

# Synopsis of the Chinese species of *Begonia* (Begoniaceae), with a reappraisal of sectional delimitation

Yu-Min Shui<sup>1</sup>, Ching-I Peng<sup>2,\*</sup>, and Cheng-Yih Wu<sup>1</sup>

<sup>1</sup>Kunming Institute of Botany, The Chinese Academy of Sciences, Kunming 650204, P.R. China

<sup>2</sup>Institute of Botany, Academia Sinica, Nankang, Taipei 115, Taiwan

(Received July 12, 2000; Accepted July 21, 2002)

**Abstract.** Nine sections of *Begonia* are recognized and illustrated based on the 150 species known from the Chinese region. They are sect. *Coelocentrum* Irmsch., sect. *Petermannia* (Klotzsch) A. DC., sect. *Alicida* C.B. Clarke, sect. *Diploclinium* (Wight) A. DC., sect. *Reichenheimia* (Klotzsch) A. DC., sect. *Parvibegonia* A. DC., sect. *Platycentrum* (Klotzsch) A. DC., sect. *Sphenanthera* (Hassk.) Warb. and sect. *Leprosae* (T.C. Ku) Y.M. Shui (combination made here). Section *Leprosae* is characterized by the trilobular, wingless, clavate, berry-like fruits. Based on a detailed analysis of fruits and placentae, the sectional placement of many species of Chinese *Begonia* is realigned. Relationships among the sections are discussed: sect. *Coelocentrum* is likely to represent one of the most ancient groups in the genus *Begonia*; sect. *Diploclinium*, a complex group, is related to several sections; sect. *Sphenanthera* is an entomochoric and entomophilous group; sect. *Leprosae* is intermediate between sections *Sphenanthera* and *Diploclinium*. *Begonia tessaricarpa* C.B. Clarke (sect. *Sphenanthera*), from Xizang, is documented here as a new record for China.

**Keywords:** *Begonia*; China; Sections; Taxonomy.

## Introduction

*Begonia* L. is a genus of ca. 1,400 species, comprising nearly all the species of Begoniaceae (Smith et al., 1986). Plants of *Begonia* usually grow in moist, tropical and subtropical areas. As plants of much horticultural interest, they have been studied by many botanists notably De Candolle (1859, 1864); Clarke (1879) and Warburg (1894) in the 19<sup>th</sup> century. It was not until 1925 that E. Irmscher reviewed the former works and classified world *Begonia* into 65 sections: 34 sections in America, 13 in Africa, and 18 in Asia. Barkley (1972) and Baranov and Barkley (1974) adopted Irmscher's system with little modification. Smith et al. (1986), despite making a significant effort to provide an illustrated guide to *Begonia*, did not attempt to delimit sections. More recently, Doorenbos et al. (1998) reviewed *Begonia*, and classified the genus into 63 sections (29 in America, 16 in Africa, and 18 in Asia). Doorenbos et al. (1998) considered sect. *Begonia* is not American-Asiatic in its distribution but strictly American (mainly in the West Indies and Brazil), which is followed here.

Irmscher (1939) was the first to classify the 51 species of *Begonia* known from China at that time into 6 sections, *Begoniastrum*, *Diploclinium*, *Sphenanthera*, *Reichenheimia*, *Platycentrum* and *Coelocentrum*. Yü (1948), the first Chinese botanist to study *Begonia* systematically, divided the 30 species of *Begonia* in south-western China into five sections: *Sphenanthera*, *Begoniastrum*, *Platycentrum*, *Parvibegonia*, and *Reichenheimia*. Liou (1983) placed 50 species from China into five sections: *Coelocentrum*, *Sphenanthera*, *Begoniastrum*, *Platycentrum* and *Reichenheimia*. More recently, Ku (1999a) recognized 139 species from China and divided them among 6 sections: *Coelocentrum*, *Begonia*, *Reichenheimia*, *Sphenanthera*, *Pleiothece* and *Platycentrum*. A detailed comparison of these studies reveals discrepancies and uncertainties in the sectional assignment of a number of species. According to our studies, the confusion resulted mainly from erroneous observations or a lack of observations altogether on the characters of fruits and placentae, the most important diagnostic characters for delimiting sections. For example, *Begonia brevicaulis* T.C. Ku (1997) placed in sect. *Reichenheimia* when initially published, is a taxonomic synonym of *Begonia gulinqingensis* S.H. Huang & Y.M. Shui (1994) in sect. *Diploclinium*. It is therefore of both scientific interest and pragmatic merit to clearly delimit the sections of Chinese *Begonia*.

\*Corresponding author. Tel: 886-2-2789-9590 ext 404; Fax: 886-2-2789-1623; E-mail: bopeng@sinica.edu.tw

## Key to the Sections of Chinese *Begonia* (Based Mainly on Chinese Material)

1. Fruit dehiscent, capsular; tepals pinkish or red, rarely white.
  2. Placentae parietal ..... Sect. 1. *Coelocentrum* Irmsch.
  2. Placentae axile.
    3. Ovary 3-locular.
      4. Placentae bifid or multifid.
        5. Flower solitary, axillary ..... Sect. 2. *Petermannia* (Klotzsch) A. DC.
        5. Flowers many, at summit of stems and branches.
          6. Herbs less than 10 cm tall; tepals less than 0.5 cm long; fruit wall papery, dehiscent irregularly ..... Sect. 3. *Alicida* C.B. Clarke
          6. Herbs or subshrubs 20-200 cm tall; tepals 0.5-1.5 cm long; fruit wall usually hard, dehiscent regularly along dorsal sutures ..... Sect. 4. *Diploclinium* (Wight) A. DC.
      4. Placentae undivided ..... Sect. 5. *Reichenheimia* (Klotzsch) A. DC.
    3. Ovary 2-locular.
      7. Plant herbaceous, tuberous, mostly deciduous; fruit dehiscent irregularly on fruit surface, the wings subequal ..... Sect. 6. *Parvibegonia* A. DC.
      7. Plant herbaceous or shrubby, rhizomatous, mostly evergreen; fruit dehiscent along sutures, abaxial wing conspicuously elongate ..... Sect. 7. *Platycentrum* (Klotzsch) A. DC.
1. Fruit tardily dehiscent, berry-like, bursting very late after maturation; tepals white, rarely pinkish.
  8. Fruit clavate, without horns or wings; ovary 3-locular; herbs; stems creeping; plant monoecious ..... Sect. 8. *Leprosae* (T.C. Ku) Y.M. Shui
  8. Fruit turbinate, with indistinct horns or wings; ovary 3-4 (-7)-locular; herbs or subshrubs; stems creeping or erect; plant monoecious (dioecious when ovary 4- or more locular) ..... Sect. 9. *Sphenanthera* (Hassk.) Warb.

### Sectional Delimitation of Chinese *Begonia*

**Sect. 1. *Coelocentrum*** Irmsch., Mitt. Inst. Allg. Bot. Hamburg 10: 533. 1939; Liou, Iconogr. Cormophyt. Sin. Suppl. 2: 532, 538. 1983, *in clavi*; Wu and Ku, Acta Phytotax. Sin. 35(1): 43, fig. 25. 1997; Doorenbos et al., The Sections of *Begonia* 84. 1998; Shui and Huang, Acta Bot. Yunnan. 21(1): 21, fig. 8: 1-14. 1999; Ku, Acta Phytotax. Sin. 37(3): 285. 1999 & Fl. Reipubl. Popularis Sin. 52(1): 127, 402. 1999; Shui, Acta Phytotax. Sin. 40(4): 374. 2002.—LECTOTYPE SPECIES: *Begonia porteri* H. Lév. & Vaniot (designated by Barkley and Baranov, 1972).

Herbs, monoecious, epipetric, rhizomatous creeping, acaulescent. Leaves mostly broadly ovate, rarely peltate, palmately veined. Inflorescence terminal, tepals red; staminate flowers: tepals 4, anthers yellow; carpellate flowers: tepals 3-5, styles 3, stigmatic surface a continual helical band with 2 coils. Ovary unilocular; placentae 3, parietal, bifid from apical to middle part of ovary but axile and undivided at base (Figures 1, 2). Capsule nodding, usually with 3 subequal wings, dehiscent.

*Cytology.*  $2n = 30$  (*B. masoniana* Irmsch.: Legro and Doorenbos, 1969).

*Distribution and Habitat.* About 18 species in China (Guangxi, SE Yunnan and S Guizhou) and Vietnam (Tonkin), seven of which published after 1995. In China, all species grow on limestones between 300 and 1,300 m elevation.

### Species Found in China:

- 1 *B. biflora* T.C. Ku
- 2 *B. bonii* Gagnep. [previously assigned to sect. *Reichenheimia* (Dorrenbos et al., 1998; Ku, 1999; Golding and Wasshausen, 2002)]
- 3 *B. cirrosa* L.B. Sm. et al.
- 4 *B. daxinensis* T.C. Ku
- 5 *B. filiformis* Irmsch. [sect. *Reichenheimia* (Irmscher, 1939; Liou, 1983; Dorrenbos et al., 1998; Ku, 1999; Golding and Wasshausen, 2002)]
- 6 *B. guangxiensis* C.Y. Wu
- 7 *B. lanternaria* Irmsch.
- 8 *B. luzhaiensis* T.C. Ku
- 9 *B. masoniana* Irmsch.
- 10 *B. morsei* Irmsch.
- 11 *B. obliquefolia* S.H. Huang & Y.M. Shui
- 12 *B. ornithophylla* Irmsch.
- 13 *B. porteri* H. Lév. & Vaniot
- 14 *B. pseudodryadis* C.Y. Wu [previously assigned to sect. *Platycentrum* (Wu and Ku, 1995; Dorrenbos et al., 1998; Golding and Wasshausen, 2002)]
- 15 *B. setuloso-peltata* C.Y. Wu
- 16 *B. umbraculifolia* Y. Wan & B.N. Chang

17 *B. yishanensis* T.C. Ku

18 *B. zhengyiana* Y.M. Shui (Shui, 2002b)

**Sect. 2. Petermannia** (Klotzsch) A. DC., Ann. Sci. Nat. Bot. Ser. 4. 11: 128. 1859; Doorenbos et al., The Sections of *Begonia* 148. 1998.—*Petermannia* Klotzsch, Monatsber. Königl. Preuss. Akad. Wiss. Berlin 124. 1854. —Sect. *Begonia* Ser. *Begonia*, pro parte, Fl. Reipubl. Popularis Sin. 52(1): 145, and *B. hainanensis* Chun & F. Chun, in *clavi*, 157. 1999.—LECTOTYPE SPECIES: *Begonia cumingiana* (Klotzsch) A. DC. (designated by Barkley and Baranov, 1972) ( $\equiv$  *Petermannia cumingiana* Klotzsch).

