

Distribution of Bryophytes in China

Hu Renliang

Department of Biology, East China Normal University, 3663 Zhong Shan Bei Road, Shanghai 200062, People's Republic of China

China is located in eastern Asia, between 18°-55°N and 74°-138°E. The total land area of about 9,600,000 km² is divided into 30 administrative areas. The climate varies from subtropic in the south to temperate in the north. The topography is complex. All of the conditions mentioned above cause the bryoflora to be complex. There are estimated to be about 2,000 species of Musci and 1,000 species of Anthocerotae and Hepaticae. The late Professor P.C. Chen considered that China could be divided into seven distributional areas, this view is supported by most Chinese bryologists today.

1. Lingnan Area (South of the Five Ridge)

This area includes Guangdong, Guangxi, eastern Fujian, southern Yunnan and Taiwan. The climate in this area is warm and humidity is high. Moss flora of this region is dominated by members of the Sematophyllaceae, Pterobryaceae, Meteoriaceae, Hookeriaceae, Cryphaceae, Trachypodaceae, Neckeraceae, Calymperaceae, Leucobryaceae, Spiridentaceae, Hypopterygiaceae, Thuidiaceae and Polytrichaceae. The hepatic flora consists mainly of members of the Lejeuneaceae, Schistochilaceae, Frullaniaceae, Porellaceae, Radulaceae and

Haplomitriaceae. Among these families there are many genera commonly found in tropical Asian, i.e. *Leucophanes*, *Callicostella*, *Cyclodictyon*, *Chaetomitriopsis*, *Dicranoloma*, *Octoblepharum*, *Exodictyon*, *Endotrichella*, *Taxithelium*, *Trichosteleum*, *Glossadelphus*, *Haplomitrium*, *Schistochila*, *Mastigophora*, *Nowellia*, *Pleurozia*, *Colura*, *Drepanolejeunea* and *Chandonanthus*.

This element of the Chinese bryoflora is closely related to that of the Philippines, India and Burma.

2. Middle China Area

This area corresponds to the central part of China and is bounded on the west by Qin Ling, on the north by the Huahe River, on the south by the Five Ridge and on the east by the East China Sea.

The climate in this region is cold, cloudy and rainy in the winter. The area also has abundant rainfall in the early summer. Since the area encompasses sections dominated by both southern and northern types of floras a mixed forest is present consisting of evergreen broad-leaf and deciduous broad-leaf forests. Present in this area are many East Asian endemic



A MAP OF DISTRIBUTION AREAS OF BRYOPHYTES IN CHINA

ciaceae, Polytrichaceae. The hepatic flora is dominated by members of the Marchantiaceae, Operculataceae, Ricciaceae, Dilaenaceae, Porellaceae and Frullaniaceae.

There are many tropical bryophyte elements in this region. Some of these are *Sphagnum jung-hunianum*, *Leucobryum javense*, *Rhodobryum giganteum*, *Meteorium sp.*, *Barbula sp.*, *Calypothecium sp.*, *Homaliodendron sp.*, *Hypopterygium sp.*, *Cyathophorella sp.*, *Hookeria acutifolia*, *Schlotheimia sp.*, *Rhacopilum aristatum*, some species of Pterobryaceae, and the following hepatics: *Monosolenium tenerum*, *Haplomitrium rotundifolium*, *Chandonanthus*, *Frullania*, and *Jubula*.

Examples of northern bryophytes found in this area are members of the Brachytheciaceae and Amblystegiaceae as well as *Climacium japonicum* and *Bryoxiphium japonicum*.

The bryoflora of this area is closely related to

the Japanese bryoflora. Many species previously considered endemic to Japan have been found in this area, i.e. *Mokinoa crispata*, *Trichocoleopsis sacculata*, *Neotrichocolea bissetii*, *Orthomiopsis japonica*, *Sphagnum oligoporum*, *Weisia longidens*, *Dolichomitrium cymbifolium* and *Miyabea fructicella*.

3. North China Area

This region is bounded on the west by the Qin Ling Mountain System, by the Huahe River on the south, to the north by the south slope of Henan Mountains and the boundary of Qinghai-Xizan Plateau.

The climate in this area is rather dry. In the spring strong winds blow huge amounts of sand in this region. Both the temperature and rainfall is low. The bryophytes found here are mainly Eurasian continental elements and the bryoflora is dominated by members of the Entodontaceae, Amblystegiaceae, Thuidiaceae,

This region is bounded on the west by the Qin Ling Mountain System, by the Huahe River on the south, to the north by the south slope of Henan Mountains and the boundary of Qinhai-Xizan Plateau.

