

ADDITIONS TO THE KNOWLEDGE OF GUIZHOU HEPATICS (SOUTH CHINA)
К ПОЗНАНИЮ ПЕЧЕНОЧНИКОВ ПРОВИНЦИИ ГУИЧЖОУ (ЮЖНЫЙ КИТАЙ)

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Abstract

The paper provides the results of a recent collaborative Russian-Chinese exploration of the Guizhou hepatic flora in southern China. In total, 99 species are listed, with seven species newly recorded for China (*Calypogeia angusta*, *Cordaea flotoviana*, *Mesoptychia chinensis*, *M. ussuriensis*, *Lophozia silvicola*, *Riccia nipponica*, and *Riccardia nagasakiensis*) and 12 others new for the Guizhou Province. Presence of regenerative structures in the specimens examined, distribution in four studied localities, the elevation, ecology and associated species are provided for each species. Oil bodies of 54 species are illustrated by color photographs.

Резюме

Изложены результаты совместной российско-китайской экспедиции по изучению печеночников провинции Гуичжоу (южный Китай). Составленный по материалам экспедиции список включает 99 видов из которых 7 (*Calypogeia angusta*, *Cordaea flotoviana*, *Mesoptychia chinensis*, *M. ussuriensis*, *Lophozia silvicola*, *Riccia nipponica*, *Riccardia nagasakiensis*) – приводятся впервые для Китая и еще 12 – для провинции Гуичжоу. Каждый вид в списке аннотирован, по изученным образцам, сведениями об экологии, высотном диапазоне произрастания и присутствии генеративных структур. Приводятся фотографии масляных тельц 54 видов по изученному материалу.

KEYWORDS: Guizhou Province, China, Hepaticae, Anthocerotae, checklist

INTRODUCTION

Guizhou Province of China (24°35'-29°09'N 103°36'-109°30'E, 176167 km²) is situated in the eastern part of Yunnan-Guizhou Plateau, which is adjacent eastward to Xiangxi Hill and westward to Diandong Plateau. The province is situated in southwest China and surrounded by the provinces of Sichuan, Hunan, Yunnan and Guangxi. It is one of the hot spots of Chinese biodiversity for vascular plants, and to some degree, for hepatics also (Xiong, 2011).

The land of this province was uplifted in the beginning of Cenozoic epoch and mostly composed by calcareous Mesozoic marine deposits. It is characterized by mild subtropical climate with annual mean temperature ranges from 10 to 20°C, gradually decreasing with increasing elevation. The annual precipitation varies from 1100 to 1600 mm in the lowlands (500-700 m a.s.l.) and distinctly increases with elevation, where the number of 'foggy' days is also higher (Xiong, 2011). The dominant type of native communities is subtropical (with many tropical elements),

evergreen forests that change to evergreen-deciduous forests above 1400-1500 m. The vegetation of the province has been under the strong human impact and most of the lowlands are agricultural lands today. The province of Guizhou lacks very high mountains. The larger parts of the territory have altitudes ranging between 800 and 1000 m, with low mountains reaching 1500 m and a few solitary high peaks, the highest being 2900 m alt.

The checklist of Chinese hepatics by Piippo (1990) includes 62 species for Guizhou (less than 10% of Chinese hepatic flora). This number hardly shows the real diversity of the group in the province. Some recent reports of 'new records' (not cited by Piippo, 1990) for the province are scattered in local Chinese literature. A great advance in recent years was the publication of "Illustration of Bryophytes in Guizhou of China (Xiong, 2011) that promoted local bryophyte studies. However, the primary task of this mentioned book was not to provide a detailed list for all taxa of bryophytes recorded in the province.

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Table 1. The description of studied localities

№	Locality	Latitude	Longitude	Altitude, m	Collecting date
1	Guiyang city area, Qianling Park	26°35'38"N	106°41'32"E	1100	18 Nov.
2	Kaiyang County, Xiang Zhi Stream	26°46'59"N	106°54'44"E	1200	19 Nov.
3	Kaiyang County, Nanjiang Gorge	26°56'52"N	106°58'52"E	900	20 Nov.
4	Duyun Municipality, Doupeng Mts.	26°23'06"N	107°21'08"E	1200-1300	21-22 Nov.

The basic goal of the present account was to provide a list of taxa that we have documented in Guizhou Province in the course of our short term field exploration, which, however, revealed several taxa new for the province and also for China as the whole.

MATERIAL AND METHODS

All the visited localities occur within the belt of evergreen subtropical forests and cover a range of altitudes between 900 to 1300 m. Their geographic description is provided in Table 1. In total 294 specimens of liverworts were collected (excluding numerous duplicates) by V.A. Bakalin and then studied in the laboratory while the plants were still alive. Some 'difficult' specimens were restudied for several times later with the purpose to clarify the identification. The leafy and 'metzgerioid' thallose hepatics were identified by V.A. Bakalin, and 'marchantioid' ones were identified by E.A. Borovichev. All studied materials are deposited in VBGI with several duplicates in KPABG.

Oil bodies were studied and photographed shortly after being collected. Their structure is important for the species identification of the hepatics and is still poorly known, especially for the East Asian taxa. Thus, photographs of oil bodies are provided here for species (Figs. 1-5) where they were available and can be pictured with acceptable quality. All of them (with one exception of *Monosolenium tenerum* that has large oil bodies, Fig. 3: 11) were made with the same scale to be comparable. All these illustrations are made from the Guizhou specimens collected by Bakalin and annotated with his collector number.

LIST OF SPECIES

The nomenclature follows mostly Yamada & Iwatsuki (2006) and Piippo (1990), with several alterations obtained from recent literatures. Each species is annotated by 1) presence of regenerative structures (sporophyte and their protective structures) and gemmae (with abbreviations: spor. – sporangia, ant. – antheridia, arch. – arche-gonia, per. – perianthia, gemm. – gemmae); 2) locality number in accordance to Table 1; 3) altitudinal range based on specimens examined; 4) habitats; and 5) associated taxa. Taxonomic comments for selected taxa are also given. The species recorded for the first time for Guizhou are marked with an asterisk and new for China with double asterisks.

Anthoceros punctatus L. (spor., ant.) – 3 – 900 m. Clay in the rice field margin, in open place. In pure mats.

**Asterella cruciata* (Steph.) Horikawa (ant., spor.) – 3 – 900 m. Moist clay on steep slope along stream, in partly shaded places. In pure mats.

Bazzania bidentula (Steph.) Steph. – 4 – 1300 m. Moist cliffs, wet caves in open to partly shaded places, in spray zone of waterfalls. With various hepatics, including *Heteroscyphus coalitus*, *Kurzia gonyotricha*, *Saccogynidium muricellum*, *Schiffneria hyalina*. (Fig. 1: 1)

B. mayebarae S. Hatt. – 4 – 1200-1300 m. Moist to wet cliffs near waterfalls (commonly in spray zone), mesic soil on slope, in partly shaded places. With various hepatics including *Cylindrocolea recurvifolia*, *Kurzia gonyotricha*, *Mnioloma fusca*, *Odontoschisma grossiverrucosum*, *Plagiochila gracilis*, *Scapania ciliata*, etc. (Fig. 1: 2)

B. oshimensis (Steph.) Horik. – 4 – 1300 m. Mesic cliffs in partly shaded places. In pure mat (one collection). (Fig. 1: 3)

B. tridens (Reinw., Blume et Nees) Trevis – 1, 4 – 1100-1200 m. Moist bare clay on slopes or moist cliffs, always in partly shaded sites. In pure mats or with various hepatics, including *Kurzia gonyotricha* and *Plectocolea truncata*. (Fig. 1: 4)

Blepharostoma minus Horikawa – 4 – 1300 m. Moist boulder in partly shaded places. With *Liochlaena subulata* and *Scapania undulata* (one collection).

