

Akaniaceae: a new family record for flora of India and lectotypification of the name *Bretschneidera sinensis*

Vikas Kumar¹, Sudhansu Sekhar Dash^{2✉}, Samiran Panday¹, Subhajit Lahiri¹,
Bipin Kumar Sinha² and Paramjit Singh²

¹Central National Herbarium, Botanical Survey of India, Howrah – 711 103, India

²Botanical Survey of India, CGO Complex, Sector-1, Salt Lake, Kolkata – 700 064, India

✉Corresponding author : ssdash2002@yahoo.co.in

एकानिएसी: भारतीय वनस्पतिजात के लिये एक नवीन कुल का अभिलेख एवं ब्रेट्सनिडेरिया साइनेन्सिस नाम का लैक्टोटाईपीफिकेशन

विकास कुमार, सुधांशु शेखर दाश, समीरन पांडे, सुभाजित लाहिड़ी,
बिपिन कुमार सिन्हा एवं परमजीत सिंह

सारांश

ब्रेट्सनिडेरिया साइनेन्सिस हेमस्ले, आईयूसीएन की संकटग्रस्त वृक्ष जातियों की लाल सूची में सम्मिलित इस जाति का संग्रहण भारत के अरुणाचल प्रदेश में स्थित नमदाफा राष्ट्रीय उद्यान एवं बाघ अभयारण्य से किया गया है, जो एकलप्ररूपी वंश ब्रेट्सनिडेरिया एवं कुल एकानिएसी का प्रथम वितरणपरक अभिलेख है। इस शोधपत्र में जाति का लैक्टोटाईपीफिकेशन कर ब्रेट्सनिडेरिया साइनेन्सिस नाम के साथ वर्गिकी विवरण प्रस्तावित किया गया है।

ABSTRACT

Bretschneidera sinensis Hemsley, an IUCN Red Listed Endangered tree species has been collected from Namdapha National Park and Tiger Reserve, Arunachal Pradesh, India which constitutes the first distributional record of the monotypic genus *Bretschneidera* and the family Akaniaceae in India. Lectotypification of the name *Bretschneidera sinensis* proposed here along with detailed taxonomic account of the species.

Keywords: Akaniaceae, *Bretschneidera sinensis*, New Record, Lectotypification, India

INTRODUCTION

Bretschneidera sinensis Hemsl., belongs to the family Akaniaceae, and is distributed in South and East China to Taiwan and N. Vietnam (Lianli Lu & Boufford, 2005). Presently Akaniaceae is represented by two monotypic genera viz. *Bretschneidera* (Hemsley, 1891), and *Akania*

(J.D. Hooker, 1862). Earlier, both genera were described under the family Sapindaceae but subsequently, *Akania* was transferred to Staphyleaceae by Solereder (1892) and finally placed in a newly established family Akaniaceae by Stapf (1912). The taxonomic placement of the genus *Bretschneidera* has been debatable. Engler & Gilg (1919)

shifted the genus from Sapindaceae to Hippocastanaceae and later based on the presence of Myrosin cells in the bark, pedicels and petals, they (Engler & Gilg, 1924) placed it in a new distinct family Bretschneideraceae under newly established suborder Bretschneiderineae of Rhoeadales. Hutchinson (1926) did not recognize the family Bretschneideraceae and transferred the genus back to the family Sapindaceae. Based on wood anatomical and molecular studies (Gadek & al., 1992; Tobe & Raven, 1995; Carlquist, 1996; Rodman & al., 1996; Ronse & al., 2002) and on morphological evidences Doweld (1996), Rodman (1991) supported distinctness of family Bretschneideraceae and Akaniaceae from Sapindaceae. More recently, Akaniaceae has been treated to include both the genera *Akania* and *Bretschneidera* (APG 1998, 2009 & 2016, The Plant List, 2016, Christenhusz & Byng, 2016).