The climate in this area is rather dry. In the spring strong winds blow huge amounts of sand in this region. Both the temperature and rainfall is low. The bryophytes found here are mainly Eurasian continental elements and the bryoflora is dominated by members of the Entodontaceae, Amblystegiaceae, Thuidiaceae, Brachytheciaceae, Dicranaceae, Ditrichaceae, Pottiaceae, Mniaceae and Bartramiaceae. Species belonging to the Bryaceae are very abundant such as: *Bryum capillare*, *B. caespiticum*, *B. cernuum*, *B. calophyllum*, *B. turbinatum* and *B. schleicheri*. Among those belonging to the Pottiaceae are *Barbula tectorum*, *B. constricta*, *B. fallax*, *B. vinealis*, *B. reflexa*, *B. rufa*, *B. unguiculata*, *Syntrichia subulata*, *S. mucronifolia*, *S. ruralis* and *S. princeps*. There are also found abundant members of the Brachytheciaceae i.e. *Brachythecium buehneri*, *B. fasciculirameum*, *B. glareosum*, *B. rivulare*, *B. populeum* and *B. plumosum*. Members of the Thuidiaceae found in this region are *Thuidium pycnothallum*, *T. philibertii*, *T. delicatum* and *T. recognitum*. There are also members of the Mniaceae plants and 2 species of *Climacium* known from this region.

4. North East Area

The North East Area encompasses three provinces located in the extreme northeastern part of China (Liaoning, Jilin and Heilong Jiang). The climate in this region is cold and dry and the bryoflora is closely related to that of northern Europe, Siberia, the Ussuri River area and the high mountain region of North America. Many species of *Sphagnum* are present: *Sphagnum magellanicum*, *S. imbricatum*,

S. palustre, *S. squarrosum*, *S. teres*, *S. angustroemii*, *S. subsecundum*, *S. riparium*, *S. obtusum*, *S. oligoporum*, *S. girgensohnii*, *S. fuscum*, and *S. acutifoliodes*. The region is also rich in members of the Amblystegiaceae (*Campylophyllum*, *Cratoneuron*, *Campylium*, *Leptodictyum*, *Hygroamblystegium*, *Drepanocladus*, *Calliergonella*) and Brachytheciaceae (*Camytothecium*, *Tomenthypnum*, *Brachythecium*, *Bryhnia*, *Cirriphyllum*, *Myuroclada*, *Scleropodium*, *Eurhynchium*, *Rhynchostegium*). In addition representatives of the Thuidiaceae, Pottiaceae, Bryaceae, Hypnaceae, Rhytidiaceae and Hylocomiaceae are also abundant. *Fontinalis antipyretica*, *F. hypnoides*, *F. squamosa* are restricted, in China, to this area.

5. Yunnan Guizhou Area

This area covers most of the Yunnan Guizhou Plateau and the western part of Sichuan province. The area has an average elevation over 1000 m with high mountains, complex landforms, and deep, foggy valleys dominating the landscape. The area has two pronounced seasons: a dry season and a rainy season.

Bryophytes in the higher elevations of this area belong mostly to north temperate elements, while those at the lower elevations land belong to more southern elements.

Among Musci, the following families are dominant: Dicranaceae, Pottiaceae, Orthotrichaceae, Meteoriaceae, Neckeraceae, Thuidiaceae, Amblystegiaceae, Brachytheciaceae, Sematophyllaceae, Hypnaceae and Polytrichaceae. Almost all Chinese genera of Sematophyllaceae (*Aptychella*, *Clastobryum*, *Clastobryella*, *Struckia*, *Pylaisiopsis*, *Brotherella*, *Sematophyllum* and *Glossadelphus*) occur in this area. Most of them represent tropic elements.

Many species usually found in northern Europe also occur in the northwestern high mountain region of this area. Examples among the mosses are *Distichum capillaceum*, *Encalypta* sp., *Paraleucobryum enerve*, and some species of the Bartramiaceae and Amblystegiaceae. Examples from the Hepatics include *Riccia glauca*, *Riccia fluitans*, *Ricciocarpus natans*, *Targionia hypophylla*, *Sauteria alpine*, *Marchantia polymorpha*, *Cononcephalum conicum*, *Dumortiera hirsuta*, many species of *Riccardia* (*R. pinguis*, *R. multifida*, *R. sinuata*, *R. palmata*), some species of *Metzgeria* (*M. furcata*, *M. conugata*, *M. hamata*, *M. pubescens*), and species of *Alicularia*, *Anastrepta*, *Anastrophyllum*, *Chandonanthus*, *Leptoscyphus taylori*, *Lophocolea*, *Chiloscyphus*, *Bazzania*, *Calypogeia*, *Trichocolea*, *Radula* and *Frullania*.