**Calycularia crispula* Mitt. – 4 – 1200-1300 m. Mesic cliffs or bare soil on slopes, in partly shaded sites. In pure mats. This is also the first record of the genus *Calycularia* in Guizhou

Calypogeia sp. – 4 – 1300 m. Mesic trunk base, in partly shaded places. – In pure mat (one collection). – The plant specimens are superficially similar to the Japanese endemic, *C. fujisana* H. Inoue, although different from the latter in the quantity of oil bodies (2-3 vs. 6-10), which are finely granulate and brownish in color, and in the shape of the underleaf. Probably this specimen represents a new taxon, but to decide on this problem, at least a DNA comparison is needed which cannot be conducted in the present study. (Fig. 1: 7)

***Calypogeia angusta* Steph. – 4 – 1200 m. Wet decaying wood on slope near waterfall or boulders along streams, in partly shaded sites. In pure mats or with *Heteroscyphus coalitus*. (Fig. 1: 5). This species is somewhat similar to *C. tosana*, however being different from the latter in decurrent underleaves and invariable smooth leaf cuticle (versus not decurrent underleaves and mostly papillose cuticle).

C. arguta Nees et Mont. (gemm.) – 1, 4 – 1100-1200 m. Moist bare clay on steep slope, in partly shaded places. – In pure mats or with *Cephalozia otaruensis*.

C. azurea Stotler et Crotz – 4 – 1300 m. Wet cliffs and caves in spray zone of waterfall, in part shade. In pure mats or with *Pallavicinia ambigua*. (Fig. 1: 6)

C. japonica Steph. (gemm.) – 1 – 1100 m. Moist bare clay on steep slope, in partly shaded places. In pure mat (one collection).

C. tosana (Steph.) Steph. – 4 – 1200-1300 m. Wet cliffs and humic soil near waterfalls. In pure mats or with various hepatics, including *Heteroscyphus coalitus* and *Schiffneria hyalina*. (Fig. 1: 8)

Cephalozia catenulata (Huebener) Lindb. – 4 – 1200-1300 m. Wet cliffs and caves in spray zone of waterfalls, in partly

- shaded sites. In pure mats or with *Cephalozia otaruensis* and *Pallavicinia* cf. *ambigua*.
- C. gollanii* Steph. (gemm.) – 4 – 1300 m. Moist boulder in partly shaded place. In pure mat (one collection).
- C. otaruensis* Steph. (per., gemm.) – 1, 4 – 1100-1300 m. Moist bare clay on slopes, moist decaying wood, wet cliffs near waterfalls, wet boulders near stream, in partly shaded places. In pure mats or with *Calypogeia arguta*, *Cephalozia catenulata*, *Cephaloziella microphylla*, *Pallavicinia* cf. *ambigua*.
- Cephaloziella microphylla* (Steph.) Douin – 4 – 1200-1300 m. Mesic to wet cliffs in partly shaded places, also in spray zone of waterfalls. With *Cephalozia otaruensis*, *Cylindrocolea recurvifolia*, *Scapania ciliata*, etc.
- Cololejeunea subkodamae* Mizut. (per., ant.) – 2 – 1200 m. Mesic cliffs, humus covering rocks, rarely over fern leaves, in partly shaded places. In pure mats or with *Lejeunea pallide-virens*, *Metzgeria lindbergii*, *Plagiochila sciophila*, *Radula kojana* on rocks. (Fig. 1: 9)
- Conocephalum japonicum* (Thunb.) Grolle – 1, 3 – 900-1100 m. Mesic cliffs or moist bare clay on slope, in partly shaded places. In pure mats.
- **C. salebrosum* Szeik., Buczk., Odrzyk. – 1-3 – 900-1200 m. Moist to wet cliffs and bare clay on steep slopes, in partly shaded to open places. In pure mats or with *Wiesnerella denudata*.
- ***Cordaea flotoviana* Nees [= *Moerckia flotoviana* (Nees) Steph.] (arch.) – 2, 3 – 900-1200 m. Moist to wet cliffs, in partly shaded places. In pure mats. (Fig. 1: 10). About used name see Mamontov et al. (2015).
- Cylindrocolea recurvifolia* (Steph.) H. Inoue (per.) – 4 – 1200-1300 m. Mesic to wet cliffs and boulders, also in waterfall spray zone, in partly shaded sites to open places. In pure mats or with *Bazzania mayebarae*, *Cephaloziella microphylla*, *Microlejeunea punctiformis*, *Odontoschisma grossiverucosum*, *Plagiochila gracilis*, *Scapania ciliata*, *Solenostoma macrocarpum*.
- Diplophyllum* aff. *serrulatum* (Müll. Frib.) Steph. (per., ant., gemm.) – 4 – 1200-1300 m. Moist cliffs in partly shaded places; mesic soil in steep slopes. In pure mats of with *Kurzia gonyotricha*, *Plectocolea truncata*, *Scapania ciliata*.
- Dumortiera hirsuta* (Sw.) Nees in Reinw. – 1, 2, 4 – 1100-1200 m. Moist to wet cliffs, also near waterfalls, moist bare clay on steep slopes, in partly shaded places. In pure mats.
- Frullania inflata* Gottsche (per., ant., arch.) – 3 – 900 m. Mesic cliffs, in partly shaded places. In pure mats.
- F. moniliata* (Reinw., Blume & Nees) Mont. – 4 – 1300 m. Moist boulder in open to partly shaded places. In pure mat (one collection). (Fig. 1: 11)
- F. muscicola* Steph. (per., ant., arch.) – 4 – 1200-1300 m. Tree trunks, mesic boulders and caves (ambiguous identification of sterile plants) on steep slopes, in partly shaded places. In pure mats. (Fig. 1: 12)
- Herbertus dicranus* (Taylor) Trevis. – 4 – 1200 m. Mesic cliffs on slope. In pure mat (one collection). Depauperate phase may be called as “*Herbertus buchii* Juslen”.
- Heteroscyphus argutus* (Reinw., Blume et Nees) Schiffn. – 2, 4 – 1200-1300 m. Mesic to wet boulders (also near streams), decaying wood and tree trunk bases, in partly shaded places. In pure mats or with *Jamesoniella autumnalis*, *Lophocolea minor*, *Nowellia curvifolia*, etc. (Fig. 2: 1)
- H. coalitus* (Hook.) Schiffn. – 1, 4 – 1100-1300 m. Moist to wet cliffs, boulders and (rarer) decaying wood near streams and in waterfall spray zones, in partly shaded places. In pure mats or with *Bazzania bidentula*, *Calypogeia angusta*, *Calypogeia tosana*, *Isotachis indica*, *Kurzia gonyotricha*, *Scapania undulata*, *Schiffneria hyalina*. (Fig. 2: 2)
- H. planus* (Mitt.) Schiffn. (arch.) – 1, 4 – 1100-1300 m. Moist bare clay on steep slopes and tree trunk bases, in partly shaded places. In pure mats or with *Heteroscyphus argutus* and *Lioclhaena subulata*. (Fig. 2: 3)
- H. zollingerii* (Gottsche) Schiffn. – 2 – 1200 m. Moist cliff in partly shaded place. With tiny plants of *Lejeunea* sp. (one collection). (Fig. 2: 4)
- **Isotachis indica* Mitt. – 4 – 1300 m. Wet cliffs in waterfall spray zone, in open place. In pure mats or with *Heteroscyphus coalitus*, *Solenostoma macrocarpum*, etc. (Fig. 2: 5). The used name was regarded by Piippo (1990) as the synonym of *I. japonica*, but we consider this taxon merits species rank, or, at least require additional studies to clarify its position.
- **Jackiella javanica* Schiffn. (gemm.) – 4 – 1200 m. Moist clay on steep slope, in open place. In pure mats or with *Riccardia nagasakiensis*. This is also the first record of family Jackiellaceae in Guizhou. (Fig. 2: 6)
- Jamesoniella autumnalis* (DC) Steph. (per.) – 4 – 1300 m. Moist boulders and decaying decorticated wood, in partly shaded sites. In pure mats or with *Heteroscyphus argutus*.
- Jubula hutchinsiae* (Hook.) Dumort. ssp. *javanica* Steph. (per., ant., spor.) – 4 – 1200 m. Wet cliffs in partly shaded places in spray zone of waterfall. In pure mat (one collection). (Fig. 2: 7)
- Kurzia gonyotricha* (Sande Lac.) Grolle – 4 – 1200-1300 m. Mesic to wet cliffs and their caves, mostly near waterfall spray zone. In pure mats or with *Bazzania mayebarae*, *Bazzania tridens*, *Diplophyllum* aff. *serrulatum*, *Heteroscyphus coalitus*, *Makinoa crispata*, *Mnioloma fusca*, *Pallavicinia* cf. *ambigua*, *Plectocolea truncata*, *Riccardia graeffei*, *Saccogynidium muricellum*, *Schiffneria hyalina*.
- Lejeunea cocoes* Mitt. – 4 – 1300 m. Mesic cliff in partly shaded place. In pure mat (one collection).
- L. japonica* Mitt. – 2 – 1200 m. Mesic cliffs and tree trunks, in partly shaded place. In pure mats. (Fig. 2: 9)
- L. obscura* Mitt. – 1 – 1100 m. Mesic cliff in part shaded place. – In pure mat (one collection). (Fig. 2: 10)
- **L. pallide-virens* S. Hatt. (per., ant.) – 2, 3, 4 – 900-1200 m. Mesic to moist cliffs in partly shaded place. In pure mats or with *Cololejeunea subkodamae*, *Lioclhaena subulata*, *Metzgeria lindbergii*, *Plagiochila sciophila*, *Porella stephaniana*, *Radula kojana*. (Fig. 2: 11)
- Lejeunea* cf. *tuberculosa* Steph. – 1 – 1100 m. Mesic cliff in partly shaded place. In pure mat (one collection). Sterile plants prevent unambiguous identification. (Fig. 2: 8)
- Lepidozia fauriana* Steph. – 4 – 1200-1300 m. Wet cliffs in open to partly shaded places in spray zone of waterfalls. In pure mats. (Fig. 2: 12)
- **L. vitrea* Steph. – 4 – 1300 m. Mesic cliffs and moist boulders, in partly shaded to open places. In pure mats. (Fig. 3: 1)
- Lioclhaena subulata* (Evans) Schljak. (gemm.) – 1, 4 – 1100-1300 m. Moist cliffs, decaying decorticated wood and bare clay on steep slopes, in partly shaded places. In pure mats or with *Blepharostoma minus*, *Heteroscyphus planus*, *Lejeunea pallide-virens*, *Lophozia silvicola*, *Scapania ciliata*, *Scapania undulata*.