The family Akaniaceae is characterized by medium to large sized trees with fibrous bark. Leaves alternate, pinnate; leaflets sub-opposite, entire or serrate or toothed; stipules minute. Inflorescences with axillary panicle or terminal racemes, bracts minute or lacking. Flowers actinomorphic or zygomorphic, bisexual. Calyx 5-lobed, imbricate. Petals 5, longer than sepals, clawed or slightly constricted at base, lacinate or emarginate at apex. Stamens 8–10, distinct, inserted at or near base of receptacle cup, filaments pubescent at base, anthers dorsally to sub-basifixed, versatile. Ovary sessile, surrounded by cupular tube, syncarpous, 3-locular, pubescent, placentation axile, ovules 2 per locule, pendulous, bitegmic; style simple, slender, curved. Fruit capsular, loculicidal, pear-shaped, three-celled, leathery, pubescent; seeds broadly ellipsoid, embryo straight, cotyledons thick.

During a recent plant exploration tour to Namdapha National Park and Tiger Reserve (NNPTR), Changlang district of Arunachal Pradesh, an interesting tree species with brilliantly coloured, showy flowers was collected. On consultation of literature (Santisuk, 1989, Chauhan & al. 1996, Lu & al., 1986, Lianli Lu & Boufford, 2005) and critical study of herbarium specimens and images from multiple herbaria (ARUN, ASSAM, BM, BSD, CAL, E, GH, IBK, K and WU), the identity of the species has been confirmed as *Bretschneidera sinensis* Hemsl. The species is an IUCN Red Listed endangered species (Sun, 1998) and erstwhile reported from China, Vietnam, Taiwan and Thailand. The occurrence of this species constitutes a new record of the family Akaniaceae and genus *Bretschneidera* for flora of India and

further extends the distribution of *Bretschneidera sinensis* Hemsl. north westwards from its present range.

MATERIAL AND METHODS

The present work is based on examination of live plants in field and study of the specimens available in multiple herbaria. The flowers were dissected from fresh material and photographed by Sony DSC-HX60V digital camera. The locality map is created by using software Arc Map 10.5, basic version. Multiple specimens and specimen images from different herbaria were studied to note the variations if any.

Typification: Hemsley (1891) cited two collections viz. *A. Henry* 10540 and 11651 from Yunnan (China) while describing *Bretschneidera sinensis*, and also provided an illustration t. 2708 in the protologue. During the search in multiple herbaria [ARUN, A, ASSAM, CAL, BSD, DD, WU, K, GH, IBK], we traced nine collections from E, K and CAL and GH [*A. Henry* 10540 (E), (K000681001, K), 00050654 (GH, image!); *A. Henry* 11651 (K000681002, K), (K000681003 K), (CAL0000024326, CAL) and 00050653 (GH)] which can be considered as original material together with the illustration number t. 2708. After critical examination of the original material, we found that specimen K000681002, is complete in all respect and well agrees with the protologue and thus designated here as lectotype of *Bretschneidera sinensis* as per Art. 9.12 of ICN (McNeill & al. 2012.).

KEY TO THE GENERA

- 1a. Leaflets 7–30, serrate along margins; inflorescences axillary panicles; flowers actinomorphic, calyx 3–4 mm long *Akania*
- 1b. Leaflets 7–15, margin entire; inflorescences terminal racemes; flowers zygomorphic; calyx 15–25 mm long *Bretschneidera*

TAXONOMY

Bretschneidera sinensis Hemsl., Hooker's Icon. Pl. 28: t. 2708. 1891; S.Y. Lu & al. in Quart. J. Chin. Forest. 19: 115–119. 1986; Santisuk in Nat. Hist. Bull. Siam Soc. 37(2): 173–176. 1989; L. Lianli & Boufford in Fl. China 8: 197. 2005. (Fig. 1-6)

Type: China, Yunnan, Szemao, 5000ft., *A. Henry* 11651 (K000681002!, Lectotype designated here); isolecotypes (K000681003!, CAL0000024326!, 00050653 (GH- image!; E!))

Bretschneidera yunshanensis Chun & F.C. How in Acta Phytotax. Sinica 7(1): 68. Pl.10. 1958. Types: China, Hunan, Wukang, Yunshan, 7 October 1950, *H.T. Chang* 4650 (SYS); Hengshan, Fangkwang Tzu, 9 May 1955, *K.H. Chu* 99 [00029207 (PE-image!; IBK00191088-image!; IBK00191089-image!).

