

## NOTES ON THE SPECIES OF *BAZZANIA* (HEPATICAE) MAINLY OF JAVA

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### Introduction

*Bazzania* is a richly developed genus of Hepaticae, as compared to other hepatics represented by large and conspicuous plants of a creeping habit, with incubous leaves and dichotomously branched shoots, which adhere to the substratum by many flagelliform branches, which are provided with reduced leaves and arise from the axils of underleaves.

After the author had collected material of some 20 species in West Java, he attempted to get some knowledge of the whole genus as it occurs in Java, and of the differences from the *Bazzania* flora of other islands in the Malaysian region. This study is presented here as a preliminary one, and as a forerunner to a fuller treatment of the genus for the whole Malaysian region. Some species are still only known from scanty type collections and their status is rather uncertain. A detailed study of the sexual branches, the perianths and involucra is not attempted here, because the available material is still very incomplete in this respect.

Species of *Bazzania* are especially frequent in moist primary forests from the lowland up into the foggy zone in the mountains, the so-called mossy forests, where they are especially abundant on tree branches. Some species prefer the acid substrate of decaying wood or the forest soil, especially in more open forest with poor sandy soil or on moist sandstone rocks. The last-named substrata are not rare in the East Borneo region visited by the author. In Java he did not notice them.

That the evergreen rain forest with a long wet season is the favourite habitat for most species of *Bazzania* is illustrated by the fact that all 25 species of this genus known from Java have been found in West Java, of which 22 alone on the volcanoes Salak and Gede-Pangrango i. e. in the wettest parts of the island, and three also in the much drier Central and East Java. Though Central and East Java have far lower collection densities in comparison to West Java it is very probable that there exists a definite correlation between a wet climate as is found in moist mountain forests, especially mossy forest and the frequency of species of *Bazzania*.

The centre of the genus seems to lie in the Malaysian region. For S.E. Asia and Oceania the total number of species may be somewhere

between 100 and 150. From South and Central America 72 taxa are recognized in the revision by Fulford (The genus *Bazzania* in Central and South America, Waltham, 1946). From Africa about 30 species were described.

Within the Malaysian region the species are rather irregularly distributed. Of the 25 species occurring in West Java 23 are also found in Sumatra, 16 also in Borneo, 14 also both in Sumatra and Borneo and several also in the Moluccas. From Borneo about 30 species are known. Several species occurring there in the lower regions are not known from Java. From Sumatra I could record 38 species of *Bazzania*. Species occurring there and not known from Java are: *B. conophylla*, *B. acutifolia*, *B. diminuta*, *B. everetti*, *B. recurva*, *B. horridula*, *B. patentistipula*, *B. wiltensii*, *B. renistipula*, *B. fuscescens*, *B. sumatrana*, *B. subserrulata*, and *B. harpago*.

The Moluccas and New Guinea seem to be most different in their *Bazzania* flora. These regions are, however, up till the present insufficiently explored regarding their bryo-flora. Preliminary studies of the genus were made by the author during his stay in the Herbarium Bogoriense, where the then keeper, Prof. Dr M. A. Donk, gave support for carrying on fieldwork in Java and Borneo; later on this study was continued during the winter of 1954/55 at Amsterdam (Hugo de Vries Laboratory).

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### Subdivision of the genus

Several attempts have been made to subdivide the genus *Bazzania* into sections. The first system was that given by Stephani (Hedwigia 25, 1886, 244) and emended in his Species Hepaticarum (Bull. Herb. Boissier II, 8, 1908, 683). This system has been modified by Fulford (loc. cit.).

The present author tried to arrange the Malaysian species into groups after he had studied their form and variation and afterwards made a study of the older systems. A comparison of his own system with those of Stephani and Fulford is here given. (Table p. 369.)

- 1) This system was also followed by Fulford in her recent paper about *Bazzania* in Central and South America (Bull. Torrey Bot. Club 86: 308—341, 1959).
- 2) The section *Connata* of Stephani's older classification (1886, loc. cit.) has been revived here so as to include all species in which the underleaves are connate with one or both leaves. All American species of his section *Serrulata* as well as one species from his section *Grandistipula* belong here. As far as Malaysian species are concerned it seems better not to maintain the section *Connatae* but to follow Stephani's system (1908) in which he considered species with connation between leaves and amphigastria as members of his sections *Serrulata* and *Grandistipula*. The two latter sections are natural groups as far as Malaysian species are concerned.

Comparison of systems used to divide *Bazzania* into Sections

Fulford 1946 American species <sup>1)</sup>	Stephani 1908 World monograph	Most natural division for Malaysian species <sup>5)</sup> into sections only
A. Not in America	A. Subgenus <i>Integrifolia</i>	VII <i>Integrifoliae</i>
B. Subgenus <i>Bidentatae</i>	B. Subgenus <i>Bidentata</i>	I <i>Bidentatae</i>
C. Subgenus <i>Tridentatae</i> Sections: 1. <i>Grandistipulae</i> 2. <i>Connatae</i> <sup>2)</sup>  4. <i>Appendiculatae</i> 3. <i>Fissistipulae</i> 5. <i>Vittatae</i>	C. Subgenus <i>Tridentata</i> Sections: 1. <i>Parvistipula</i> <sup>3)</sup> 2. <i>Grandistipula</i> 3. <i>Serrulata</i> 4. <i>Appendiculata</i> 5. <i>Fissistipula</i> 6. <i>Cordistipula</i> <sup>4)</sup>	II <i>Minutae</i> , <i>Section nova</i>  IV <i>Grandistipulae</i> V <i>Serrulatae</i> VI <i>Fissistipulae</i>  III <i>Vittatae</i>

- 3) This section was considered artificial by Fulford (1946) and the species were included in the section *Grandistipulae*. This seems a wise measure also regarding Malaysian species.
- 4) This section has also been discarded by Fulford (1946) as being artificial and the species were included in sections *Grandistipulae* and *Appendiculatae*. All Malaysian species belong to the section *Grandistipulae* as defined in the present revision.
- 5) The Roman numbers indicate the sequence in which the sections are treated in this revision. A distinction between subgenera is dropped because the group *Integrifoliae* is considered strongly related to the *Serrulatae* and the supposed gap between *Bidentata* and *Tridentata* of Stephani and Fulford appears to be bridged by the new section *Minutae*. The whole genus deserves to be divided into series of sections rather than into subgenera.

## Key to the sections

- 1a. All leaves with two lobes . . . . . I. *Bidentatae*  
 b. Leaves with two or three lobes or entire . . . . . 2  
 2a. Leaves with distinct vittae . . . . . 3  
 b. Leaves without distinct vittae . . . . . 4  
 3a. Leaves with verrucose cuticle, entire or with indistinct lobes, amphigastria entire  
     III. *Vittatae*  
 b. Leaves with smooth cuticle, sharply lobed as are the amphigastria II. *Minutae*  
 4a. Leaves generally without lobes, margins serrulate . . . . VII. *Integrifoliae*

- b. Leaves generally with three (sometimes indistinct) lobes . . . . . 5
- 5a. Leaf lobes toothed, cells with distinct bulging trigones . . . . . VI. *Serrulatae*
- b. Leaf lobes generally not toothed or if toothed leaf cells with smaller trigones (cf *B. intermedia*)
- 6a. Amphigastria longer than broad or as broad as long, generally lobed; leaf cells with bulging trigones . . . . . V. *Fissistipulae*
- b. Amphigastria entire or only slightly lobed, broader than long or as long as broad, leaf cells with small trigones or with slightly bulging trigones, in the last case amphigastria more or less reniform . . . . . IV. *Grandistipulae*

## I. BIDENTATAE

This section is characterized by species with only 2-lobed leaves. It is possible, however, that in this way plants of different affinities are taken together. Some species make somewhat the impression to belong to other sections. A final revision, however, of this section cannot be given on the basis of Malaysian material only.