Herbs or subshrubs, monoecious, terrestrial; stem with a creeping base. Leaves pinnately veined. Flowers solitary, axillary, tepals red; staminate flowers unknown; carpellate flowers: tepals 5, styles 3, bifid, stigmatic surface with 2 coils. Placentae bifid from summit to the base of ovary. Capsules nodding, 3-locular, with 3 subequal wings (Figure 3).

*Cytology.*  $2n = 30$  (seven species, e.g., *B. isoptera* Dryand. ex J.E. Sm.: Legro and Doorenbos, 1969, 1971, 1973), 44 (three species, e.g., *B. brevirimosa* Irmsch.: Legro and Doorenbos, 1969, 1971).

*Distribution and Habitat.* Over 193 species in SE Asia, mainly Malaysia (Doorenbos et al., 1998); only one species, *Begonia hainanensis* Chun & F. Chun, in China (endemic to Hainan Province, on wooded valley cliffs, ca. 300m)

*Species Found in China.* *Begonia hainanensis* Chun & F. Chun [previously assigned to sect. *Begoniastrum* (Liou, 1983) and sect. *Begonia* (Ku, 1999)]

**Sect. 3. Alicida** C.B. Clarke, Fl. Brit. Ind. 2: 637. 1879. Wu and Ku, Acta Phytotax. Sin. 33(3): 252, fig. 2. 1995; Doorenbos et al., The Sections of *Begonia* 64. 1998.—LECTOTYPE SPECIES: *Begonia alicida* C.B. Clarke, “*alaecida*” (designated by Barkley and Baranov, 1972).

Herbs, monoecious, terrestrial, rarely epiphytic (*B. peii* C.Y. Wu), erect; stem usually less than 10 cm tall; leaves palmately veined. Inflorescence terminal; staminate flowers: tepals 4, red, filaments fused up to 1/2, anthers yellow; carpellate flowers: tepals 3 or 4, red, styles 2 (rarely 3), fused at base, bifid or half-moon shaped band without coils. Placentae axile, bifid at middle of ovary, unknown at summit and the base of ovary. Fruit suberect, 3-locular, irregularly dehiscent, with 3 subequal wings (Figure 4).

*Cytology.* Unknown.

*Distribution and Habitat.* Four species in Burma and China. Only one species, *Begonia peii* C.Y. Wu, in China, occurring on limestone rocks at ca. 1,000 m in Xishuangbanna, southern Yunnan.

*Species Found in China.* *Begonia peii* C.Y. Wu [previously assigned to sect. *Parvibegonia* (Doorenbos et al., 1998; Golding and Wasshausen, 2002) and sect. *Begonia* (Ku, 1999)]

**Sect. 4. Diploclinium** (Lindl.) A. DC., Ann. Sci. Nat. Bot. Ser. 4. 11: 129. 1859; Doorenbos et al., The Sections of *Begonia* 90. 1998.—*Diploclinium* Lindl., Veg. Kingd. 319. 1846.—Sect. *Diploclinium* and *Trilobararia* Irmsch., Mitt. Inst. Allg. Bot. Hamburg 6: 354. 1927.—Sect. *Begonia* Ser. *Diploclinium* (Lindl.) S.H. Huang & Y.M. Shui ex T.C. Ku, Fl. Reipubl. Popularis Sin. 52(1): 145, in *clavi*, 128, 152, pl. 31: 1-5. 1999.

Sect. *Begonia* (excluding type), sensu Wu and Ku, Acta Phytotax. Sin. 33(3): 251, 269, 254, figs. 1, 4, 5, 7, 8, 9, 10, 15. 1995 & Acta Phytotax. Sin. 35(1): 50, fig. 30. 1997; Shui and Huang, Acta Bot. Yunnan. 21(1): 15, fig. 3:1-9. 1999; Ku, Fl. Reipubl. Popularis Sin. 52(1): 128, 144, in *clavi*. 1999.—Sect. *Begoniastrum* A. DC., Ann. Sci. Nat. Bot. Ser. 4. 11: 123. 1859; Yü, Bull. Fan. Mem. Inst. Biol. 1(2): 115. 1948; Liou, Iconogr. Cormophyt. Sin. Suppl. 2: 533. 1983.—LECTOTYPE SPECIES: *Begonia grandis* Dryand. (designated by Doorenbos et al., 1998)(= *Diploclinium evansianum* (Andrews) Lindl.).

Herbs or subshrubs, monoecious, terrestrial, seldom epiphytic, erect, acaulous or stems decumbent, occasionally with a tuberous base and axillary bulbils. Inflorescence usually terminal, rarely axillary, oblique in some species, tepals pink; staminate flowers: tepals 4 (rarely 2), anthers yellow, connective scarcely protruded; carpellate flowers: tepals 4 or 5 (rarely 2 or 3), styles 3, style-branches often twisted, stigma forming a continual helical band with 1 or 2 coils. Placentae axile, bifid or cleft at upper and middle part of ovary, rarely parietal at the upper part (*Begonia wangii* T.T. Yü; Figure 5A), either bifid or undivided at the ovary base. Capsules erect or nodding, 3-locular, with 3 equal or unequal wings (Figures 5-9).

*Cytology.*  $2n = 22$  (*B. cyclophylla* Hook. f.: Legro and Doorenbos, 1971; *B. fimbriatipula* Hance: Doorenbos et al., 1998; *B. picta* Sm.: Legro and Doorenbos, 1969); 26 (*B. acaulis* Merr. & Perry: Legro and Doorenbos, 1969; *B. fenicis* Merr.: Oginuma and Peng, 2002), 28 (*B. grandis* Dryand. var. *evansiana* (Andrews) Irmsch.: Legro and Doorenbos, 1969), 30 (*B. cavaleriei* H. Lév.: Tian et al., 2002), 32 (*B. subnummularifolia* Merr.: Legro and Doorenbos, 1971), 36 (*B. ravenii* C.I. Peng & Y.K. Chen: Peng et al., 1988; Oginuma and Peng, 2002), 38 (*B. taiwaniana* Hayata: Peng and Chen, 1991; Oginuma and Peng, 2002), 44 (*B. nigritarum* (Kamel) Steud.: Doorenbos et al., 1998), 52 (*B. lukuana* Y.C. Liu & C.H. Ou: Oginuma and Peng, 2002), 56 (*B. fenicis* Merr.: Kokubugata and Madulid, 2001).

*Distribution and Habitat.* About 160 species in Asia, as far north as 45° N latitude. Forty-five species in China, growing on thick humus in forest along rivers, or occurring on rock faces and/or tree trunks, often with tuberous stem-base, occasionally with thin and elongate rhizomes creeping on ground surface; elev. ca. 300-3,600 m.

*Species Found in China:*

1 *B. acutitepala* K.Y. Guan & D.K. Tian [previously assigned to sect. *Begonia* (Guan and Tian, 2000; Golding and Wasshausen, 2002)]

2 *B. alveolata* Yü [previously assigned to sect. *Begoniastrum* (Yü, 1948; Liou, 1983); sect. *Begonia* (Ku, 1999)]

—*Begonia pingbienensis* C.Y. Wu [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)], syn. nov.

A detailed comparison of the holotypes of *B. pingbienensis* (H.T. Tsai 61724) and *B. alveolata* (C. W. Wang 82780), both from Pingbien, Yunnan, reveals that the two species are synonymous.

3 *B. arborea* Y.M. Shui (Shui, 2002a)

4 *B. asperifolia* Irmsch. [previously assigned to sect. *Begoniastrum* (Irmscher, 1927, 1939; Yü, 1948; Liou, 1983); sect. *Begonia* (Ku, 1999)]

5 *B. cavaleriei* H. Lév. [previously assigned to sect. *Begoniastrum* (Liou, 1983); sect. *Begonia* (Ku, 1999)]

6 *B. cehengensis* T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1997; Ku, 1999)]

7 *B. clavicaulis* Irmsch. [previously assigned to sect. *Begoniastrum* (Irmscher, 1939; Yü, 1948; Liou, 1983) and sect. *Begonia* (Ku, 1999)]

8 *B. coptidimontana* C.Y. Wu [previously assigned to sect. *Alicida* (“*Alaecida*”, Wu and Ku, 1995); sect. *Begonia* (Ku, 1999)]

9 *B. dentatobracteata* C.Y. Wu [“*B. dentato-bracteata*”, previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]

10 *B. fenicis* Merr. [previously assigned to sect. *Begonia* (Ku, 1999)]

11 *B. fimbristipula* Hance [previously assigned to sect. *Begoniastrum* (Irmscher, 1939; Yü, 1948; Liou, 1983); sect. *Begonia* (Ku, 1999)]

12 *B. fordii* Irmsch. [previously assigned to sect. *Begoniastrum* (Irmscher, 1939); sect. *Begonia* (Ku, 1999)]

13 *B. glechomifolia* C.M. Hu ex C.Y. Wu & T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]

14 *B. grandis* Dryand. [previously assigned to sect. *Begoniastrum* (Irmscher, 1939; Yü, 1948); sect. *Begonia* (Ku, 1999)]

—*B. sinensis* A. DC. [previously assigned to sect. *Begoniastrum* (Irmscher, 1927; Liou, 1983)]

—*B. evansiana* Andrews [previously assigned to sect. *Begoniastrum* (Liou, 1983)]

15 *B. guishanensis* S.H. Huang & Y.M. Shui

—*B. rhodophylla* C.Y. Wu [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)], syn. nov.

A careful examination of the holotypes of both *B. guishanensis* and *B. rhodophylla*, both from Lunan County, Yunnan, reveals that they are synonymous. In fact, in the protologue of *B. rhodophylla* Wu and Ku (1995) cited as paratypes the holotype (Y.M. Shui B91-

651) and a paratype (Y.M. Shui Lunan 44) of *B. guishanensis* S.H. Huang & Y.M. Shui, which was published a year earlier. Thus, we reduce *B. rhodophylla* C.Y. Wu to the synonym of *B. guishanensis* S. H. Huang & Y.M. Shui.

