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油果樟属和近缘属的网脉结构式样

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摘要: 对油果樟属(*Syndiclis* Hook. f.)及其近缘属琼楠属(*Beilschmiedia* Nees)、孔药楠属(*Sinopora* J. Li *et al.*)、国产土楠属(*Endiandra* R. Br.)和 *Potameia* 的网脉结构进行了观察。结果表明,它们的网脉结构可分为 3 种类型:A 型网格小且小脉无游离末端;B 型网格小但有不分枝或简单分枝的游离末端;C 型网格粗且网脉末端多分枝。琼楠属网脉结构多样,具有全部 3 种类型,其余 4 属均仅有 1 种类型,油果樟属、孔药楠属以及土楠属均为 A 型,明显不同于 *Potameia* 的 C 型网脉结构。

关键词: 油果樟属; 樟科; 网脉; 解剖; 分类学

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Venation Pattern of *Syndiclis* Hook. f. and Its Related Genera

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Abstract: Minor venation patterns of *Syndiclis*, *Beilschmiedia*, *Potameia*, *Sinopora*, and *Endiandra* were observed. The results showed that their venation patterns could be grouped into three types, the Type A with fine leaf reticulations bearing no free ending of veinlets, the Type B with fine leaf reticulations having free and simple ending of veinlets, and the Type C with coarse leaf reticulations possessing profusely branched ending of veinlets. *Beilschmiedia* was provided with the most diversified venation including all 3 types while other genera had only one of the 3 types each. *Syndiclis*, *Sinopora*, and the Chinese *Endiandra* shared the Type A venation pattern which was different from *Potameia* with the Type C venation pattern.

Key words: *Syndiclis*; Lauraceae; Venation; Anatomy; Taxonomy

Syndiclis Hook. f. of Lauraceae belongs to Subtrib. Beilschmiediineae Kosterm., and is closely related to *Beilschmiedia* Nees, *Potameia* Thou., *Sinopora* J. Li *et al.*, and *Endiandra* R. Br.[1-3]. The genus was once merged into *Potameia* because of their overall morphological resemblance[4], Li & Pai[1] and Li *et al.*[5] retained its generic status in both Flora Reipublicae Popularis Sinicae and Flora of China because staminodes are 4 in *Syndiclis* but 2 in *Potameia*. This is not conclusive because *Syndiclis* is not well studied. Less than 30 collections are housed in herbarium, and variation of flower features of the genus is not clear in detail at present. Whether differences other than the staminodes are present between *Syndiclis* and its related genera have remained unknown.

Syndiclis is endemic to Asia, mainly in the Tropical India and South China[6](Fig. 1), and includes

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10 species with one species in Buthan and all other 9 species in China. *Syndiclis paradoxa* Hook. f. is from Buthan, the only known specimen is *Booth* s.n. (K!), *S. chinensis* Allen and *S. lotungensis* S. Lee are from Hainan, *S. furfuracea* H. W. Li, *S. marlipoensis* H. W. Li, *S. fooningensis* H. W. Li, *S. sichourensis* H. W. Li, and *S. pingbienensis* H. W. Li are from SE Yunnan, *S. anlungensis* H. W. Li is from Guizhou, and *S. kwangsiensis* (Kostermans) H. W. Li is the only known species of this genus in Guangxi. Xia *et al.*[7] described *S. hongkongensis* N. H. Xia *et al*, but it was soon separated and combined into *Sinopora hongkongensis* (N. H. Xia *et al.*) J. Li et al.[8].

Leaf characters were believed to be useful in taxonomy of Lauraceae[9-13]. Minor venation patterns in Neotropical *Beilschmiedia* were generally grouped into two types according to size of areoles, viz. fine or coarse, Nishida[11] and Nishida & Christophel[12] further divided the fine type into two types based on presence and branching of free ending veinlets.

The minor venation patterns of *Syndiclis* were not known and this study is to present new data on venation patterns of *Syndiclis* and its related genera.