1. *Bazzania fallax* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 158 — *Mastigobryum fallax* Lac., Ann. Mus. bot. Lugd. Bot. 1, 1864, 304 — *Mastigobryum borneense* De Not., Mem. R. Acad. Sc. Torino 28, 1874, 39, pl. 31.

Plants of small dimensions, characterized by their dark brown colour, the two-lobed leaves, relatively big amphigastria and distinct trigones in their cell structure. It is not impossible that this is the same as *B. uncigera* var. *fallax* Lac. ms., leg. Korthals, Sumatra (L). More material of this and other species will probably reveal whether or not this species belongs somewhere in the vicinity of *B. uncigera* of the section *Fissistipulae*.

Distr.: Java, Borneo, Banka.

JAVA. Without exact locality: *Korthals s.n.*, lectotype (L).

BORNEO. Mt. Sakumbang: *Korthals* (L).

BANKA. Mt. Maras: v. *Diest* (L).

2. *Bazzania wiltensii* (Steph.) Schiffn., Consp. Hep. Arch. Ind. 1898, 180 — *Mastigobryum wiltensii* Steph., Hedwigia 25, 1886, 237.

Plants of delicate structure, leaves oblong acuminate into two small lobes with faint vittae, amphigastria as broad as the stem, about two times broader than long, apex faintly bilobed.

SUMATRA. West Coast: *Wiltens* (L, isotype); Mt. Singgalang, mossy forest near summit: *Meijer 6278* (L).

## II. MINUTAE, nova sectio

Plantae minutae, foliis trilobulatis vel bidentatis, vittatis, amphigastria lobulis acutis.

The plants belonging to this section have many characters in common with members of the section *Bidentatae* but they cannot be included in that section because the leaves often have three lobes. As they cannot be placed in other sections either it seems justified to create for them a

separate one. This section forms a gradual transition between Stephani's subgenera *Bidentata* and *Tridentata*.

3. *Bazzania subtilis* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 174 — *Mastigobryum subtile* Lac., Ann. Mus. bot. Lugd. Bat. 1, 1864, 302, pl. 7.

Characterized by two- or three-lobed leaves, bearing a vitta, cells with small trigones and sharply lobed amphigastria. In Java it seems to be a rare species. Closely related is a species which also belongs to this section: *Bazzania remotifolia* Herz., Trans. Br. Bryol. Soc. 1, 1950, 304 non *B. remotifolia* Horikawa, Journ. Sc. Hir. Un. (Bot.) 2, 1934, 193. I propose for that species the new name *B. herzogiana* Meijer, nom. nov. It resembles *B. wiltensii* from Sumatra as to its dimensions and possession of vittae. *B. wiltensii*, however, is a member of the section *Bidentatae*, also differing in its amphigastria which are short and entire.

Distr.: Java, Sumatra, Borneo. As to the specimen from Amboina, comm. Luerksen, it is doubtful whether it belongs to this species.

JAVA. West Java, Mt. Pangrango near Tugu, along a road, 1100 m alt.: Meijer 3324a (BO).

SUMATRA. Without exact locality: Korthals s.n., lectotype (L) — West coast, Lubuk Sikaping, Mt. Gadang: Van Borssum Waalkes 2015b (BO).

BORNEO. Serawak, Mt. Mattang, Beccari 1866 (L).

### III. VITTATAE

Characterized by blunt to three-lobed leaves which bear distinct vittae. Owing to the minutely verruculose cuticle they have a blue-green appearance. Hyaline amphigastria.

4. *Bazzania vittata* (Gott.) Trev., Mem. Ist. Lomb. 13, 1877, 414; Evans, Pap. Mich. Ac. Sc. 17, 1933, 111 — *Mastigobryum vittatum* Gott., in Syn. Hep. 1845, 216; Lindenberg & Gottsche, Spec. Hep. Monogr. Mastigobryum, 1851, 6, pl. 2.

The only species of this section in Java. It is a very common species and easy to recognize by its vittae and its blue appearance. The apices of the leaves are variably truncate with three short teeth or rounded, retuse or subentire. *B. luzonensis* (Steph.) should be another species of this section, according to Evans (Pap. Mich. Ac. Sc. 17, 1933, 113), the plants being larger, the ventral branches more frequently flagelliform and the leaves narrower and more often three-toothed than in *B. vittata*. Another species belonging to this section is *Bazzania flavescens* (St.) Schiffn., Consp. Hep. Arch. Ind. 1898, 158. (*Mastigobryum flavescens* St., Hedwigia 25, 1886, 6, pl. 3, fig. 1—3) from Celebes. It bears the same verruculose cuticle, giving it a blue colour and it possesses the same hyaline amphigastria and vittae as *B. vittata*. Differences are found in the fact that not only the leaves but also the amphigastria are verrucose and in the more distinctly lobed leaves. It is rather astonishing that Stephani afterwards (Sp. Hep. 3, 1909, 341) placed this species in the genus *Mastigopelma*, in which it differs widely from the type species, *M. simplex* Mitten, represented among others in the Geneva herbarium.

Ecology: in primary forests, in Java known from 1200—2700 m.

Distr.: Java, Sumatra, Philippines.

JAVA. Without exact locality: Zollinger, Korthals, Junghuhn (L) — West Java, Bogor: Kurz HB 3760 (BO); Mt. Pamabula pr. Tugu: Kurz (L); Mt. Pangrango: De Vriese (L); Tjibodas region to Kandang Badak, numerous coll.: Verdoorn, Neervoort and Meijer (BO); Mt. Gede above Sukabumi: Verdoorn 1636; Mt. Tangkuban Prahu: Verdoorn 1863 (BO); Mt. Papandajan: Verdoorn 3422, 3426, 4920 (BO); Telaga Bodas: Korthals (L), Verdoorn 1606, 4919 (BO); Mt. Patuhan: Verdoorn 1652 (BO); Mt. Tjikorai: Verdoorn 1279 (BO).

SUMATRA. West Coast: Wülfens (L); Mt. Sago near Pajakumbuh: Meijer 6227 (L); Mt. Singgalang: Meijer 6276 (L), also reported by Evans l.c.

PHILIPPINES. Luzon, Mt. Maquiling: C. B. Robinson, Bur. Sc. 17311 (L).

#### IV. GRANDISTIPULAE

This section is well represented in Java (9 species). Common characters are: amphigastria entire or only slightly lobed, as well as the leaves without auricles or appendages. Other characters vary: cells with slight trigones only or with distinct trigones (*B. praerupta*), amphigastria hyaline throughout (*B. tridens*), partly (*B. intermedia*) or not at all, margin recurved or not. Amphigastria slightly cordate (*B. javanica*) to strongly so (*B. praerupta*), free or more or less connate with lateral leaves (*B. densa*). Leaf margins in most species entire but in one (*B. intermedia*) irregularly serrulate.

#### Key to the species

- 1a. Amphigastria broader than the stems, irregularly lobed or emarginate, all cells hyaline . . . . . 5. *B. tridens*
- b. Amphigastria without hyaline cells or with hyaline border only . . . . . 2
- 2a. Amphigastria with hyaline border, leaf lobes often serrulate . . . . . 10. *B. intermedia*
- b. Amphigastria without hyaline border . . . . . 3
- 3a. Apex of older amphigastria patent or (and) reflexed . . . . . 4
- b. Apex of older amphigastria not patent or reflexed . . . . . 7
- 4a. Leaves more or less falcate . . . . . 5
- b. Leaves not falcate or only slightly so . . . . . 6
- 5a. Leaves slightly falcate, apex with three distinct lobes . . . . . 11. *B. serpentina*
- b. Leaves strongly falcate, apex blunt, with three indistinct lobes or entire . . . . . 7. *B. zollingeri*
- 6a. Amphigastria about as broad as long, margin toothed . . . . . 9. *B. sumbavense*
- b. Amphigastria broader than long, margin entire . . . . . 8. *B. densa*
- 7a. Amphigastria reniform, two to three times as broad as the stem, leaf lobes different in length, divergent . . . . . 12. *B. praerupta*
- b. Amphigastria not more than twice as broad as the stem, not reniform . . . . . 8
- 8a. Amphigastria emarginate at apex, somewhat broader than the stem, not closely appressed to the stem . . . . . 13. *B. javanica*
- b. Amphigastria slightly and irregular lobed at apex, not broader than the stem, somewhat broader than long and closely appressed to the stem . . . . . 6. *B. pectinata*

5. *Bazzania tridens* (R., Bl., N.) Trev., Mem. Instit. Lomb. 13, 1877, 415; Evans, Pap. Mich. Ac. Sc. 17, 1933, 77, pl. 14, fig. 1—11 — *Jungermannia tridens* R., Bl., N., Nov. Act. 12 (1), 1824, 228 — *Mastigobryum tridens* Nees, Syn. Hep. 1845, 227; Lindenb. et Gott., Sp. Hep. Monogr. Mastigobryi, 1851, 81, pl. 14, fig. 1—5 — *M. ceylanicum* Mitten, J. Linn.