16 *B. gulinqingensis* S.H. Huang & Y.M. Shui [as sect. *Begonia* (Ku, 1999)]

—*B. brevicaulis* T.C. Ku, Acta Phytotax. Sin. 35(1): 53, fig. 31. 1997, non *B. brevicaulis* A. DC. [previously assigned to sect. *Reichenheimia* (Wu and Ku, 1997; Dorrenbos et al., 1998)]

—*B. sinobrevicaulis* T.C. Ku [previously assigned to sect. *Reichenheimia* (Ku, 1999; Golding and Wasshausen, 2002)], syn. nov.

Our careful examination of all the *Begonia* collections from Malipo County, Yunnan, where both holotypes of *B. sinobrevicaulis* and *B. gulinqingensis* were collected, as well as additional field explorations to the type locality revealed that the placentae of *B. sinobrevicaulis* are axial and bifid in each locule. Thus, it clearly belongs to sect. *Diploclinium*. Furthermore, morphological comparison of *B. sinobrevicaulis* and *B. gulinqingensis* suggests that the two are conspecific.

17 *B. hymenocarpa* C.Y. Wu, as sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)

18 *B. imitans* Irmsch. [previously assigned to sect. *Begoniastrum* (Irmscher, 1939); sect. *Begonia* (Ku, 1999)]

19 *B. josephii* A. DC. [previously assigned to sect. *Begoniastrum* (Liou, 1983); sect. *Begonia* (Ku, 1999)]

20 *B. labordei* H. Lév. [previously assigned to sect. *Begoniastrum* (Irmscher, 1927, 1939; Yü, 1948; Liou, 1983); sect. *Begonia* (Ku, 1999)]

21 *B. lukuana* Y.C. Liu & C.H. Ou [previously assigned to sect. *Begonia* (Ku, 1999)]

22 *B. malipoensis* S.H. Huang & Y.M. Shui [previously assigned to sect. *Begonia* (Ku, 1999)]

23 *B. miranda* Irmsch. [previously assigned to sect. *Begoniastrum* (Irmscher, 1951; Liou, 1983); sect. *Begonia* (Ku, 1999)]

24 *B. morifolia* T.T. Yü [previously assigned to sect. *Begoniastrum* (Yü, 1948; Liou, 1983); sect. *Begonia* (Ku, 1999)]

—*B. anceps* Irmsch. [previously assigned to sect. *Begoniastrum* (Irmscher, 1951); sect. *Begonia* (Ku, 1999)], syn. nov.

According to Prof. C.Y. Wu (pers. comm.), *B. anceps* is separable from *B. morifolia* by having less deeply serrate leaves. However, leaf shapes tend to be variable and the two species are hardly distinguishable otherwise. *Begonia anceps* Irmsch. is hereby reduced to a synonym of *B. morifolia* T.T. Yü.

25 *B. muliensis* T.T. Yü (1948) [previously assigned to sect. *Begoniastrum* (Ku, 1999); sect. *Begonia* (Ku, 1999)]

- 26 *B. nymphaeafolia* T.T. Yü [previously assigned to sect. *Reichenheimia* (Yü, 1948; Barkley, 1972)]
- 27 *B. obsolescens* Irmsch. [previously assigned to sect. *Coelocentrum* (Irmscher, 1951; Liou, 1983; Ku, 1999; Golding and Wasshausen, 2002); sect. *Begonia* (Shui and Huang, 1999)]  
—*B. fengii* T.C. Ku [previously assigned to sect. *Platycentrum* (Wu and Ku, 1995); sect. *Begonia* (Ku, 1999)], syn. nov.
- We have examined an isotype of *B. fengii* (*K.M. Feng* 22990, KUN), which is the same as *B. obsolescens* in aspects, characters of fruits, indumentum, etc. Types of both *B. fengii* and *B. obsolescens* were collected from Malipo Xian, Yunnan. In our opinion, *B. fengii* is merely a diminutive individual of *B. obsolescens* and should be reduced to a synonym of the latter species.
- 28 *B. peltatifolia* H.L. Li [previously assigned to sect. *Reichenheimia*? (Dorrenbos et al., 1998; Golding and Wasshausen, 2002); sect. *Begonia* (Ku, 1999)]
- 29 *B. picta* Sm. [previously assigned to sect. *Begonia* (Ku, 1999)]
- 30 *B. ravenii* C.I Peng & Y.K. Chen [previously assigned to sect. *Begonia* (Ku, 1999)]
- 31 *B. rongjiangensis* T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]
- 32 *B. rotundilimba* S.H. Huang & Y.M. Shui [previously assigned to sect. *Begonia* (Ku, 1999)]
- 33 *B. ruboides* C.M. Hu ex C.Y. Wu & T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]
- 34 *B. setifolia* Irmsch. [previously assigned to sect. *Platycentrum* (Irmscher, 1939; Barkley et al., 1972; Liou, 1983; Dorrenbos et al., 1995; Golding and Wasshausen, 2002) and sect. *Begonia* (Ku, 1999)]  
—*B. tsaii* Irmsch. [previously assigned to sect. *Platycentrum* (Irmscher, 1951; Barkley et al., 1972; Dorrenbos et al., 1998; Ku, 1999; Golding and Wasshausen, 2002)], syn. nov.
- We have examined an isotype of *B. tsaii* Irmsch. (*H. T. Tsai* 62727, PE). Although this specimen was badly pressed, the long, red setae on the upper surfaces of leaves and long crisped hairs on the petioles are immediately indicative of *B. setifolia* Irmsch. In addition, the first author's field study and collection for many years in SE Yunnan where both 'taxa' co-occur strongly suggests that *B. tsaii* Irmsch. is conspecific with *B. setifolia* Irmsch.
- 35 *B. sinofloribunda* Dorr [*B. floribunda* T.C. Ku, non *B. floribunda* Carrière, previously assigned to sect. *Platycentrum* (Wu and Ku, 1997; Ku, 1999)]
- 36 *B. sino-vietnamica* C.Y. Wu [previously assigned to sect. *Begonia* (Wu and Ku, 1997; Ku, 1999)]
- 37 *B. summoglabra* T.T. Yü [previously assigned to sect. *Begoniastrum* (Yü, 1948), sect. *Reichenheimia* (Liou, 1983) and sect. *Begonia* (Ku, 1999)]

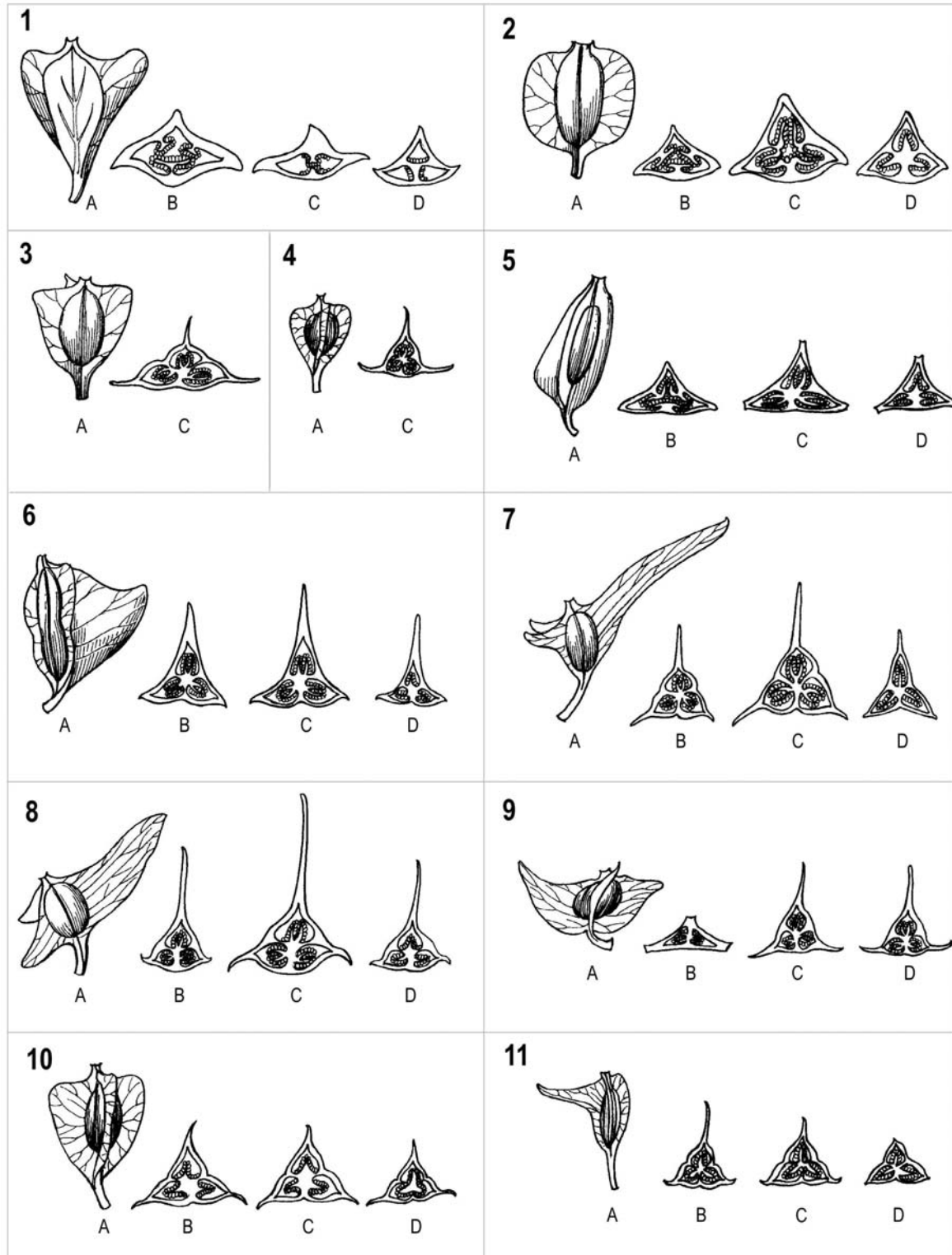
- 38 *B. taiwaniana* Hayata [previously assigned to sect. *Platycentrum* (Barkley and Baranov, 1972), sect. *Begoniastrum* (Liou, 1983) and sect. *Begonia* (Ku, 1999)]
- 39 *B. taliensis* Gagnep. [previously assigned to sect. *Begoniastrum* (Irmscher, 1927, 1939; Liou, 1983), sect. *Reichenheimia* (Yü, 1948; Barkley et al., 1972) and sect. *Begonia* (Ku, 1999)]
- 40 *B. wangii* T.T. Yü [previously assigned to sect. *Reichenheimia* (Yü, 1948; Barkley et al., 1972), sect. *Begoniastrum* (Liou, 1983) and sect. *Begonia* (Ku, 1999)]
- 41 *B. wenshanensis* C.M. Hu ex C.Y. Wu & T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]
- 42 *B. xingyiensis* T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]
- 43 *B. xishuiensis* T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999)]
- 44 *B. yui* Irmsch. [“yuii”, previously assigned to sect. *Begoniastrum* (Irmscher, 1951; Liou, 1983) and sect. *Begonia* (Ku, 1999)]
- 45 *B. yunnanensis* H. Lév. [previously assigned to sect. *Begoniastrum* (Irmscher, 1939; Yü, 1948; Liou, 1983) and sect. *Begonia* (Ku, 1999)]

As the most polymorphic section in Asia (Doorenbos et al., 1998), sect. *Diploclinium* is not only similar to the New World sections *Begonia* and *Knesebeckia* (Klotzsch) A. DC., but also related to several other sections in Asia. Further studies of sect. *Diploclinium* are desirable.