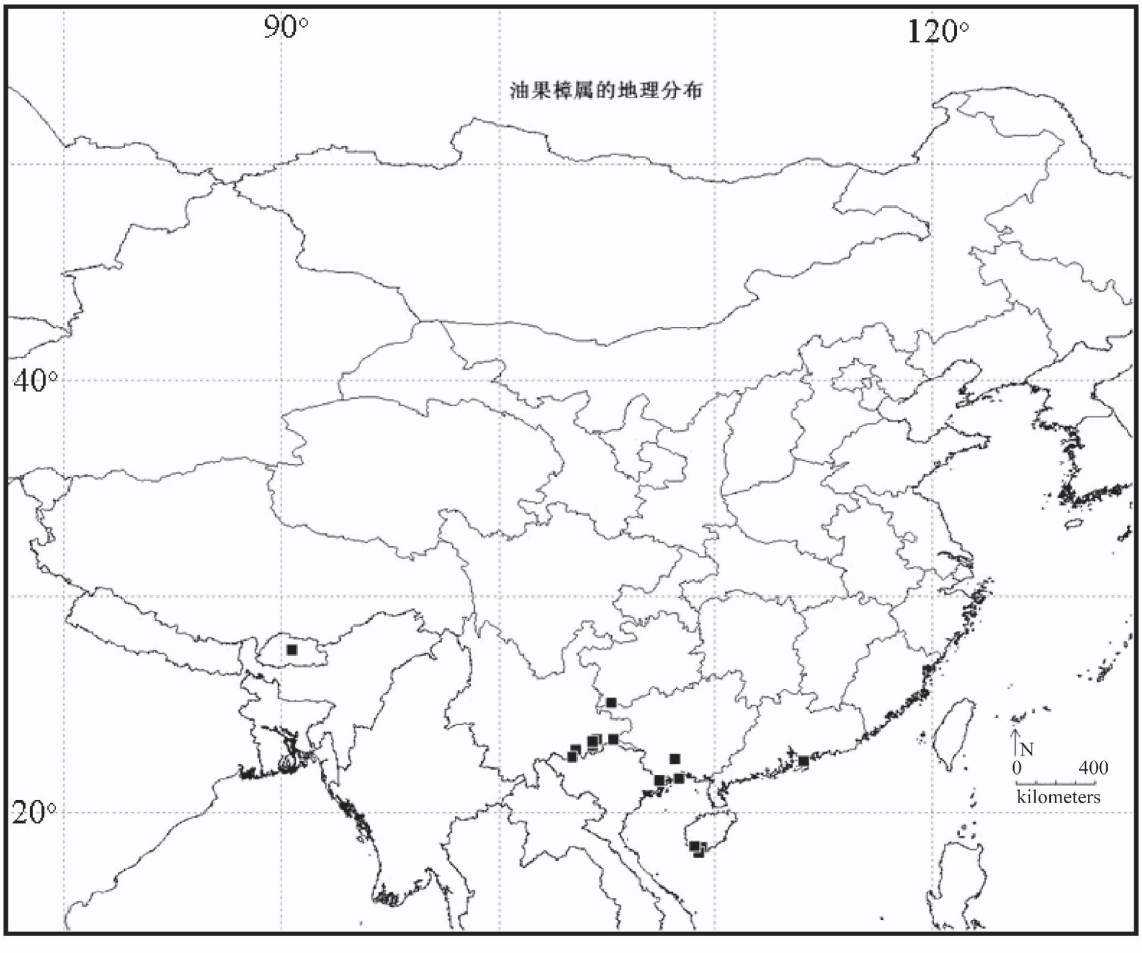

Fig. 1 Distribution of *Syndiclis* (■)

1 Materials and methods

Mature leaf materials were sampled from herbarium specimens (Table 1). Leaf samples were cut into small pieces (1.0 cm × 1.0 cm) which were soaked into NaOH solution (20%) at 42℃ until margin of samples became whitened. Leaf mesophyll was cleaned away under light microscope. Venation was stained with Safranin (1%)-ethanol (50%) solution for 5 minutes. Observations were made under anatomical microscope (Nikon SMZ1000) at 10 × 2 times, photographing was conducted using a digital

camera (DXM 1200F). Diameter of the smallest areole of veinlet reticulations was measured in 10 visual fields. Average diameter of the smallest areole was calculated.

