Cytotaxonomic Study of Hypodematium (Hypodematiaceae) from China

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Abstract

Chromosome numbers and reproductive biology of nine species of the fern genus Hypodematium (Hypodematiaceae) from China were investigated. The chromosome numbers of eight species are reported here for the first time: H. daochengensis n=41 (41 II); H. fordii n=40 (40 II), n=80 (40 II+40 I), 2n=120; H. glandulosopilosum n=41 (41 II), 2n=82, 2n=123; H. gracile n=41 (41 II); H. hirsutum n= 41 (41 II); H. microleptoides n=41 (41 II); H. sinense n= 40 (40 II) and H. squamulosopilosum n=41 (41 II). Two cytotypes, n=82 (41 II+41 I) and 2n=123 in H. crenatum, are reported for the first time. Our results showed that the species with these cytotypes are agamospermous triploids: H. crenatum n = 82 (41 II +41 I), H. glandulosopilosum n = 82 (41 II +41 I) and H. fordii n = 80 (40 II +40 I), based on the unequal size and presence of aborted spores in the sporangium, and the allotriploid hybrid chromosomes in the spore mother cell at the diakinesis stage of meiosis I. The remaining species are sexual diploids and tetraploids, based on the chromosome number n = 41 and n=82 at the diakinesis stage of meiosis I of spore mother cells. The relationships among habitat preferences, frond hairs and reproductive modes in Hypodematium are discussed and illustrated. It appears that plants with large fronds and sparse, thin hairs, living in humid and shady places undergo sexual reproduction, while small plants living in sunny and dry conditions with thick hairs undergo agamospermous reproduction. The distribution pattern and basic chromosome number all indicated the basic chromosome number x= 41 was plesiomorphic, whereas x=40 was apomorphie. Chromosome aneuploid changes occurred in this genus. The distribution of the sexual diploids and tetraploids and agamospermous triploids suggests that the genus might have originated in the Himalayas and dispersed from there to northeast Asia and Japan.

Key words: Hypodematium, chromosome number, cytotaxonomy, reproductive mode, China

Introduction

The fern genus Hypodematium Kunze (Hypodematiaceae) consists of limestone endemics distributed in subtropical and warm temperate Asia and Africa. It includes 18 species, of which 14 species are distributed in the limestone areas of eastern (Shandong province) and southwestern (Yunnan, Sichuan, Guangxi and Guangdong provinces) China, which are the distribution centers of this genus (Tsai & Shieh, 1994; Shing et al., 1999; Wang et al., 2010).

Species of Hypodematium grow in rock crevices in limestone areas. Rhizome dictyostele; lamina 3-4 pinnate, setose with long, soft, acicular and glandular hairs throughout the petiole, rachis and lamina; sorus round with hairy indusium, which is reniform, usually asymmetrical, and attached by a deep sinus. The characteristics of Hypodematium (vascular bundles, hairs, sorus, indusium, gametophyte and chromosome) caused the genus to be confused with those of Athyriaceae (Pichi Sermolli, 1977), Thelypteridaceae (Ching, 1963) and Dryopteridaceae (Loyal, 1960; Nayar & Nisha, 1970; Tryon & Tryon, 1982; Kramer & Green, 1990). Ching (1975) treated this genus as a monotypic family Hypodematiaceae, which was supported by Christenhusz (2011) and Zhang (2012) based on molecular analysis. While Hypodematium was thought to be close to Leucostegia Presl (Tsutsuji & Kato,
Systematic position of the genus Hypodematiurn

Hypodematiurn has been included in Athyriaceae (Pichi Sermolli, 1977), Thelypteridaceae (Ching, 1963) and Dryopteridaceae (Loyal, 1960; Nayar & Nisha, 1970; Tryon & Tryon, 1982; Kramer & Green, 1990), because its characteristics (vascular bundles, hairs, sorus, indusium, gametophyte and chromosome) were confused with those of other families. Ching (1975) treated this genus as a monotypic family Hypodematiaceae, which was supported by Christenhusz (2011) and Zhang (2012), the last two also included Leucostegia Presl in Hypodematiaceae. Based on molecular analysis, Hypodematiurn was considered to be closely related to Leucostegia Presl (Tsutsumi & Kato, 2006; Smith et al., 2006; Schuettpelz & Pryer, 2007; Liu et al., 2007), however, this is not supported by evidence from macro-morphology and microcharacteristics of the epidermis (Wu et al., 1991; Wang et al., 2012).

The plesiomorphic basic chromosome numbers of Hypodematiurn is x = 41, which is the same as that of Leucostegia Presl. Based on the chromosome evidence, our study supports the close relationship of Hypodematiurn with Leucostegia Presl. However, the systematic position of Hypodematiurn is still unclear and further study is still needed.

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