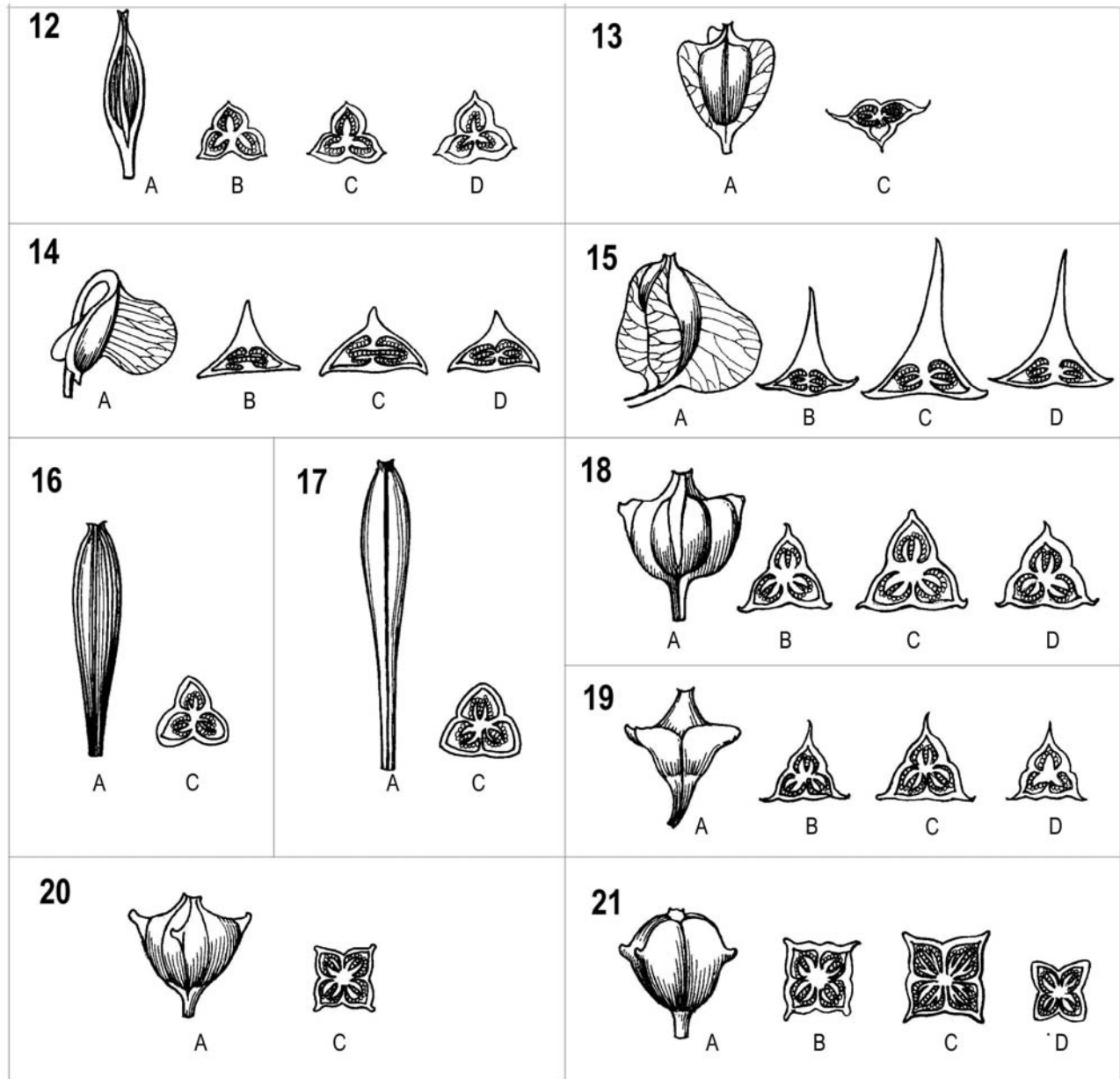
**Sect. 5. *Reichenheimia*** (Klotzsch) A. DC., Prodr. 15(1): 385. 1864; Liou, Iconogr. Cormophyt. Sin. Suppl. 2: 533, 537. 1983; Wu and Ku, Acta Phytotax. Sin. 35(1): 53, fig. 31. 1997; Doorenbos et al., The Sections of *Begonia* 170. 1998; Ku, Fl. Reipubl. Popularis Sin. 52(1): 128, 129, *in clavi*, 197. 1999.—*Reichenheimia* Klotzsch, Abh. Königl. Akad. Wiss. Berlin ‘1854’: 174. 1855 & *Begoniaceae*. 54. 1855.—LECTOTYPE SPECIES: *Begonia tenera* Dryand. (designated by Barkley and Baranov, 1972) (= *Reichenheimia thwaitesii* (Hook.) Klotzsch).

Herbs, monoecious, epipetric, stemless, rarely erect, mostly deciduous with a tuberous stem-base, rarely rhizomatous. Inflorescence terminal, tepals pink, rarely white; staminate flowers: tepals 4, rarely 2, anthers yellow, filaments free or fused at base; carpellate flowers: tepals 2-5, styles 3, mostly persistent, fused at base, shortly bifid, stigma forming a continual helical band with 1 coil. Placentae axile and undivided from the top to the bottom of ovary, rarely bifid at the upper part. Capsule 3-locular, wings 3, subequal, the wings rarely different (*B. lithophila* C.Y. Wu) or lacking (*B. wilsonii* Gagnep.) (Figures 10-12).

*Cytology*.  $2n = 30$  (*B. morelii* Irmsch.: Legro and Doorenbos, 1973), 32 (*B. floccifera* Bedd.: Sharma and Bhattacharyya, 1961; Legro and Doorenbos, 1971), 34 (*B. goeensis* N.E. Br.: Legro and Doorenbos, 1969), 44 (*B. nuri* Irmsch.: Legro and Doorenbos, 1973).



**Figures 1-11.** Fruits and placentae of representative species of *Begonia* from China\* (illustrated by L. Wang). **Sect. *Coelocentrum*:** 1, *B. obliquifolia* (Shui B92-20, YUNU), 2, *B. cirrosa* (Shui B92-64, YUNU); **Sect. *Petermannia*:** 3, *B. hainanensis* (modified from Chun and Chun, 1939); **Sect. *Alicida*:** 4, *B. péii* (P. J. Pei 59-9976, KUN); **Sect. *Diploclinium*:** 5, *B. wangii* (Shui B91-307, YUNU), 6, *B. cavaleriei* (Shui B91-287, YUNU), 7, *B. guishanensis* (Shui B91-651, YUNU), 8, *B. coptidimontana* (Shui B91-595, YUNU), 9, *B. obsolescens* (Shui B91-120, YUNU); **Sect. *Reichenhaimia*:** 10, *B. parvula* (Shui B91-628, YUNU), 11, *B. lithophila* (Shui B91-650, YUNU). \*In each figure the lateral view of a fruit is designated by A; the upper, middle and basal cross-section of an ovary is designated by B, C, and D, respectively.



**Figures 12-21.** Fruits and placentae of representative species of *Begonia* from China (illustrated by L. Wang) (cont.). **Sect. Reichenhaimia:** 12, *B. wilsonii* (G.H. Yang 57191, KUN); **Sect. Parvibegonia:** 13, *B. discreta* (C. W. Wang 79447, PE); **Sect. Platycentrum:** 14, *B. oreodoxa* (Shui 90-42, YUNU), 15, *B. psilophylla* (Shui B91-409, YUNU); **Sect. Leprosae:** 16, *B. leprosa* (modified from Hooker, 1900), 17, *B. longicarpa* (D. K. Tian 9727, KUN); **Sect. Sphenanthera:** 18, *B. crassirostris* (Shui B91-610, YUNU), 19, *B. balansana* (Shui B91-21, YUNU), 20, *B. tetragona* (Shui 12924, KUN), 21, *B. ceratocarpa* (Shui B92-06, YUNU). \*In each figure the lateral view of a fruit is designated by A, and the upper, middle and basal cross-section of an ovary is designated by B, C, and D, respectively.

*Distribution and habitat.* About 46 species in SE Asia and E Asia as far as India. In China, about 5 species, ranging from SW China to SE China, mostly in warm, tropical secondary forests at 300-2,600 m.

*Species Found in China:*

- 1 *B. chingii* Irmsch.
- 2 *B. henryi* Hemsl.

- 3 *B. lithophila* C.Y. Wu [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999) and sect. *Diploclinium* (Dorrenbos et al., 1998)]
- 4 *B. parvula* H. Lév. & Vant.
- 5 *B. wilsonii* Gagnep. [previously assigned to sect. *Begoniastrum* (Irmscher, 1939) and sect. *Diploclinium* (Dorrenbos et al., 1998; Golding and Wasshausen, 2002)]

**Sect. 6. Parvibegonia** A. DC., Ann. Sci. Nat. Bot. Ser. 4. 11: 136. 1859; Doorenbos et al., The Sections of *Begonia* 170. 1998.—LECTOTYPE SPECIES: *Begonia martabanica* A. DC. (designated by Barkley, 1972).

