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Article

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Taxonomic notes on the genus *Hedyotis* sensu lato (Rubiaceae) in China

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Abstract

The genus *Hedyotis* sensu lato was splitted into several genera on basis of morphological and molecular evidences. Under this generic delimitation, seven new taxonomic treatments, including six new synonyms and one new combination, are proposed for the *Flora of China*. The name *Hedyotis tenelliflora* that misapplied to *Scleromitrion angustifolium* is also corrected with morphological comparison.

Keywords: *Dimetia*, new combination, new synonym

Introduction

Hedyotis Linnaeus (1753: 101) sensu lato includes more than 550 species worldwide and is one of the large genera of the family Rubiaceae. Although several molecular phylogenetic analysis provided much valuable information and robust support for the subdivision of this large genus in recent years (Terrell & Robinson 2003, Guo *et al.* 2011, Guo *et al.* 2013, Wikström *et al.* 2013, Wang *et al*. 2014), the taxonomic nomenclature is historically intricate and still a big obstacle for better understanding the species diversity of this complex, mainly because of not only the thousands of validly, invalidly, legitimately, illegitimately published names, but also its worldwide distribution. The present taxonomy of *Hedyotis* is therefore still regional and needs to be improved based on the comprehensive examination of the herbarium specimens and field population observation, as well as the molecular phylogenetic analysis.

The following treatments to the Chinese *Hedyotis* species are mainly based on my extensive examination of the herbarium materials, detailed observations on the field populations, and comprehensive analysis of molecular data. The related articles of *ICN* (Turland *et al.* 2018) were followed for nomenclature changes.

1. *Scleromitrion angustifolium* (Chamisso & Schlechtendal) Bentham (1852: 172).—*Hedyotis angustifolia* Chamisso & Schlechtendal (1829: 153); *Oldenlandia angustifolia* (Chamisso & Schlechtendal) Bentham (1861: 151), nom. illeg. [later homonym of *Oldenlandia angustifolia* (Michaux 1803: 85) A. Gray (1853: 68). Type:—PHILIPPINES. Luzon, *Chamisso s.n.*, LE, *n.v.*).

The species *Scleromitrion angustifolium* is very common in South China, but it has long been misidentified as *Hedyotis tenelliflora* Blume (1826: 971) in many floras, such as Ko (1974: 300, 1999: 41), Chao (1978: 278), Liu & Yang (1998: 271), Chen (2003: 36), Ko *et al*. (2005: 121), Chen & Taylor (2011: 170), and Chen (2012: 476). *Scleromitrion angustifolium* is morphologically different from *Hedyotis tenelliflora* in linear-lanceolate, 3–9 mm width (vs lanceolate leaves in 1–1.7 cm width in *H. tenelliflora*) leaves, 1–4 (vs 7–9 in *H. tenelliflora*)-bristled stipule, loculicidally dehiscent (vs septicidally from base to apex and then loculicidally in *H. tenelliflora*) capsules (Fig. 1). Geographically, *H. tenelliflora* is endemic to Indonesia, especially Java Islands, according to the available collections.

