A new species (*Begonia giganticaulis*) of Begoniaceae from southern Xizang (Tibet) of China

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Abstract

*Begonia giganticaulis*, a huge new species in *Begonia* sect. *Platycentrum* of Begoniaceae from southern Xizang (Tibet) of China, is described. Morphologically, it is mostly similar to *B. longifolia* and *B. acetosella*, but clearly differs from the former mainly by its dioecious and taller plants, sparse hairs on abaxial veins, longer inflorescence, unique shape of fruits, and differs from the latter mainly by its late and longer flowering time, 6-tepals of female flower and 3-loculed ovary. The phylogenetic analyses also support the separation of the new species from other taxa. Based on the current data, its conservation status is assigned to Endangered (B2a) according to the IUCN Red List Categories and Criteria.

Keywords

Conservation status, molecular evidence, morphology, southern Tibet, taxonomy

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Introduction

Zangnan (southern Tibet) of China is located to the south of the Himalayas, including most parts of Cona, Lhünzê, Mêdog and Zayü counties, and some smaller parts of Nang and Mainling counties (Liu 2019). This region is very warm and rainy because of the southwest monsoon carrying heavy water and heat from the Indian Ocean. Owing to high average annual precipitation and high-proportion of forest coverage (Hao et al. 2010), the plant diversity is very high in Zangnan. However, this area still remains under-explored and needs more study in the future.

After a series of plant surveys recently, the authors have a better understanding of the diversity of Begonia in Tibet, particularly in its southern part (namely Zangnan) including Mêdog county. Up until now, 39 species and 4 varieties had been found in Tibet (Gu et al. 2007; Camfield and Hughes 2018; Tian et al. 2020) (Table 1). In addition, Begonia limprichtii Irmsch. (Irmscher 1922) was newly reported by Borah et al. (2021a) in southern Tibet, but this record is likely based on a wrong identification and further study is needed. Of these, 31 species and 3 varieties are distributed in Mêdog. Recently, after several field surveys in Mêdog, we found several new species and at least three natural hybrids. Here we described Begonia giganticaulis D.K.Tian & W.G.Wang sp. nov. from Mêdog, a new species of huge plant size, which is morphologically similar to both B. longifolia Blume (Blume 1827) and B. acetosella Craib (Craib 1912). The morphological differences of the three species are compared, and the new species is also supported by molecular evidence.

Material and methods

Morphological analysis

The field surveys were conducted on habitat, distribution, population size, morphology and specimen collection of the new species. Diagnosis of the morphological difference between the new species and its similar species was based on literature review, examination of herbarium specimens, and observation of both wild and cultivated plants.

Phylogenetic analysis

The treatment on sections of Begonia follows Shui et al. (2019). To ascertain the relationship of the new species within sect. Platycentrum (Klotzsch) A.DC. (de Candolle 1859), two female and three male individuals were sampled, and three individuals of B. longifolia, two individuals of B. acetosella, and three individuals of B. acetosella var. hirtifolia Irmsch. (Irmscher 1939) were sampled and sequenced. 13 taxa within sect. Platycentrum were selected based on Moonlight et al. (2018) to ascertain the phylogenetic relationship of the new species. Begonia cavaleriei H.Lév. (Léveille 1909) from sect. Coelocentrum Irmsch. (Irmscher 1939) was used as outgroup. All
**Table 1.** A checklist of *Begonia* species in Tibet.

