

Full Length Research Paper

Structural characters of leaf epidermis in *Neolepisorus* (Polypodiaceae)

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The surface structure of the foliar epidermis of 5 species, 2 forms and 8 populations in *Neolepisorus* was investigated under light microscopes. The result shows that their stomata are distributed in the lower leaf epidermis and parallel to the veins. The types of stomata found were polocytic, axilloctytic, copolocytic, coaxilloctytic and anomotetracytic. They were different in stomatal type, stomatal index, the epidermal features, type of curved anticlinal walls. These differences contributed evidences for the taxon identification and systematics of *Neolepisorus*.

Key words: *Neolepisorus*, leaf epidermis, stomatal apparatus types.

INTRODUCTION

Neolepisorus Ching (Polypodiaceae) is a natural group characterized by simple, 3-lobed or palmately lobed leaves usually with a chartaceous texture, distinct lateral veins, anastomosing venation, and areolae with included forked veinlets. Sori are usually large, round or oval, covered with peltate, clathrate, iridescent dark brown scales; usually borne near costa and lying in a single row between the main veins or sometimes irregularly spaced. The genus occurs in tropical and subtropical Asia and Africa with one center of distribution in the Yangtze River area of south and southwest China. Its species are largely endemic to mainland China, the exceptions being the one endemic to Madagascar, one found in Indo-Himalayas, upper Burma, northern Thailand, Indo-China and China, and a third in Japan, Philippines and China (including Taiwan). As originally proposed by Ching (1940), *Neolepisorus* consisted of three species: *N. lastii* (Baker) Ching, *N. ovatus* (Bedd.) Ching and *N. ensatus* (Thunb.) Ching. Subsequently Ching and Shing (1983) published a regional taxonomic revision of Chinese *Neolepisorus* which recognized 10 species, a conclusion confirmed by Lin Youxing (2000).

Leaf epidermal characteristics such as the deposition of

wax crystalloids, hair and stomata types are of potential taxonomical importance. However, this was rather given little attention by Wang (2007). And as far as we are aware, no observations under light microscopy (LM) have been published. The aim of this study was to present a more detailed study of the leaf epidermal features of the 5 species, 2 forms and 8 populations of *Neolepisorus* for the first time.

MATERIALS AND METHODS

The materials examined in this study were obtained from the specimens at WUK. Their species names, which essentially followed Ching and Shing, (1983), together with the collection localities, are shown in Table 1. Samples were taken from fully expanded sun-exposed leaves. The materials for LM observation were boiled in water for about 10 min and then macerated for 18 h in a mixture of H₂O₂ and acetic acid (1:1) at 37°C. Pieces of leaf epidermises were stained in a solution of safranin in 50% alcohol before being mounted on glycerin gel. To check the constancy of epidermal structure, at least five slides were made from different parts of a single leaf or from different leaves for each species.

RESULTS

The characteristics of leaf epidermis of the *Neolepisorus* are listed in Table 2. It appeared that stomatal and other epidermal features are constant within species and thus

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Table 1. Vouchers for leaf epidermis of *Neolepisorus*.

Taxon	Locality	Voucher (herbarium)
<i>Neolepisorus ovatus</i> (Bedd.) Ching	Suichuan, Jiangxi, China	J. S. Yue et al. 4132
<i>N. emeiensis</i> Ching et Shing	Chengkou, Chongqing, China	T. L. Dai 107331
<i>N. sinensis</i> Ching	Shuangbai, Yunnan, China	R.C. Ching 528
<i>N. tsaii</i> Ching et Shing	Tiansui, Gansu, China	R.C. Ching 53323
<i>N. dengii</i> Ching et P. S. Wang	Yaan, Sichuan, China	T. P. Wang 8542
<i>N. dengii</i> f. <i>hastatus</i> Ching et P. S. Wang	Pingli, Shaanxi, China	Y. S. Chen et al. 2206
<i>N. ovatus</i> f. <i>deltoideus</i> Ching (Population Nanzheng)	Nanzheng, Shaanxi, China	K.J. Fu 10762
<i>N. ovatus</i> f. <i>deltoideus</i> Ching (Population Guanxian)	Guanxian, Sichuan, China	T. P. Wang 10039

Table 2. Leaf epidermal characters of *Neolepisorus* under LM.