Soc. 5, 1861, 105 (syn. nov.) — *M. olivaceum* Steph., Bull. Herb. Boissier II. 8, 1908, 757 (syn. nov.) — *M. tjibeurum* Steph., Sp. Hep. 6, 1924, 483 — *M. typicum* Steph., Sp. Hep. 6, 1924, 484.

Plants characterized by their distinct, sharply lobed, slightly or not falcate leaves with slightly prominent vittae. Amphigastria hyaline, cell walls thin or fairly thickened, quadrate, somewhat broader than or as broad as the stem, oil bodies 3—5 in each cell. Variation is found in dimensions and width of amphigastria. Ventral leaf basis more or less rounded. In other islands this species has closely related forms. The present author noticed several of these, especially in his Borneo collections. They differ for example by shorter, more blunt leaves and by amphigastria which are in their lower half not hyaline. It will not always be easy to make a sharp distinction between the different forms. The most constant character of *B. tridens* is the structure of the cell net in its leaves. Small quadrate cells border the indistinct vitta along the dorsal and ventral leaf margin and they are bigger, rather elongate with small trigones, at the apex. The vitta is laying more at the ventral than at the dorsal side of the leaf.

Ecology: On decaying wood or forest soil in primary forest, in Java from 1000—2500 m.

Distr.: Java, Sumatra, Borneo, Moluccas.

JAVA. Without exact locality: *Horsfield* (BM), *Korthals* (L), *Kurz HB 3763* (BO) — West Java. Without exact locality: *Teyssmann* (L); Tji Anten, Leuwiliang: *Meijer 1117, 1131* (BO); Salak: *Kurz* (L); Puntjak, Telaga Warna: *Luwit & Butot* (GRON); Mt. Gede, Tjijbodas-Tjibeureum: *Verdoorn, Meijer, Neervoort*, numerous coll. (BO); Mt. Pangrango: *Meijer, Neervoort*, numerous coll. (BO); Gegerbintang ridge: *Kurz, s.n.* (L), ibidem: *Meijer, Neervoort*, numerous coll. (BO); Mt. Tangkuban Prah: *Verdoorn 3482, 3489* (BO); crater Tjiwidae, without coll. (L); Mt. Tilu: *Verdoorn 1981* (BO); Mt. Malabar: *Verdoorn 1929* (BO); Mt. Papandajan: *Verdoorn 3414, 3425* (BO); Telaga Bodas: *Verdoorn 1609, 1893* (BO); Tjikorai: *Verdoorn 1245, 1253* (BO) — Central Java, Mt. Lawu: *Verdoorn 123, 1501* (BO) — East Java, Mt. Kawi: *Verdoorn 1067* (BO); Mt. Pandansari: *Verdoorn 1013* (BO); Mt. Tengger: *Verdoorn 1737* (BO); Mt. Walis: *Clason* (GRON).

SUMATRA. Without exact locality: *Teyssmann* (L); expedition 1878 (L) West Coast, Padang: *Wiltens* (L); Mt. Sago: *Meijer 6265, 6266, 6267* etc. (L); Mt. Korinchi: *Meijer 7820*, Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes 2005, 2014, 2015e* — Mentawai Islands, Siberut, *Van Borssum Waalkes 2715* (BO) — East coast, Prapat, *Van der Wijk 1833* (GRON).

BANKA: *Kurz* (L).

CERAM: *De Vriese* (L).

6. *Bazzania pectinata* (Lindenb. et Gottsche) Schiffn., Nov. Act. 60, 1893, 259, pl. 16, fig. 11; Evans, Pap. Mich. Ac. Sc. 17, 1933, 81, pl. 14, fig. 12—19 — *Jungermannia tridens* var.  $\beta$  Nees, Hep. Jav. 1830, 61 — *Mastigobryum tridens* var.  $\beta$  Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 227 — *Mastigobryum pectinatum* Lindenb. et Gottsche, Spec. Hep. Monogr. Mastigobryi, 1851, 84, pl. 14, fig. 6—10.

Characterized by its more or less falcate leaves, frequently bluntly lobed, amphigastria not hyaline, narrower than the stem, broader than long in outline, irregularly retuse and appressed to the stem. This species is easily distinguished from *B. tridens* by the structure of its amphigastria and by the more falcate leaves. It seems to be closely related to *B. densa* which differs by its recurved upper margin of the amphigastria.

Ecology: in mountain forest 1000—2000 m, on bark.

Distr.: Java, Sumatra, Borneo.

JAVA. Without exact locality: *Blume* (isotype?), *Junghuhn*, *Teysmann*, *Korthals* (L) — West Java. Without further locality: *Zippelius*, *Treub*, *Teysmann* (L); Tji Anten, Leuwiliang: *Meijer* 1112, 1192 (BO); Mt. Megamendung: *Verdoorn* 3097 (BO); Tjibodas: *Nymann* (L); Tjibodas-Tjibeureum: *Verdoorn*, *Neervoort*, *Meijer*, numerous collections (BO); Mt. Pangrango: *Meijer* 299a, 756, 765 (BO); Mt. Gegerbintang: *Meijer* 466, 471b, ibidem: *Neervoort* 1702, 2325 (BO); Lembang: *Korthals* (L); Tangkuban Prah: *Meijer* 3519 (BO); Mt. Patuha: *Verdoorn* 3478 (BO); Mt. Malabar: *Verdoorn* 954 (BO).

SUMATRA. Without exact locality: *Teysmann* (L) — West Coast, Mt. Sago: *Meijer* 6224 (L); Mt. Singgalang: *Meijer* 6279, 6283 (L); Mt. Tandikat: *Meijer* 6290 (L); Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 2015d, 2022b, 2025 (BO); Mt. Korinchi: *Meijer* 8736 (L).

BORNEO. Without exact locality: *Korthals* (L).

7. *Bazzania zollingeri* (Lindenb.) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Mastigobryum zollingeri* Lindenb. in Meissn., Bot. Zeit. 6, 1848, 462; Lacoste, Ann. Mus. bot. Lugd. Bat. 1, 1864, 302, pl. 8; De Notaris, Mem. Ac. Sc. Torino II. 28, 1874, 35, pl. 16.

Characterized by strongly falcate leaves, almost entire or more distinctly two- or three-lobed, with cells at apex much smaller than at base, trigones small, amphigastria hyaline, broader than long or as broad as long, about the same width as the stem, short tongue-shaped, at older parts of the stem reflexed at apex.

Distr.: Java, Sumatra.

JAVA. West Java, Salak: *Zollinger* 815z (type L); Tangkuban Prah: *Van der Wijk* (GRON).

SUMATRA. East coast, Brastagi: *Van der Wijk* 1742 (GRON) — West coast, Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 1922 (BO); Taram, Tjajmpo-region about 500 m alt.: *Meijer* 8426 (L).