| Species                        | Reference                      | County            |
|-------------------------------|--------------------------------|-------------------|
| *Begonia aborensis* Dunn      | Dunn 1920                      | Médog             |
| *Begonia acetotella* Craib    | Craib 1912                     | Médog             |
| *Begonia annulata* K.Koch     | Koch 1857                      | Médog             |
| *Begonia asperifolia* Irmsch. | Irmscher 1927                 | Bomê, Zayû, Lhûn-zê, Médog |
| *Begonia burkiiii* Dunn       | Dunn 1920                      | Médog             |
| *Begonia cathcartii* Hook.f. & Thomson | Hooker 1855 | Zayû              |
| *Begonia dinica* Buch.-Ham. ex D.Don | Don 1825            | Dinggyé           |
| *Begonia disformis* (Irmsch.) | Leong et al. 2015             | Médog             |
| *Begonia flagellaris* Hara    | Hara 1973                      | Gyîrong, Nyalam   |
| *Begonia flaviiflora var. flaviiflora* Hara | Hara 1970             | Médog             |
| *Begonia flaviiflora var. gamblei* (Irmscher) Golding & Karegeannes | Golding and Karegeannes 1984 | Médog          |
| *Begonia giganticaulis* D.K.Tian & W.G. Wang sp. nov. | In this study | Médog          |
| *Begonia grandis* Dryand.     | Dryander 1791                  | Zayû              |
| *Begonia griffithiana* (A.DC.) Warb. | Warburg 1894               | Médog             |
| *Begonia bandelii* Irmsch.    | Irmscher 1921                  | Médog             |
| *Begonia batacru Buch.-Ham. ex D.Don | Don 1825            | Médog, Cona       |
| *Begonia iridescent Dunn*     | Dunn 1920                      | Médog, Zayû       |
| *Begonia josephi* A.DC.       | de Candolle 1859              | Cona, Dinggyé, Lhûn-zê, Médog, Yadong |
| *Begonia kerkarmonyingensis* Taram, D.Borah & M.Hughes | Taram et al. 2021          | Médog             |
| *Begonia labordei* H.Lév.     | Léveillé 1904                  | Zayû              |
| *Begonia limprichtii* Irmsch. | Borah et al. 2021a            | Médog             |
| *Begonia longifolia* Blume    | Blume 1827                     | Médog             |
| *Begonia medogensis* J.W.Li, Y.H.Tan & X.H.Jin | Li et al. 2018           | Médog             |
| *Begonia megapetala* A.DC.    | de Candolle 1859              | Zayû              |
| *Begonia nepalensis* (A.DC.) Warb. | Warburg 1894               | Cona              |
| *Begonia ovatifolia* A.DC.    | de Candolle 1859              | Médog             |
| *Begonia oyuniae* M.Taram & N.Krishna | Taram et al. 2020         | Médog             |
| *Begonia plumata var. plumata* D.Don | Don 1825            | Médog             |
| *Begonia palimata var. houingiana* (Champion ex Bentham) Golding & Karegeannes | Golding and Karegeannes 1984 | Médog          |
| *Begonia palimata var. khiziana* (Irmsch.) Golding & Kareg | Golding and Karegeannes 1984 | Médog          |
| *Begonia picta* Sm.           | Smith 1805                     | Gyîrong, Médog, Nyalam |
| *Begonia pseudoheydeyi* Y.M.Shui & W.H.Chen | Chen et al. 2019         | Médog             |
| *Begonia rex Putz.*           | Putzev 1857                    | Médog             |
| *Begonia roxburghii* (Miq.) A.DC. | de Candolle 1864          | Médog             |
| *Begonia scintillans* Dunn    | Dunn 1920                      | Médog             |
| *Begonia shilendrae* Rekha Morris & P.D.McMillan | Morris and McMillan 2012 | Cona             |
| *Begonia sikkimensis* var. sikkimensis A.DC. | de Candolle 1859        | Médog             |
| *Begonia sikkimensis* var. kamengensis* Rekha Morris, P.D.McMillan & Golding ex Golding | Golding 2009             | Cona             |
| *Begonia sikkimensis* D.Borah, Taram & Wahlsteen | Borah et al. 2021b       | Médog             |
| *Begonia sikkimensis* var. kamengensis* Rekha Morris, P.D.McMillan & Golding ex Golding | Golding 2009             | Cona             |
| *Begonia shilendrae* Clarke   | Clarke 1879                    | Médog             |
| *Begonia tesaricarpa* C.B.Clarke | Clarke 1879              | Médog             |
| *Begonia thomsonii* A.DC.     | de Candolle 1859              | Médog             |
| *Begonia xanthina* Hook.f.    | Hooker 1852                    | Médog             |
| *Begonia zhongyangiana* W.G.Wang et S.Z.Zhang | Wang et al. 2019        | Médog             |