Trees 20–22 m tall; with clear bole up to 15 m, bark grey-brown. Leaves alternate, imperipinnate, 25–80 cm long, sparsely hairy in leaf axils or glabrous; petiole 10–25 cm long; petiolules 2–10 mm; stipules very early caducous; leaflets 7–15, elliptic, oblong-lanceolate or ovate-lanceolate, slightly oblique at base, 6–26 × 2.5–9.0 cm, papery in young stage, coriaceous at maturity, glabrous on both surface, sometimes hairy on midrib, lower surface glaucous, base rounded to cuneate, margin entire, acuminate to acute at apex; lateral veins 8–15 pairs. Inflorescence 20–40 cm long, terminal raceme. Flowers zygomorphic, 3–5 cm across, showy, rose white; pedicels slender, 2–4 cm long, reddish green. Calyx broadly tubular, 1.5–2.3 × 1.2–2.7 cm with 5 truncate lobes, pubescent on both surface, glaucous, rose white outside, with broad and prominent greenish band at regular intervals inside. Petals imbricate, broadly spatulate to obovate-cuneate, 1.8–2.0 × 1.5–2.0 cm, apex rounded and notched, base cuneate, adnate to inner side of calyx tube, with a long claw; upper petals hood like, slightly larger, covering stamens and style, pinkish white, inner surface rose pink with prominent red streaks. Stamens 8, free, 2.5–3.0 cm, long, terete, curved downwards along with gynoecium, close together in one group, hairy at base; anther dorsifixed. Ovary broadly ellipsoid to globular, 3–4 mm, sessile, trimerous, placentation axile, style 3–4 cm, bent abruptly downward apically, ovary and style hairy. Fruits ellipsoid-globose to subglobose to ovoid or obovoid, 3.5–4.5 cm long and 3.3–3.5 cm wide, obscurely 3-angled, 3-valved, valves leathery thick, surface warty, pubescent; fruit stalk 2.5–3.5 cm long; seeds ellipsoid-globose, compressed, 1.2–2.5 × 1.2–1.8 cm, smooth or sparsely hairy towards chalaza, yellowish orange-red. Pollens sub-oblate to oblate, tricolpate.

Flowering:-March-April.

Distribution:- India (Present Report), S China, Thailand (Santisuk, 1989); Vietnam (Lianli Lu & Boufford 2005); Taiwan (Lu & al., 1986)

Status:- The species is assessed as Endangered A1cd ver. 2.3 (Sun, 1998). During the present study, we could locate only two mature trees in NNPTR.

Habitat:- Found growing in Tropical rain forests at elevation of 450 m in association with *Dipterocarpus retusus* Blume, *Pterospermum acerifolium* (L.) Willd., *Ficus auriculatum* Lour, *Mesua ferrea* L., etc.

Specimens examined:- **India**, Arunachal Pradesh, Changlang District, Namdapha National Park, 26-04-2017, 500 m, *V.Kumar, S. Lahiri & S. Panday* 74239 (CAL!, ARUN!).

China, Hunan, 950–1100 m, *Handel Mazzetti* 12130 (E!, WU acc. no. WU044937-image!, WU044938-image!, WU044939-image!); Pana, Changseng, 23-10-1930, Y. Tsiang (E !) Yunnan, Mengtze, A. Henry 10540 (K000681001!, 00050654 (GH-image!, 00095084 (US-Image !). **Taiwan**, Yangming Shan National Park, N of Taipei City, SW-Central part of park along road from Chutzu-Hu (Bamboo Lake) to Tayiokeng Recreation Area, 430 m, 03-10-1989, *D.E. Boufford & al.* 25251 (L0102488, L0102489, Image !); Taipei, Yangmingshan National Park, 19-08-1987, *Robert F. Torne & al.* 62929 (PE 01121580- image!).

Chromosome no.: 2n = 18 (Tobe & Peng, 1990).