Terms used here are basically from Nishida[11] and Nishida & Christophel[12].

Table 1 Vouchers and their deposit

Taxon	Locality	Collection	Deposit
Syndiclis anlungensis H. W. Li	Anlong, Guizhou	T. S. Chang & Y. T. Chang 5464	PE
S. chinensis Allen	Baoting, Hainan	F. C. How 73136	PE
S. fooningensis H. W. Li	Funing, Yunan	C. W. Wang 89102	PE
S. kwangsiensis (Kosterm.) H. W. Li	Shiandashan, Guangxi	R. C. Ching 7939	PE
S. marlipoensis H. W. Li	Malipo, Yunnan	K. M. Feng 12983	PE
S. pingbienensis H. W. Li	Pingbian, Yunnan	K. M. Feng 4986	PE
	Pingbian, Yunnan	K. M. Feng 5072	PE
S. sichourensis H. W. Li	Xichou, Yunnan	K. M. Feng 12247	PE
Beilschmiedia appendiculata (Allen) S. Lee et Y. T. Wei	Sanya, Guangdong	Lau 6	PE
	Ledong, Guangdong	236-6 Exped. 3759	PE
	Lingshui, Guangdong	H. Y. Liang 61807	PE
	Chengmai, Hainan	Lei C. L. 818	PE
B. delicata S. Lee et Y. T. Wei	Damiaoshan, Guangxi	S. H. Chun 16454	PE
	Zheng'an, Guizhou	P. C. Tsoong 40	PE
	Yanshan, Yunnan	C. W. Wang 84217	PE
	Rongxian, Guangxi	S. H. Chun 9644	PE
B. erythrophloia Hayata	Anhui	Saith Coke 1264	PE
B. glauca S. Lee et L. F. Lau	Hainan	Hainan Exped. 00676	PE
B. henghsienensis S. Lee et Y. T. Wei	Hengxian, Guangxi	Z. Z. Chen 50668	PE
B. intermedia Allen	Fangcheng, Guangdong	Anonymous 221018	PE
	Hainan	Diaoluoshan Exped. KT020	PE
	Longjin, Guangxi	Y. K. Li 00242	PE
	Lingshui, Hainan	L. Deng 3166	PE
	Gan'en, Hainan	H. Y. Liang 65158	PE
	Baisha, Guangdong	S. K. Lau 25462	PE
B. kweichowensis Cheng	Ceheng, Guizhou	Z. Y. Cao 1202	PE
	Damiaoshan, Guangxi	S. H. Chun 16367	PE
	Longlin, Guangxi	Y. K. Li P00665	PE
	Chishui, Guizhou	P. C. Tsoong 263	PE
B. laevis Allen	Baoting, Hainan	Hainandong Exped. 797	PE
B. linocieroides H. W. Li	Cheli, Yunnan	C. W. Wang 78447	PE
B. longipantiolata Allen	Sanya, Hainan	C. Wang 34640	PE
B. macropoda Allen	Baoting, Hainan	Diaoluoshan Exped. 2913	PE
B. obconida Allen	Gan'en, Hainan	H. Y. Liang 65199	PE
B. obscurinervia H. T. Chang	Guangxi	Anonymous 70057	PE
B. pergamentacea Allen	Hainan	N. K. Chun 44015	PE
	Hainan	S. K. Lau 26359	PE
	Guangdong	Tsang & Fung 693	PE
B. purpurascens H. W. Li	Yunnan	Sino-Russia Exped. 7626	PE
B. robusta Allen	Kungming, Yunnan	Kunming Station 80146	PE
	Wenshan, Yunnan	K. M. Feng 11142	PE
	Motuo, Xizang	Qinghai-Xiang Exped. 74-4385	PE

