Haplopteris amboinensis* or *H. forrestiana* (a synonym of *H. doniana*), is described here as *Haplopteris yakushimensis*. Both macro- and micromorphological characteristics were compared with these two species. Chartaceous matured fronds, shallowly grooved adaxial costae and obtuse carinate abaxial costae are the diagnostic characteristics that distinguish *H. yakushimensis* from the other species in the genus. A phylogeny based on plastid regions *chlL*, *ndhF* and *matK* of 14 East-Asian *Haplopteris* species, including our new taxon is presented here.

### Introduction

The Old World fern genus *Haplopteris* Presl (1836: 141) includes ca. 25 species with highest diversity in the tropics. Prior to the study of Crane (1997), the species in the genus were placed in *Vittaria* Smith (1793: 413) and Vittariaceae, but the placement of these species in *Haplopteris* as a genus of Pteridaceae is now widely accepted (e.g. Christenhusz *et al.* 2011).

In Japan five species are usually recognized (Ohwi 1957, Iwatsuki 1992, Nakaike 1992, Iwatsuki 1995, Ebihara 2011): *Haplopteris ensiformis* (Sw.) Crane (1997: 514), *H. flexuosa* (Fée) Crane (1997: 514), *H. forrestiana* (Ching) Crane (1997: 514), *H. fudzinoi* (Makino) Crane (1997: 514) and *H. zosterifolia* Crane (1997: 514). Among these, *H. forrestiana* has the narrowest distribution, only having been reported from Yakushima Island. Recently Zhang (2003) synonymized *H. forrestiana* under *H. doniana* (Mett. ex Hieron.) Crane (1997: 514) and stated that the Japanese specimens of *H. forrestiana* were misidentified as *H. amboinensis* (Fée) Zhang (2003: 460). To be certain about the correct placement of these specimens, we carried out a phylogenetic study, which we present below.

### Material and methods

Material from Yakushima Island is especially morphologically and genetically compared with *H. amboinensis* and *H. doniana*. Rhizome scales and paraphyses were examined with a light microscope (LEICA DMR). A tabletop scanning electron microscope (TM-3000 Hitachi) was used to examine the morphology of the spores and paraphyses following the method of Chen *et al.* (2013). Fifteen spores were randomly sampled to measure their size. Voucher specimens are deposited in the herbarium of the Taiwan Forestry Research Institute (TAIF) and the herbarium of the Japan National Museum of Nature and Science (TNS) (Table 1).

To infer a molecular phylogeny of *Haplopteris* including our new samples from Yakushima Island, plastid regions *chlL*, *ndhF* and *matK* were sequenced from 14 samples of East-Asian *Haplopteris* and *Antrophyum* Hieron.

**Etymology:**—The species is named for the type locality.

**Additional specimens examined:**—JAPAN. Kagoshima Pref., Yakushima Island, Miyanoura. 14 August 1963, *Kawabata s.n.* (TNS VS-155833!). Nakabase River, 4 January 2009, *Oka K-090106* (TNS VS-736790!). Mt. Hasadake, 24 July 1978, *Kawahara s.n.* (TNS VS-583567!). Nakabase River, 29 December 1964, *Heki 6570* (TNS VS-789799!).

**Conservation status:**—The species is listed as a critically endangered species (CR) in the latest red list of Japan (Ministry of Environment, Japan, 2012). Among a number of endangered species mostly due to overgrazing by sika deer (Takatsuki 2009), this species seems to have a high risk of extinction. Formal IUCN red listing is yet to be carried out for this taxon.

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