

## Preliminary list of bryophytes of Heishiding Nature Reserve, Guangdong Province, China

Li, Zhi-Hua

Department of Biology, Zhongshan University, Guangzhou, China

Piippo, Sinikka

Botanical Museum, University of Helsinki, Unioninkatu 44, SF-00170 Helsinki, Finland

**Abstract.** Thirty-seven species of hepatics and 66 species of mosses are reported from Heishiding Nature Reserve, including eight taxa new to China and one species new to mainland China. The new taxa for China are *Ectropothecium aneitense* Broth., *Gammiella tonkinensis* (Broth. & Par.) Tan, *G. touwii* Tan, *Hypnum fauriei* Card., *Papillidiopsis complanata* (Dix.) Buck & Tan, *Syrrhopodon prolifer* Schwaegr. var. *papillosum* (C.Müll.) Reese, *Trichosteleum pseudo-mammosum* Fleisch., and *Trichostomum crispulum* Bruch; and the species new to mainland China is *Isocladiella surcularis* (Dix.) Tan & Mohamed. The phytogeography of the area and the bryophytes are discussed.

Heishiding Nature Reserve is situated in Fungkei County, in the western part of Guangdong Province (Fig. 1). It covers ca. 4000 ha of evergreen broad-leaved forest and mixed forest with rich flora and fauna. The Tropic of Cancer runs through its center. On the west the area is bordered by the Xizang River, causin

favorable conditions of moisture and warmth. Because Heishiding is a transitional zone between the tropics and subtropics, it is the northern limit for specialized tropical plants, as well as the southern limit for specialized subtropical plants. Moreover, it is the juncture of the south Chinese and west Chinese flora.