(Continued)

Taxon	Locality	Collection	Deposit
B. tsangii Merr.	Cangwu, Guangxi	S. H. Chun 10197	PE
	Fengchuan, Guangdong	Cheng Huang 164534	PE
	Hainan	X. G. Li 200232	PE
	Gan'en, Hainan	H. Y. Liang 63278	PE
	Gan'en, Hainan	H. Y. Liang 63362	PE
	Dinghushan, Guangdong	G. L. Shi 13490	PE
	Yunan	Y. Lin 15116	PE
	Xinyi, Guangdong	C. Wang 31093	PE
	Guangdong	W. T. Tsang 20588	PE
B. tungfangensis S. Lee et L. Lau	Hainan	236-6 Exped. 1530	PE
B. xizangensis Tsui	Motuo, Xizang	S. Z. Cheng et B. S. Li 4694	PE
B. yaanica (N. Chao) N. Chao	Yaan, Sichuan	Y. C. Yang 3404	PE
B. yunnanensis Hu	Pingbian, Yunnan	Y. M. Chui 005013	PE
	Jinghong, Yunan	H. Tsiang 4205	PE
Potameia chartacea Kosterm.	Madagacar	Mepherson 17177	MO
P. microphylla Kosterm.	Madagascar	Henk van der Werff. 12655	MO
P. incisa Kosterm.	Madagascar	Rabeheridra 664	MO
P. micrantha van der Werff.	Madagascar	Henk van der Werff. 12771	MO
Endiandra coriacea Merr.	Taiwan	Y. C. Lin& H. C. Wu 00335	PE
E. dolicocarpa S. Lee et Y. T. Wei	Hekou, Yunnan	Kunming Station 5385	PE
Sinopora hongkongensis (N. H. Xia & et al.) J. Li et al.	Hongkong	L. T. Lo & et al. 337	IBSC

2 Results

Minor venation patterns in *Syndiclis* and its related genera (*Beilschmiedia*, *Endiandra*, *Sinopra*, and *Potameia*) can be grouped into three types (Table 2). Type A has fine leaf reticulations with none free ending of veinlets (Fig. 2-1), *e.g.* all *Syndiclis* species, *Sinopora hongkongensis*, two species of *Endiandra*, *B. obscurivervia*, *B. yunnanensis*, and *B. tungfangensis*. Type B is fine leaf reticulations with free and simple ending of veinlets (Fig. 2-2), *e. g. Beilschmiedia glauca*. Type C bears coarse leaf reticulations with free and profusely branched ending of veinlets including most of the *Beischmieida* species from China and the sampled *Potameia* in this study (Fig. 2-3). The Type A and Type B have small diameter of areoles of veinlets less than 0.51 mm but the Type C has areoles of veinlets with diameter varying in 0.9 ~ 2.31 mm (Table 2). Venation patterns of *Beilschmiedia* are diversified and include all three types while other sampled genera have only one single type each, *Syndiclis*, *Sinopra*, and *Endiandra* belong to the Type A, and *Potameia* belongs to the Type C.

Minor veinlet reticulations of *Syndiclis* are fine. Ends of veinlets are usually connected forming fine areoles. The average diameter of the smallest areole of reticulations is 0.18 ~ 0.28 mm.

The two *Endiandra* species from China have fine leaf veinlet reticulations. Ends of veinlets are connected or free but not profusely branched. The average diameter of the smallest areole of reticulations is 0.51 in *E. coriacea* but 0.47 in *E. dolichocarpa*.

The 4 sampled *Potameia* species all have coarse leaf reticulations. Ends of veinlets are free and profusely branched in areoles. The average diameter of the smallest areole of reticulations lies between 1.47 ~ 2.07 mm.