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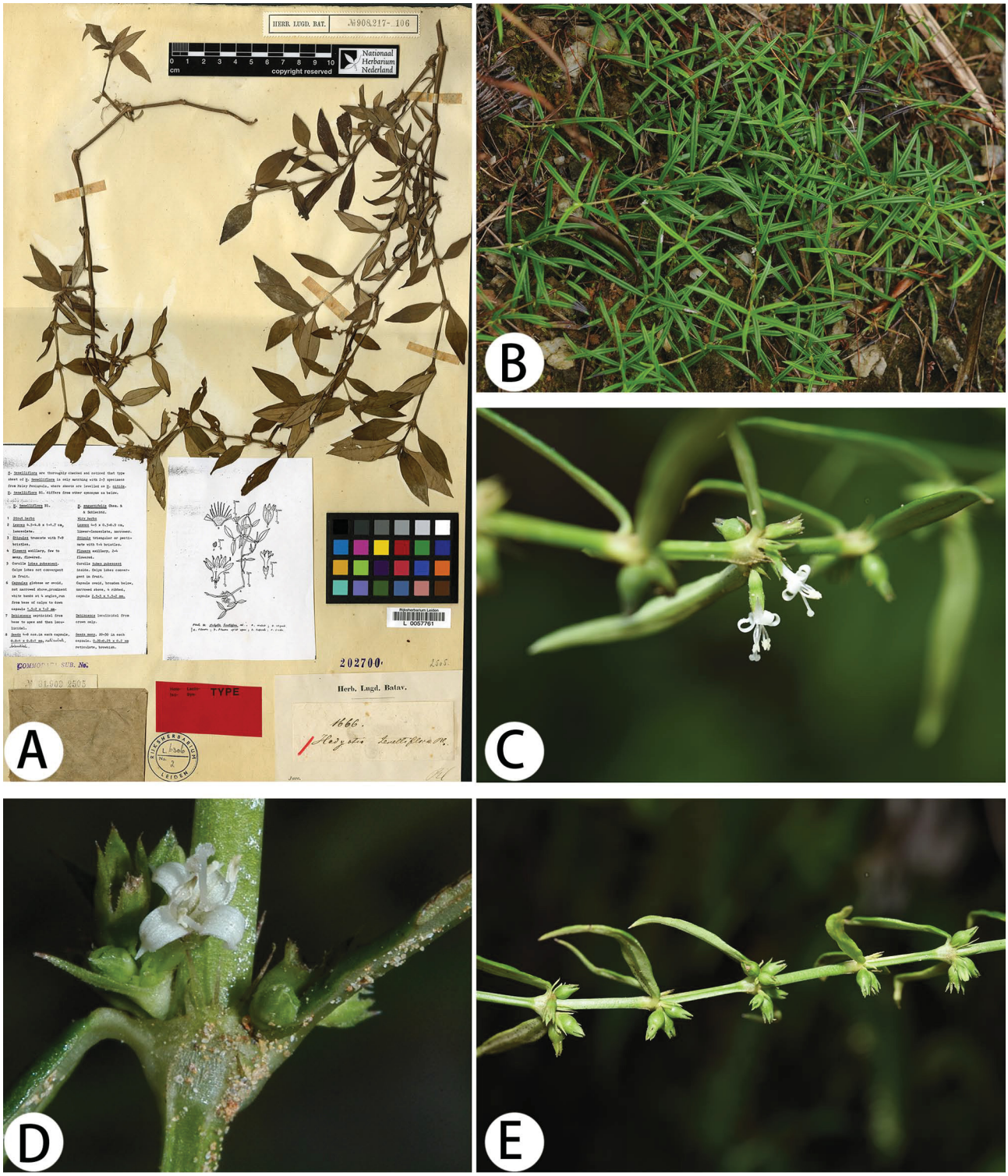

FIGURE 1. Morphological comparison between *Hedyotis tenelliflora* (A) and *Scleromitrion angustifolium* (B-E). **A.** Type of *Hedyotis tenelliflora* (L0057761), **B-E**. Habit, inflorescence, stipule, and capsules of *Scleromitrion angustifolium*, respectively. Colorful images photographed by the author.

2. *Dimetia auricularia* (L.) R.J. Wang, ***comb. nov.—****Hedyotis auricularia* Linnaeus (1753: 101). *Exallage auricularia* (L.) Bremekamp (1952: 142); *Metabolos auricularius* (L.) Blume ex Bremekamp (1939: 439); *Oldenlandia auricularia* (L.) Schumann (1891: 25). Type:—SRI LANKA (holotype: LINN 123.2 [photo]!).