- Lophocolea heterophylla* (Schrad.) Dumort. (per., ant.) – 1 – 1100 m. Decaying stump in partly shaded sites. In pure mat (one collection).
- L. minor* Nees (gemm., per.) – 1, 4 – 1100-1300 m. Mesic tree trunk, moist decaying decorticated wood, in partly shaded places. In pure mats or with *Heteroscyphus argutus*, *Nowellia curvifolia*, *Riccardia palmata*.
- **L. muricata* (Lehm.) Nees – 4 – 1300 m. Mesic boulder in partly shaded place. In pure mat (one collection). (Fig. 3: 2)
- ***Lophozia silvicola* H. Buch – 4 – 1300 m. Moist boulder in partly shaded place. With *Liochlaena subulata*, *Scapania ciliata*, *Scapania undulata* (one collection). This unexpected record of mainly boreal taxon will be discussed in details later. (Fig. 3: 3)
- Makinoa crispata* (Steph.) Miyake (arch.) – 4 – 1300 m. Moist to wet cliffs and their caves also in the spray zone of waterfalls, in partly shaded to open places. In pure mats or with *Kurzia gonyotricha*, *Pallavicinia ambigua*, *Radula kojana*, *Saccogynidium muricellum*, *Trichocolea tomentella*. (Fig. 3: 4)
- Marchantia emarginata* Reinw. ssp. *tosana* (Steph.) Bischl. (spor.) – 1, 2 – 1100-1200 m. Moist cliffs and bare clay on steep slopes, in partly shaded places. In pure mats.
- M. paleacea* Bertol. (gemm.) – 1, 4 – 1100-1300 m. Moist to wet clay on slopes, in open places. In pure mats.
- ***Mesoptychia chinensis* Bakalin, Vilnet et Xiong (per., ant.) – 2 – 1200 m. Partly shaded sedimentary cliffs (presumably composed of basic rocks) in a broadleaved (mostly evergreen) subtropical forest on a steep slope above the valley. In pure mats. This newly described species is discussed in details by Bakalin et al. (2015). (Fig. 3: 5)
- ***M. ussuriensis* (Bakalin) L. Söderstr. & Váňa (per., ant.) – 3 – 900 m. Moist cliffs in partly shaded place. In pure mats. (Fig. 3: 6)
- Metacalypogeia cordifolia* (Steph.) H. Inoue – 4 – 1200-1300 m. Mesic boulders and bare clay, in partly shaded places. In pure mats. (Fig. 3: 7)
- **Metasolenostoma rubripunctatum* (S. Hatt.) Bakalin et Vilnet [= *Plectocolea rubripunctata* S. Hatt.] (gemm.) – 2 – 1200 m. Moist clay on slope, in partly shaded places. With *Nardia assamica* and *Scapania* sp. (one collection). (Fig. 3: 8)
- Metzgeria consanguinea* Schiffn. (gemm.) – 4 – 1300 m. Mesic tree trunk, partly shaded. In pure mat (one collection).
- M. lindbergii* Schiffn. (ant., arch.) – 2, 4 – 1200-1300 m. Mesic boulders, cliffs and tree trunks, partly shaded. In pure mats or with *Cololejeunea subkodamae*, *Lejeunea pallide-virens*, *Plagiochila sciophila*, *Radula kojana*.
- **M. temperata* Kuwah. (gemm.) – 2, 4 – 1200-1300 m. Tree trunks and over leaves, in partly shaded places. In pure mats.
- Microlejeunea punctiformis* (Taylor) Steph. – 2, 4 – 1200-1300 m. Tree trunks and mesic to moist boulders, in partly shaded places. In pure mats or with *Cylindrocolea recurvifolia*, *Radula cavifolia*. (Fig. 3: 9)
- Mnioloma fusca* (Lehm.) R.M. Schust. – 4 – 1300 m. Wet cliff cave in partly shaded places, in spray zone of waterfall. In pure mats or with *Kurzia gonyotricha*. (Fig. 3: 10)
- Monosolenium tenerum* Griff. (ant., arch.) – 3 – 900 m. Moist clay on steep slope to river, in full shade. In pure mats or with *Phaeoceros laevis* subsp. *carolinianus*. (Fig. 3: 11)
- Nardia assamica* (Mitt.) Amakawa (per., ant.) – 2, 4 – 1200 m. Moist clay on slopes, in open to partly shaded places. In pure mats or with *Metasolenostoma rubripunctatum*, *Plectocolea truncata*.
- Nowellia curvifolia* (Dicks.) Mitt. – 4 – 1300 m. Moist decaying decorticated wood, moist boulders along streams, in partly shaded places. In pure mats or with several taxa on decaying wood: *Heteroscyphus argutus*, *Lophocolea minor*, *Riccardia palmata*.
- Odontoschisma denudatum* (Mart.) Dumort. (gemm.) – 4 – 1300 m. Moist decaying decorticated wood in valley, in partly shaded place. In pure mat (one collection). (Fig. 3: 12)
- O. grossiverrucosum* Steph. – 4 – 1200-1300 m. Mesic cliffs and their caves, in partly shaded places. In pure mats or with *Bazzania mayebarae*, *Cylindrocolea recurvifolia*, *Plagiochila gracilis*. (Fig. 4: 1)
- Pallavicinia ambigua* (Mitt.) Steph. (per., arch.) – 4 – 1200-1300 m. Wet cliffs and their caves (also in spray zone of waterfalls), moist clay on steep slopes, in partly shaded places. In pure mats or with *Calypogeia azurea*, *Cephalozia catenulata*, *C. otaruensis*, *Kurzia gonyotricha*, *Makinoa crispata*, *Riccardia graeffei*. (Fig. 4: 2)
- Pellia endiviifolia* (Dicks.) Dumort. (per.) – 1, 2, 4 – 1100-1200 m. Mesic to moist cliffs and clay on steep slopes, in partly shaded places. In pure mats.
- Phaeoceros laevis* Prosk. ssp. *laevis* (ant.) – 1, 3 – 900-1100 m. Moist bare clay on steep slopes and rice fields margins, in open places. In pure mats.
- P. laevis* Prosk. subsp. *carolinianus* (Michx.) Prosk. (ant., arch., spor.) – 3, 4 – 900-1300 m. Moist to wet clay on steep slopes, in open places. In pure mats or with *Monosolenium tenerum*.
- Plagiochasma appendiculatum* Lehm. & Lindenb. (ant., spor.) – 1, 3 – 900-1100 m. Mesic cliffs in partly shaded places. In pure mats.
- P. cordatum* Lehm. & Lindenb. (ant., spor.) – 2, 3 – 900-1200 m. Mesic cliffs in partly shaded places. In pure mats.
- Plagiochila gracilis* Lindenb. et Gottsche – 4 – 1200-1300 m. Mesic cliffs and their caves, in partly shaded places. In pure mats or with *Bazzania mayebarae*, *Cylindrocolea recurvifolia*, *Odontoschisma grossiverrucosum*. (Fig. 4: 3)
- P. ovalifolia* Mitt. – 4 – 1200 m. Moist boulder in partly shaded place. With *Radula kojana* (one collection). (Fig. 4: 4)
- P. sciophila* Nees et Lindenb. – 2, 4 – 1200 m. Mesic to moist cliffs, mesic bare roots, in partly shaded sites. In pure mats or with *Cololejeunea subkodamae*, *Lejeunea cf. pallide-virens*, *Metzgeria lindbergii*, *Radula kojana*. (Fig. 4: 5)
- Plectocolea truncata* (Nees) Bakalin (per., ant.) – 1, 4 – 1100-1300 m. Mesic to moist clay on slopes and in the caves, moist cliffs (also near waterfall spray zone). In pure mats or with *Bazzania tridens*, *Diplophyllum aff. serrulatum*, *Kurzia gonyotricha*, *Nardia assamica*, *Scapania ciliata*. (Fig. 4: 6)
- P. virgata* Mitt. (per.) – 4 – 1300 m. Wet cliffs in open place in spray zone of waterfall. In pure mat (one collection).
- Plicanthus hirtellus* (F. Weber) R.M. Schust. – 4 – 1300 m. Mesic boulder, in partly shaded place. In pure mat (one collection).
- Porella caespitans* (Steph.) S. Hatt. var. *nipponica* S. Hatt. – 2 – 1200 m. Mesic boulder and bare tree roots, in partly shaded to open places. In pure mats. (Fig. 4: 7)
- P. campylophylla* (Lehm. & Lindenb.) Trevis. – 4 – 1300 m. Mesic boulder, in partly shaded place. – In pure mat (one collection). (Fig. 4: 8)
- P. japonica* (Sande Lac.) Mitt. – 4 – 1300 m. Mesic cliff in partly shaded place. In pure mat (one collection). (Fig. 4: 9)
- **P. stephaniana* (C. Massal.) S. Hatt. – 2 – 1200 m. Mesic cliff in partly shaded place. In pure mat (one collection).