The voucher specimens were deposited in the herbarium of Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences (HITBC). For DNA sequencing, the total genomic DNA was extracted from silica-dried leaves by a modified CTAB
**Table 2.** Sampled taxa and GenBank accession numbers of *Begonia giganticaulis* and the related taxa used for phylogenetic analysis.

| Taxa                                | Collector, Voucher (Herbarium) | Origin                  | ITS     | rpL16     | ndhA     | References                                                                 |
|-------------------------------------|---------------------------------|-------------------------|---------|-----------|----------|-----------------------------------------------------------------------------|
| *B. acetosella* Craib               | Wang, W.G., WWG004 (HITBC)      | Mengla, Yunnan, China   | MW690105| MW658199  | MW658212 | In this study                                                              |
| *B. acetosella* Craib               | Wang, W.G., WWG005 (HITBC)      | Mengla, Yunnan, China   | MW690106| MW658200  | MW658213 | In this study                                                              |
| *B. acetosella* var. hirtifolia      | Wang, W.G., WWG0261 (HITBC)     | Ruili, Yunnan, China    | MW690107| MW658204  | —        | In this study                                                              |
| *B. acetosella* var. hirtifolia      | Wang, W.G., WWG0262 (HITBC)     | Ruili, Yunnan, China    | MW690108| MW658202  | MW658214 | In this study                                                              |
| *B. acetosella* var. hirtifolia      | Wang, W.G., WWG0300 (HITBC)     | Ruili, Yunnan, China    | —       | MW658203  | MW658215 | In this study                                                              |
| *B. apiota* Blume                   | —                               | —                       | —       | —         |          | Chiang (unpublished); Thomas et al. (2011)                                  |
| *B. balansana* Gagnep.              | —                               | —                       | —       | —         |          | Forrest and Holling-sworth (2003); Chung et al. (2014); Moonlight et al. (2018) |
| *B. cathayana* Hems.                | —                               | —                       | —       | —         |          | Yang et al. (unpublished); Chung et al. (2014); Zhao (unpublished)           |
| *B. cavaleriei* H.Lév.              | —                               | —                       | —       | —         |          | Chung et al. (2014); Tong et al. (2019)                                     |
| *B. decora* Stapf                   | —                               | —                       | —       | —         |          | Forrest and Holling-sworth (unpublished); Chung et al. (2014)               |
| *B. giganticaulis* D.K.Tian & W.G.Wang | —                               | —                       | —       | —         |          | Forrest and Holling-sworth (unpublished); Chung et al. (2014); Moonlight et al. (2018) |
| *B. handelii* Irmsch.               | Wang, W.G., WWG001 (HITBC)      | Mengla, Yunnan, China   | MW690102| MW658196  | MW658209 | In this study                                                              |
| *B. hatacara* Buch.-Ham. ex D.Don   | —                               | —                       | —       | —         |          | Forrest and Holling-sworth (unpublished); Chung et al. (2014)               |
| *B. longifolia* Blume               | Wang, W.G., WWG001 (HITBC)      | Mengla, Yunnan, China   | MW690102| MW658196  | MW658209 | In this study                                                              |
| *B. longifolia* Blume               | Wang, W.G., WWG002 (HITBC)      | Mengla, Yunnan, China   | MW690103| MW658197  | MW658210 | In this study                                                              |
New species, *Begonia*

The chloroplast DNA *rpL16* intron, *ndhA* intron and the nuclear ribosomal DNA internal transcribed spacer (nrITS) region were used to infer the phylogenetic relationship of the new species. The *rpL16* intron were amplified by the primer *rpL16*-F and *rpL16*-R and sequenced by the primer *ndhA* intron the primer *ndhAX*1 and *ndhAX*2 (Thomas et al. 2011) were used. The nrITS region was amplified and sequenced by the primer 51NT and 26S1Rev (Clement et al. 2004). The sampled sequences were downloaded from NCBI and accession numbers were listed in Table 2.

