Bryophytes Abroad

Over the past 20 years the Royal Botanic Garden Edinburgh (RBGE) has been involved with many botanical expeditions to Yunnan Province in south-west China, organized through our ‘twinning’ agreement with the Kunming Institute of Botany in Yunnan. In 2010, our colleagues in the institute offered to organize an autumn expedition to south-west Sichuan Province, to the north of Yunnan – part of the Qinghai–Tibetan plateau and the Hengduan Mountains, the eastern extension of the Himalaya. Thanks to generous funding from The Royal Horticultural Society, Alpine Garden Society and other sponsors, four of us set out for China on 25 August 2010 for over a month. The primary focus of the expedition was to be collection of herbarium specimens and seed of plants of potential horticultural interest, but I was able to focus on bryophytes. My colleagues were two horticultural staff members from RBGE, John Mitchell (expedition leader) and Ross Irvine, and David Wallbridge who had just finished his horticulture training at RBG Kew, and had secured his funded place on the expedition by open competition.

Sichuan Province

Sichuan is a large province covering 220,000 square miles, with a population of over 110 million people. Many of these live in the central Chengdu Plain, a rich agricultural and industrial basin. Sichuan has around 9,000 native species of higher plants, about one-third of the Chinese total. It has many rich and biodiverse forests, for example the network of Panda reserves such as Wolong. It also has several big mountains, including the famous ‘Minya Konka’ (now Gongga Shan, 7,556 m) at one time claimed by the explorer Joseph Rock to be the highest mountain in the world. Our study area lay on the Tibetan plateau south-west of Chengdu and included the catchments of three large rivers – the Yalong Jiang, Litang Qu and Shuiluo He, all of which flow south eventually to join the Jinsha Jiang (Yangtze River).

Past bryological exploration of Sichuan

The Austrian Heinrich Handel-Mazzetti during his stay in China from 1914 to 1918 visited Sichuan twice, travelling north from his base near Lijiang in Yunnan Province, to the southern counties of Sichuan, between 21 March and 23 June 1914 (Huili, Dechang, Xichang, Zhaojue and Yanyuan Counties) and again from 23 July to 11 August 1915 (to Yanyuan and Muli Counties). His bryophyte collections are enumerated by Brotherus (1929), Nicholson et al. (1930) and Pippoo et al. (1997), and were the first bryophytes to be collected in Sichuan. Since that time relatively few non-Chinese bryologists appear to have collected in Sichuan. A Finnish/ Chinese expedition visited north-west Sichuan in 1991 which resulted in a liverwort checklist for the province (Pippoo et al. 1997). M. Higuchi and colleagues from the National Science Museum, Tokyo, visited Sichuan in 1996 and reported the discovery of a new liverwort species, Exormotheca bischleri Furuki & Higuchi (Furuki & Higuchi, 2006). However, numerous Chinese bryologists have collected in Sichuan, sometimes in collaboration with the American bryologists S. He and P.L. Redfearn, and their collections have been widely utilized in compilation of recent Chinese bryophyte floras such as Wu & Wang (2000). Bryophytes known from Sichuan province are enumerated in the checklists of Pippoo (1990) and Redfearn et al. (1996). Thus much is known about Sichuan bryophytes, but as with almost all of China, many regions are poorly explored and new discoveries will always result from careful fieldwork.

The 2010 expedition

On 25 August we flew to Chengdu, capital of Sichuan, where we met our Chinese colleagues who had driven up in two 4×4 vehicles from Kunming – Dr Meng Ying, a specialist on Poly-
FieldBryology No103 | Feb11

and two of her students, Deng Tao and Liu Ya-Hui. They proved to be exceptionally able organizers and field botanists, and along with two drivers made up a very enthusiastic and lively team. After some last-minute shopping we set off westwards on the Chengdu–Lhasa highway, at first a new motorway but later a normal but very busy road with lots of big trucks and big potholes. Our first stop was in Mexi, close to the huge Gongga Shan mountain, clothed at lower elevations in wet broadleaf forest, but our permits did not allow collecting in the nature reserve other than along the roadside. Our next stop was in Kangding, a large town tightly wedged in a steep-sided gorge with cloud-shrouded mountains all around, then west to cross the Zheduo Shan pass at 4,996 m altitude – we were never to see due to cloud. After leaving Litang, we headed south along the valleys of the Litang Qu and Shuiluo He rivers and cliffs and screes – a superb botanical finale.