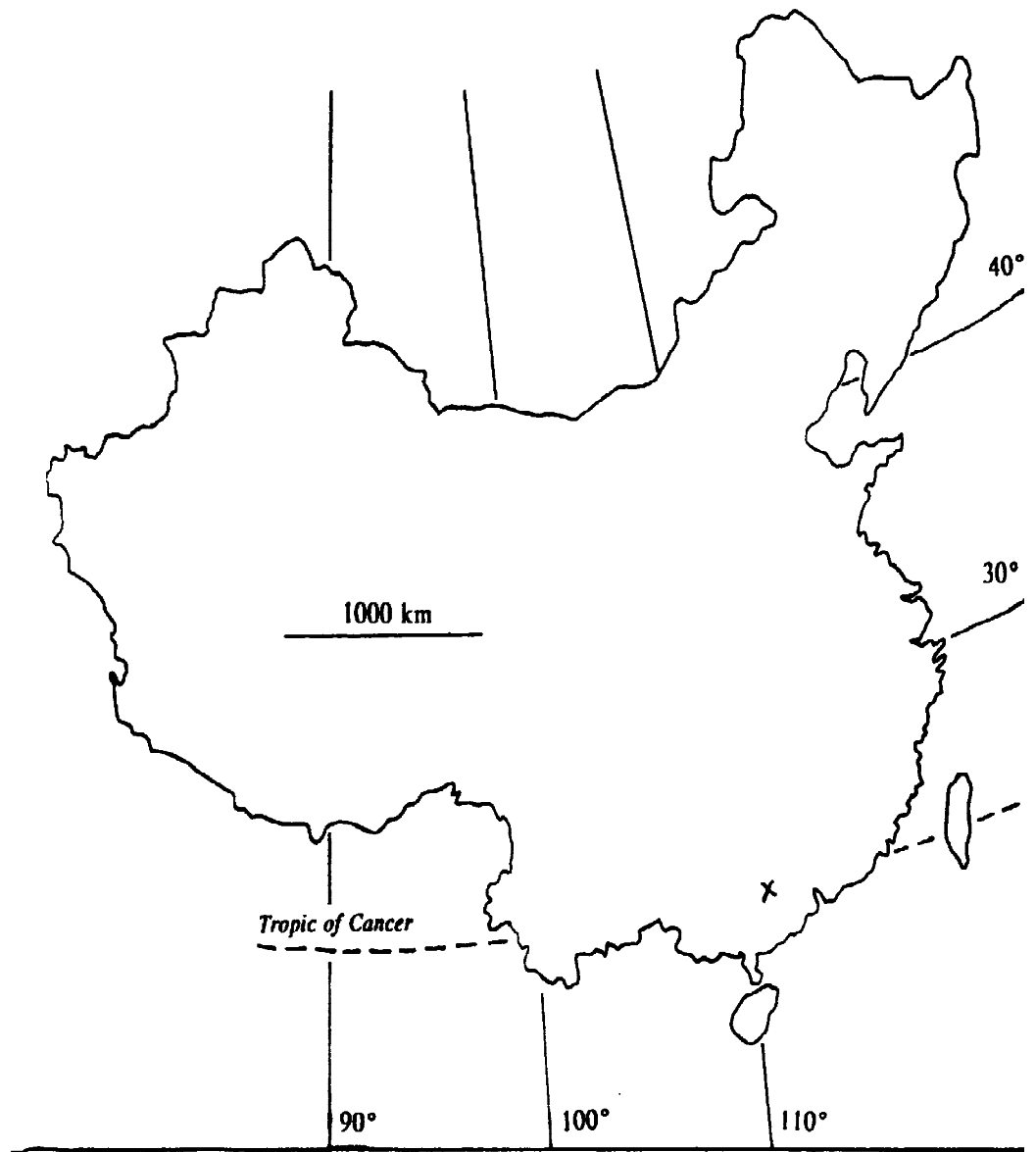


Fig. 1. The location of Heishiding Nature Reserve, Guangdong

Therefore, Heishiding Nature Reserve is a rare research base in China for the study of forest ecosystem.

Recently, the Experimental Centre for Ecosystem Study of Tropical and Subtropical Forests was established by the Educational Committee of the People's Republic of China. Zhongshan University has been entrusted by the Educational Committee with supervision of the Centre, which includes accepting specialists, scholars and students to do research or teaching work in various fields of biology and geoscience in the Heishiding area. Within this context, it is necessary to investigate the biological resources including bryophytes. Since 1981 the senior author and his students have made several fieldtrips to collect bryophytes in Heishiding Nature Reserve. The present authors also collected bryophytes in the area in April 1989.

The present preliminary study on the bryophytes of Heishiding provides a list of 37 species of hepatics in 21 genera and 15 families, and 66 species of mosses in 37 genera and 20 families. Some doubtful specimens are omitted from the present study to be studied in the future.

### Vegetation of Heishiding Nature Reserve

Heishiding Nature Reserve is located at 23°27'N and 111°53'E. It is part of the Huangang mountain range of the Yunkei mountain system. Its topography rises and falls across a large area descending from southeast to northwest. It is part of a low mountainous region, of elevation mainly from 150 to 700 m. The main peak is 927 m above the sea level. The geological structure of the area consists mainly of granite of the Devonian Period. The climate is subtropical monsoon, with the average temperature 19.6°C, and the average minimum 10.6°C. The frost-free period is 297 days. The mean annual rainfall is 166.78 mm, falling mainly from April to September and accounting for 79% of the total precipitation. Relative humidity is more than 80% (Wang & Liu 1987).

The zonal vegetation of the region is south subtropical evergreen broad-leaved forest, with a high tropical component. The vegetation can

be divided roughly into four types:

(1) Below 600 m: south subtropical broad-leaved forest, mainly consisting of *Castanopsis*, *Lithocarpus*, *Cryptocarya chinensis* (Hance) Hemsl., *C. concinna* Hance and genera of Theaceae;

(2) from 600 to 800 m: south subtropical mountainous broad-leaved forest, mainly consisting of species with scaly buds, e.g. *Cinnamomum* and *Castanopsis fabri* Hance. *Lithocarpus litseifolius* (Hance) Chun, *Manglietia fordiana* Oliver, *Michelia foveolata* Merr. ex Dandy, *Altingia chinensis* (Champ.) Oliver ex Hance, and genera of Rubiaceae, Aquifoliaceae and Symplocaceae are also abundant;

(3) from 750 to 800 m: small amount of mountainous evergreen broad-leaved forest and brushwood with bryophytes, mainly consisting of *Symplocos stellaria* Brand, *Altingia chinensis*, *Castanopsis fabri*, *Syzygium buxifolium* Hook. & Arn. and *Ilex*;

(4) above 900 m: shrubs and grassland, mainly consisting of *Rhododendron*, *Vaccinium*, and families of Symplocaceae, Asteraceae, Lamiaceae, Cyperaceae and Gramineae (Shi 1987).