- Radula cavifolia* Hampe – 4 – 1200 m. Tree trunk in partly shaded place. With *Microlejeunea punctiformis* (one collection). (Fig. 4: 10)
- R. constricta* Steph. (gemm.) – 3, 4 – 900-1300 m. Mesic cliffs, boulders and tree trunks, in partly shaded places. In pure mats. (Fig. 4: 11)
- R. javanica* Gottsche – 4 – 1300 m. Mesic boulder in partly shaded site. In pure mat (one collection). (Fig. 4: 12)
- R. kojana* Steph. (gemm.) – 2, 4 – 1200-1300 m. Moist to wet (also in spray zone of waterfalls) cliffs and boulders, in partly shaded places. In pure mats or with *Cololejeunea subkodamae*, *Lejeunea pallide-virens*, *Makinoa crispata*, *Metzgeria lindbergii*, *Plagiochila ovalifolia*, *Plagiochila sciophila*, *Porella stephaniana*. (Fig. 5: 1)
- ***Reboulia hemisphaerica* (L.) Raddi subsp. *australis* R.M. Schust. (ant., arch.) – 1 – 1100 m. Moist bare clay on steep slope, in partly shaded place. In pure mat (one collection).
- **Riccardia graeffei* (Steph.) Hewson – 4 – 1200 m. Wet cliffs in partly shaded places in spray zone of waterfall. With *Kurzia gonyotricha*, *Pallavicinia cf. ambigua*. (Fig. 5: 2)
- ***R. nagasakiensis* (Steph.) S. Hatt. (ant., arch, gemm.) – 4 – 1200-1300 m. Wet cliffs in open places in spray zone of waterfalls, moist bare clay on steep slope, in part shade. In pure mats or with *Jackiella javanica*. (Fig. 5: 3)
- R. palmata* (Hedw.) Carruth. (arch.) – 2, 4 – 1200-1300 m. Moist to wet decaying decorticated wood, also near streams, in partly shaded places. In pure mats or with *Lophocolea minor*, *Nowellia curvifolia*. (Fig. 5: 4, 5)
- R. glauca* L. (spor.) – 3 – 900 m. Clay in the rice field margin, in open place. In pure rosettes or with *Riccia huebeneriana*.
- R. huebeneriana* Lindenb. (spor.) – 3 – 900 m. Clay in the rice field margin, in open place. In pure rosettes or with *Riccia glauca*.
- ***Riccia nipponica* S. Hatt. (spor.) – 2 – 1200 m. Clay in the rice field margin, in open place. In pure rosettes (one collection).
- Saccogynidium muricellum* (De Not.) Grolle – 4 – 1200-1300 m. Wet cliffs and their caves in partly shaded sites, in spray zone of waterfalls. In pure mats or with *Bazzania bidentula*, *Kurzia gonyotricha*, *Makinoa crispata*, *Mnioloma fusca*, *Schiffneria hyalina*. (Fig. 5: 6)
- Scapania ciliata* Sande Lac. – 4 – 1200-1300 m. Mesic to wet cliffs and boulders, in partly shaded sites. In pure mats or with *Bazzania mayebarae*, *Cephaloziella microphylla*, *Cylindrocolea recurvifolia*, *Diplophyllum aff. serrulatum*, *Liochlaena subulata*, *Lophozia silvicola*, *Mnioloma fusca*, *Plectocolea truncata*, *Scapania undulata*. (Fig. 5: 7)
- **S. undulata* (L.) Dumort. (gemm.) – 4 – 1200-1300 m. Moist to wet boulders near streams. In pure mats or with *Blepharostoma minus*, *Heteroscyphus coalitus*, *Liochlaena subulata*, *Lophozia silvicola*, *Scapania ciliata*. (Fig. 5: 8)
- Schiffneria hyalina* Steph. (per.) – 4 – 1300 m. Mesic clay on steep slopes and moist to wet cliffs (also in waterfall spray zone), in partly to fully shaded sites. In pure mats or with *Bazzania bidentula*, *Calypogeia tosana*, *Heteroscyphus coalitus*, *Kurzia gonyotricha*, *Saccogynidium muricellum*.
- Solenostoma macrocarpum* (Steph.) Váňa & D.G. Long (per., ant.) – 4 – 1200-1300 m. Wet cliffs in open to partly shaded places in spray zone of waterfall. In pure mats. (Fig. 5: 9)
- Trichocolea tomentella* (Ehrh.) Dumort. – 4 – 1300 m. Moist cliff in open to partly shaded places in spray zone of waterfalls. In pure mats or with *Makinoa crispata* and *Pallavicinia* sp.