8. *Bazzania densa* (Lac.) Schiffn., Consp. Hep. Arch. Ind., 1898, 151 — *Mastigobryum densum* Lac., Ned. Kruidk. Arch. 3, 1854, 418, Natuurk. Tijdschr. N. Indië 10, 1856, 395; Syn. Hep. Jav. 1856, 40, pl. 7.

Plants with blunt leaf apex, amphigastria broader than long, upper margin reflexed, slightly broader than the stem. Cells only with small trigones. Somewhat related to *B. pectinata*, which differs in its non-reflexed margin of amphigastria and to *B. zollingeri* which possess stronger falcate and blunter leaves. The variety *connata* Lacoste (Ann. Mus. bot. Lugd. Bat. 1, 1863, 302) has been named *Mastigobryum connatum* Steph. (Hedwigia 24, 1885, 248, pl. 2, fig. 2) and *Bazzania connata* (Steph.) Schiffn., (Consp. Hep. Arch. Ind. 1898, 150); its type comes from Sumatra, leg. *Teysmann* (L). It seems too early to decide whether this form deserves specific rank as the amphigastria are also at one or both sides connate with the leaves in the type of *B. densa*. Related species are *B. concinnata* De Not. and *B. borneensis* Steph.

Ecology: probably a species of open sunny habitat in Borneo, frequently in so-called padang forests on decaying wood or on acid soil, in Java especially in lower regions (750—1800 m) of the mountains.

Distr.: Java, Sumatra.

JAVA. Without exact locality: *Junghuhn*, type (L) — West Java, Tji Anten, Leuwiliang: *Meijer* 1115 (BO); Tangkuban Prah: *Verdoorn* 1870, ibidem: *Meijer* 3507, 3508, 3512 (BO).

SUMATRA. West coast, Mt. Nantigo near Mt. Sago: *Meijer* 6286 (L), Mt. Sago: *Meijer* 6260, 6262, 6710, 6780 (L).

9. *Bazzania sumbavensis* (Steph.) Steph., Eng. Bot. J. 23, 1896, 307 — *Mastigobryum sumbavense* Steph., Hedwigia 25, 1886, 236, pl. 2, fig. 13—15.

Plants somewhat smaller than in *B. tridens*. Leaves lingulate, margins almost parallel, apex bluntly lobed, amphigastria broader than the stem, somewhat broader than long, rectangular, irregular lobed at occasionally recurved apex. Leaf cells with small trigones. According to Stephani (loc. cit.) this species should be distributed from Nepal to Samoa. It seems rather closely related to *Bazzania patentistipa* (Lac.) Schiffn. from Borneo and Sumatra but the latter is more restricted to lowland regions. *Bazzania conophylla* (Lac.) Schiffn. from Banka and recently detected by me in Sumatra is also related to this species but its amphigastria are about as narrow as the stem and the leaf cells possess bulging trigones.

Distr.: Java, Sumatra.

JAVA. Without exact locality, herb. Lacoste (L) — West Java, Mt. Gede: *Verdoorn* 2105, 2836; ibidem: *Meijer* 4189, 4190; ibidem: *Bouman* s.n. (GRON 3498); Pangrango: *Neervoort* 421; Papandajan: *Verdoorn* 3448 (BO); Idjen Plateau: *Clason* (GRON 3433).

SUMATRA. West coast, Mt. Merapi: *Meijer* 6296 (L); ibidem: *Van Borssum Waalkes* 2248a (BO).

10. *Bazzania intermedia* (Lindenb. et Gottsche) Trev., Mem. Ist. Lomb. 13, 1877, 415; Evans, Pap. Mich. Ac. Sc. 17, 1933, 89, pl. 15; fig. 16—25. — *Mastigobryum intermedium* Lindenb. et Gottsche, Spec. Hep. Monogr. Mastigobryi, 1851, 82, pl. 12. — *Mastigobryum concinnum* De Not., Mem. Real. Ac. Sc. Torino II. 28, 1874, 33, pl. 25. — *Bazzania concinna* (De Not.) Trev., Mem. Ist. Lomb. 13, 1877, 415.

Differing from *B. tridens* by the irregularly serrulate, but sometimes almost entire leaf apex and the distinct band of chlorophyll cells in the lower half of the amphigastria. In addition, the trigones in the leaf cells are more prominent. This species comes near the members of the section *Serrulatae*. It is, however, so strongly linked with the section *Grandistipulae* that it cannot be removed from that section. Some forms with almost entire leaves and a small band of chlorophyll cells in the amphigastria are difficult to separate from *B. tridens*.

Ecology: probably a lowland species which is now very rare or absent in Java.

Distr.: Java, Sumatra, Banka, Borneo.

JAVA. Without exact locality: *Kuhl et v. Hasselt, Teysmann* (L) — West Java, Salak: *Kurz* (L).

SUMATRA. Without exact locality: *Korthals* (L), also mentioned by Evans (loc. cit.) from that island. — West coast, Lubuk Sikaping, Mt. Gadang: *Van Borssum Waalkes* 2013, 2018 (BO).

BANKA. *Kurz* (L).

BORNEO. Serawak, Mt. Mattang: *Beccari*, isotype of *Mastigobryum concinnum* De Not. (L) — East Borneo, Peak of Balikpapan: *Meijer* 1276, 1284a (BO); Sangkulirang: *Kostermans HB* 6149 (BO).

11. *Bazzania serpentina* (Nees) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Bazzania serpentina* (Nees) Schiffn., Consp. Hep. Arch. Ind. 1898, 173. —

*Jungermannia serpentina* Nees, Hep. Jav. 1830, 62 — *Mastigobryum serpentinum* (Nees) Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 233; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 111, pl. 19.

Leaves short falcate, cells with bulging trigones, more or less orbicular amphigastria with recurved upper margin. The only species with which *B. serpentina* may be confused is *B. praeupta*, but the latter may be distinguished by their less falcate leaves which are longer and more sharply pointed and by the more auriculate amphigastria, with the upper margin generally not reflexed.

Ecology: in mountain forests, above 1000 m.

Distr.: Java, Sumatra, Borneo.

JAVA. Without exact locality: *Junghuhn*, *Teysmann*, *Zippelius* and *Korthals* (L) — West Java, locality unknown: *Hasskarl* (L); Salak: *Kurz* (L); Mt. Pangrango: *de Vriese*, *Kuhl et v. Hasselt* (L); Mt. Gede: *Verdoorn* 2126, 2415, 2897 (BO), ibidem: *Neervoort* 2552d (BO); Telaga Bodas: *Korthals* (L).

SUMATRA. West coast, Mt. Singgalang: *Meijer* 6270, 6289 (L).

BORNEO. *Korthals* (L).

12. *Bazzania praeupta* (Reinw., Bl., N.) Trev., Mem. Ist. Lomb. 13, 1877, 414. — *Jungermannia praeupta* Reinw., Bl., N., Nova Act. 12, 1824, 229 — *Mastigobryum praeuptum* (Reinw., Bl., N.) Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1840, 224; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi 1851, 58, pl. 10, fig. 1—7. — *Bazzania sandei* Steph., Hedwigia 25, 1886, 206, pl. 3, fig. 39—43.

Plants distinct by their orbicular amphigastria, cell walls with bulging trigones and sharp, more or less divergent leaf lobes. For differences with *B. serpentina* see under that species. Living material from Sumatra showed oil bodies, round to oblong, 5—8 in each cell.

Ecology: from 1700—2500 m in primary forest on tree branches.

Distr.: Java, Sumatra, Borneo, Moluccas.

JAVA. Without exact locality: *Teysmann*, *Junghuhn*, *Korthals* (L) — West Java, Salak: *Kurz* (L); Pangrango: *Kuhl et v. Hasselt*, *De Vriese* (L); ibidem: *Neervoort* 509 (BO); ibidem: *Meijer* 754 (BO); Mt. Gede about 2000—3000 m: *Verdoorn* 1135, 1141, 2105, 2336; ibidem: *Meijer* 3018, 3998, 4006, 4120 (BO); ibidem: *Neervoort* 2522, 2545 (BO); ibidem: *Bouman* (GRON 3481); Tangkuban Prah: *Korthals* (L); Telaga Bodas: *Korthals* (L); Papandajan: *Korthals* (L); Mt. Patuha: *Verdoorn* 700, 703, 705 (BO).