The bryoflora of this region appears closely related to the Himalayan bryoflora as evidenced by the number of species both regions have in common, i.e. *Sphagnum khastanum*, *Anoetangium tortifolium*, *Orthomnium* sp., *Duthiella* sp., *Actinothuidium* sp., *Lyellia* sp., *Pogonatum perichaetiale*, *P. microstomum* and *P. thomsonii*. Both regions have a number of hepatic species in common eg. *Scapania levieri*, *S. griffithii*, *S. nepalensis*, *S. orientalis*, *Porella hastata*, *P. macroloba*, *P. perrottiana* and *Notoscyphus indica* as well as many members of the Plagiochilaceae, Fimbriaceae, *Plagiochisma*, *Bazzania*, *Lepidozia*, *Chandonanthus* and *Herberta*.

6. Qinghai Xizan Area

This area includes Qinghai, the northwestern part of Sichuan and almost all part of Xizan. The largest part of this area is made up of the Qinghai Xizan Plateau. The elevation of this region is high and the climate is dry and cold.

The bryophytes in this region are concentrated in forest regions. Moss families that dominate the bryoflora of this region include the Dicranaceae, Leucobryaceae, Polytrichaceae, Pottiaceae, Grimmiaceae, Bryaceae, Mniaceae, Meteoriaceae, Thuidiaceae, Amblystegiaceae, Brachytheciaceae, Hypnaceae and Hylocomiaceae. Hepatic families that are commonly encountered include the Herbertaceae and Marchantiaceae.

7. Xingiang Inner Mongolia Area

This region covers nearly all of Xingiang and Inner Mongolia. The elevation in most places of this region is over 1,000 m. The climate is very dry and cold, a large portion of this area consists of dry grassland and cold desert. In the coniferous forests of this area there are found members of the Bryaceae, Mniaceae, Pottiaceae, Thuidiaceae, Amblystegiaceae, Fontinaliaceae, Aulacomniaceae, Timmiaceae, Splachnaceae and Polytrichaceae.

The bryophytes of the coniferous forests in this region are similar to those of the northeastern area mentioned above except that the region has very few east Asian endemic elements. Species commonly found in this area include *Dicranum elongatum*, *D. muhlenbeckii*, *D. spurium*, *Polytrichum juniperinum*, *Brachythecium glaciale*, *B. albicans*, *B. velutinum*, *B. salebrosum*, *B. plumosum*, *Cirriphyllum crassinervium*, *C. piliferum*, *Camptothecium lutescens*, *Abietinella abietinia*, *Thuidium philibertii*, *Hylocomium proliferum*, *Climacium dendroides*, *Pleurozium schreberi*, *Plagiomnium rostratum*, *Mnium lycopodioides*, *Cyrtomnium hymenophylloides*, *Drepanocladus aduncus*, *D. vernicosus*, *D. uncinatus*, *D. lycopodioides*, *D. exannulatus*, *D. sendtneri*, *Hvgrohypnum luridum*, *Cratoneuron commutatum*, *Helodium plandowii*, *Aulacomnium palustre*, *A. turgidum*, *Ptilium crista-castrensis*, *Bryum caespiticum*, *B. schleicheri*, *B. turbinatum*, *B. pallens*, *B. calophyllum*, *B. rutilans*, *Anomobryum* sp. and *Pohlia nutans*.

In general the bryoflora of this area is dominated by Eurasian species that are cold resistant. No East Asian elements are present that differ from those present in north or northeastern China.

II. Brief Introduction to Current

bryophyte section has been written by Lee, Liu and Gao (Shanghai Nature History Museum). Lee and Zen are presently working on the 'Moss flora of Yunnan', for which they have collected more than 50,000 specimens.

3. Studies on applications of bryophytes

Gao and Cao are studying the usefulness of peat moss. Hu and Wang are studying 'the uses of bryophytes as an indicator of air pollution.'

4. On ecological research
Hu and his colleagues, Guo, Liu, Wang and Zhu are near completion of their project entitled "An investigation of Bryophytes in subtropic evergreen broadleaf forests in China". In connection with this study there was a science trip last fall to the northwestern part of China (Sichuan, Guizhou, Yunnan) where more than 2,000 bryophytic samples were collected.

5. Taxonomy of bryophytes

The following individuals are working independently on various contributions to the Bryoflora of China project: P. C. Wu (Polytrichaceae, Sematophyllaceae); Gao (Dicranaceae, Plagiochilaceae, Marchantiaceae); Luo (Porellaceae, Bryaceae); Chang (Leucodontaceae, Cryphaeaceae); S. K. Lee (Pottiaceae, Mniaceae); Z. H. Lee (Fissidentaceae, Leucobryaceae); Lin (Calymperaceae); Hu (Entodontaceae, Brachytheciaceae). Some of the resulting monographs have now been published and some are near completion.