Wiesnerella denudata (Mitt.) Steph. – 1, 4 – 1100-1200 m. Moist to mesic bare clay on steep slope, in partly shaded places. In pure mats or with *Conocephalum salebrosum*.

DISCUSSION

In total 99 species were collected and identified. Despite the collection is rather small and fragmentary, we report 7 species new for China and other 12 are new for Guizhou Province.

One of the reported taxa new for China is *Calypogeia angusta*, a troublesome species, if not impossible for identification without oil-bodies, which requires study of the fresh collected material. Two species of *Mesoptychia*: *M. chinensis* and *M. ussuriensis*, both recently described, belong to the poorly known group of the genus distributed in East Asia and discussed in details in a separate paper (Bakalin et al., 2015). The unexpected record of boreal *Lophozia silvicola* in great distance from the nearest known localities in South Siberia and the Russian Far East is discussed separately by Bakalin & Xiong (2015). The record of *Cordaea flotoviana* was also surprising. This species is restricted mostly to Europe and North America, with a single known locality in Shikotan Island of the Kurils in East Asia (Mamontov et al., 2015). We can explain the absence of *C. flotoviana* in the checklists published for other areas of East Asia on the basis of its confusion with *Pallavicinia* spp. and especially with the closely related *Cordaea erimona* (Steph.) Mamontov, Konstant., Vilnet & Bakalin. The finding of *Riccia nipponica* is also impressive and its biogeographical significance is discussed in a different publication by Borovichev & Bakalin (2015).

One *Riccardia* species, newly recorded for China, *R. nagasakiensis*, is poorly known and understood before the excellent revision of this genus for Japan by Furuki (1991), and ergo, it is probably not so rare in East Asia. However the reliable identification of these species is possible only based on fresh materials, as oil-bodies are essential for the plant identification.

Most of the new records for Guizhou hepatics were somewhat expected because these newly recorded taxa were also known from the middle elevation of mountains in some other areas of East Asia. That they were not mentioned before can be explained by their undercollecting in many areas. This statement concerns at least species that are widely distributed in subtropical East Asia, such as *Asterella cruciata*, *Calycularia crispula*, *Jackiella javanica*, *Lepidozia vitrea*, *Scapania undulata*. Other newly recorded taxa belong to poorly known, although distinct taxa: *Lejeunea pallide-virens*, *Metzgeria temperata*, *Porella stephaniana*. The relatively recently described *Conocephalum salebrosum* is also added to the list of Guizhou hepatic flora. *Isotachis indica* is not always recognized as a distinct species (often treated as a synonym of *I. japonica*), and this is probably the reason it was not recorded before for Guizhou. Other hepatics new for Guizhou are *Lophocolea muricata* – quite a rare taxon in East Asia,