SUMATRA. Without exact locality: *Korthals* (L), *André Wiltens*, type of *Bazzania sandei* Steph. (L) — West coast, Mt. Sago: *Meijer* 6229, 6816a (L); Mt. Singgalang: *Meijer* 6282, 7255a, 7257, 7389a, 8130a (L).

BORNEO. Without exact locality: *Korthals* (L).

CERAM: *de Vriese* (L).

13. *Bazzania javanica* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 163 — *Mastigobryum javanicum* Lac., Ned. Kruidk. Arch. 3, 1854, 418; Syn. Hep. Jav. 1856, 42, pl. 8.

Much resembling minute forms of *B. praeupta* but leaves and amphigastria more distant; leaves partly 2-lobed, amphigastria not or scarcely auricled.

Ecology: from 1700—2000 m in primary forest.

Distr.: Java, Sumatra, Moluccas.

JAVA. Without exact locality: *Jungtuhn*, type (L) — West Java, Mt.

Salak: *Kurz* (L); Mt. Pangrango: *Meijer* 818 pp. (BO); Mt. Malabar: *Verdoorn* HB 998 (BO).

SUMATRA. West coast, Padang: *André Wiltens* (L); Mt. Sago: *Meijer* 6235 (L).  
CERAM: *De Vriese* (L).

#### V. FISSISTIPULAE

The principal characters of this section are: big amphigastria of firm texture, either entire or slightly or strongly lobed or (and) auricled, ventral leaf basis slightly or greatly widened, cells in most cases of a firm structure, with bulging trigones, leaf lobes acute, entire or only slightly serrulate.

#### Key to the species

- 1a. Amphigastria orbicular to quadrangulate with reflexed entire margin; leaves with ventral appendage narrowed towards the apex three lobed, sometimes with dentate lobes . . . . . 20. *B. commutata*
- b. Leaves and amphigastria of another structure . . . . . 2
- 2a. Dorsal leaf basis with dentate lobe, amphigastria with many sharp lobes . . . . . 18. *B. calcarata*
- b. Dorsal leaf basis without dentate lobe . . . . . 3
- 3a. Leaves narrow, somewhat falcate, at the base three to five times as broad as near the apex, amphigastria rectangular, irregularly lobed at the lateral margins, upper half often reflexed . . . . . 14. *B. uncigera*
- b. Leaves broader, less falcate . . . . . 4
- 4a. Amphigastria longer than broad, lateral margin entire or slightly lobed, apex irregularly dentate or lobed, base auricled . . . . . 19. *B. linguaeformis*
- b. Amphigastria as broad as long or broader than long . . . . . 5
- 5a. Lateral margins of amphigastria generally with big lobes . . . . . 6
- b. Amphigastria more or less quadrate, margins only slightly lobed and dentate . . . . . 15. *B. uncigera* var. *gibba*
- 6a. Well-developed amphigastria, broader than long, almost entire or short-lobed at the lateral margins, at their apex with 4—5 lobes, basis shortly auriculate . . . . . 16. *B. gedecana*
- b. Well-developed amphigastria about as long as broad, along whole margin sharply lobed, often with big primary lobe and smaller secondary lobes, basis with big auriculae, the length of which is  $\frac{1}{2}$ — $\frac{3}{4}$  of total length of the amphigastria . . . . . 17. *B. paradoxa*
- c. Amphigastria quadrangulate, as long as broad or longer than broad, lobed along the margin, less distinctly auriculate, plants more robust than any other species of this section (not mentioned further in this paper) . . . . .  
*B. sumatrana* (Lac. in Steph.) Schiffn.

14. *Bazzania uncigera* (Reinw., Bl., N.) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Jungermannia uncigera* Reinw., Bl., Nees, Nov. Act. 12, 1824, 230 — *Mastigobryum uncigerum* (Reinw., Bl., N.) Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 233; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 112, pl. 19, fig. 6—10.

Rather small plants, characterized by 2—3 lobed narrow leaves and rectangular amphigastria, longer than broad, with irregularly lobed margins. Amphigastria especially on younger branches, at base concavely bulging and the apex slightly recurved.

Ecology: between 1300 and 2000 m on stems and branches of trees in mossy forest.

Distr.: Java, Sumatra.

JAVA. Without exact locality: *Teysmann* (L) — West Java, Mt. Salak: *Kurz* (L); Mt. Gede: *Zippelius* (L); ibidem: *Meijer* 4164b (BO); Tjibodas, Mt. Garden: *Van der Wijk* 1103 (GRON); Tjibodas-Tjibeureum: *Verdoorn* 2024, ibidem: *Meijer* 3474 (BO); Mt. Pangrango: *Meijer* 777b, 868, 908a, 3358 (BO); Gegerbintang: *Meijer* 932b, Neervoort 1196 (BO) — East Java, Dorowatti: *Clason* (GRON 3414).

SUMATRA. West coast, Expedition 1878, a variety with greater and broader leaves (L); Pajakumbuh, Mt. Sago: *Meijer* 6220, 6221 etc. (L); Mt. Tandikat: *Meijer* 6292 (L); Mt. Korinchi: *Meijer* 7597, 7668, 7713, 7715 (L) — East coast, Brastagi: *Van der Wijk* 1651, 1691 (GRON).

15. *Bazzania uncigera* var. *gibba* (Lac.) Meijer, var. nov. — *Bazzania gibba* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 959 — *Mastigobryum gibbum* Lac., in Dozy, Ned. Kruidk. Arch. 4, 1855, 94; Lac., Syn. Hep. Jav. 1856, 45, pl. 9.

Plants resembling *B. uncigera*, but leaves relatively broader and more bluntly lobed, at ventral base auricled, amphigastria about as broad as long, bulging at base, margin with irregular blunt teeth, at apex somewhat reflexed. Leaf cells strongly incrassate. Rarely collected. Differs from *B. everetti* St. from Borneo and Sumatra by its relatively longer amphigastria, which are bulging at base and the brown colour of the cell walls.

Distr.: Java, Sumatra.

JAVA. Without exact locality: *Junghuhn*, type (L) — West Java: *Teysmann* (L).

SUMATRA. West coast: *André Wiltens* (L); Mt. Korinchi: *Meijer* 7687, 7699 (L); Mt. Sago: *Meijer* 6868, 8235c (L).

16. *Bazzania gedeanana* (Steph.) Meijer, comb. nov. — *Mastigobryum gedeanum* Steph., Sp. Hep. 3, 1909, 540; Sp. Hep. 6, 1924, 463 — *Mastigobryum fleischeri* Steph., Bull. Herb. Boissier II. 8, 1908, 945; Sp. Hep. 3, 1908, 495, non *M. fleischeri* Steph., Bull. Herb. Boissier II. 8, 1908, 773; Sp. Hep. 3, 1908, 457 — *Mastigobryum uncigera* var. Nees., Hep. Jav. 1830, 61; Gottsche, Lindenb. et Nees., Syn. Hep. 1845, 233; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 112, pl. 19, fig. 6—10.

Plants with rather broad and relatively short leaves, not much narrowed towards apex, amphigastria broader than long, with 4—6 lobes at apex and slightly or not lobed at lateral margin, not or only slightly auricled at base. Among Stephani's Icones a drawing was found of a specimen collected by Fleischer on Mt. Gede, probably the type of *B. gedeanana*; I could not find this in Stephani's herbarium where it was indicated as lacking: "manque". Almost identical with this species is *Mastigobryum everetti* Steph. from Borneo and the Philippines. *Mastigobryum malaccense* St. should be compared with this species.

Ecology: Mt. forests above 1000 m altitude, bark epiphyte.