Herbs tuberous, rarely stemless, monoecious; leaves palmately veined. Inflorescence terminal, tepals less than 0.5 cm long, red; staminate flowers: tepals 4, filaments fused to a column, anthers yellow; carpellate flowers: tepals 4 or 5, styles 2 (-3), often persistent, stigma kidney or moon-shaped, ovary 2(-3)-locular. Placentae bifid at the middle and upper part of ovary, unknown at the base. Capsule suberect, with 3 unequal wings and papery walls, bursting in an irregular fashion (Figure 13).

*Cytology.*  $2n = 56$  (*B. crenata* Dryand.: Legro and Doorenbos, 1971).

*Distribution and habitat.* Twenty-nine species in SE Asia and E Asia as far as India. Only one species, *B. discreta* Craib., in China, on rocks in thickets in Xishuangbanna, southern Yunnan.

*Species Found in China.* *Begonia discreta* Craib. [previously assigned to sect. *Diploclinium* (Barkley and Baranov, 1972; Doorenbos et al., 1998; Golding and Wasshausen, 2002); as sect. *Begonia* (Ku, 1999)]

**Sect. 7. Platycentrum** (Klotzsch) A. DC., Ann. Sci. Nat. Bot. Ser. 4. 11: 134. 1859; Yü, Bull. Fan. Mem. Inst. Biol. 1(2): 122. 1948; Irmischer, Notes Roy. Bot. Gard. Edinburgh 21: 39. 1951; Barkley, Buxtonian 1 (Suppl. 4): 12. 1972; Liou, Iconogr. Cormophyt. Sin. Suppl. 2. 533, 536. 1983; Wu and Ku, Acta Phytotax. Sin. 33: 265. 1995; Acta Phytotax. Sin. 35: 54. 1997; Doorenbos et al., The Sections of *Begonia* 155. 1998; Shui and Huang, Acta Bot. Yunnan. 21: 16. 1999; Ku, Fl. Reipubl. Popularis Sin. 52: 129, 212. 1999.—*Platycentrum* Klotzsch, Abh. Königl. Akad. Wiss. Berlin '1854': 243. 1855; Begoniac. 123. 1855.—Sect. *Parvibegonia* auct non A. DC, as to *B. houttuynioides* Yü, Bull. Fan. Mem. Inst. Biol. 1(2): 125. 1948.—LECTOTYPE SPECIES: *Begonia xanthina* Hook. (designated by Barkley and Baranov, 1972) ( $\equiv$ *Platycentrum xanthinum* (Hook.) Klotzsch).

Herbs or subshrubs, monoecious, terrestrial, seldom epiphytic, creeping or erect, with thin or thick rhizomes; leaves palmate-veined or pinnate-veined, unlobed or lobed, rarely palmate-foliolate (*B. hemsleyana* Hook. f.). Inflorescence terminal or axillary; tepals pink, rarely yellow (*B. flaviflora* H. Hara) or green (*B. polytricha* C.Y. Wu); staminate flowers: tepals 4, filaments free, anthers yellow, rarely red (*B. purpureofolia* S.H. Huang & Y.M. Shui, *B. polytricha* C.Y. Wu), connectives occasionally projecting; carpellate flowers: tepals 5, rarely 3 (consistent in *B. austrotaiwanensis* Y.K. Chen & C.I Peng), 4 (consistent in *B. oreodoxa* Chun & F. Chun ex C.Y. Wu & Ku) or 6(-10) [occasional in *B. formosana* (Hayata) Masam.], styles 2, rarely 3 (*B. versicolor* Irmischer.), not persistent, bifid, stigma of 2 or 3 coils. Ovary 2-locular. Placentae axile, bifid or multi-fid from apical to basal part of ovary, rarely parietal at upper part of ovary (*B. oreodoxa* Chun & F. Chun ex C.Y. Wu & Ku). Capsule nodding, wings 3, unequal, the largest of which

considerably elongating downwards, nearly always without ventral sutures between the large and smaller wings (Figures 14-15).

*Cytology.*  $2n = 22$  (*B. rex* Retz.; *B. laciniata* Roxb.: Sharma et al., 1960; *B. rex* Retz.: Tian et al., 2002; *B. cathayana* Hemsl., *B. circumlobata* Hance, *B. hemsleyana* Hook. f., *B. palmata* D. Don ("B. laciniata Roxb."), etc.: Legro et al., 1969; *B. hemsleyana* Hook.: Tian et al., 2002; *B. versicolor* Irmischer.: Legro et al., 1971, Tian et al., 2002; *B. sikkimensis* A. DC.: Legro et al., 1973; *B. palmata* D. Don.: Peng et al., 1991; Oginuma and Peng, 2002; *B. palmata* D. Don var. *browningiana* (Champ. ex Benth.) J. Golding & C. Karez.: Tian et al., 2002, 20 (*B. cathayana* Hemsl.: Legro et al., 1969), 36 (*B. austrotaiwanensis* Y.K. Chen & C.I Peng: Peng and Chen, 1990; Oginuma and Peng, 2002), 38 (*B. austrotaiwanensis* Y.K. Chen & C.I Peng: Peng and Chen, 1990; Oginuma and Peng, 2002; *B. chitoensis* T.S. Liu & M.J. Lai: Oginuma and Peng, 2002), 44 (several cultivars of *B. rex* Retz.: Sharma et al., 1960; *B. venusta* Ridl.: Legro et al., 1971), 60 (*B. formosana* (Hayata) Masam.: Peng and Sue, 2000; Oginuma and Peng, 2002), 64 (*B. formosana* (Hayata) Masam.: Oginuma and Peng, 2002).

*Distribution and habitat.* About 110 species from India and central China to SE Asia. Sixty-three species in China, occurring S of Yangtze River and SE Tibet and in Taiwan. These species are either terrestrial on thick humus, epiphytic on trees, or epipetric on rock faces or crevices, at 100-2,200 m.

*Species Found in China:*

- 1 *B. algaia* L.B. Sm. & Wassh.
- 2 *B. augustinei* Hemsl. [previously assigned to sect. *Begoniastrum* (Yü, 1948)]  
—*B. menglianensis* Y.Y. Qian, syn. nov.  
A study of the protologue of *B. menglianensis* (Qian, 2001) immediately revealed the overall similarity between *B. menglianensis* and *B. augustinei* except that the former is more glabrous. However, we were able to examine an isotype of *B. menglianensis*, Y.Y. Qian 3110 (KUN), which showed that the upper surfaces of leaves are densely covered with short hairs. Thus we feel confident that *B. menglianensis* should be synonymized under *B. augustinei*.
- 3 *B. austrotaiwanensis* Y.K. Chen & C.I Peng
- 4 *B. baviensis* Gagnep.
- 5 *B. brevisetulosa* C.Y. Wu
- 6 *B. cathayana* Hemsl.
- 7 *B. chishuiensis* T.C. Ku
- 8 *B. chitoensis* T.S. Liu & M.J. Lai [previously assigned to sect. *Begonia* (Ku, 1999)]
- 9 *B. chuniana* C.Y. Wu [previously assigned to sect. *Parvibegonia* (Golding and Wasshausen, 2002)]
- 10 *B. circumlobata* Hance
- 11 *B. cucurbitifolia* C.Y. Wu
- 12 *B. daweishanensis* S.H. Huang & Y.M. Shui



- 13 *B. dielsiana* E. Pritz.  
 14 *B. digyna* Irmsch.  
 15 *B. discrepans* Irmsch.  
 16 *B. dryadis* Irmsch.  
 17 *B. duclouxii* Gagnep. [previously assigned to sect. *Reichenheimia* (Yü, 1948)]  
 18 *B. edulis* H. Lév.  
 19 *B. emeiensis* C.M. Hu ex C.Y. Wu & T.C. Ku  
 20 *B. flaviflora* H. Hara  
 21 *B. formosana* (Hayata) Masam.  
     —*B. tarokoensis* M.J. Lai, syn. nov.  
 22 *B. forrestii* Irmsch.  
 23 *B. gagnepainiana* Irmsch.  
 24 *B. gungshanensis* C.Y. Wu  
 25 *B. hatacoa* Buch.-Ham. ex D. Don  
 26 *B. hekouensis* S.H. Huang  
 27 *B. hemsleyana* Hook. f.  
 28 *B. houttuynioides* T.T. Yü [previously assigned to sect. *Parvibegonia* (Yü, 1948; Barkley and Baranov, 1972)]  
 29 *B. howii* Merr. & Chun [previously assigned to sect. *Diplocinium*? (Dorrenbos et al., 1998; Golding and Wasshausen, 2002)]  
 30 *B. kouytcheouensis* Guillaumin [previously assigned to sect. *Reichenheimia* (Barkley and Baranov, 1972)]  
 31 *B. lacerata* Irmsch.  
 32 *B. laminariae* Irmsch. [previously assigned to sect. *Begoniastrum* (Liou, 1983)]  
 33 *B. limprichtii* Irmsch.  
 34 *B. lipingensis* Irmsch.  
 35 *B. longanensis* C.Y. Wu  
 36 *B. longialata* K.Y. Guan & D.K. Tian  
 37 *B. macrotoma* Irmsch.  
 38 *B. maguanensis* S.H. Huang & Y.M. Shui  
 39 *B. manhaoensis* S.H. Huang & Y.M. Shui  
 40 *B. megalophyllaria* C.Y. Wu  
 41 *B. mengtzeana* Irmsch.  
 42 *B. nantoensis* M.J. Lai & N.J. Chung  
 43 *B. oreodoxa* Chun & F. Chun  
 44 *B. palmata* D. Don  
     —*B. randaiensis* Sasaki (cf. Lai, 1979)  
 45 *B. paucilobata* C.Y. Wu  
 46 *B. pedatifida* H. Lév.  
 47 *B. polytricha* C.Y. Wu  
 48 *B. psilophylla* Irmsch.  
 49 *B. purpureofolia* S.H. Huang & Y.M. Shui  
 50 *B. reflexisquamosa* C.Y. Wu  
 51 *B. repenticaulis* Irmsch.  
 52 *B. rex* Putz.