Beilschmiedia includes two types of leaf reticulations. The coarse type has ends of veinlets

profusely branched (*e.g. B. intermedia*, *B. longipetiolata*, *B. pergamentacea*), and the average diameter of the smallest areole of reticulations ranges from 0.9 ~ 2.31 mm. The fine type usually has either connected ends of veinlets or rarely free but not profusely branched (*e.g. B. glauca*, *B. obscurinervia*, *B. tungfangensis*, and *B. yunnanensis*). The average diameter of the smallest areole of reticulations varies from 0.35 ~ 0.51 mm.

Sinopora hongkongensis has fine leaf reticulations. Ends of veinlets are connected. The average diameter of the smallest areole of reticulations is 0.28 mm.

Table 2 Venation structure and average diameter of the smallest areole of veinlet reticulations

Species	Veinlet reticulations	Free veinlet ends present	Veinlet ends branching	Areole diameter (mm)	Group
S. anlungensis	Fine	N	N	0.22	A
S. chinensis	Fine	N	N	0.32	A
S. fooningensis	Fine	N	N	0.18	A
S. kwangsiensis	Fine	N	N	0.31	A
S. marlipoensis	Fine	N	N	0.24	A
S. pingbienensis	Fine	N	N	0.19	A
S. sichourensis	Fine	N	N	0.22	A
B. appendiculata	Coarse	Y	Y	1.43	C
B. delicata	Coarse	Y	Y	1.21	C
B. erythrophloia	Coarse	Y	Y	1.04	C
B. glauca	Fine	Y	N/Y	0.51	B
B. henghsienensis	Coarse	Y	Y	1.44	C
B. intermedia	Coarse	Y	Y	1.45	C
B. kweichowensis	Coarse	Y	Y	2.31	C
B. laevis	Coarse	Y	Y	1.67	C
B. linocieroides	Coarse	Y	Y	1.00	C
B. longipantiolata	Coarse	Y	Y	1.56	C
B. macropoda	Coarse	Y	Y	1.23	C
B. obconica	Coarse	Y	Y	1.01	C
B. obscurinervia	Fine	N	N	0.47	A
B. pergamentacea	Coarse	Y	Y	1.46	C
B. purpurascens	Coarse	Y	Y	1.16	C
B. robusta	Coarse	Y	Y	1.31	C
B. tsangii	Coarse	Y	Y	0.90	C
B. tungfangensis	Fine	N	N	0.50	A
B. xizangensis	Coarse	Y	Y	1.28	C
B. yaanica	Fine	Y	Y	0.97	C
B. yunnanensis	Fine	N	N	0.34	A
P. chartacea	Coarse	Y	Y	2.07	C
P. microphylla	Coarse	Y	Y	1.74	C
P. incise	Coarse	Y	Y	1.68	C
P. micrantha	Coarse	Y	Y	1.47	C
E. coriacea	Fine	N	N	0.51	A
E. dolicocarpa	Fine	N	N	0.47	A
Sinopora hongkongensis	Fine	N	N	0.28	A