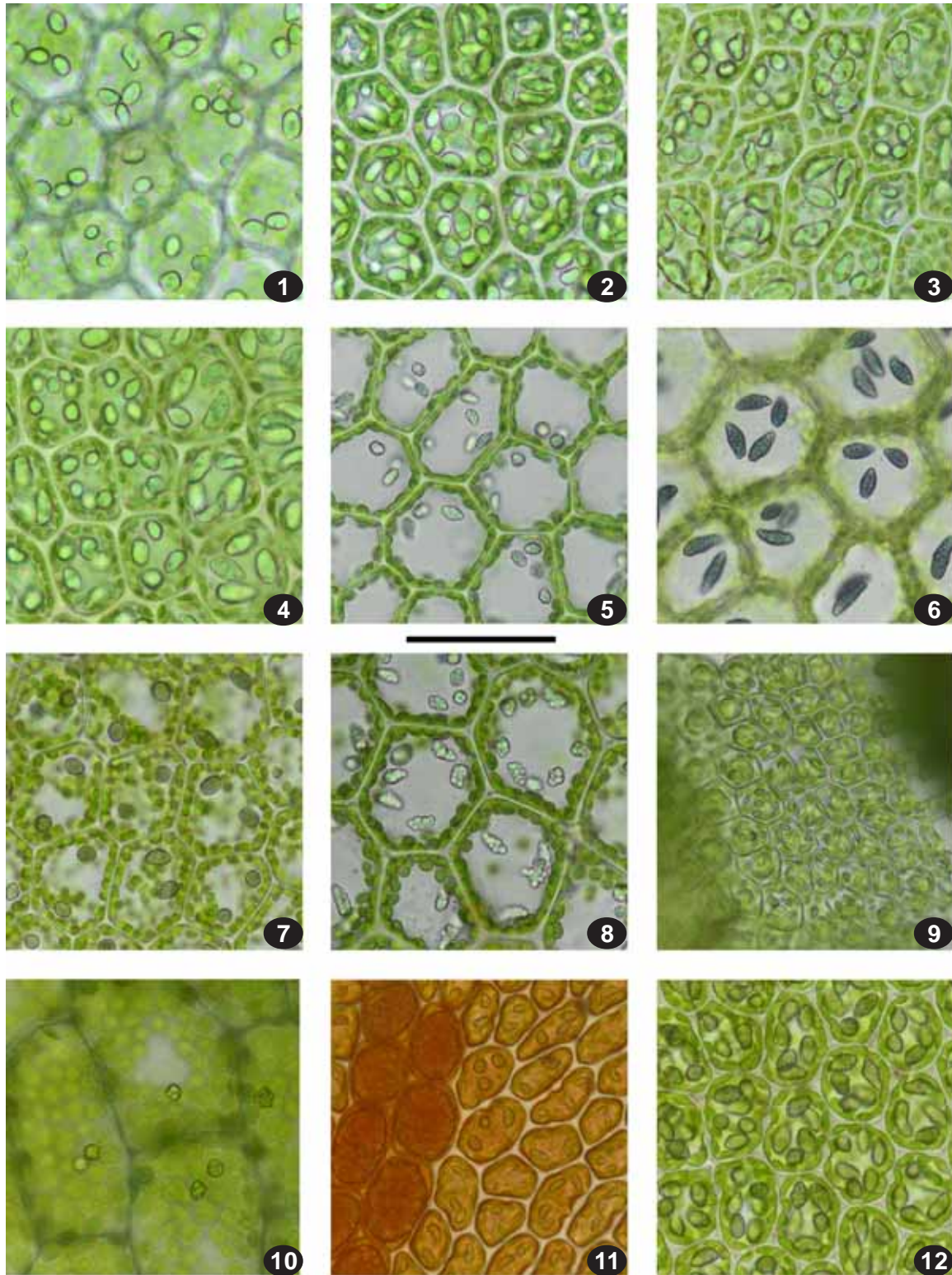


Fig. 1. Oil-bodies of some Hepaticae in Guizhou: 1 – *Bazzania bidentula* (Steph.) Steph., smooth, ellipsoidal (56-62-13); 2 – *B. mayebarae* S. Hatt., smooth, ellipsoidal (56-99-13); 3 – *B. oshimensis* (Steph.) Horik., smooth, ellipsoidal, partly bifoveate (56-61-13); 4 – *B. tridens* (Reinw., Blume et Nees) Trevis, smooth, ellipsoidal (50-33-13); 5 – *Calypogeia angusta* Steph., finely botryoidal, ellipsoidal to fusiform (55-19-13); 6 – *C. azurea* Stotler et Crotz, botryoidal, fusiform (56-77-13); 7 – *Calypogeia* sp., ellipsoidal, coarsely granulate (56-19-13); 8 – *C. tosana* (Steph.) Steph., botryoidal, fusiform (56-65-13); 9 – *Cololejeunea subkodamae* Mizut., smooth, spherical to ellipsoidal (51-17-13); 10 – *Cordaea flotoviana* Nees, coarsely granulate, spherical (53-9-13); 11 – *Frullania moniliata* (Reinw., Blume & Nees) Mont., granulate, spherical to irregularly oblong (56-44-13); 12 – *F. muscicola* Steph., granulate, ellipsoidal to fusiform (55-4-13). Scale 50 μ m for 1-12. All specimens on which photograph is based are in VBGI.

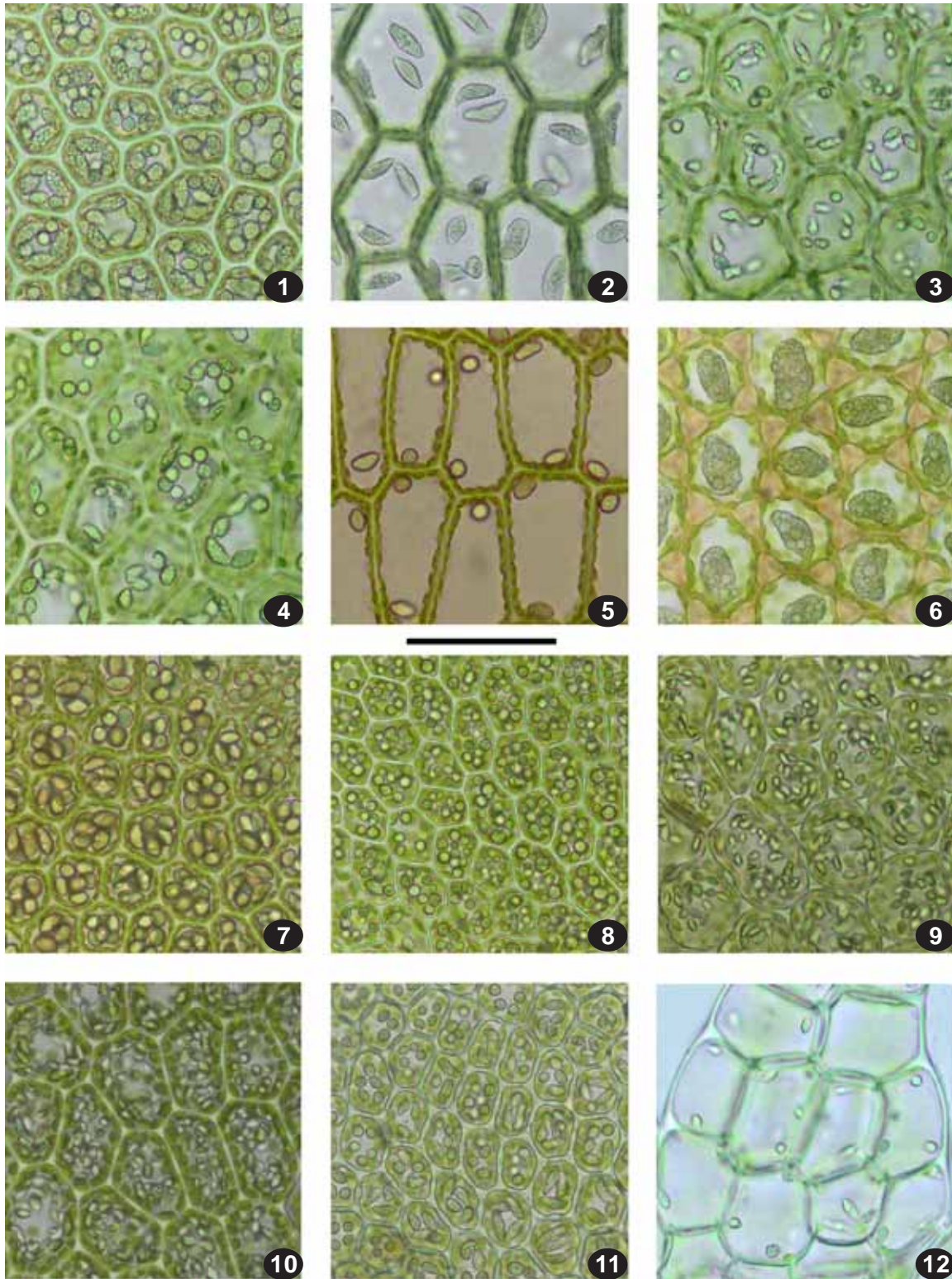


Fig. 2. Oil-bodies of some Hepaticae in Guizhou: 1 – *Heteroscyphus argutus* (Reinw., Blume et Nees) Schiffn., coarsely granulate, spherical to ellipsoidal (56-24-13); 2 – *H. coalitus* (Hook.) Schiffn., granulate, fusiform (56-85-13); 3 – *H. planus* (Mitt.) Schiffn., coarsely granulate, fusiform (50-31-13); 4 – *H. zollingerii* (Gottsche) Schiffn., coarsely granulate, spherical to fusiform (51-8-13); 5 – *Isotachis indica* Mitt., granulate, spherical to ellipsoidal (56-87-13); 6 – *Jackiella javanica* Schiffn., coarsely granulate, with one-several eyes, irregularly oblong (55-48-13); 7 – *Jubula hutchinsiae* (Hook.) Dumort. ssp. *javanica* Steph., smooth, spherical to ellipsoidal (55-52-13); 8 – *Lejeunea* cf. *tuberculosa* Steph., granulate, spherical (50-6-13); 9 – *L. japonica* Mitt., smooth, ellipsoidal to fusiform (51-46-13); 10 – *L. obscura* Mitt., granulate, ellipsoidal (50-12-13); 11 – *L. pallide-virens* S. Hatt., granulate, spherical to ellipsoidal (51-17-13); 12 – *Lepidozia fauriana* Steph., finely botryoidal, spherical to fusiform (56-80-13). Scale 50 μ m for 1-12. All specimens on which photograph is based are in VBGI.