Sequences of each DNA region were aligned by MUSCLE online (https://www.ebi.ac.uk/Tools/msa/muscle/, Madeira et al. 2019) and adjusted manually when necessary. Indels were treated as gap. For testing the congruence within *rpL16* intron, *ndhA* intron and nrITS, the analysis of the incongruence length difference (ILD) was performed with 100 replicates under default heuristic search using PAUP v.4.0a (Swofford 2002) and the phylogenetic trees were constructed based on each dataset. The p value was 0.40 and no conflict among each phylogenetic trees, indicating the congruence among these datasets (Farris et al. 1994).

The parsimony analysis was conducted using PAUP v.4.0 b10 (Swofford 2002). The Maximum Parsimony (MP) analysis was run using a heuristic search with 1, 000 replicates and tree-bisection-reconnection (TBR) with no reconnection limit. Bootstrap was used to assess the node support by 1000 replicates using TBR branch swapping. The Bayesian analysis was conducted using MrBayes v.3.1.2 (Ronquist and Huelsenbeck 2003) with 1, 000, 000 generations under the Markov chain Monte Carlo (MCMC) chains. The average standard deviation of split frequencies was 0.004210 after 1, 000, 000 generations. The consensus tree was constructed after burn-in 25% of the trees. The Posterior Probability (PP) was used to assess the branch supports.

| Taxa             | Collector, Voucher (Herbarium) | Origin          | ITS     | *rpL16* | *ndhA* | References                           |
|------------------|--------------------------------|-----------------|---------|---------|--------|-------------------------------------|
| *B. longifolia*  | Wang, W.G., WWG003 (HITBC)     | Mengla, Yunnan, China | MW659019 | MW658219 | MW658211 | In this study                       |
| *B. nepalensis*  | —                              | —               | AY753726 | —       | MH207257 | Tebbitt et al. (2006); Moonlight et al. (2018) |
| (A.DC.) Warb.    |                                |                 |         |         |        |                                     |
| *B. obovoides*   | —                              | —               | —       | —       | —      | Thomas et al. (2011)                |
| Craib            |                                |                 |         |         |        |                                     |
| *B. pavoidea*    | —                              | —               | —       | —       | —      | Thomas et al. (2011)                |
| Ridl.            |                                |                 |         |         |        |                                     |
| *B. pedatifida*  | —                              | —               | —       | —       | —      | Tong et al. (2019)                  |
| H.Lév.           |                                |                 |         |         |        |                                     |
| *B. roxburghii*  | —                              | —               | —       | —       | —      | Forrest and Hollingsworth (2003); Thomas et al. (2011) |
| A.DC.            |                                |                 |         |         |        |                                     |
| *B. versicolor*  | —                              | —               | —       | —       | —      | Forrest and Hollingsworth (unpublished); Chung et al. (2014); Thomas et al. (2011) |
| Irmsch.          |                                |                 |         |         |        |                                     |
Results

Taxonomic treatment

*Begonia giganticaulis* D.K.Tian & W.G.Wang, sp. nov.
urn:lsid:ipni.org:names:77234844-1
Figs 1–4

**Type.** China. Xizang (Tibet) Autonomous Region: Mêdog county (墨脱县), Beibeng town (背崩乡), Baimu Xiri river (白母西日河), forest slope of river valley or water’s edge along stream, 29°21’9”N, 95°11’21”E, elev. 1320 m, 10 September 2020, Dai-Ke Tian, Fang Wen, Qing-Gong Mao, & Zhu Lu, TDK4773-A (holotype CSH! Barcode number: 0180561, ♀)

**Diagnosis.** The new species is mostly similar to *B. longifolia* and *B. acetosella*, but clearly differs from the former mainly by its dioecious (vs. monoecious), taller (to 4 m vs. less than 2 m) plants, longer (vs. shorter) inflorescence, and unique shape of fruits, and differs from the latter mainly by its taller (to 4 m vs. less than 2 m) plants, late and longer (Jun. to Oct. vs. Mar. to Apr.) flowering time, longer (6–20 mm vs. 5–12 mm) pedicel, 6 (vs. 4) tepals of pistillate flower and 3 (vs. 4)-loculed ovary (Table 3, Fig. 3).