Collecting methods

Bryophytes were collected in the field into folded packets made from ‘rite-in-the-rain’ paper. Enough for two to four (or more) duplicates of each collection was collected where possible in the field. Notes on locality, habitat and substrate were recorded on the packets, and GPS readings and altitudes recorded in a notebook. Each evening, specimens were sorted and cleaned, and data written up in a notebook. Selected liverworts were cleaned and placed in small ziplock bags with silica gel for DNA extraction. Packets were dried using cool air by means of two electric fans. No heat drying was used (in contrast to vascular plants). When dry, packets were bundled in A4-sized ziplock bags and transported to Xinduqiao for sorting, packeting, labelling and identification. Two batches were mailed to Kunming and the final batch was taken by car. The whole collection was finally mailed to Edinburgh from Kunming for DNA extraction. Moss epiphytes were relatively few, with the rarity of families Meteoriaceae, Pterobryaceae and Neckeraeaceae a particularly striking contrast to vascular plants. When dry, packets were bundled in A4-sized ziplock bags and packed into cardboard boxes for shipment. Two electric fans. No heat drying was used (in contrast to vascular plants). When dry, packets were bundled in A4-sized ziplock bags and packed into cardboard boxes for shipment. Two electric fans. No heat drying was used (in contrast to vascular plants). When dry, packets were bundled in A4-sized ziplock bags and packed into cardboard boxes for shipment.

The expedition investigated habitats largely in the cool temperate and alpine zones, from 2,780 to 4,900 m altitude. The habitats fall into three broad groups, broadleaf forests and scrub, conifer-dominated forests and alpine vegetation. The bryophyte interest of these three zones is outlined below, although in many localities these habitats intergraded, for example some temperate broadleaf forests may have had conifers removed by logging, and effects of grazing and burning have often transformed forests into scrub or grassland. Consequently, the bryophytes often overlap between these broad habitat types.

Broadleaf forests and scrub

Wet mossy broadleaf forests were relatively rare; those we encountered occurred between 2,780 and 4,000 m on Erlang Shan, Gaversi Shan and south of Julong, and were dominated by Acer, Rhododendron, Viburnum, Ribes, etc. Moss epiphytes were relatively few, with the rarity of families Meteoriaceae, Pterobryaceae and Neckeraeaceae a particularly striking contrast with Yunnan, and also limited numbers of species of leafy liverworts such as Metacalylophaga alternisfolia, Frullania, Herbertia, Lepidozia, Plagiochila and Bazzania, and no epiphyllous Lejeuneaceae. Species such as Conocephalum japonicum and Hookeria acarulata, frequent in Yunnan, were rare. Large mosses were abundant in the ground layer including Dicranum, Hylocomium, Rhytidium and Rhodobryum errantrice. Most other broadleaf forests encountered were rather dry in character, with small sclerophyll trees such as Quercus semecarpifolia which were...
often reduced to scrub by grazing. These had a limited ground bryoflora with Abietinella abietina, Entodon, Hypnum, Rhytidium rugosum, Thuidium, etc. and noticeably few leafy liverworts. However, the tree trunks and branches of shrubs had interesting epiphytes such as Orthotrichum, Ulota (two species which are new to science), Leucodon secundus and Zygodon. Rock outcrops amongst scrub, especially on the more basic schists and slate, had interesting thalloid liverworts such as Asterella leptophylla, Conocephalum salebrosum, Mannia californica, Reboulia hemisphaerica, Plagiochasma and Targionia hypophylla. Boulders amongst the scrub often had Grimmia and Racomitrium species, as yet unidentified, and Hedwigia ciliata.

Two valleys with relatively dry scrub (between Jiawa and Mula, and east of Daocheng) were especially interesting with damp mossy banks under the shrubs with a very rich assemblage of liverworts, including Aitchisoniella himalayensis, Asterella leptophylla, Exormotheca bischleri, Mannia californica, Plagiochasma sp., Preissia sp., Reboulia hemisphaerica and several Riccia spp. The Preissia may be a completely new species with very large flat-topped receptacles. E. bischleri is endemic to Sichuan Province, and has only been collected once previously, while A. himalayensis is new to China and is an interesting and unusual monotypic genus known only from the north-west of the Himalaya of India, and considered to be extremely rare and endangered. Two colonies were found.