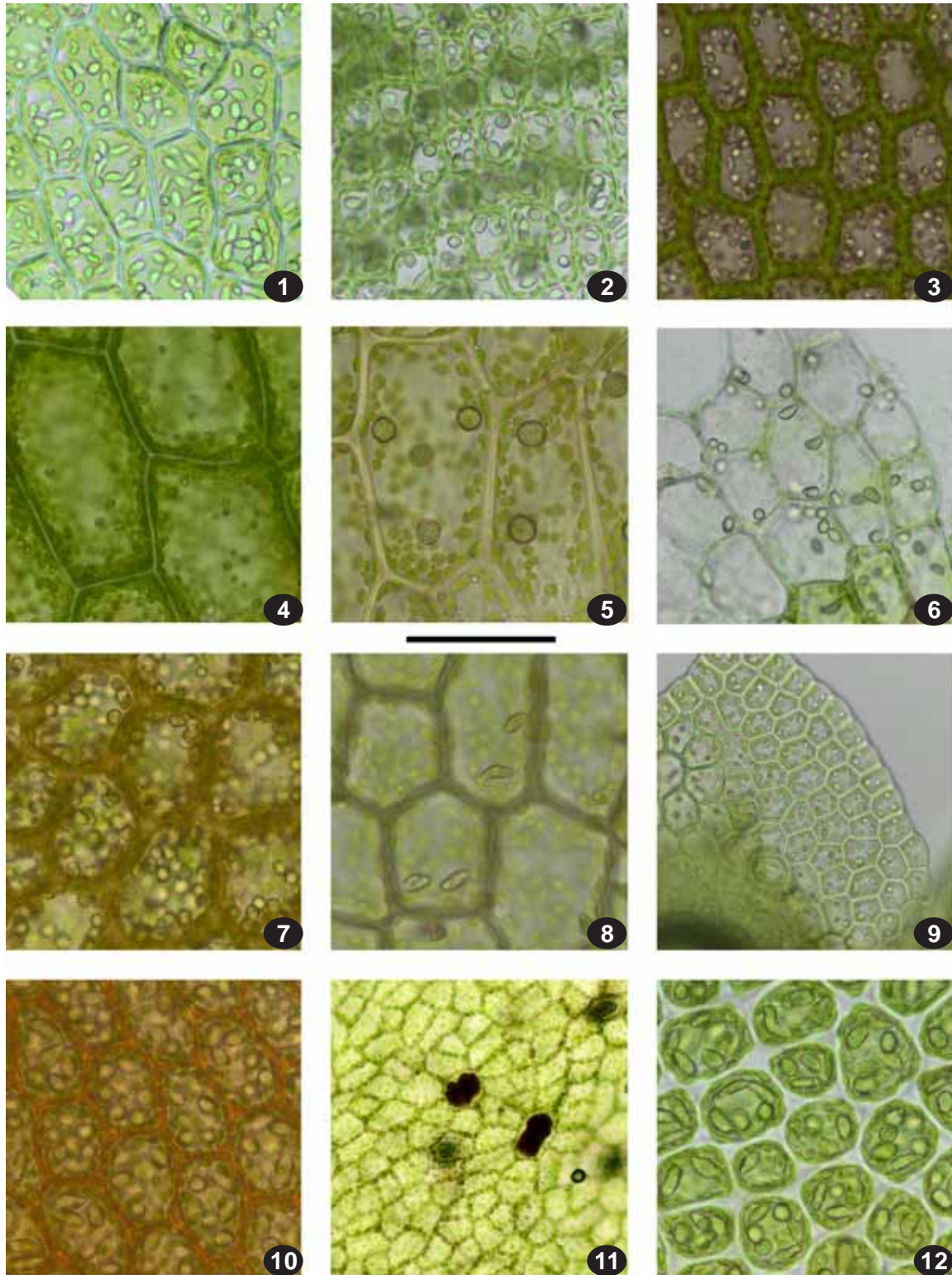


Fig. 3. Oil-bodies of some Hepaticae in Guizhou: 1 – *Lepidozia vitrea* Steph., finely botryoidal, ellipsoidal to irregularly oblong (56-53-13); 2 – *Lophocolea muricata* (Lehm.) Nees (56-34-13), granulate, spherical to ellipsoidal; 3 – *Lophozia silvicola* H. Buch, smooth, spherical, biconcentric (56-41-13); 4 – *Makinoa crispata* (Steph.) Miyake, granulate, spherical (56-92-13); 5 – *Mesoptychia chinensis* Bakalin, Vilnet et Xiong, granulate, spherical (51-11-13); 6 – *M. ussuriensis* (Bakalin) L. Söderstr. & Vána, finely granulate, spherical to irregularly oblong (53-10-13); 7 – *Metacalypogeia cordifolia* (Steph.) H. Inoue, granulate, spherical to ellipsoidal (56-8-13); 8 – *Metasolenostoma rubripunctatum* (S. Hatt.) Bakalin et Vilnet, granulate, fusiform (51-52-13); 9 – *Microlejeunea punctiformis* (Taylor) Steph., finely granulate, spherical (56-31-13); 10 – *Mnioloma fusca* (Lehm.) R.M. Schust., granulate, ellipsoidal to irregularly oblong (56-98-13); 11 – *Monosolenium tenerum* Griff., coarsely granulate, irregularly oblong (53-25-13); 12 – *Odontoschisma denudatum* (Mart.) Dumort., granulate, ellipsoidal to irregularly oblong (56-25-13). Scale 50 µm for 1-10, 12; 200 µm, for 11. All specimens on which photograph is based are in VBGI.