Etymology:- The genus was named in honour of Dr. Emil Bretschneider, an Esthonian botanist.

Note:- The seeds of *Bretschneidera sinensis* are of non-endospermic nature and show low germination rate. Probably, this is one of the reasons of the its sporadic distribution in Indo-china region. Exploitation in similar region in NE India and Myanmar may further extend and fill the gaps in the distribution of this species. The showy and attractive raceme inflorescence of the species has a great potential for ornamental purpose and appears to be suitable for avenue plantation. *Bretschneidera sinensis* was originally described from Yunnan (China), and subsequently also collected from N Taiwan and N Thailand. Later on, *B. yunshanensis* was described by Chun & How (1958) from Human and Hengshan in China and they differentiated it from *B. sinensis* on the basis of size of flowers, fruits and seeds; however, this was only a variation and merged with *B. sinensis* by Santisuk (1989). Botanical Survey of India is planning to propose a joint programme of propagation and conservation of this rare and interesting tree species on pilot project mode.



Fig. 1: Habit of *Bretschneidera sinensis* Hemsl.



Fig. 2: Inflorescence of *Bretschneidera sinensis* Hemsl. showing the arrangement of the flowers.

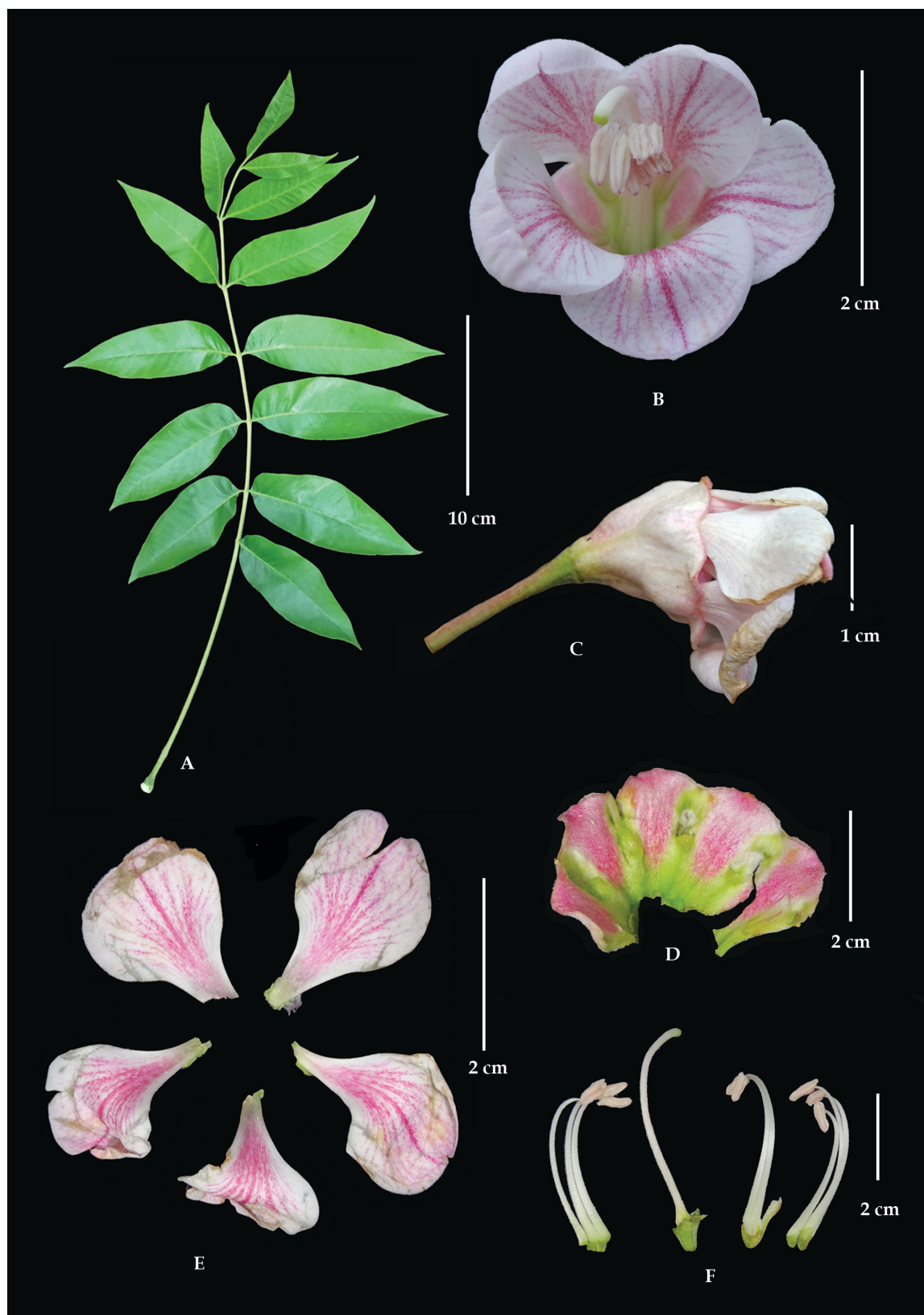