Hedyotis lianshanensis Ko (1995: 41). Type:—CHINA. Guangdong, Lianshan County. 23 May 1958, *P.C. Tam 58017* (holotype: IBK00191483!; isotypes: IFP, KUN331245!, PE00737198!). ***syn. nov.***

Hedyotis auricularia Linnaeus (1753: 101) was designated as the generic type by Chamisso & Schlechtendal (1829: 153) because it was listed at the first by Linnaeus (1753: 101). After a century, it was also recommended to be the generic standard-species by Hitchcock & Green (1929). But because the character of its indehiscent capsule was unfit for the "dehiscent capsules" in the generic protologue, as noted by Blume (1826: 990), Bremekamp (1939: 438, 1952: 29, 141) proposed to choose *H. fruticosa* Linnaeus (1753: 101) as the generic type. This proposal was later formally approved by the Subcommittee 3C (Javis 1992) and supported by Terrell & Robinson (2003). In addition, considering that it was a mistake to regard *Hedyotis auricularia* Linnaeus as the generic type, Bremekamp (1952: 140) established the new genus *Exallage* and designated *E. auricularia* (Linnaeus) Bremekamp (1952: 142) as the generic type after making a new taxonomic combination based on *Hedyotis auricularia* Linnaeus. Molecular analysis revealed that *Exallage* should be synonymized with *Dimetia* (Wight & Arnott 1834: 406) Meisner (1839: 160) because of their close relationship and synapomorphic characters, such as spinous stipules, axillary or terminal inflorescences, septicidally dehiscent or indehiscent capsules (Guo *et al.* 2013). *Exallage* therefore should be merged into *Dimetia*, resulting in the new combination of *Hedyotis auricularia* Linnaeus.

Hedyotis lianshanensis W.C. Ko (1995: 41) has small and lacerate or bristle stipules in comparison with *H. platystipula* Merrill (1922: 510) while being published (Ko 1995), but it is much similar to *Dimetia auricularia* in terms of leaf, stipule and inflorescence morphology. *Hedyotis lianshanensis* was also accepted as a "good" species by Ko (1999) herself and then by Ko *et al.* (2005: 121) and Chen & Taylor (2011: 163). Field specimen collection and morphological observation to different populations at the type locality of *H. lianshanensis* shows that the stipules usually enlarge a little at the initial developmental stage of inflorescences. This morphological variation falls into the regular range in *Dimetia auricularia* populations.

3. *Hedyotis baotingensis* Ko (1995: 43). Type:—CHINA. Hainan, Baoting County, 11 October 1936, *S. K. Lau 27972* (holotype: IBSC0017462!; isotypes: HUH-A00251057 [photo]!, KUN [No. 0777365]!). Fig. 2.

Hedyotis dinganensis Wang *et al*. (2019: 44). Type:—CHINA. Hainan, Dingan County, 21 April 2018, *Wang Qinglong 787641* (holotype: IBSC0831115!). ***syn. nov.***

Wang *et al*. (2019) selected *Hedyotis yazhouensis* F. W. Xing & R. J. Wang (Wang & Xing 2003: 87) and *H. paridifolia* Dunn (1912: 366), two morphologically much different species, rather than the conspecific one, *H. baotingensis*, for comparison in the diagnosis while publishing *H. dinganensis*. *Hedyotis baotingensis* usually grows into a separately rosulate herb when young (Fig. 2, A & C), but it may have a long prostrate stem from mother body to its derived elements with aging (Fig. 2, B & D). *Hedyotis baotingensis* is similar to *H. yazhouensis* in appearance of their rosulate figure and capitate inflorescence, but differs obviously in the leaf venation, stipule and flower morphology.

4. *Hedyotis loganioides* Bentham (1861: 149).—*Oldenlandia loganioides* (Bentham) Kuntze (1891: 292). Type:—CHINA. Hong Kong, Hong Kong Island, on the top of Mount Gough, *C. Wilford, s.n.* (holotype: K000760550 [photo]!).