### Bryogeography of the area

Knowledge of the Heishiding bryoflora is still scarce. Some trends can, however, be noted: (1) There are some widely distributed bryophytes with mainly northern hemisphere distribution, such as *Blepharostoma trichophyllum* (L.) Dum., *Hyophila involuta* (Hook.) Jaeg. and *Odontoschisma denudatum* (Nees) Dum. (2) Strictly boreal taxa are lacking, except *Lophozia obtusa* (Lindb.) Evans. (3) There are many species with a wide tropical and subtropical distribution, e.g. *Bryum billardieri* Schwaegr., *Dumortiera hirsuta* (Sw.) Nees, *Heteroscyphus argutus* (Reinw. et al.) Schiffn., *Rhodobryum giganteum* (Schwaegr.) Par., *Syrrophodon prolifer* Schwaegr., and Lejeuneaceae. (4) Many species are SE-Asian, e.g. *Fissidens zippelianus* Dozy & Molk., *Kurzia gonyotricha* (Sande Lac.) Grolle, *Makinoa crispata* (Steph.) Miyake, *Notoscyphus lutescens* (Lehm. & Lindenb.) Mitt., and *Plagiomnium succulentum* (Mitt.) T.Kop.

(5) Very many species, especially of mosses, are east Asiatic.

Based on this material, it is difficult to judge which are the most common bryophyte species in the area. Lejeuneaceae and *Radula acuminata* Steph. growing on tree leaves are certainly frequent. Despite the high proportion of subtropical and tropical elements in the flora, however, most of the collections were made on the rock.

### A preliminary list of bryophytes

In the previous list published from the area (Anonymous 1987), 21 hepatics and 63 mosses were reported for Heishiding. Of them nine hepatics and 42 mosses were unaccounted for the present study.

In the list below the order of the moss families mainly follows Chen et al. (1963, 1978), and that of the hepatic families Grolle (1983). The records of the novelties for the Chinese moss flora are mostly based on the list by Redfearn & Wu (1986). The names of the collectors are abbreviated as follows: L = Li Zhi-Hua; P = Sinikka Piippo; S = Shi Su-Hua; Z & S = Zhang Jun-Li & Sun Li; and W = Wang Hui-Shen. Unless otherwise indicated, all the specimens have been identified by the present authors, Li the mosses and Piippo hepatics. The specimens are located in H and SYS.

#### A. Hepatics

##### Lepidoziaceae

*Bazzania japonica* (Sande Lac.) Lindb. - Z & S 114, S 058; on rock.

*B. tridens* (Reinw. et al.) Trev. - Z & S 101, 131, L 87015, P 6678, S 017, 061; on rock.

*Kurzia gonyotricha* (Sande Lac.) Grolle - L 87014, P 6647, 6651, 6652, 6682, 6683, 6689; on soil (sand and clay) and rock.

*Lepidozia vitrea* Steph. - S 008; on rock.

##### Calypogeiaceae

*Calypogea tosana* (Steph.) Steph. - P 6659,

6717; on humus and on sand.

##### Cephaloziaceae

*Odontoschisma denudatum* (Nees) Dum. - L 87054, P 6645, 6657, 6673, 6698; on soil and humus. New for Guangdong (cf. Piippo 1990).

##### Jungermanniaceae

*Notoscyphus lutescens* (Lehm. & Lindenb.) Mitt. - L 87004, 87016, 87033, 87046, 87-07, Z & S 46, 140; on rock and on soil (sand).

##### Lophoziaceae

*Lophozia* cf. *obtusa* (Lindb.) Evans - Z & S 169; on rock.

##### Scapaniaceae

*Scapania ciliata* Sande Lac. - Z & S 68, 100; on rock. New for Guangdong (cf. Piippo 1990).

*S. stephanii* K. Müll. - S 056; on rock.

##### Geocalycaceae

*Heteroscyphus argutus* (Reinw. et al.) Schiffn. - L 87037, 87042, Z & S 11, 82; on rock and trunk.

*H. coalitus* (Hook.) Schiffn. - L 87057, P 6703; on soil.

##### Plagiochilaceae

*Plagiochila* cf. *frondescens* (Nees) Lindenb. - Z & S 157; on rock.

*P. sciophila* Nees - Z & S 23, 92; on rock.

##### Radulaceae

*Radula acuminata* Steph. - Z & S 146, W 8801 - 8803, 8805, 8808 - 8821, 8824 - 8827, 8830, 8832, 8837, 8850, 8851, 8855, 8857, 8858, 8860, 8864, Z & S 81146; on leaf.

*R. apiculata* Sande Lac. - Z & S 63; on bark. New for Guangdong (cf. Piippo 1990).

##### Frullaniaceae

*Frullania moniliata* (Reinw. et al.) Mont. - S 060, 065; on trunk.