Distr.: Sumatra, Java, Philippines.

JAVA. Without exact locality: *Teysmann*, *Junghuhn* (L) — West Java, Mt. Salak: *Kurz* (L); Mt. Gede: *Fleischer*, figured in *Icones Stephani*; Tjibodas: *Verdoorn* 2497; ibidem: *Meijer* 205 (BO); Pangrango: *Meijer* 385b, 867, 3360 (BO) — Central Java, Mt. Lawu: *Verdoorn* 826 (BO) — East Java, Mt. Siamat: *Verdoorn* 1564 (BO).

SUMATRA. West coast, Mt. Sago: *Meijer* 6749 (L).

PHILIPPINES. Polillo prope Luzon: *MacGregor*, Bur. of So. 10502 (G).

17. *Bazzania paradoxa* (Lac.) Steph., Engl. Bot. Jahrb. 23, 1896, 307 — *Bazzania paradoxa* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898,

168; Evans, Pap. Mich. Ac. Sc. 17, 1933, 102, pl. 18, fig. 1—11 — *Mastigobryum paradoxum* Lac., Ned. Kruidk. Arch. 3, 1854, 419; Syn. Hep. Jav. 1856, 46, pl. 9.

Big plants characterized by strongly auricled amphigastria, in adult state margin divided into about 10 primary lobes which are provided with secondary incisions. Sometimes only primary lobes well developed. Leaf lobes sharp, mostly of different length. One of the most characteristic species of Java. Only to be confused with *B. gedeana*, when young branches are compared.

Ecology: between 1200—1630 m in Java.

Distr.: Malaya, Sumatra, Java, Borneo.

JAVA. Without exact locality: *Gesker* (L) — West Java: *Teysmann* (L); Mt. Salak: *Zollinger* (L); Mt. Gede: *Zippelius* (L); Mt. Pangrango: *Meijer 3337* (BO); Gegerbintang: *Neervoort 1050* (BO).

SUMATRA. West coast: *André Wiltens* (L); ibidem: *Teysmann* (L); ibidem: expedition 1878 (L); also reported by Evans (loc. cit.) from Sumatra; Pajakumbuh, Mt. Sago: *Meijer 6221a, 6222, 6259, 8267* (L); Mt. Tandikat: *Meijer 6294, 8096* (L); Mt. Singgalang: *Meijer 6275a* (L) — East coast, Brastagi: *Van der Wijk 1615* (GRON).

MALAYA. Pahang: *Henderson 1* (GRON).

BORNEO. East Borneo, Peak of Balikpapan: *Meijer 1831* (BO).

18. *Bazzania calcarata* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1848, 149 — *Mastigobryum calcaratum* Lac., Ann. Mus. bot. Lugd. Bat. 1, 1864, pl. 8, 304.

Delicate plants with sharp, often divergent, pointed leaf lobes, densely armed amphigastria and a very peculiar toothed auricle at the ventral leaf base. This species seems to be very rare in Java. It is closely related to *B. lancifolia* St. from Celebes. *Bazzania richardsii* Herzog., Trans. Br. Bryol. Soc. I, 1950, 302, probably belongs to this species.

Distr.: Malaya, Sumatra, Java, Borneo.

JAVA. Without exact locality: *Zippelius*, lectotype (L).

SUMATRA. West coast: expedition 1878 (L); Mt. Gadang near Lubuk Siking: *Van Borssum Waalkes 20115a* (BO); Mt. Korinchi, 1600—2000 m: *Meijer 8691* (L); Taram, Tjampo region: *Meijer 8432* (L).

MALAYA. Pahang: *Henderson 37* (GRON).

BORNEO. South Borneo, Mt. Sakumbang: *Korthals* (L) — East Borneo, Peak of Balikpapan, Sulau Mandau terrace: *Meijer* (BO).

19. *Bazzania linguaeformis* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 164 — *Mastigobryum linguaeforme* Lac., Ned. Kruidk. Arch. 4, 1855, 94; Syn. Hep. Jav. 1856, 41, tab. 8.

Rather robust plants. Leaves oval-oblong from a broad dorsal rounded base narrowed towards the apex, ventral leaf base slightly auricled. Leaf cells with big bulging trigones. Amphigastria generally longer than broad, auricled at their base, slightly lobed and with recurved margin et apex.

Distr.: Sumatra, Java.

JAVA. Without exact locality, herb. *Dozy & Molkenboer*, type (L) — West Java, Gegerbintang ridge, 1700—1750 m: *Meijer 499* (BO).

SUMATRA. West coast: *André Wiltens* (L); Pajakumbuh, Mt. Sago: *Meijer 6248* (L).

20. *Bazzania commutata* (Lindenb. et Gott.) Schiffn., Consp. Hep. Arch. Ind. 1898, 149 — *Mastigobryum commutatum* Lindenb. et Gottsche.,

Sp. Hep. Monogr. Mastigobryi, 1851, 97, pl. 22 — *Mastigobryum miquelianum* Lehm., Pugillus 10, 1837, 8 (syn. nov.) — *Bazzania miqueliana* (Lehm.) Schiffn., Consp. Hep. Arch. Ind. 1898, 167.

Plants with very broad leaf bases, leaves oval with a broad base, narrowed towards an irregular lobed or toothed apex. Ventral leaf base occasionally with small appendages. Amphigastria imbricate, almost quadrate, with short rounded auricles, margin reflexed. Cells in leaves and amphigastria with bulging trigones. This species resembles *B. indica* in its type of amphigastria and *B. spiralis* in the serrulation of its leaf lobes, a character which is, however, not always well pronounced.

Distr.: Java.

JAVA. Without exact locality and collector (L); ibidem: comm. Miquel, type of *B. miqueliana* (S-PA) — West Java: *Teysmann* (L); Tji Anten, Leuwiliang: *Meijer 3461* (BO); Gegerbintang ridge: *Neervoort 2028, 3076* (BO); Mt. Gede, Tjibodas, between Mt. Garden and Tjibeureum: *Verdoorn 2518* (BO).

#### VI. SERRULATAE

This section comprises a group of closely related species, all of which have in common the serrulate leaf margins.

#### Key to the species

- 1a. Amphigastria without hyaline border . . . . . 2
- b. Amphigastria with hyaline border . . . . . 4
- 2a. Amphigastria about as long as broad, margin flat and irregularly serrulate . . . . . 21. *B. longicaulis*
- b. Margin of amphigastria reflexed, leaves more or less falcate . . . . . 3
- 3a. Leaves lingulate, apex of amphigastria entire . . . . . 24. *B. desciscens*
- b. Leaves shorter, amphigastria serrulate at apex . . . . . 25. *B. indica*
- 4a. Margins of amphigastria generally imbricate, more or less quadrate, flat . . . . . 22. *B. erosa*
- b. Amphigastria not imbricate, with recurved margin, broader than long, apex recurved . . . . . 23. *B. spiralis*

21. *Bazzania longicaulis* (Lac.) Schiffn., Consp. Hep. Arch. Ind. 1898, 165 — *Mastigobryum longicaule* Lac., Ann. Mus. bot. Lugd. Bat. 3, 1864, 303, pl. 8.

The diagnostic characters of this species are: narrow oblong leaves, amphigastria longer than broad, margin not reflexed, without hyaline band, sharply toothed, in some cases with primary and secondary teeth. There is some variation in the dentation of leaves and amphigastria. A detailed description of this species has been given by Evans (Pap. Mich. Ac. of Sc. and Arts 27, 1933, 93—97, pl. 16) after material from North Sumatra (Karoland), under the name of *B. erosa*. This name is a consequence of a misinterpretation of Stephani's description of that species.

Distr.: Sumatra, Java, Philippines.

JAVA. Without exact locality: *Teymann anno 1858* (L); ibidem: *anno 1859, type* (L) — West Java, Mt. Salak: *Kurz* (L); Mt. Pangrango: *Meijer 755, 759, 766, 770* (BO); Mt. Gegerbintang: *Meijer 460* (BO); Mt. Papandajan: *Verdoorn 1840* (BO).