Taxa	Adaxial epidermis						Abaxial epidermis		Figure 1
	Shape of cells	Pattern of anticlinal walls	Shape of cell	Pattern of anticlinal walls	Size range of stomata (μm^2)	Stomata index	Type of somatal apparatus		
<i>Neolepisorus ovatus</i>	Irr	sinuous	Irr	sinuous	56.2 × 33.1	10.2	Pol, Axi, Cop, Coa	1, 2	
<i>N. emeiensis</i>	Pol	sinuolate	Irr	sinuous	45.6 × 29.1	12.5	Pol, Axi, Cop, Coa, Ano	3, 4	
<i>N. sinensis</i>	Irr	sinuate	Irr	sinuate	48.4 × 33.3	8.4	Pol, Axi, Cop, Coa, Ano	5, 6	
<i>N. tsaii</i>	Irr	sinuate	Irr	sinuous	55.9 × 32.7	9.5	Pol, Axi, Cop, Coa	7, 8	
<i>N. dengii</i>	Pol	sinuolate	Irr	sinuous	44.7 × 26.3	11.9	Pol, Axi, Cop, Coa	9, 10	
<i>N. dengii</i> f. <i>hastatus</i>	Pol	sinuolate	Irr	sinuous	48.6 × 32.6	16.2	Pol, Axi, Cop, Coa, Ano	11, 12	
<i>N. ovatus</i> f. <i>deltoideus</i>	Irr	sinuous	Irr	sinuous	46.9 × 31.7	10.7	Pol, Axi, Cop, Coa	13, 14	
<i>N. ovatus</i> f. <i>deltoideus</i>	Irr	sinuous	Irr	sinuous	46.7 × 30.8	7.9	Pol, Axi, Cop, Coa, Ano	15, 16	

Irr = Irregular; Pol = Polygonal; Ano = Anomocytic; Pol = Polocytic; Cop = Copolocytic; Axi = Axillocytic; Coa = Coaxillocytic.

may be used in analysis.

Epidermal cell

The epidermal cells of the *Neolepisorus* as seen under LM are usually irregular or polygonal in shape, with anticlinal walls that are sinuolate, sinuous or sinuate. The patterns of anticlinal cells may vary in different species or between adaxial (Ad) and abaxial (Ab) epidermises of the same

species: sinuous walls are found in *N. ovatus*, *N. emeiensis*, *N. dengii* and *N. tsaii* (Ad and Ab; Figure 1 numbers 1, 2, 4, 8, 10, 12, 13 to 16); sinuolate walls in *N. emeiensis* and *N. dengii* (Ad; Figure 1, nos. 3, 9 and 11); sinuate walls in *N. sinensis* and *N. tsaii* (Ad and Ab; Figure 1, nos. 5, 6 and 7).

Stomatal apparatus

All the species studied herein have the stomatal

apparatus restricted in abaxial epidermises. The shape of the stomata is usually elliptic or wide elliptic. The stomata can be polocytic, axillocytic, copolocytic, coaxillocytic, and rarely anomocytic. However, these types of stomata often occur in a single leaf. The size range of stomata was (44.7 - 56.2) × (26.3 - 33.3) μm^2 . The stomatal density differed from species to species. The stomatal index ranged from 16.2% in *N. dengii* f. *hastatus*, with the stomata being densely distributed, to 8.4% in *N. sinensis*, with the stomata being sparsely