**Description.** Herb perennial, evergreen, to 4 m tall, dioecious. Rhizome short, stout, nearly unbranched, reddish brown, to 12 cm thick. Stem erect, reddish brown or green, glabrous, internodes to 5 cm thick, with many longitudinally fusiform whitish spots, cross section of stem often reddish brown, nodes notably enlarged, to 7 cm thick, with unequally oval to round whitish spots, many shrubby branches on the upper part of main stem. Stipule long-triangular, light green or pinkish green, 9–25 × 2–8 mm, glabrous, margin entire, dorsal ridge pinkish, apex acuminate with arista 4–6 mm long. Petioles green, pink to red, glabrous, 7–22 cm long, 1–3 mm thick. Leaf blade ovate-lanceolate to lanceolate, 4–19 × 0.8–8 cm, adaxial green, muriculate to nearly glabrous, adaxial veins slightly concave; abaxial greyish green, veins usually red, convex, main veins sparsely and obliquely strigose; base obliquely cordate, margin shallowly and remotely denticate, apex long caudate; Inflorescence dichasial cyme, axillary, short, 3–5 cm long, unbranched to branched once, rachis glabrous, green, pinkish green to red, base usually red-brown, 7–15 mm long, 1–1.5 mm thick, 3–11 male flowers or 1–5 female per inflorescence. Bract often caducous, pinkish green, long triangular, glabrous, ca. 6 × 3 mm, apex acuminate; bracteoles smaller. Staminate flower: pedicel glabrous, white, whitish or pinkish green, 10–14 mm long, ca.1 mm thick; corolla 18–24 mm in diameter; tepals 4, subequal, glabrous, outer 2, obovate, 9–14 × 6–9 mm, apex obtuse, adaxially white and middle-upper part abaxially pink, or pure white for some individuals, longitudinal veins unapparent; inner 2, pure white, obovate to obovate-lanceolate, 8–13 × 5–7 mm, apex obtuse; androecium nearly actinomorphic, ca. 5 mm long, 6–7 mm in diam; stamens 48–60, filaments free, 1–2 mm long; anther yellow, 2–3 mm long, apex obtuse or nearly so. Pistillate flower: pedicel white or green-white,
New species, *Begonia*

**Figure 1.** Habitat and large-sized plant of *Begonia giganticaulis* D.K. Tian & W.G. Wang, sp. nov. **A** habitat showing plants (arrows indicate) growing along stream bank **B** flowering plant growing along slope of valley **C** one of the tallest individuals with Dr. Dai-Ke Tian. (Photos **A** by Dai-Ke Tian **B** by Shi-Wei Guo **C** by Qing-Gong Mao).
Figure 2. Morphology of *Begonia giganticaulis* D.K. Tian & W.G. Wang, sp. nov. **A** one of the single tallest plants cut into four sections **B** main stem base **C** stems showing colour of nodal cross-sections **D** main stem with much expanded node and whitish-green lines or spots **E** expanded node on terminal branch **F, G** male plant branches showing inflorescences and different colours **H** female branches **I** adaxially (left) nearly glabrous and abaxially sparse hairs on veins (right, arrows indicate) on blade surfaces **J** stipules showing shape and colour. (Photo **F** by Wen-Guang Wang; others by Dai-Ke Tian).
Figure 3. Flower and fruit morphology of *B. giganticaulis* compared with its close species *B. longifolia* and *B. acetosella*. **A–H** *Begonia giganticaulis* **A** staminate flowers with pinkish outer tepals **B** staminate flowers with white tepals **C, D** pistillate flower **E** ovary sections showing different colour **F** fruits on branch **G, H** dorsal and front views of fruits **I–K** *B. longifolia* **I** flowering and fruiting branch **J** fruits showing short horns **K** ovary dissection **L–O** *B. acetosella* **L** staminate flower **M** pistillate flower **N, O** fruits with short horns or wings. (Photos **C** by Shi-Wei Guo **E** (left) **L, M & O** by Wen-Guang Wang; others by Dai-Ke Tian).
Figure 4. Illustration of Begonia giganticaulis D.K. Tian & W.G. Wang, sp. nov. (Drawn by Mr. Zhi-Min Li) A male flowering branches B female flowering branches C main stem line spots, much expanded node and internode base D expanded node and internode base on small upper branches E leaf blade F leaf (abaxial), showing sparse hairs on veins G stipule H staminate flowers I, J pistillate flower K side view of androecium L stamens M ovary and stigmas N fruit O dissection of ovary showing placentae.
New species, *Begonia*