SUMATRA. West coast, expedition 1878 (L), Padang: *André Wiltens*; Pajakumbuh, Mt. Sago: *Meijer 6219, 6225, etc.* (L); Mt. Singgalang: *Meijer 6284* (L); Mt. Tandikat: *Meijer 6291, 8091, 8100b* (L); Mt. Korinchi: *Meijer 7701, 7708, etc.* (L).

PHILIPPINES. Mindanao, Mt. Apo: Elmer 1157c (L); Negros, Cuernos Mts.: Elmer 9907 (L).

22. *Bazzania erosa* (Reinw., Bl., N.) Trev., Mem. Ist. Lomb. 13, 1877, 415 — *Jungermannia erosa* Reinw., Bl., N., Nov. Act. 12, 1824, 230 — *Jungermannia erosa* var.  $\alpha$  Nees, Hep. Jav. 1830, 63 — *Mastigobryum erosum* (Reinw., Bl., N.) Lindenb. var.  $\alpha$ , in Gottsche, Lindenb. et Nees., Syn. Hep. 1845, 229, Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 49, pl. 16, fig. 1—5.

Plants with shorter leaves than in *B. longicaulis*. Amphigastria generally imbricate, as long as broad or somewhat broader than long, margin with border of hyaline cells, not recurved. In this restricted sense *B. erosa* is not so difficult to distinguish from *B. spiralis*, where the amphigastria are more distant, generally broader than long and recurved at their margin.

The detailed description given by Evans (Pap. Mich. Ac. of Sc. and Arts 17, 1933, 93—97, pl. 16) under the name of this species points to *B. longicaulis*.

Ecology: on branches of trees, exposed to the sun, primary forests 1000—2000 m above sea level.

Distr.: Ceylon, Sumatra, Banka, Java, Celebes, Moluccas, Philippines, Carolines.

CEYLON. herb. v. d. Bosch (L).

JAVA. Without exact locality: Korthals, Zippelius, Junghuhn (L) — West Java: Teysmann (L); Salak: Zollinger 3560d (L); Tugu: Kurz (L); Gegerbintang: Kurz (L); ibidem: Meijer 516 (BO); Pangrango: Meijer 297 (BO); Gede, Tjibeureum: Meijer 409, 4091 (BO); Kandang Badak: Van der Wijk 437 (GRON).

SUMATRA. Without exact locality: Korthals (L); ibidem: expedition 1878 (L) — West Coast, Mt. Sago: Meijer 6228, 6230, 6250 (L); Mt. Korinchi: Meijer 6787, 8700 (L); Lubuk Sikaping, Mt. Gadang: Van Borssum Waalkes 2015f (BO) — East Coast, Brastagi: Van der Wijk 1651b (GRON).

BANKA, inter Klappa et Prang: Kurz, mixed with *B. spiralis* (L).

CELEBES. Tjamba: Simon Thomas (L).

HALMAHEIRA: De Vriese (L).

CAROLINE ISLANDS. Ponape, Mt. Poaipoai: Glassmann 2489 (L).

23. *Bazzania spiralis* (Reinw., Bl., N.) Meijer, comb. nov. — *Jungermannia spiralis* Reinw., Bl., N., Nov. Act. 12, 1824, 231 — *Mastigobryum spirale* (Reinw., Bl., N.) Steph., Bull. Herb. Boiss. II. 8, 1908, 857; Sp. Hep. 3, 1908, 481 — *Bazzania schildii* Herz., Ann. Nat. Hist. Mus. Wien 53, 1943, 366 — *Jungermannia erosa* var.  $\beta$  Nees p.p., Hep. Jav., 1830, 63 — *Mastigobryum erosum* var.  $\beta$  Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 229; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 99, pl. 16, fig. 6—9.

Plants with oblong leaves, leaf lobes sometimes confluent with the serrulation, dorsal base of leaf occasionally with small appendages, amphigastria distant, broader than long, margin serrulate (or entire) with hyaline border, recurved. Forms with bigger and more imbricate amphigastria are not easily separable from *B. erosa*, but as both forms can grow together and then remain distinct, it does not seem likely that they belong to one single species.

Ecology: on branches of trees.

Distr.: Malaya, Banka, Sumatra, Java, Borneo.

JAVA. Without exact locality and collector (L).

SUMATRA. West Coast: *André Wiltens* (L); ibidem: *Schild* (Herzog loc. cit.).

BANKA, Mt. Maras: v. *Diest* (L); inter Klappa et Prang: *Kurz* (L).

MALAYA. Pahang: *Henderson 32* (GRON).

BORNEO, Mt. Sakumbang: *Korthals* (L) — North Borneo, Kinabalu: *J. Whitehead* (BM).

HALMAHEIRA: *Pleyte 391b* (BO).

**24. *Bazzania desciscens*** (Steph.) Meijer, comb. nov. — *Mastigobryum desciscens* Steph., Bull. Herb. Boiss. II. 8, 1908, 862; Sp. Hep. 3, 1908, 487 — *Mastigobryum erosum* var.  $\gamma$  Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep., 1845, 229; Lindenberg et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 99, pl. 16, fig. 9—12.

Plants with narrow-oblong, somewhat falcate leaves, amphigastria broader than long, without hyaline border, apex reflexed. Differs from *B. indica* especially by the different type of leaf and cell net and from *B. erosa* and *B. spiralis* by its narrower leaves and the lack of a hyaline border in the amphigastria.

Distr.: Sumatra, Java.

JAVA. West Java, Mt. Megamendung 1200 m: *Verdoorn 3077* (BO).

SUMATRA. West Coast: *Teymann* (L); Mt. Tandikat 2000 m: *Meijer 6293* (L).

**25. *Bazzania indica*** (Gottsche et Lindenb.) Trev., Mem. Ist. Lomb. 13, 1877, 414 — *Mastigobryum indicum* Gottsche et Lindenb., in Gottsche, Lindenberg et Nees, Syn. Hep., 1845, 230; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 102, pl. 19.

Diagnostic characters: oval-ovate leaves, sometimes with indistinct lobes, along upper margin generally sharply serrulate. Amphigastria more or less quadrate, margin serrulate, without hyaline border, recurved. Leaves and amphigastria all densely imbricate.

Distr.: Sumatra, Java, Borneo.

JAVA. Without exact locality and collector, herb. *Dozy & Molkenboer* (L), ibidem: *Korthals, Zippelius* (L) — West Java, Mt. Gede, Tjibodas, Mt. Garden: *Meijer 5739* (BO); path to Tjibeureum: *Van der Wijk 125* (GRON); Mt. Guntur: *Verdoorn 1662* (BO).

SUMATRA. Without exact locality: *Korthals* (L) — West Coast: *André Wiltens* (L); Pajakumbuh, Mt. Sago: *Meijer 6249, 6255* (L) — East Coast, Brastagi: *Van der Wijk 1641* (GRON).

BORNEO. Without exact locality and collector (L).

## VII. INTEGRIFOLIAE

This section is closely related to the section *Serrulatae*. All species show also serrulate leaves, the only difference being that no special leaf lobes are visible.

**26. *Bazzania loricata*** (Reinw., Bl., Nees) Trev., Mem. Ist. Lomb. 13, 1877, 414; Evans, Pap. Mich. Ac. Sc. 17, 1933, 70, pl. 13 — *Jungermannia loricata* Reinw., Bl., Nees, Nov. Act. 12, 1824, 233 — *Mastigobryum loricatum* Lindenb., in Gottsche, Lindenb. et Nees, Syn. Hep. 1845, 217; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi, 1851, 12, pl. 4.