Hedyotis bodinieri Léveillé (1912: 64).—*Oldenlandia bodinieri* (Léveillé) Chun (1934: 310). Type:—CHINA. Hong Kong, New Territory, Summit of Taimoshan, 7 May 1895, *E. M. Bodinier 1158* (holotype: E00220484 [photo]!; isotype: HUH-A00233522 [photo]!). ***syn. nov.***

The type specimens of *H. loganioides* Bentham (1861: 149) and *H. bodinieris* Léveillé (1912: 64) were both collected from Hong Kong. Léveillé (1912) didn't compare with the sympatric conspecific species, *H. loganioides*, while describing his new species. The difference between the two species only limits to the density of pubescence at the young shoots and peduncles, according to the original description, that is, glabrous in *H. loganioides* and puberulent in *H. bodinieris*. Field observation on the different populations at all known localities showed that this feature varies a little with the changing of habitats. The young shoots are slight hairy when the habitats are opened and sunny but glabrous when shady and humid. All stems and shoots become glabrous with aging. The species grows uncommonly in the mountainous slope, near summit or under the forest, of the Pearl River Delta district of Guangdong province, China.

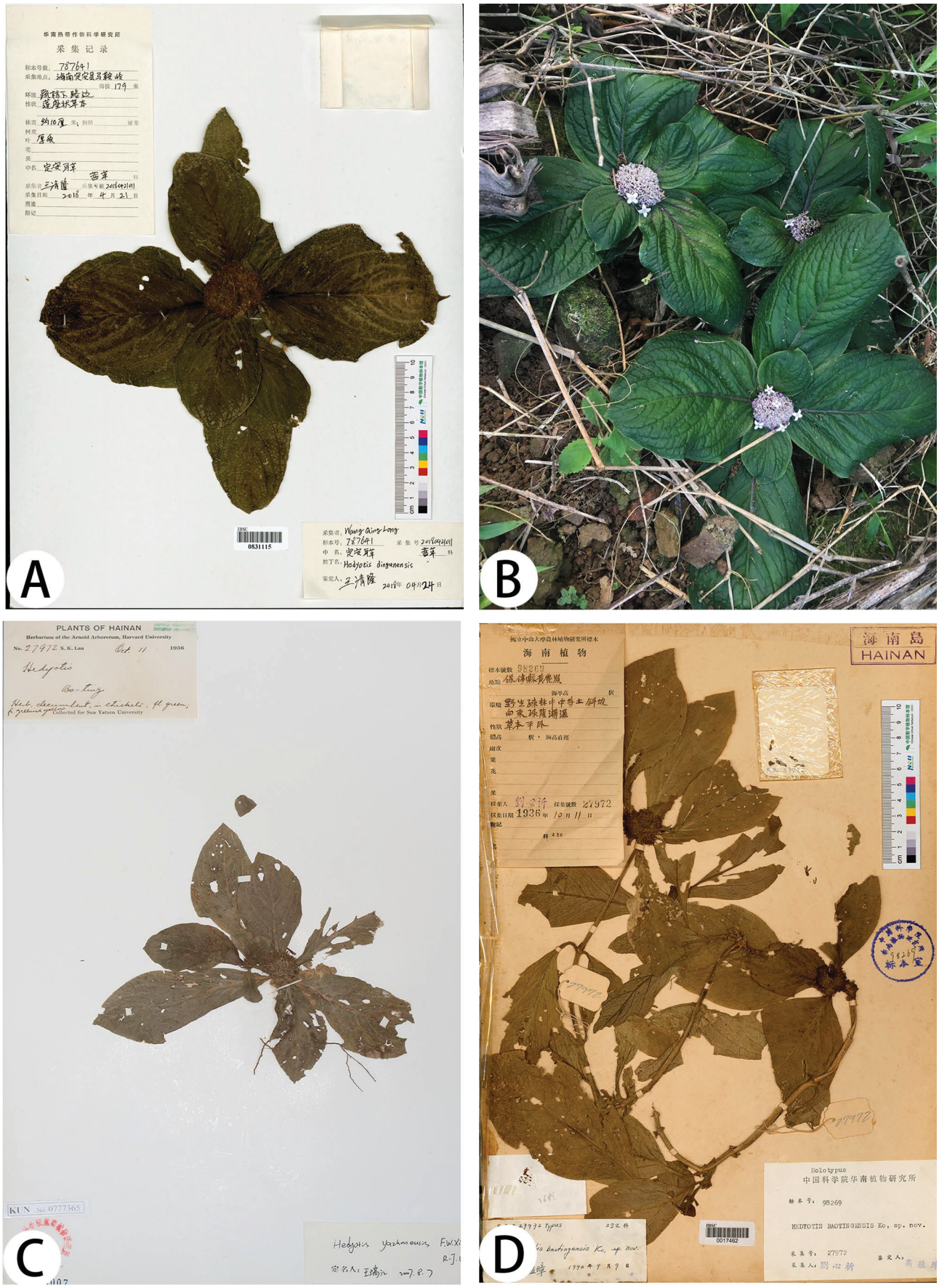

FIGURE 2. *Hedyotis dinganensis* and *H. baotingensis*. A-B. Holotype (IBSC0831115) and habit of *Hedyotis dinganensis* (photographed by Mr. Lang-Xing Yuan), respectively, C-D. Isotype (KUN, No. 0777365) and holotype (IBSC0017462) of *Hedyotis baotingensis*, respectively.



FIGURE 3. The variation pattern of indument and flowers in different populations of *Hedyotis matthewii* in South China. Photographed by the author.

5. *Hedyotis matthewii* Dunn (1909: 376).—*Oldenlandia mathewii* (Dunn) Chun (1934: 312). Type:—CHINA. Guangdong Province, Lianzhou River, December 1907, *C. G. Matthew, Hongk. Herb. No. 5042* (holotype: HK13684!, isotypes: IBSC0021613!, K000174523[photo]!). Fig. 3.

Hedyotis assimilis Tutcher (1915: 32).—*Oldenlandia assimilis* (Tutcher) Chun (1934: 310). Type:—CHINA. Guangdong Province, North River, Kou Wang Shek, 12 April 1914, *W. J. Tutcher, Hongk. Herb. No. 10883A*. (lectotype: HK13622!, isolectotype: K000760561 [photo]!, designated by Institute of Botany, Chinese Academy of Sciences (1959: 1615)). ***syn. nov.***