## Lejeuneaceae

*Cololejeunea floccosa* (Lehm. & Lindenb.) Schiffn. - W 8811, 8850, 8851, 8858; on leaf.

*C. goebelii* (Gott. ex Schiffn.) Schiffn. - W 8847; on leaf.

*C. lanciloba* Steph. - W 8812, 8815, 8842, 8846, 8848; on leaf. New for Guangdong (cf. Piippo 1990).

*C. latilobula* (Herz.) Tix. var. *dentata* (Chen & Wu) Piippo - W 8832; on leaf.

*C. ocellata* (Horik.) Bened. - W 8811; on leaf. New for Guangdong (cf. Piippo 1990).

*C. ocelloides* (Horik.) Mizut. - W 8849, P 6687; on leaf and trunk. New for Guangdong (cf. Piippo 1990).

*C. pseudocrystallina* Chen & Wu - W 8817; on leaf. New for Guangdong (cf. Piippo 1990).

*C. spinosa* (Horik.) Pandé & Misra - W 8813, 8824, 8825, 8862; on leaf.

*Lejeunea catanduana* (Steph.) Miller et al. - W 8813, 8819, 8850, 8855, 8858; on leaf. New for Guangdong (cf. Piippo 1990).

*L. flava* (Sw.) Nees - W 8806, 8813; on leaf. New for Guangdong (cf. Piippo 1990).

*Leptolejeunea elliptica* (Lehm. & Lindenb.) Schiffn. - W 8801, 8804, 8806, 8807, 8810, 8811, 8813 - 8816, 8819 - 8821, 8823, 8825 - 8828, 8830 - 8837, 8839 - 8841, 8843 - 8849, 8851 - 8863, 8865, L 9018, 9019, 9021 - 9024, 9030, 9032, 9035 - 9040, Z & S 181, P 6721, 6726 - 6728; on leaf.

*L. hainanensis* Chen - W 8812, 8818, 8829, 8836, 8838, 8842; on leaf. New for Guangdong (cf. Piippo 1990).

*Lopholejeunea applanata* (Reinw. et al.) Schiffn. - Z & S 175; on leaf.

*L. eulopha* (Tayl.) Schiffn. - Z & S 153, P 6722; on rock and twig.

*Trocholejeunea sandvicensis* (Gott.) Mizut. - W 8806, Z & S 81153; on leaf.

## Makinoaceae

*Makinoa crispata* (Steph.) Miyake - S 014, 032, L 8702, 8703, P 6664, Z & S 59; on rock and sand.

## Pallaviciniaceae

*Pallavicinia levieri* Schiffn. - L 87011; on rock. New for Guangdong (cf. Piippo 1990).

*P. subciliata* (Aust.) Steph. - Z & S 14, 38, 75, S 024, 31, L 84-01, 84-18; on rock.

## Wiesnerellaceae

*Dumortiera hirsuta* (Sw.) Nees - Z & S 159, L 87035, P 6661, 6663; on soil and rock.

## Marchantiaceae

*Marchantia paleacea* Bertol. - L 87045, 87060, P 6711, Z & S 133; on soil and on humus. Subsp. *paleacea* is new for Guangdong (cf. Piippo 1990).

## B. Mosses

## Dicranaceae

*Campylopus atrovirens* De Not. - Z & S 1, 2, S 010; on soil.

*C. japonicus* Broth. - L 84-17, 84-28; on soil.

*C. umbellatus* (Arnott) Par. - L 84-33, S 050, Z & S 26; on rock.

*Dicranella coarctata* (C. Müll.) Bosch & Lac. - S 002, 004, 006, 009; on rock.

*Holomitrium densifolium* (Wils.) Wijk & Marg. - Z & S 69; on rock.

*Trematodon longicollis* Michx. - S 011, 013, 054; on sand and on rock.

## Leucobryaceae

*Leucobryum bowringii* Mitt. - L 87-04, 87-05, 87-034, 87-038, S 070; on rock, soil and decaying log.

*L. chlorophyllosum* C. Müll. - L 84-11, 84-23, 84-25, Z & S 36, 37; on soil, trunk and rock.

*L. scabrum* Lac. - L 84-30, 84024, 84030, Z & S 56, 113, S 030, 046; on rock, soil and trunk.

*Octoblepharum albidum* Hedw. - L 87019; on trunk.

## Fissidentaceae

*Fissidens adelphinus* Besch. - L 84-13, 84-21; on rock.