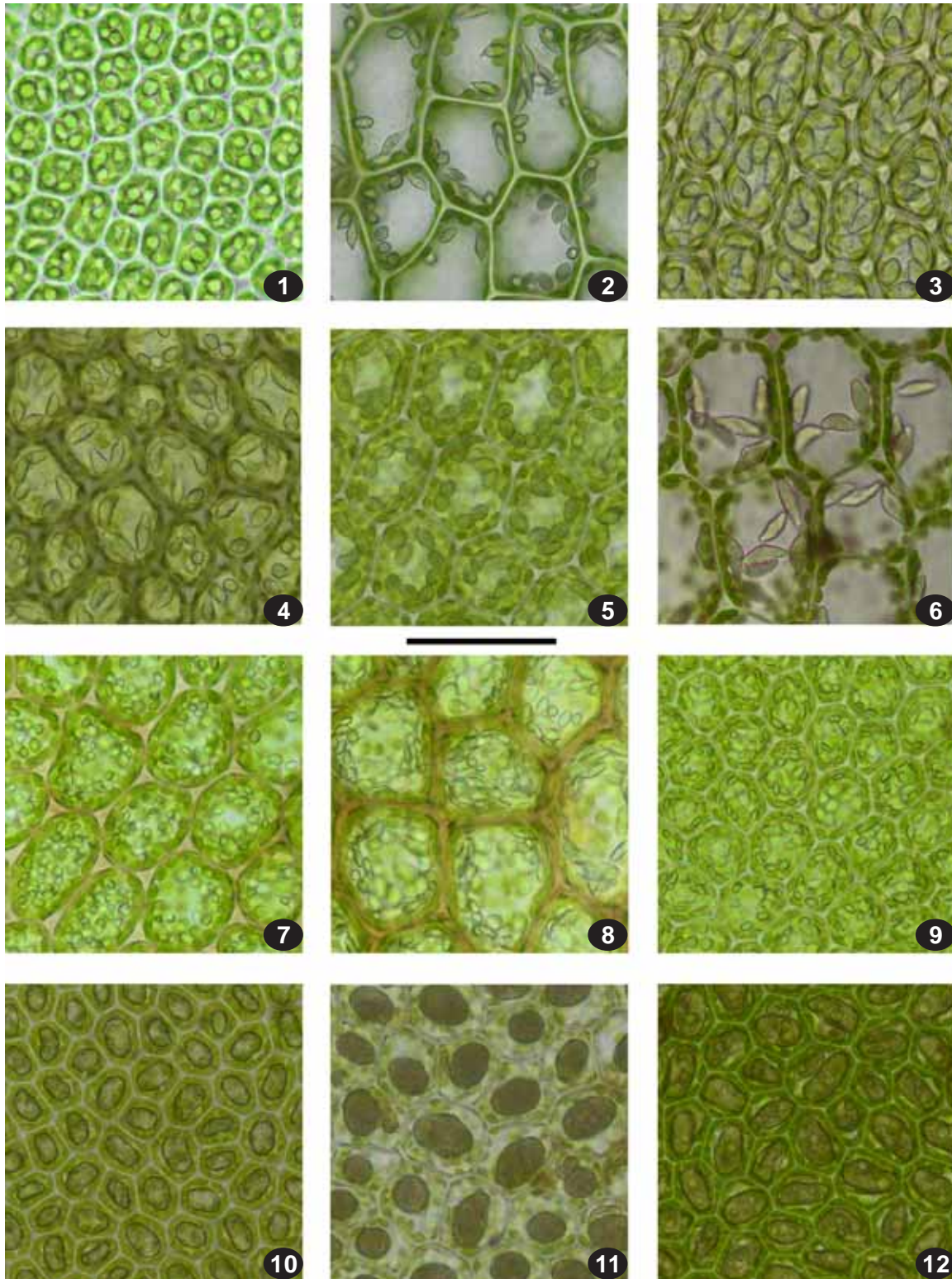


Fig. 4. Oil-bodies of some Hepaticae in Guizhou: 1 – *Odontoschisma grossiverrucosum* Steph., finely granulate, spherical to irregularly oblong (56-50-13); 2 – *Pallavicinia ambigua* (Mitt.) Steph., granulate, fusiform (55-44-13); 3 – *Plagiochila gracilis* Lindenb. et Gottsche, finely botryoidal, fusiform to irregularly oblong (55-24-13); 4 – *P. ovalifolia* Mitt., finely granulate, fusiform (55-14-13); 5 – *P. sciophila* Nees et Lindenb., granulate, spherical to ellipsoidal and fusiform (51-24-13); 6 – *Plectocolea truncata* (Nees) Bakalin, granulate, fusiform (50-25-13); 7 – *Porella caespitans* (Steph.) S. Hatt. var. *nipponica* S. Hatt., smooth, spherical to fusiform (51-19-13); 8 – *P. campylophylla* (Lehm. & Lindenb.) Trevis., smooth, ellipsoidal to fusiform (56-30-13); 9 – *P. japonica* (Sande Lac.) Mitt., smooth, ellipsoidal to fusiform (56-54-13); 10 – *Radula cavifolia* Hampe, coarsely granulate, irregularly oblong (55-2-13); 11 – *R. constricta* Steph., coarsely granulate, irregularly oblong (56-28-13); 12 – *R. javanica* Gottsche, coarsely granulate, irregularly oblong, with 1-2 eyes (56-29-13). Scale 50 μ m for 1-12. All specimens on which photograph is based are in VBGI.

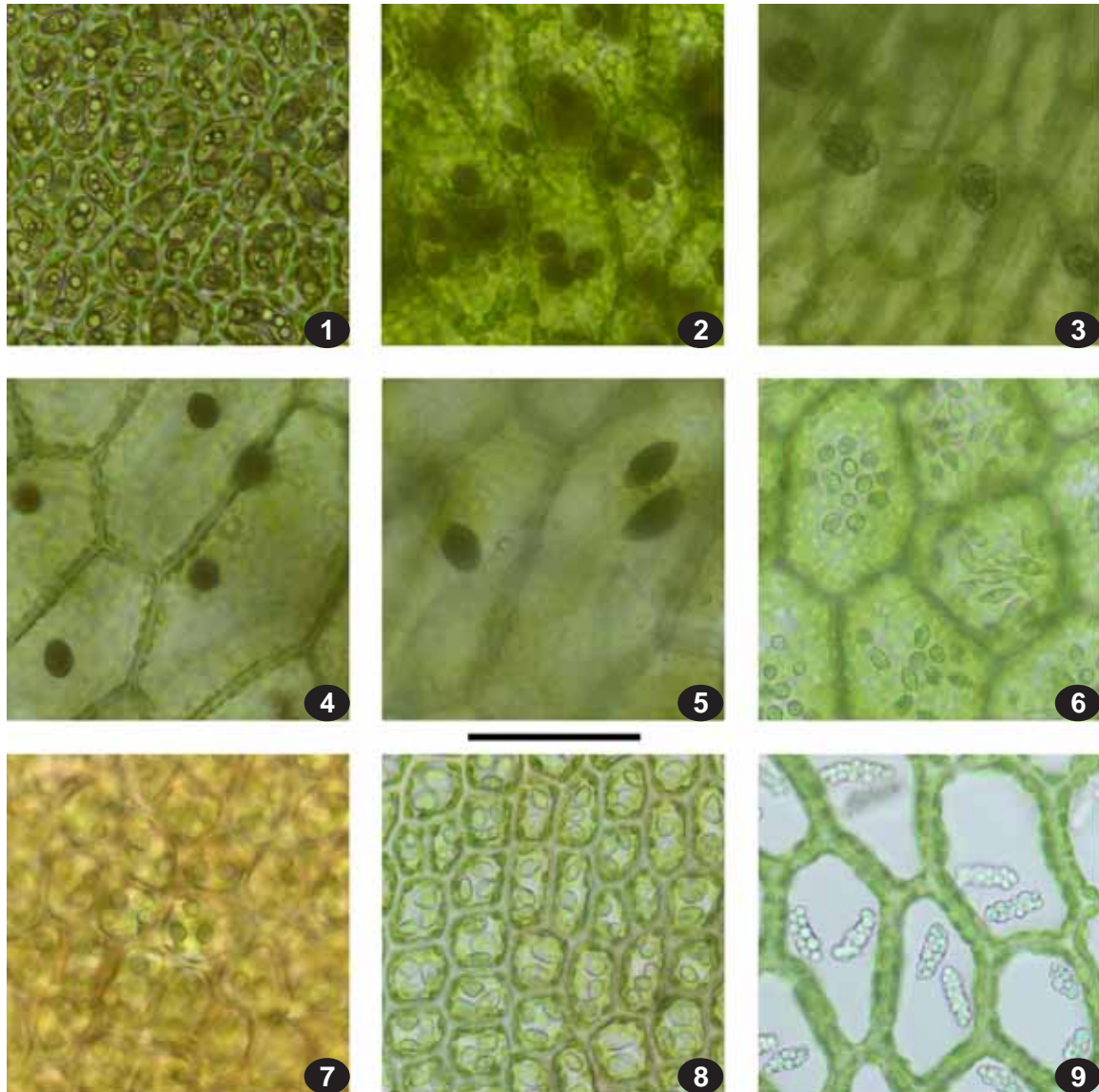


Fig. 5. Oil-bodies of some Hepaticae in Guizhou: 1 – *Radula kojana* Steph., coarsely granulate, with 1-several eyes, irregularly oblong (56-94-13); 2 – *Riccardia graeffei* (Steph.) Hewson, coarsely granulate, ellipsoidal to spherical and fusiform (55-50-13); 3 – *R. nagasakiensis* (Steph.) S. Hatt., inner cells, coarsely granulate, spherical to ellipsoidal (55-42-13); 4 – *R. palmata* (Hedw.) Carruth., granulate, spherical to ellipsoidal (51-39-13); 5 – *R. palmata* (Hedw.) Carruth., inner cells, granulate, fusiform (51-39-13); 6 – *Saccogynidium muricellum* (De Not.) Grolle, granulate, spherical to ellipsoidal and fusiform (55-60-13); 7 – *Scapania ciliata* Sande Lac., granulate, spherical (55-25-13); 8 – *Scapania undulata* (L.) Dumort., granulate, ellipsoidal to irregularly oblong (56-45-13); 9 – *Solenostoma macrocarpum* (Steph.) Váňa & D.G. Long, botryoidal, fusiform to irregularly oblong (55-55-13). Scale 50 μ m for 1-9. All specimens on which photograph is based are in VBGI.

and *Metasolenostoma rubripunctatum* – easily recognizable, but not a so common species.

The basic feature of the hepatic diversity of Guizhou has the characteristic of the flora of humid, subtropical climate in mountainous areas of East Asia. The total number of taxa known in Guizhou is difficult to estimate accurately at present because of the scattering information in miscellaneous local Chinese papers and numerous misidentifications of taxa. The number of known records that we can accept here, without doubt, is about 120 species – but this is rather far from the real taxonomic diversity of hepatics of this province.

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