Fig. 3: *Bretschneidera sinensis* Hemsl. A. Leaf, B. Flower front view, C. Flower lateral view D. Calyx, opened out, adaxial view, E. Petals, F. Stamens and Pistil.



Fig. 4: Locality map of *Bretschneidera sinensis* in Arunachal Pradesh (Arc Map 10.5, basic version).

ACKNOWLEDGEMENTS

Authors are thankful to the Mountain Division MOEFCC, New Delhi for financial Assistance (File no. NMHS/2015-16/LG-05) under NMHS Scheme. Thanks are also due to the PCCF, Forest Department, Arunachal Pradesh and Project Director, Namdapha Tiger Reserve and National Park for permission and logistic support. one of us (PS) is thankful to the authorities at BM, E, and K for giving permission to consult collections during his recent visit. We are also thankful to Dr. Anthony R. Brach, Harvard University Herbaria, Harvard, for providing specimen images lodged at A; to Curators of K, WU, L, GH, PE, IBK for providing specimen images on website. We also acknowledge Royal Botanic Gardens, Kew for allowing to print the digital image of the lectotype designated here. We also thank Dr. Gopal Krishna and Dr. Abhishek Bhattacharjee of Central National Herbarium (CAL) for their help during identification.



Fig. 5: Distribution of *Bretschneidera sinensis* Hemsl. (in Red dots) in India, China, Vietnam, Thailand & Taiwan



Fig. 6: Lectotype image of *Bretschneidera sinensis*.

(© The Board of Trustees of the Royal Botanic Gardens, Kew. Reproduced with the consent of the Royal Botanic Gardens, Kew.)