*F. areolatus* Griffith - L 87028; on soil.

*F. dubius* P. Beauv. - S 059, L 87009, 87036; on rock, soil and trunk.

*F. geminiflorus* Dozy & Molk. - *S* 016, 037*B*; on rock and decaying log.  
*F. oblongifolius* Hook. & Wils. - *Z* & *S* 151, *S* 055; on soil and rock.  
*F. obscurirete* Broth. & Par. - *L* 87052; on soil.  
*F. zippelianus* Dozy & Molk. - *L* 84-15, 87023; on rock.

#### Calymperaceae

*Syrhobodon prolifer* Schwaegr. var. *papillosus* (C. Müll.) Reese - *Z* & *S* 74, *L* 84-26, 87032; on trunk. New for China.

#### Pottiaceae

*Barbula unguiculata* Hedw. - *S* 003, *Z* & *S* 16; on rock.  
*Hyophila involuta* (Hook.) Jaeg. - *Z* & *S* 34; on rock.  
*Hymenostomum edentulum* (Mitt.) Besch. - *Z* & *S* 130; on trunk.  
*Trichostomum crispulum* Bruch - *L* 84-19, *Z* & *S* 8; on rock. New for China.  
*Weissia controversa* Hedw. - *L* 87061; on soil.

#### Bryaceae

*Bryum billardieri* Schwaegr. - *Z* & *S* 55, 132; on rock.  
*B. giganteum* (Schwaegr.) Arnott - *Z* & *S* 93; on rock.  
*B. pallescens* Schleich. ex Schwaegr. - *S* 049; on rock.

#### Mniaceae

*Plagiomnium rhynchophorum* (Hook.) T. Kop. - *S* 042; on rock.  
*P. succulentum* (Mitt.) T. Kop. - *S* 040, *L* 87062; on rock and soil.

#### Bartramiaceae

*Philonotis revoluta* Bosch & Lac. - *S* 039; on soil.

#### Orthotrichaceae

*Macromitrium formosae* Card. - *S* 038; on rock.

*M. holomitroides* Nog. - *Z* & *S* 97; on trunk.  
*M. nepalense* (Hook. & Grev.) Schwaegr. - *L* 84-29; on trunk.  
*M. sinense* Bartr. - *L* 84-02, *Z* & *S* 112; on rock.  
*Schlotheimia grevilleana* Mitt. - *L* 84-31, 84-35, *S* 047; on tree trunk and root.  
*S. pungens* Bartr. - *L* 84-32; on rock.

#### Meteoriaceae

*Meteorium subpolytrichum* (Besch.) Broth. - *S* 052; on rock.  
*Pseudobarbella attenuata* (Thwait. & Mitt.) Nog. - *Z* & *S* 156; on trunk.  
*P. laosiensis* (Broth. & Par.) Nog. - *Z* & *S* 94, *S* 066; on trunk and rock.  
*P. levieri* (Ren. & Card.) Nog. - *LAX*; on trunk.

#### Neckeraceae

*Homali dendron flabellatum* (J. Sm.) Fleisch. - *L* 87021; on rock.

#### Lembophyllaceae (by B. C. Tan)

*Isocradiella surcularis* (Dix.) Tan & Mohamed - *S* 019, 028, 036, *Z* & *S* 110, *L* 87041; on trunk. This species is known from Taiwan, but is new for mainland China.

#### Hookeriaceae

*Distichophyllum* cf. *perlimbatum* Broth. - *S* 021, 037*A*, *L* 8408, 84-24, 84-38, 87-01, 87010, 87091, *Z* & *S* 21, 24, 43, 73, 121; on soil and rock. If correctly determined, new for China.

#### Hypopterygiaceae

*Cyathophorella tonkinensis* (Broth. & Par.) Broth. - *S* 018; on trunk.  
*Hypopterygium japonicum* Mitt. - *S* 025, 062; on rock.

#### Thuidiaceae

*Claopodium assurgens* (Sull. & Lesq.) Card. - *Z* & *S* 62; on trunk.  
*C. prionophyllum* Broth. - *L* 84-20, 87056, *Z* & *S* 25; on soil and rock.  
*Thuidium cymbifolium* (Dozy & Molk.) Dozy

& Molk. - *Z & S 128, 176, S 035, 049*; on rock.  
*T. delicatulum* (Hedw.) Mitt. var. *radicans*  
 (Kindb.) Crum et al. - *Z & S 44, L 87007*; on soil.  
*T. glaucinoides* Broth. - *L 84-26, Z & S 15, 60, S*  
*005*; on rock and soil.  
*T. pristocalyx* (C. Müll.) Jaeg. - *L 84-07*; on rock.