6–12 mm long, 0.8–1 mm thick; corolla 20–25 mm, tepals 6, rarely 4, glabrous, outer 3 (rarely 2), obovate or long obovate, thick and rigid, 12–18 × 7–10 mm, adaxial surface nearly white, distinctly concave, abaxially pink on middle-upper part, inner 3 (rarely 2), obovate-lanceolate to oblanceolate or long elliptical, slightly narrower than outer tepals, 10–19 × 6–8 mm, white, glabrous, apex obtuse; styles + stigmas 5 mm long, 7–8 mm wide; styles 3, free; stigmas yellow, nearly U-shaped, each side spirally twisted 1.5 circles; ovary pink or green, with white convex spots; placentation axile, 3-loculed, each placenta 2-branched. **Peduncle** green to pinkish green, glabrous, 8–12 mm long, ca. 1 mm thick. **Fruit** red, pink or green, glabrous, triangular-gyroscopic, 8–11 × 1–12 mm wide, concave between two placentas, wingless to occasionally short ridged, apex with beak 3–4 mm long. Flowering Jun.–Oct., fruiting Jul.–Dec.

**Additional specimen examined.** **China. Xizang:** Mêdog County (墨脱县), Beibeng Town (背崩乡), Baimu Xiri River (白母西日河), forest slope of river valley or water’s edge along stream, 29°21’9”N, 95°11’21”E, elev. 1320 m, 10 September 2020, Dai-Ke Tian, Fang Wen, Qing-Gong Mao, & Zhu Lu TDK4773-B (paratype CSH!), △; 29°20’0”N, 95°10’49”E, elev. 1110 m, 10 September 2020, Dai-Ke Tian, Fang Wen, Qing-Gong Mao, & Zhu Lu TDK4765-A, TDK4765-B, (paratype CSH!); 29°18’32”N, 95°10’38”E, elev. 980 m, 10 September 2020, Dai-Ke Tian, Fang Wen, Qing-Gong Mao, & Zhu Lu TDK4777 (paratype CSH!); near Ani Bridge (阿尼桥), 29°16’42”N, 95°10’49”E, elev. 810 m, 3 July 2020, Wen-Guang Wang, You-Yun Li, Xing-Da Ma, & Jian-Yong Shen, WWG 2014 (paratype, HITBC!), WWG 2015 (paratype HITBC!); elev. 1100 m, 16 September 1974, anonymous 2608 (paratype PE!); elev. 800–1400 m, 30 June 1980, Wei-Lie Chen 10809 (paratype PE!); near No. 2 Bridge, 29°16’42”N, 95°10’49”E, elev. 810 m, 1 October 2017, Dai-Ke Tian, Yan Xiao, Xin Zhong, Li-Zhi Tian & Zhu Lu TDK3429 (paratype CSH!); Beibeng to Hanni (汗密), elev. 840 m, 7 August 2010, South Tibet Expedition Team (藏南队), Xiao-Hua Jin, Shu-Dong Zhang, Zhong-Yang Li, Bao-Cheng Wu, Xian-Yun Mu, Jing Li & Wei-Tao