- 53 *B. rockii* Irmsch.  
 54 *B. rubropunctata* S.H. Huang & Y.M. Shui  
 55 *B. scitifolia* Irmsch.  
 56 *B. sikkimensis* A. DC.  
 57 *B. smithiana* T.T. Yü ex Irmsch.  
 58 *B. subhowii* S.H. Huang  
 59 *B. truncatiloba* Irmsch.  
 60 *B. tsoongii* C.Y. Wu  
 61 *B. versicolor* Irmsch.  
 62 *B. villifolia* Irmsch. [previously assigned to sect. *Begoniastrum* (Liou, 1983)]  
 63 *B. yingjiangensis* S.H. Huang [previously assigned to sect. *Parvibegonia* (Golding and Wasshausen, 2002)]

**Sect. 8. Leprosae** (T.C. Ku) Y.M. Shui, comb. nov.—Sect. *Begonia* Subsect. *Crassirostris* T.C. Ku Ser. *Leprosae* T.C. Ku, Fl. Reipubl. Popularis Sin. 52(1): 128, 144, 149, 401. 1999.—Sect. *Parvibegonia* auct. non A. DC, as to *B. leprosa* Hance, Yu, Bull. Fan. Mem. Inst. Biol. 1(2): 125. 1948.—Sect. *Sphenanthera* (Hassk.) Warb. pro parte, as to *B. leprosa* Hance: Irmscher, Mitt. Inst. Allg. Bot. Hamburg 10: 556. 1939; Yü, Bull. Fan. Mem. Inst. Biol. 1(2): 125. 1948; Liou, Iconogr. Cormophyt. Sin. Suppl. 2:536, 541. 1983, *in clavi*; Guan and Tian, Acta Bot. Yunnan. 22(2): 129, 2000.—Sect. *Reichenheimia* (Klotzsch) A. DC. Subsect. *Wilsonianae* T.C. Ku Ser. *Cylindricae* T.C. Ku, Fl. Reipubl. Popularis Sin. 52(1): 128, 197, 401. 1999, syn. nov.—TYPE SPECIES: *Begonia leprosa* Hance (1883).

Herbs monoecious, terrestrial, with slender creeping rhizomes, without erect stems, leaves broadly ovate, oblique at base, palmately nerved, glabrous on upper surface, tomentose beneath. Inflorescence cymose, shorter than petiole, tepals white, rarely bisexual (occasional in *B. leprosa* Hance); staminate flowers: tepals 4, filaments fused at base, anthers oblong and yellow; carpellate flowers: tepals 3-5, styles 3, bifid, stigma 2-coiled. Ovary 3-locular. Placentae axile and bifid from apical to basal part of ovary. Fruit not dehiscent, berry-like, pendulous, thick-walled, clavate, without horns or wings (Figures 16-17).

Sect. *Leprosae* (T.C. Ku) Y.M. Shui is similar to sect. *Sphenanthera* A. DC. in the berry-like fruit. Fruit of the latter, however, is turbinate and with horns or wings. Sect. *Leprosae* is also similar to sect. *Mezierea* (Goudich.) Warb. [in Africa] in fruit shape, but the latter has parietal or septal placentae (Doorenbos et al., 1998). It may be that sect. *Leprosae* is a transitional section between Asia and Africa.

*Cytology.*  $2n = 20$  (*B. longicarpa* K.Y. Guan & D.K. Tian: Tian et al., 2002)

*Distribution and habitat.* Three species in southern China, one of which also found in Vietnam (Tonkin). In China (Guangdong, Guangxi and Yunnan), on moist soil at river banks or on rocks nearby a limestone cave in tropical forests, at 30-300 m altitude.

*Species Found in China:*

- 1 *B. cylindrica* D.R. Liang & X.X. Chen [previously assigned to sect. *Reichenheimia* (Ku, 1999)]
- 2 *B. leprosa* Hance [previously assigned to sect. *Sphenanthera* (Irmscher, 1939; Barkley and Baranov, 1972), sect. *Parvibegonia* A. DC and sect. *Begonia* (Ku, 1999)]  
—*B. bretschneideriana* Hemsl. [previously assigned to sect. *Sphenanthera* (Irmscher, 1939)]
- 3 *B. longicarpa* K.Y. Guan & D.K. Tian [previously assigned to sect. *Sphenanthera* (Guan and Tian, 2000)]

**Sect. 9. *Sphenanthera*** (Hassk.) Warb. in Engler and Prantl, Nat. Pflanzenfam. 3(6a): 138, 141. 1894; Yü, Bull. Fan. Mem. Inst. Biol. 1(2): 114. 1948; Liou, Iconogr. Cormophyt. Sin. Suppl. 2: 533, 535. 1983; Doorenbos et al., The Sections of *Begonia* 194. 1998; Shui and Huang, Acta Bot. Yunnan. 21(1): 11, 1999; Ku, Fl. Reipubl. Popularis Sin. 52(1): 128, 206. 1999.—Sect. *Pleiothece* T.C. Ku, Fl. Reipubl. Popularis Sin. 52(1): 129, 211, 401. 1999, syn. nov. —*Sphenanthera* Hassk., Versl. Kon. Akad. Wetensch. 4: 139. 1855.—LECTOTYPE SPECIES: *Begonia robusta* Blume (designated by Dorrenbos et al., 1998) ( $\equiv$  *Sphenanthera robusta* (Blume) Hassk. ex Klotzsch).

Herbs or subshrubs, terrestrial, monoecious with 3-locular ovary or dioecious with 4 or more locules; stems creeping, or erect with short and thick rhizomes; leaves auriculate, very obliquely palmately veined. Inflorescence axillary, short and congested; tepals white or pink; flowers of the dioecious species fragrant; staminate flowers: tepals 4, sometimes to 6 cm long, anthers yellow; carpelate flowers: tepals 4 or 5, styles 3-7, deciduous, free, deeply bifid, stigma forming a continual helical band with multiple coils. Ovary 3-7-locular (often variable within the same individual). Placentae bifid from bottom to apex of fruit, rarely unclefted at base. Fruits pendulous or recurved, berry-like, turbinate, thick-walled, the walls wingless or with obscure wings or horns, bursting very late or irregularly after falling (Figures 18-21).

*Cytology.*  $2n = 20$  (*B. ceratocarpa* S.H. Huang & Y.M. Shui: Tian et al., 2002), 22 (*B. inflata* C.B. Clarke: Legro and Dorrenbos, 1969; *B. roxburghii* A. DC.: Legro and Dorrenbos, 1971; *B. hayatae* Gagnep.: “*B. aptera* Blume”, Peng and Su, 2000, Oginuma and Peng, 2002; *B. silletensis* subsp. *mengyangensis* M.C. Tebbitt & K.Y. Guan: “*B. mengyangensis* subsp. *mengyangensis* M.C. Tebbitt & K.Y. Guan”, Tian et al., 2002), and 88 (possibly in *B. robusta* Blume: Dorrenbos et al., 1998).

*Distribution and habitat.* About 27 species from India to Indochina as far as Malaysia, Indonesia. Eleven species in China, distributed mainly in tropical valleys of Taiwan, Fujian, Guangdong, Hainan, Guangxi, Guizhou, Yunnan and Tibet, usually found on deep humus soil at forest margin, at 60-1,300 m altitude.

*Species Found in China:*

- 1 *B. acetosella* Craib

- 2 *B. balansana* Gagnep. [previously assigned to sect. *Pleiothece* T.C. Ku (Ku, 1999)]  
—*B. handelii* Irmsch.  
—*B. xinyiensis* T.C. Ku [previously assigned to sect. *Begonia* (Wu and Ku, 1995; Ku, 1999); sect. *Diploclinium?* (Dorrenbos et al., 1998; Golding and Wasshausen, 2002)], syn. nov.

The type (*Z. Huang 31748*, PE) of *B. xinyiensis* is a plant with a staminate inflorescence. No additional specimens were available for examination by Wu and Ku (1995). Thus, important characters such as female flowers and fruits were not described in the protologue of *B. xinyiensis*. However, diagnostic characters of *B. xinyiensis* include a unisexual inflorescence, ovate bracts and elongate, prostrate rhizomes, which is characteristic of *B. balansana*. Furthermore, type of *B. xinyiensis* was collected from southern Guangdong, which is within the range of widespread *B. balansana*. In our opinion, the two species are conspecific.

- 3 *B. ceratocarpa* S.H. Huang & Y.M. Shui
- 4 *B. crassirostris* Irmsch. [previously assigned to sect. *Begonia* (Ku, 1999)]
- 5 *B. hayatae* Gagnep. [previously assigned to sect. *Begonia* (Ku, 1999)]
- 6 *B. inflata* C.B. Clarke
- 7 *B. lancangensis* S.H. Huang
- 8 *B. prostrata* Irmsch.
- 9 *B. silletensis* (A. DC.) C.B. Clarke ssp. *mengyangensis* M.C. Tebbitt & K.Y. Guan (Tebbit and Guan, 2002)
- 10 *B. tessaricarpa* C. B. Clarke

The species, previously known from India (Assam), is a new record for China. It is documented here for the first time. China. Xizang. Medog County, Genbala hill, under forests, herb, 650 m, with fruits, 28 Nov 1992, *ETM 1720* (KUN 0372087, KUN 0372086).

- 11 *B. tetragona* Irmsch.

## Natural Hybrids Between Members of Different Sections

1. Between Members of sect. *Platycentrum* and sect. *Diploclinium*.

*Begonia*  $\times$  *buimontana* Yamamoto, assigned to sect. *Begonia* (Ku, 1999).

The hybridity and parentage of *B.  $\times$ buimontana* Yamamoto were documented thoroughly by Peng and Chen (1991). Detailed analyses of morphology, flowering habit, pollen stainability, chromosome number, meiotic chromosome behavior and geographical distribution suggest that *B.  $\times$ buimontana* Yamamoto represents a natural hybrid between *B. palmata* D. Don [sect. *Platycentrum*] and *B. taiwaniana* Hayata [sect. *Diploclinium*] in Taiwan.