Conifer-dominated forests with Fir (Abies), Spruce (Picea) and Larch (Larix), 3,300–4,200 m

Coniferous forests were widespread, the most bryologically interesting being dominated by Fir (Abies) in valleys with a higher rainfall, whereas on drier slopes spruce (Picea) was dominant, and in other areas Larch (Larix). These forests always contained an understorey of smaller woody broadleaves, such as Acer, Betula, Rhododendron, and Sorbus species, etc., and were best-developed in areas south-west of Litang, around Daocheng, several parts of Jiulong, County and north of Kangding. These forests were humid and had a rich development of bryophytes on the ground, on living trees and logs, and on rocks and along streamsides. Larger terrestrial mosses included Actinothuidium hookeri, Hypnum, Dicranum, Hylocomium, Neckera, Polytrichum, Ptillium crista-castrensis, Rhodobryum ontariense and Rhytidiadelphus.

Epiphytes were frequent, for example the leafy liverworts Bazzania, Herbertia, Plagiochila, Scapania, Lophozia and Frullania, and the mosses Dicranum, Leucodon secundus, Neckera, Pseudolekea, Paraleucobryum, Ulota (sp. nov.) and Zygodon. In only one forest south of Jiulong larger liverworts such as Anastrophyta orcadensis were more in evidence, especially a large Scapania species and Anastrophyllum alpinum on the mossy base of a Rhododendron. On rotten stumps and logs Buchamia pancketa was found in one site, and more commonly Anastrophyllum ellipticum, Jamesoniella, Lophozia incisa and Trichonaria exigua. Rock outcrops (especially when calcareous) were always of interest with Bartramia, Encalypta, Plagiothecium neriifolium, Psychromitrion, Trinia and Tortella tortuosa.

Alpine zone, with Juniper/Rhododendron scrub, open rocks and screes, Kobresia meadows, marshy streamsides and lake margins, 3,980–4,900 m

The expedition targeted many alpine areas for their interesting vascular plants, on high passes such as the Zheduo Shan, Gaversi Shan, Tuer (Rabbit) Pass, the Litang to Lamaya road, the Jiawa to Dewu road, south-east of Daocheng.
and on the new airport road north-west of Kangding. Most of these areas were on granite, where cliffs, boulder fields and dry screes were studied along with stream sides, marshes and lake margins. Open slopes had a limited flora, but Rhytidium rugosum and Abietinella abietina were very common. Damp soil patches amongst dwarf Kobresia clumps had a flora of tiny liverworts including Anthelia juratzkana, Lophozia devolvens and Marsupella spp.; in places Sphagnaceae colonized dung or animal remains, particularly Tetraphodan angustatus and Veitia nivalis. The acidic granite rocks were often colonized by Racontitrium and Androrea species. The liverwort flora amongst the granite boulders was disappointingly limited with few large liverworts apart from Lophozia decolorans and Abietinella asiatica.

Significant finds

During the expedition particular focus was given to complex thalloid liverworts (the Marchantiidae) because of current research interests at RBGE. Not only did south-west Sichuan prove to be of great interest for these plants, but also the wet summer meant that these plants were very conspicuous and in excellent fertile condition. Riccia species were found almost everywhere (but because of taxonomic difficulties no identifications can easily be made at present), but the best find was undoubtedly Aitchisonella himalayensis, listed in the World Red List of Bryophytes and new to China. Exomorphaea bischleri was also of great interest as it is endemic to Sichuan and was found in excellent fertile condition. One collection of Preissia may be a new species as it is much larger in size than the widespread P. quadrate (which was also found in two sites). Both Mannia species seen, M. californica and M. controversa subsp. asiatica, were new to Sichuan, as was Clevea hyalina.

Other liverworts new to Sichuan included Aneura crateriformis, Calymbella crispula, Lophocolea minor and Tritomaria exsecta, and the mosses Campylophyllum balleri, Meiella uliginosa, Orthotrichum obtusifolium, Sclatia glaucescens and Veitia nivalis. However, a large proportion of the bryophytes are provisionally identified only to genus level, and the help of specialists around the world is actively being sought for identifications. In this way many other interesting finds are expected.

David G. Long
Royal Botanic Garden, 20A Inverleith Row, Edinburgh EH3 5LR (e d.long@rbge.ac.uk)

Acknowledgments

Funding to support this expedition from the Royal Botanic Garden Edinburgh, Royal Horticultural Society and Alpine Garden Society is gratefully acknowledged. Staff at the Kunming Institute of Botany, particularly Dr Yang Yongqing, are thanked for organizing the transport, accommodation and necessary permits, and particularly our three Kunming botanists in the field: Dr Meng Ying, Deng Tao and Liu Ya-Hai.

References