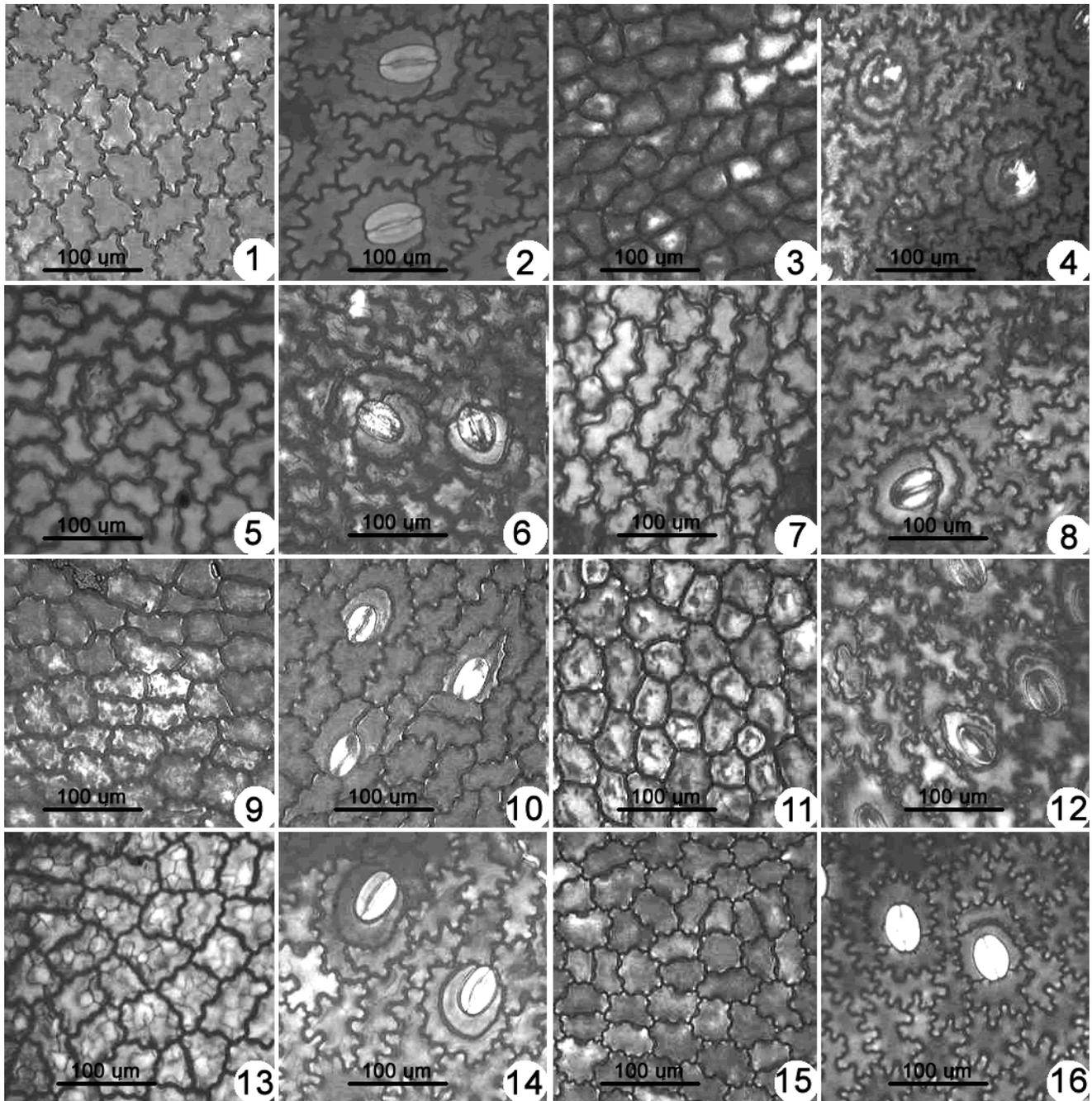


Figure 1. The characters of leaf epidermis of *Neolepisorus* under LM. 1 and 2, *Neolepisorus ovatus*; 3 and 4, *N. emeiensis*; 5 and 6, *N. sinensis*; 7 and 8, *N. tsaii*; 9 and 10, *N. dengii*; 11 and 12, *N. dengii* f. *hastatus*; 13 and 14, *N. ovatus* f. *deltoideus* (Population Nanzheng); 15 and 16, *N. ovatus* f. *deltoideus* (Population Guanxian).

distributed.

DISCUSSION

The leaf epidermal cells in the fern genus *Neolepisorus* are usually irregular or polygonal in shape, and the stomatal apparatus are restricted in abaxial epidermises.

The main stomatal apparatus types in all species examined in this study were polocytic and axillocytic. The cuticular membrane of the leaf epidermal was generally sinuate to sinuolate. In all species, the leaf epidermal features were fairly similar, which indicated the affinity of *Neolepisorus* suggested by Sen and Hennipmam, (1981).

In addition, the patterns of anticlinal walls and the stomata types were constant within species, and thus

could provide some anatomical evidences for the classification of *Neolepisorus* in some species. For example, *N. emeiensis* and *N. dengii* differed in the shape of the lamina base, but have similarly shaped epidermal cells, including the distribution, structure and type of stomata, thus suggesting that *N. dengii* can be considered a synonym of *N. emeiensis*.

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