| Table 3. Morphological comparison of *Begonia giganticaulis*, *B. longifolia* and *B. acetosella*. |
| --- |
| **Character** | **B. giganticaulis** | **B. longifolia** | **B. acetosella** |
| Plant sexuality | dioecious | monoecious | dioecious |
| Height (m) | up to 4 | less than 2 | less than 2 |
| Petiole length (cm) | 0.7–7 | 1–12 | 1–10 |
| Leaf blade surface | muriculate | glabrous to less muriculate | muriculate to hirsutulous |
| Inflorescence peduncle length (mm) | 7–15 | 4–10 | 2–10 |
| Flower number | 1–11 | 1–11(15) | 1–3(5) |
| Tepal number of pistillate flower | 3 | 6 | 6 |
| Tepal colour | pinkish to white | white | pinkish to white |
| Ovary | 3-loculed | 3-loculed | 4-loculed |
| Pedicel length (mm) | | | |
| Male flower | | | |
| Female flower | | | |
| Fruit horn or wing | none to rarely short crest | none to short crest or horns | short to long horns or wings |
| Flowering time | June-October | June-December | March-April |
Distribution and habitat. Currently known from at least two localities in Mêdog, southern Xizang (Tibet), China (Fig. 5). It grows on the slopes under forest along streams, elevation 450–1400 m.

Conservation status. *Begonia giganticaulis* is currently found in at least two localities in Mêdog of Tibet. Additional populations might be discovered when more surveys are conducted in China-India border region. However, based on current data, it should be categorised as Endangered: B2a (IUCN 2019) due to < 500 km² area of occupancy with severely fragmented habitat consisting of < 5 known populations totally under 1000 individuals by estimation.

*Jin, STET2304* (paratype PE!); Hanmi to Maniweng (马尼翁), elev. 800–1000 m, 6 August 1974, Qingzang Team 74-4114 (paratype PE!); elev. 1200 m, 24 June 1983, Bo-Sheng Li & Shu-Zhi Chen 05229 (paratype PE!); Maniweng to Ani Bridge, elev. 700–1000 m, 3 August 1972, Tibet Expedition Team, Institute of Biology 1631 (paratype HNWP!).
New species, Begonia

**Etymology.** The specific epithet refers to the huge (very tall and thick stem) plant size of the new species, which is the tallest begonia in Asia.

**Molecular systematic relationship**

We obtained 12 nrITS, 13 rpL16 intron, and 13 ndhA intron of the new species and related Begonia taxa. In order to reconstruct the phylogenetic relationship of the new species, 13 taxa within sect. Platycerium were included and B. cavaleriei from sect. Coelocentrum was selected as outgroup. In total, the matrix was composed of 26 accesses and contained the 962 bp rpL16 intron, the 1109 bp ndhA intron and the 672 bp nrITS sequence. Of the total 2743 characters, 132 were parsimony informative.

Based on MP analysis, the new species was clustered with B. acetosella and B. acetosella var. hirtifolia (Fig. 6A), while it was clustered with B. longifolia under BI analysis (Fig. 6B). Both MP and BI analyses showed that all five individuals of the new species were clustered together and separated from other taxa (Fig. 6A, BS: 100%; Fig. 6B, PP:1.00).

**Notes.** – The earliest specimen of Begonia giganticaulis was collected in 1972 between Maliweng and Ani Bridge, Mêdog, Tibet, China. This species is similar to B. acetosella in appearance when its flowers are unavailable for observation, therefore, it was misidentified (24 June 1983, Bo-Sheng Li & Shu-Zhi Chen 05229, PE! was wrongly identified as B. acetosella by C.Z. Gu in March 2004). Also, due to its high similarity to B. longifolia particularly in morphology of flowers and fruits, B. giganticaulis was
wrongly labelled as *B. longifolia* by Morris (2010) who found this species in southern Mêdog county.

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