N: Absent; Y: Present

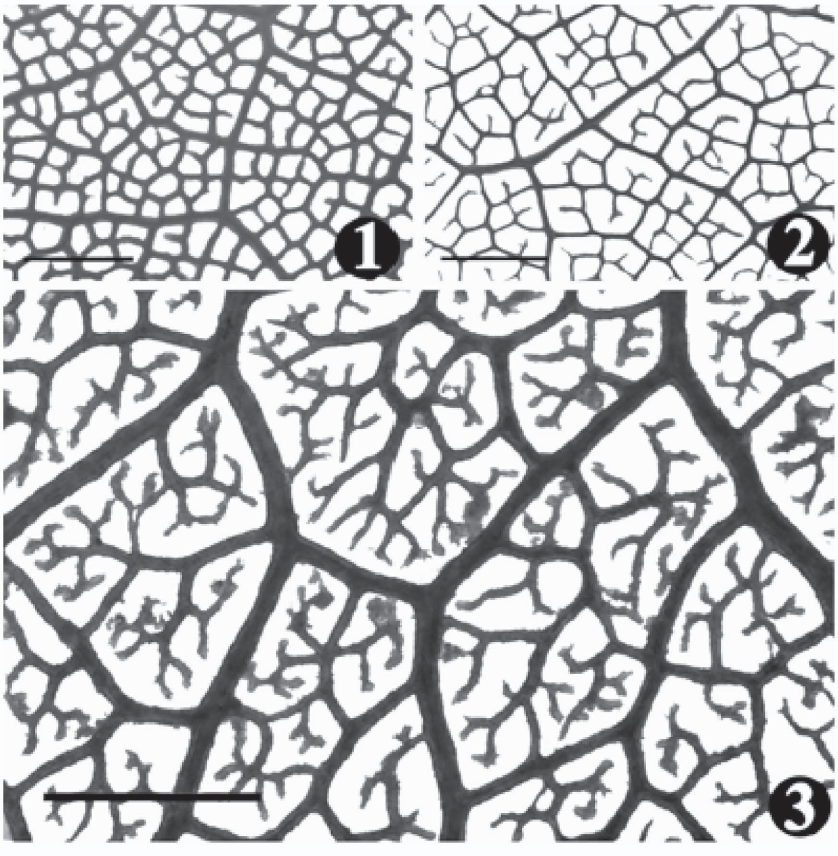

Fig. 2 Optical micrographs of minor venation patterns
1. Type A; 2. Type B; 3. Type C. Bars = 1 mm

3 Discussion

All three types occurred in the Neotropical *Beilschmiedia* are also present in Asiatic *Beilschmiedia*. Most of the Asiatic *Beilschmiedia* bear the Type C venation pattern with only a few exceptions. *Beischmiedia delicata* and *B. tsangii* usually have fine leaf reticulations visible with unaided eyes, but occasionally have coarse reticulations. The results of this study clearly show they belong to the Type C because their veinlets have free ending and are profusely branched. *Beilschmiedia glauca* has the Type B venation pattern which is quite close to the Type A both in the size of areoles and in the frequent connection of veinlet ends.

The venation pattern is usually consistent within genus, e. g. *Syndiclis*, *Endiandra*, *Potameia*, and *Sinopra*, but diversified in *Beilschmiedia* according to this study, Nishida & Christophel[12], and Nishida[11]. Thus this character can't be used for infrageneric grouping in *Syndiclis*, but it is informative in *Beilschmiedia* which can be classified into three groups, viz. *B. yunnanensis* group, *B. glauca* group, and *B. intermedia* group. This kind of grouping is not parallel to grouping using other characters (*e. g.* terminal bud type, fertile stamen number, fruit shape or sculpture) in *Beilschmiedia*. For an example, the Type A venation pattern including the *B. yunnanensis* group, *Endiandra*, *Syndiclis* and *Sinopra* bears small terminal buds, but species in the *B. intermedia* group has both large and small type of terminal buds.

Syndiclis and *Sinopra* share one same type of minor venation pattern (*viz*. Type A) while the Type A venation of both *Syndiclis* and *Sinopra* is clearly different from the Type C of the sampled *Potameia*. As a result, venation patterns might be a potential difference between *Syndiclis* and *Potameia*.

All the sampled *Endiandra* and *Potameia* ranged within *Beilschmiedia* in minor venation patterns, but whether this character can be used for infrageneric classification for the two genera or not is not clear. Further studies based on full sampling are encouraged

for the two genera.

Though it seems that the 3 types of venation patterns are parallel in *Syndiclis* and its related genera, evolution of the venation characters can't be discussed within a phylogenetic frame for the time being. *Beilschmiedia* seems not a monophyletic group with one clade close to *Endiandra* and the other to *Potameia*[2]. In addition, less than 10 percent species for these genera were sampled and there are no representatives of *Syndiclis* in those molecular phylogenies.

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