2. Between members of sect. *Platycentrum* and sect. *Sphenanthera*.

*Begonia ×taipeiensis* C.I Peng (Peng and Sue, 2000). Based on a comparison of morphology, geographical distribution, pollen stainability, seed set, cytological observation, and experimental crosses, Peng and Su (2000) concluded that *B. ×taipeiensis* represents F<sub>1</sub> progeny from natural hybridization between *B. formosana* (Hayata) Masam. [sect. *Platycentrum*] and *B. hayatae* Gagnep. [“*B. aptera* Blume”, sect. *Sphenanthera*] in Taiwan. Data from experimental crosses and molecular studies further confirmed unidirectional hybridization in *B. ×taipeiensis*, i.e., formation of the natural hybrid *B. ×taipeiensis* occurs via pollen transfer from *B. aptera* to the maternal species, *B. formosana* (Peng and Chiang, 2000; Chiang et al., 2001).

## Relationships of the Sections of Chinese *Begonia*

Section *Coelocentrum* is likely to be the most ancient group among Asian *Begonia* because of its parietal placentae (Reitsma, 1983). Section *Coelocentrum* is closely related to some species in sect. *Diploclinium*, such as *Begonia wangii* T.T. Yü and *B. peltatifolia* H.L. Li. Members of sect. *Diploclinium* have parietal placentae near the apex of the ovary (Figure 5B). Members of both sections grow on rocks in limestone areas, which provide a refuge to many seed plants (Ying et al., 1993; Shui et al., 1999) in China (SE Yunnan, S Guizhou, SE Guangxi) and Vietnam (Tonkin). Plants of *Begonia* sect. *Coelocentrum* may well be a group in this refuge with ancient characters. By way of prolongation and fusion of placentae from the middle of ovary to top (Gauthier, 1950, 1957; Jin and Wang, 1994), sect. *Diploclinium* seems to have evolved from sect. *Coelocentrum* into a large group in Asia.

Sect. *Diploclinium*, a complex group, is related to many other sections. Sect. *Platycentrum* has apparently derived from sect. *Diploclinium* by the complete degeneration of one of the three ovarian cells. Transitional species include *Begonia versicolor* Irmsch., with 3 stigmas, and *B. obsolescens* Irmsch. as well as *B. gulinqingensis* S.H. Huang & Y.M. Shui, which has one degenerating ovarian cell (Shui and Huang, 1999). Plants of sect. *Platycentrum* have speciated profusely in tropical and subtropical mountains. Sect. *Reichenheimia* is probably evolved from a tuberous and stemless group of sect. *Diploclinium* through the fusion of placentae. *Begonia labordei* H. Lév. and *B. guishanensis* S.H. Huang & Y.M. Shui (Huang and Shui, 1994) are representative of transitional species in being deciduous and having tuberous stem-base, characters of sect. *Reichenheimia* that adapt to seasonally dry or cold areas. Sections *Petermannia*, *Parvibegonia* and *Alicida* are probably also related to sect. *Diploclinium* with bifid axile placentae, but the number of species of the three sections in China are not sufficient to reveal their relationship with plants of sect. *Diploclinium*. Further studies may reveal the need of dividing sect. *Diploclinium* and sect. *Petermannia*, two large and divergent sections in Asia (Doorenbos et al., 1998).

Sect. *Sphenanthera* is a peculiar group. The fragrant tepals, unisexual inflorescence and berry-liked fruits sug-

gest that plants of this section have evolved into an entomochoric and entomophilous group. Sect. *Leprosae* is similar to sect. *Sphenanthera* in having berry-like fruits, but the occasional occurrence of bisexual flowers in *B. leprosa* (sect. *Leprosae*) (Hance, 1883) implies its primitiveness. It is possible that sect. *Leprosae* represents an intermediate section between sections *Sphenanthera* and *Diploclinium*.

## Alphabetical List of Chinese *Begonia* Species with Sectional Assignment

The Chinese species of *Begonia* are listed below with reference to their sectional placement. Asterisks (\*) indicate names accepted in the account of Chinese *Begonia* by Ku (1999a) that we place in synonymy with species to the right of the equal (=) sign.

- 1 *B. acetosella* Craib, sect. *Sphenanthera*
- 2 *B. acutitepala* K.Y. Guan & D.K. Tian, sect. *Diploclinium*
- 3 *B. algaia* L.B. Sm. & Wassh., sect. *Platycentrum*
- 4 *B. alveolata* T.T. Yü, sect. *Diploclinium*  
\**B. anceps* Irmsch. = *B. morifolia* T. T. Yü
- 5 *B. arboreta* Y. M. Shui, sect. *Diploclinium* (Shui, 2002a)
- 6 *B. asperifolia* Irmsch., sect. *Diploclinium*
- 7 *B. augustinei* Hemsl., sect. *Platycentrum*
- 8 *B. austrotaiwanensis* Y.K. Chen & C.I Peng, sect. *Platycentrum*
- 9 *B. balansana* Gagnep., sect. *Sphenanthera*
- 10 *B. baviensis* Gagnep., sect. *Platycentrum*
- 11 *B. biflora* T.C. Ku, sect. *Coelocentrum*
- 12 *B. bonii* Gagnep., sect. *Coelocentrum*
- 13 *B. brevisetulosa* C.Y. Wu, sect. *Platycentrum*
- 14 *B. ×buimontana* Yamam. = *B. palmata* D. Don [sect. *Platycentrum*] × *B. taiwaniana* Hayata [sect. *Diploclinium*]
- 15 *B. cathayana* Hemsl., sect. *Platycentrum*
- 16 *B. cavaleriei* H. Lév., sect. *Diploclinium*
- 17 *B. cehengensis* T.C. Ku, sect. *Diploclinium*
- 18 *B. ceratocarpa* S.H. Huang & Y.M. Shui, sect. *Sphenanthera*
- 19 *B. chingii* Irmsch., sect. *Reichenheimia*
- 20 *B. chishuiensis* T.C. Ku, sect. *Platycentrum*
- 21 *B. chitoensis* T.S. Liu & M.J. Lai, sect. *Platycentrum*
- 22 *B. chuniana* C.Y. Wu, sect. *Platycentrum*
- 23 *B. circumlobata* Hance, sect. *Platycentrum*
- 24 *B. cirrosa* L.B. Sm. & Wassh., sect. *Coelocentrum*
- 25 *B. clavicaulis* Irmsch., sect. *Diploclinium*
- 26 *B. coptidimontana* C.Y. Wu, sect. *Diploclinium*
- 27 *B. crassirostris* Irmsch. sect. *Sphenanthera*
- 28 *B. cucurbitifolia* C.Y. Wu, sect. *Platycentrum*

- 29 *B. cylindrica* D.R. Liang & X.X. Chen, sect. *Leprosae*  
 30 *B. daweshanensis* S.H. Huang & Y.M. Shui, sect. *Platycentrum*  
 31 *B. daxinensis* T.C. Ku, sect. *Coelocentrum*  
 32 *B. dentato-bracteata* C.Y. Wu, sect. *Diploclinium*  
 33 *B. dielsiana* E. Pritz., sect. *Platycentrum*  
 34 *B. digyna* Irmsch., sect. *Platycentrum*  
 35 *B. discrepans* Irmsch., sect. *Platycentrum*  
 36 *B. discreta* Craib, sect. *Parvibegonia*  
 37 *B. dryadis* Irmsch., sect. *Platycentrum*  
 38 *B. duclouxii* Gagnep., sect. *Platycentrum*  
 39 *B. edulis* H. Lév., sect. *Platycentrum*  
 40 *B. emeiensis* C. M. Hu, sect. *Platycentrum*  
     \**B. fengii* T. C. Ku = *B. obsolescens* Irmsch.  
 41 *B. fenicis* Merr., sect. *Diploclinium*  
 42 *B. filiformis* Irmsch., sect. *Coelocentrum*  
 43 *B. fimbriatipula* Hance, sect. *Diploclinium*  
 44 *B. flaviflora* H. Hara, sect. *Platycentrum*  
     \**B. floribunda* T.C. Ku = *B. sinofloribunda* Dorr  
 45 *B. fordii* Irmsch., sect. *Diploclinium*  
 46 *B. formosana* (Hayata) Masam., sect. *Platycentrum*  
 47 *B. forrestii* Irmsch., sect. *Platycentrum*  
 48 *B. gagnepainiana* Irmsch., sect. *Platycentrum*  
 49 *B. glechomifolia* C.M. Hu ex C.Y. Wu & T.C. Ku, sect. *Diploclinium*  
 50 *B. grandis* Dryand., sect. *Diploclinium*  
 51 *B. guangxiensis* C.Y. Wu, sect. *Coelocentrum*  
 52 *B. guishanensis* S.H. Huang & Y.M. Shui, sect. *Diploclinium*  
 53 *B. gulinqingensis* S.H. Huang & Y.M. Shui, sect. *Diploclinium*  
 54 *B. gungshanensis* C.Y. Wu, sect. *Platycentrum*  
 55 *B. hainanensis* Chun & F. Chun, sect. *Petermmania*  
     \**B. handelii* Irmsch. = *B. balansana* Gagnep.  
 56 *B. hatacoa* Buch.-Ham. ex D. Don, sect. *Platycentrum*  
 57 *B. hayatae* Gagnep., sect. *Sphenanthera*  
 58 *B. hekouensis* S.H. Huang, sect. *Platycentrum*  
 59 *B. hemsleyana* Hook. f., sect. *Platycentrum*  
 60 *B. henryi* Hemsl., sect. *Reichenheimia*  
 61 *B. houttuynioides* Yü, sect. *Platycentrum*  
 62 *B. howii* Merr., sect. *Platycentrum*  
 63 *B. hymenocarpa* C. Y. Wu, sect. *Diploclinium*  
 64 *B. imitana* Irmsch., sect. *Diploclinium*  
 65 *B. inflata* C. B. Clarke, sect. *Sphenanthera*  
 66 *B. josephii* A. DC., sect. *Diploclinium*  
 67 *B. kouy-tcheouensis* Guillaumin, sect. *Platycentrum*  
 68 *B. labordei* H. Lév., sect. *Diploclinium*  
 69 *B. lacerata* Irmsch., sect. *Platycentrum*  
 70 *B. laminariae* Irmsch., sect. *Platycentrum*  
 71 *B. lancangensis* S.H. Huang, sect. *Sphenanthera*  
 72 *B. lanternaria* Irmsch., sect. *Coelocentrum*  
 73 *B. leprosa* Hance, sect. *Leprosae*  
 74 *B. limprichtii* Irmsch., sect. *Platycentrum*  
 75 *B. lipingensis* Irmsch., sect. *Platycentrum*  
 76 *B. lithophila* C.Y. Wu, sect. *Reichenheimia*  
 77 *B. longanensis* C.Y. Wu, sect. *Platycentrum*  
 78 *B. longialata* K.Y. Guan & D. K. Tian, sect. *Platycentrum*  
 79 *B. longicarpa* K.Y. Guan & D. K. Tian, sect. *Leprosae*  
     \**B. longiciliata* C.Y. Wu = *B. rex* Putz.  
 80 *B. lukuana* Y.C. Liu & C.H. Ou, sect. *Diploclinium*  
 81 *B. luzhaiensis* T.C. Ku, sect. *Coelocentrum*  
 82 *B. macrotama* Irmsch., sect. *Platycentrum*  
 83 *B. maguanensis* S.H. Huang & Y.M. Shui, sect. *Platycentrum*  
 84 *B. malipoensis* S.H. Huang & Y.M. Shui, sect. *Diploclinium*  
 85 *B. manhaoensis* S.H. Huang & Y.M. Shui, sect. *Platycentrum*  
 86 *B. masoniana* Irmsch., sect. *Coelocentrum*  
 87 *B. megalophyllaria* C.Y. Wu, sect. *Platycentrum*  
     \**B. menglianensis* Y.Y. Qian = *B. augustinei* Hemsl.  
 88 *B. mengtzeana* Irmsch., sect. *Platycentrum*  
 89 *B. miranda* Irmsch., sect. *Diploclinium*  
 90 *B. morifolia* T.T. Yü, sect. *Diploclinium*  
 91 *B. morsei* Irmsch., sect. *Coelocentrum*  
 92 *B. muliensis* T.T. Yü, sect. *Diploclinium*  
 93 *B. nantoensis* M.J. Lai & N.J. Chung, sect. *Platycentrum*  
 94 *B. nymphaeifolia* T.T. Yü, sect. *Diploclinium*  
 95 *B. obliquefolia* S.H. Huang & Y.M. Shui, sect. *Coelocentrum*  
 96 *B. obsolescens* Irmsch., sect. *Diploclinium*  
 97 *B. oreodoxa* Chun & F. Chun ex C.Y. Wu & T.C. Ku, sect. *Platycentrum*  
 98 *B. ornithophylla* Irmsch., sect. *Coelocentrum*  
 99 *B. palmata* D. Don, sect. *Platycentrum*  
 100 *B. parvula* H. Lév. & Vant., sect. *Reichenheimia*  
 101 *B. paucilobata* C.Y. Wu, sect. *Platycentrum*  
 102 *B. pedatifida* H. Lév., sect. *Platycentrum*  
 103 *B. péii* C.Y. Wu, sect. *Alicida*  
 104 *B. peltatifolia* H.L. Li, sect. *Diploclinium*  
 105 *B. picta* Sm., sect. *Diploclinium*  
     \**B. pingbienensis* C.Y. Wu = *B. alveolata* T.T. Yü  
 106 *B. polytricha* C.Y. Wu, sect. *Platycentrum*  
 107 *B. porteri* H. Lév. & Vaniot, sect. *Coelocentrum*  
 108 *B. prostrata* Irmsch., sect. *Sphenanthera*