REFERENCES

- APG 1998. An ordinal classification for the families of flowering plants. *Ann. Missouri Bot. Gard.* 85:531–553.
- APG 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. APG III. *Bot. J. Linn. Soc.* 161: 105–121.
- APG 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. APG IV. *Bot. J. Linn. Soc.* 181: 1–20.
- CARLQUIST, S. 1996. Wood anatomy of Akaniaceae and Bretschneideraceae: a case of near identity and its systematic implications. *Syst. Bot.* 21:607–616.
- CHAUHAN, A.S., K.P. SINGH AND D.K. SINGH 1996. in (ed. P.K.Hajra) *A contribution to the Flora of Namdapha Arunachal Pradesh.*, Botanical Survey of India, Kolkata. pp. 422.
- CHRISTENHUSZ, M.J.M. AND J.W. BYNG 2016. The number of known plants species in the world and its annual increase. *Phytotaxa* 261(3): 201–217.
- CHUN, W.Y. AND F.C. HOW 1958. Contributions to the Flora of South China (I). *Acta Phytotax. Sin.* 1958 7 (1): 1–90.
- DOWELD, A.B. 1996. The carpology and taxonomic relationships of *Bretschneidera* (Bretschneideraceae). *Acta Bot. Maladania* 21:79–90.
- ENGLER, A. AND E. GILG 1919. *Syllabus der Pflanzenfamilien*. Gebrüder Borntraeger, Berlin.
- ENGLER, A. AND E. GILG 1924. *Syllabus der Pflanzenfamilien*. 9th ed. Gebrüder Berlin: Borntraeger.
- GADEK, P.A., C.J. QUINN, J.E. RODMAN, K.G. KAROL, E. CONTI, R.A. PRICE, AND E.S. FERNANDO 1992. Affinities of the Australian endemic Akaniaceae: new evidence from rbcL sequences. *Austral. Syst. Bot.* 5: 717–724.
- HEMSLEY, W.B. 1891. *Bretschneidera sinensis*. In: Thiselton-Dyer WT, ed. *Hooker's Icones Plantarum*, 28(1): Pl.2708. London: Dulau & Cie.
- HOOKE, J.D. 1862. *Akania* In: Bentham, G. & Hooker, J.D. *Genera Plantarum*: ad exemplaria imprimis in Herbariis Kewensibus servata definita vol 1(1): 409. London: L Reeve & Co.
- HUTCHINSON, J. 1926. *Families of Flowering Plants-I. Dicotyledons*. Clarendon Press, Oxford.
- LIANLI, LU AND DAVID E. BOUFFORD 2005. *Bretschneidera sinensis* Hemsley In: Wu, Z.Y., Raven, PH. & Hong, D.Y. (Eds.) *Flora of China*. vol. 8. Science Press, Beijing in association with Missouri Botanical Garden, St. Louis, pp. 197.
- LU, S.Y., K.S. HSU AND F.H. FAN 1986. Bretschneideraceae, a new family record for the flora of Taiwan. *Quart. J. Chin. Forest.* 19: 115–119.
- MCNEILL, J., F.R. BARRIE, W.R. BUCK, V. DEMOULIN, W. GREUTER, D.L. HAWKSWORTH, P.S. HERENDEEN, S. KNAPP, K. MARHOLD, J. PRADO, W.F. PRUD'HOMME VAN REINE, G.F. SMITH, J.H. WIERSEMA, AND N.J. TURLAND 2012. International Code of Nomenclature for algae, fungi, and plants (Melbourne Code), Adopted by the Eighteenth International Botanical Congress Melbourne, Australia, July 2011.
- RODMAN, J.E. 1991. A taxonomic analysis of glucosinolate producing plants. Part 2. Cistidaceae. *Syst. Bot.* 16:619–629.
- RODMAN, J.E., K.G. KAROL, R.A. PRICE AND K.J. SYTSMA 1996. Molecules, morphology, and Dahlgren's expanded order Capparales. *Syst. Bot.* 21: 289–307.
- RONSE, DE CRAENE L.P. T.Y.A. YANG, P. SCHOLS AND E.F. SMETS 2002. Floral anatomy and systematics of *Bretschneidera* (Bretschneideraceae). *Bot. J. Linn. Soc.* 139: 29–45.
- SANTISUK, T. 1989. The monotypic family Bretschneideraceae newly recorded for Thailand. *Nat. Hist. Bull. Siam Soc.* 37: 173–176.
- SOLEREDER, H. 1892. Über die Staphyleaceengattung *Tapiscia* Oliv. *Ber. Dtsch. Bot. Ges.* 10: 545–551.
- STAPE, O. 1912. Akaniaceae: A new family of Sapindales. *Bull. Misc. Inform.* 1912: 378–380.
- SUN, W. 1998. *Bretschneidera sinensis*. The IUCN Red List of Threatened Species 1998: e.T32324A9697750. <http://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T32324A9697750.en>. (accessed May 25, 2017).
- THE PLANT LIST 2016. Version 1.1. Published on the Internet; <http://www.theplantlist.org/> (accessed May 25, 2017).
- TOBE, H. AND C.I. PENG 1990. The embryology and taxonomic relationships of *Bretschneidera* (Bretschneideraceae). *Bot. J. Linn. Soc.* 103: 139–152.
- TOBE, H. AND P.H. RAVEN 1995. Embryology and relationships of *Akania* (Akaniaceae). *Bot. J. Linn. Soc.* 118:261–274.