The most striking characters of this species are: imbricate, oblong leaves and rounded rectangular amphigastria, the latter hyaline-bordered. Leaf cells with bulging trigones. *Mastigobryum insignis* De Not., from

Borneo, is a related species, with entire or slightly 3-lobed leaves and amphigastria not bordered by hyaline cells. *Bazzania recurva* (Mont.) Trevis differs both from this and from *B. loricata* by its rounder leaves, its amphigastria with recurved margin and its very thick incrassate cell walls.

Ecology: growing on decaying wood in mountain forests.

Distr.: Sumatra, Java.

JAVA. Without exact locality: *Junghuhn* (L) — West Java: *Teysmann* (L); Salak: *Kurz* (L); Mt. Gede: *Zippelius* (L).

SUMATRA. West Coast, Mt. Sago: *Meijer 6226, 6232* (L), etc. Also mentioned by EVANS (loc. cit.) from Sumatra.

**27. *Bazzania distans*** (Nees) Trev., Mem. Ist. Lomb. 13, 1877, 414 — *Jungermannia distans* Nees, Hep. Jav. 1830, 65 — *Mastigobryum distans* Lindenb., in Gott., Lindenb. et Nees, Syn. Hep. 1845, 216; Lindenb. et Gottsche, Sp. Hep. Monogr. Mastigobryi 1851, 4, pl. 1 — *Calypogeia ? distans* St., Hedwigia 25, 1886, 239.

Delicate plants, in habit resembling a species of *Calypogeia*, differing, however, by its cells with trigones and its leaves which are serrulate at their apex. Margin of amphigastria somewhat recurved. Leaves and amphigastria rather distant. The whole plant looks like a depauperate form of *B. loricata*.

Distr.: Sumatra, Java.

JAVA. West Java, Mt. Salak: *Kurz* (L); Megamendung, Tugu: *Kurz* (L).

SUMATRA. West Coast, Mt. Singgalang, 2800 m: *Meijer 7384b* (L).

## Index to scientific names

Synonyms in *italics*. Numbers refer to those of the species in the text; I means Introduction. An asterisk \* denotes a new taxon, name, or combination.

### BAZZANIA

*acutifolia* (I)  
*borneensis* Steph. (8)  
*calcarata* (Lac.) Schiffn. (18)  
*commutata* (Lindenb. et Gottsche) Schiffn. (20)  
*concinna* (De Not.) Trev. (10)  
*concinna* De Not. (8)  
*connata* (Steph.) Schiffn. (8)  
*conophylla* (Lac.) Schiffn. (I, 9)  
*densa* (Lac.) Schiffn. (6, 8)  
*\*desciscens* (Steph.) Meijer (24)  
*diminuta* (I)  
*distans* (Nees) Trev. (27)  
*erosa* (Reinw., Bl., N.) Trev. (21, 22, 23, 24)  
*everetti* Steph. (I, 15)  
*fallax* (Lac.) Schiffn. (1)  
*flavescens* (Steph.) Schiffn. (4)  
*fuscescens* (I)  
*\*gedeana* (Steph.) Meijer (16, 17)  
*gibba* (Lac.) Schiffn. (15)  
*harpago* (I)

*\*herzogiana* Meijer (3)  
*horridula* (I)  
*indica* (Gottsche et Lindenb.) Trev. (20, 24, 25)  
*intermedia* (Lindenb. et Gottsche) Trev. (10)  
*javanica* (Lac.) Schiffn. (13)  
*lancifolia* Steph. (18)  
*linguaeformis* (Lac.) Schiffn. (19)  
*longicaulis* (Lac.) Schiffn. (21, 22)  
*loricata* (Reinw., Bl., Nees) Trev. (26, 27)  
*luzonensis* (Steph.) (4)  
*miqueliana* (Lehm.) Schiffn. (20)  
*paradoxa* (Lac.) Schiffn. (17)  
*paradoxa* (Lac.) Steph. (17)  
*patentistipa* (Lac.) Schiffn. (9)  
*patentistipula* (I)  
*peetinata* (Lindenb. et Gottsche) Schiffn. (6, 8)  
*praerupta* (Reinw., Bl., N.) Trev. (11, 12, 13)  
*recurva* (Mont.) Trev. (I, 26)

- remotifolia* Herz. (3)  
*remotifolia* Horikawa (3)  
*renistipula* (1)  
*richardsii* Herzog (18)  
*sandei* Steph. (12)  
*schildii* Herz. (23)  
*serpentina* (Nees) Schiffn. (11)  
*serpentina* (Nees) Trev. (11, 12)  
*\*spiralis* (Reinw., Bl., N.) Meijer  
 (20, 22, 23, 24)  
*subserrulata* (1)  
*subtilis* (Lac.) Schiffn. (3)  
*sumatrana* (I, Key Sect. V)  
*sumbavensis* (Steph.) Steph. (9)  
*tridens* (Reinw., Bl., N.) Trev. (5,  
 6, 9, 10)  
*uncigera* (Reinw., Bl., N.) Trev. (1,  
 14, 15)  
*uncigera* var. *fallax* Lac. (1)  
*\*uncigera* var. *gibba* (Lac.) Meijer  
 (15)  
*vittata* (Gott.) Trev. (4)  
*wiltensii* (Steph.) Schiffn. (I, 2, 3)  
*zollingeri* (Lindenb.) Trev. (7, 8)

## CALYPOGEIA

- †distans* Steph. (27)

## JUNGERMANNIA

- distans* Nees (27)  
*erosa* Reinw. (22)  
*erosa* var.  $\alpha$  Nees (22)  
*erosa* var.  $\beta$  Nees p.p. (23)  
*loricata* Reinw., Bl., Nees (26)  
*praerupta* Reinw., Bl., N. (12)  
*serpentina* Nees (11)  
*spiralis* Reinw., Bl., N. (23)  
*tridens* Reinw., Bl., N. (5)  
*tridens* var.  $\beta$  Nees (6)  
*uncigera* Reinw., Bl., Nees (14)

## MASTIGOBRYUM

- borneense* De Not. (1)  
*calcaratum* Lac. (18)  
*ceylanicum* Mitten (5)  
*commutatum* Lindenb. et Gottsche  
 (20)  
*concinnum* De Not. (10)  
*connatum* Steph. (8)

- densum* Lac. (8)  
*desciscens* Steph. (24)  
*distans* Lindenb. (27)  
*erosum* (Reinw., Bl., N.) Lindenb.  
 var.  $\alpha$  (22)  
*erosum* var.  $\beta$  Lindenb. (23)  
*erosum* var.  $\gamma$  Lindenb. (24)  
*everetti* Steph. (16)  
*fallax* Lac. (1)  
*flavescens* Steph. (4)  
*fleischeri* Steph. (16)  
*gedeanum* Steph. (16)  
*gibbum* Lac. (15)  
*indicum* Gottsche et Lindenb. (25)  
*insignis* De Not. (26)  
*intermedium* Lindenb. et Gottsche  
 (10)  
*javanicum* Lac. (13)  
*linguaeforme* Lac. (19)  
*longicaule* Lac. (21)  
*loricatum* Lindenb. (26)  
*malaccense* Steph. (16)  
*miquelianum* Lehm. (20)  
*olivaceum* Steph. (5)  
*paradozum* Lac. (17)  
*pectinatum* Lindenb. et Gottsche (6)  
*praeruptum* (Reinw., Bl., N.)  
 Lindenb. (12)  
*serpentinum* (Nees) Lindenb. (11)  
*spirale* (Reinw., Bl., N.) Steph. (23)  
*subtile* Lac. (3)  
*sumbavense* Steph. (9)  
*tjibeurum* Steph. (5)  
*tridens* Nees (5)  
*tridens* var.  $\beta$  Gottsche, Lindenb. et  
 Nees (6)  
*typicum* Steph. (5)  
*uncigera* var. Nees (16)  
*uncigerum* (Reinw., Bl., N.)  
 Lindenb. (14)  
*vittatum* Gott. (4)  
*wiltensii* Steph. (2)  
*zollingeri* Lindenb. (7)

## MASTIGOPELMA

- simplex* Mitten (4)