- 109*B. pseudodryadis* C.Y. Wu, sect. *Coelocentrum*  
 110*B. psilophylla* Irmsch., sect. *Platycentrum*  
 111*B. purpureofolia* S.H. Huang & Y.M. Shui, sect. *Platycentrum*  
     \**B. randaiensis* Sasaki = *B. palmata* D. Don  
 112*B. ravenii* C.I Peng & Y.K. Chen, sect. *Diploclinium*  
 113*B. reflexisquamosa* C.Y. Wu, sect. *Platycentrum*  
 114*B. repenticaulis* Irmsch., sect. *Platycentrum*  
 115*B. rex* Putz., sect. *Platycentrum*  
     \**B. rhodophylla* C.Y. Wu = *B. guishanensis* S.H. Huang & Y.M. Shui  
 116*B. rockii* Irmsch., sect. *Platycentrum*  
 117*B. rongjiangensis* T.C. Ku, sect. *Diploclinium*  
 118*B. rotundilimba* S.H. Huang & Y.M. Shui, sect. *Diploclinium*  
 119*B. ruboides* C.M. Hu ex C.Y. Wu & T.C. Ku, sect. *Diploclinium*  
 120*B. rubropunctata* S.H. Huang & Y.M. Shui, sect. *Platycentrum*  
 121*B. scitifolia* Irmsch., sect. *Platycentrum*  
 122*B. setifolia* Irmsch., sect. *Diploclinium*  
 123*B. setuloso-peltata* C.Y. Wu, sect. *Coelocentrum*  
 124*B. sikkimensis* A. DC., sect. *Platycentrum*  
 125*B. silletensis* (A. DC.) C.B. Clarke subsp. *mengyangensis* M.C. Tebbitt & K.Y. Guan, sect. *Sphenanthera* (Tebbit and Guan, 2002)  
     \**B. sinobrevicaulis* T.C. Ku = *B. gulinqingensis* S. H. Huang & Y.M. Shui  
 126*B. sinofloribunda* Dorr, sect. *Diploclinium*  
 127*B. sino-vietnamica* C. Y. Wu, sect. *Diploclinium*  
 128*B. smithiana* T. T. Yü ex Irmsch., sect. *Platycentrum*  
 129*B. subhowii* S. H. Huang, sect. *Platycentrum*  
 130*B. summoglabra* T. T. Yü, sect. *Diploclinium*  
 131*B. ×taipeiensis* C.I Peng = *B. formosana* (Hayata) Masam. [sect. *Platycentrum*] × *B. hayatae* Gagnep. [*B. aptera* Blume], sect. *Sphenanthera* (Peng and Su, 2000)  
 132*B. taiwaniana* Hayata, sect. *Diploclinium*  
 133*B. taliensis* Gagnep., sect. *Diploclinium*  
     \**B. tarokoensis* M.J. Lai = *B. formosana* (Hayata) Masam.  
 134*B. tessaricarpa* C.B. Clarke, sect. *Sphenanthera*  
 135*B. tetragona* Irmsch., sect. *Sphenanthera*  
 136*B. truncatiloba* Irmsch., sect. *Platycentrum*  
     \**B. tsaii* Irmsch. = *B. setifolia* Irmsch.  
 137*B. tsoongii* C.Y. Wu, sect. *Platycentrum*  
 138*B. umbraculifolia* Y. Wan & B.N. Chang, sect. *Coelocentrum*  
 139*B. versicolor* Irmsch., sect. *Platycentrum*  
 140*B. villifolia* Irmsch., sect. *Platycentrum*  
 141*B. wangii* T.T. Yü, sect. *Diploclinium*  
 142*B. wenshanensis* C.M. Hu ex C.Y. Wu & T.C. Ku, sect. *Diploclinium*  
 143*B. wilsonii* Gagnep., sect. *Reichenheimia*  
 144*B. xingyiensis* T.C. Ku, sect. *Diploclinium*  
     \**B. xinyiensis* T.C. Ku = *B. balansana* Gagnep.  
 145*B. xishuiensis* T.C. Ku, sect. *Diploclinium*  
 146*B. yingjiangensis* S.H. Huang, sect. *Platycentrum*  
 147*B. yishanensis* T.C. Ku, sect. *Coelocentrum*  
 148*B. yui* Irmsch., “yuii”, sect. *Diploclinium*  
 149*B. yunnanensis* H. Lévl., sect. *Diploclinium*  
 150*B. zhengyiana* Y.M. Shui, sect. *Coelocentrum* (Shui, 2002b)

**Acknowledgments.** We thank Professors Su-Hua Huang (YUNU) and De-Zhu Li (KUN) for helpful suggestions on the manuscript, and Dr. Hai-Ning Qin (PE) and Professor Kai-Yun Guan for providing useful literature. We are indebted to Ms. Wen-Hong Chen and Hui-Chun Hsiao for technical assistance and Miss Ling Wang for the handsome illustration. The authors are grateful for detailed reviews of the manuscript by Drs. David E. Boufford and Thomas G. Lammers. This study was supported in part by research grants from National Science Council and Academia Sinica, Taiwan, to Ching-I Peng.

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## 中國秋海棠屬組的大綱

稅玉民<sup>1</sup> 彭鏡毅<sup>2</sup> 吳征鎰<sup>1</sup>

<sup>1</sup>中國科學院昆明植物研究所

<sup>2</sup>中央研究院植物研究所

本文在研究中國 150 種秋海棠屬植物的基礎上，附圖界定了 9 個組的範圍，它們是：側膜組 [Sect. *Coelocentrum* Irmsh.]、等翅組 [Sect. *Petermannia* (Klotzsch) A. DC.]、小花組 [Sect. *Alicida* C.B. Clarke]、秋海棠組 [Sect. *Diploclinium* (Wight) A. DC.]、單座組 [Sect. *Reichenheimia* (Klotzsch) A. DC.]、小海棠組 [Sect. *Parvibegonia* A. DC.]、扁果組 [Sect. *Platycentrum* (Klotzsch) A. DC.]、無翅組 [Sect. *Sphenanthera* (Hassk.) Warb.] 和棒果組 [Sect. *Leprosae* (T.C. Ku) Y.M. Shui]。其中，棒果組是一個新組，它以三室、無翅、棒狀和漿果狀的果實與其他組相區別。另根據果實和胎座特徵，訂正了許多種在組等級的位置。本文也討論了一些組間的關係：側膜組植物子房一室，具側膜胎座，為最原始的類群；子房三室，胎座二裂的秋海棠組是一個分化中心類群，其一室退化而演變成扁果組（胎座裂片有多次分裂的趨勢），其胎座裂片癒合為一片而成單座組（適應乾旱或寒冷的環境）；無翅組具漿果（有時為雌雄異株或多室）而向蟲媒和蟲播的演化趨勢發展。本文並報導原產印度阿薩姆，近年於西藏發現之中國新紀錄種：陀螺果秋海棠 *Begonia tessaricarpa* C.B. Clarke。

**關鍵詞：**大綱；組；秋海棠屬；中國；分類學。