#### Sematophyllaceae (by B. C. Tan)

*Gammiella tonkinensis* (Broth. & Par.) Tan - *Z*  
*& S 99*; on trunk. New for China.  
*G. touwii* Tan - *S 048*; on trunk. New for China.  
*Palisadula chrysophylla* (Card.) Toy. - *S 045,*  
*063*; on trunk.  
*Papillidiopsis complanata* (Dix.) Buck & Tan -  
*L 84-39*; on trunk. New for China.  
*Sematophyllum caespitosum* (Hedw.) Mitt. - *Z*  
*& S 164*; on rock.  
*S. subhumile* (C. Müll.) Fleisch. - *Z & S 12*; on  
 trunk.  
*Trichosteleum pseudo-mammosum* Fleisch. - *Z*  
*& S 64, S 057*; on trunk. New for China.

#### Hypnaceae

*Ectropothecium aneitense* Broth. & Watts - *S*  
*015, 067*; on rock and on soil. New for China.  
*E. perminutum* Broth. ex Bartr. - *Z & S 22, L*  
*87013, 87027*; on rock.  
*Hypnum fauriei* Card. - *L 84-03, Z & S 35, 139*;  
 on soil and rock. New for China.  
*H. plumaeforme* Wils. - *S 033, 064*; on rock and  
 on soil.  
*Pseudotaxiphyllum pohliaecarpum* (Sull. & Lesq.)  
 Jaeg. - *Z & S 95, 104, L 87012, 87031, 87058*; on  
 rock and soil.  
*Vesicularia reticulata* (Dozy & Molk.) Broth. -  
*L 84-37, 87044*; on rock and on soil.

#### Diphysciaceae

*Diphyscium fulvifolium* Mitt. - *L 84-20*; on rock.

#### Polytrichaceae (by J. Hyvönen)

*Pogonatum cirratum* (Sw.) Brid. subsp. *fusca-*  
*tum* (Mitt.) Hyvönen - *Z & S 119, 150, 181, L 84-*  
*36*; on soil and rock.  
*P. neesii* (C. Müll.) Dozy - *S 007, 012, Z & S 118,*  
*186*; on rock and soil.

#### Acknowledgements

The senior author wishes to express his deep gratitude to Prof. Timo Koponen for his sincere help, which enabled him to work on the present study with the junior author in Finland from June to December 1990. He also offers his sincerest thanks to the Bryophyte Museum of Helsinki University for allowing him to use the library, specimens and other facilities. He is most grateful to the Academy of Finland and the Finnish-Chinese Botanical Foundation for financial support for this study.

The collecting work of the junior author in China was made possible by the exchange programme between the Academies of Finland and China. The present authors desire to express their appreciation to Drs. Benito C. Tan, Jaakko Hyvönen, William R. Buck and Prof. Pan-Cheng Wu for confirming and identifying some specimens, and to Dr. Carol Norris for revising the English. Prof. Hironori Deguchi is cordially thanked for many improvements. The project is supported by the National Natural Science Foundation of China, the Academy of Finland and the Finnish-Chinese Botanical Foundation.

#### References

- Anonymous 1987.** Index of plants. Hepaticae & Musci. [Heishiding Natural Reserve]. *Ecologic Science 1*, 2: 184-190.
- Chen, P.-C. et al. 1963.** Genera Muscorum Sinicorum. Pars Prima. iii-x, 1-304. Beijing.
- **1978.** Genera Muscorum Sinicorum. Pars secunda. i-viii, 1-331. Beijing.
- Grolle, R. 1983.** Nomina Generica Hepaticarum; references, types and synonymies. *Acta Botanica Fennica 121*: 1-62.
- Piippo, S. 1990.** Annotated catalogue of Chinese Hepaticae and Anthocerotae. *Journal of the Hattori Botanical Laboratory 68*: 1-192.
- Redfearn, P. Jr. & Wu, P.-C. 1986.** Catalog of the mosses of China. *Annals of the Missouri Botanical Garden 73*: 177-208.
- Shi, S.-H. 1987.** Studies on the Flora of Heishiding Natural Reserve of Guangdong. *Ecologic Science 1*, 2: 44-64.
- Wang, B.-S. & Liu, X.-G. 1987.** The characteristics of the vegetation in Heishiding Natural Reserve. *Ecologic Science 1*, 2: 1-18.