Hedyotis mellii Tutcher (1915: 32).—*Oldenlandia mellii* (Tutcher) Chun (1934: 313). Type:—CHINA. Guangdong Province, Fungman, 12 April 1914, *R. Mell, Hongk. Herb. No. 10942*. (holotype: HK13687!; isotype: IBSC0285854!). ***syn. nov.***

These species are very common in South China, especially in Guangdong Province, China. The morphological differences to delimit them include the stipule shape (entire, glandular-serrate or -serrulate, lobbed, or setose), inflorescence morphology (e.g., flower number, pedicel length), ratio of corolla lobes to tube, indument of calyxes, corolla, filaments and styles (glabrous vs hairy). Field observation on the abundant populations growing from the north to central Guangdong and adjacent provinces revealed that the stipule and leaf shape, pedicel length, the hair density covering the stems, leaves and inflorescences, inflorescence structure, and the length of corolla lobes and tube vary continuously and have no much distinct morphological difference. The plants growing in north Guangdong are usually dense hairy probably because of the high altitude and latitude and low temperature of the habitats. For the populations in central Guangdong, they often have sparse hairs or are glabrous probably due to the low altitude and latitude and high temperature. Molecular phylogenetic analysis sampling from its distribution region also indicated that these species always cluster in the same clade (Guo *et al.* 2011, Guo *et al.* 2013). These available evidence indicate that these three species are actually conspecific.

6. *Hedyotis shenzhenensis* Chen (2007: 331). Type:—CHINA. Guangdong, Shenzhen, Longgang, Paiyashan Mountain, 16 May 2007, *Tao Chen 8043* (holotype: SZG0029990!; isotypes: HUH-A00291304 [photo]!, SZG0029991!, SZG0029992!, SZG0029993!, SZG0029994!).

Hedyotis shiuyingiae Chen (2008: 283). Type:—CHINA. Hong Kong, Tai Po, 12 July 2007, *Tao Chen, Y. W. Lam & K. Y. Lam 2007004* (holotype: HK, *n.v.*; isotypes: E00268786 [photo]!; HUH-A00291305 [photo]!). ***syn. nov.***

According to the original description, *H. shiuyingiae* Chen (2008: 283) differs from *H. shenzhenensis* Chen (2007: 331) by its conspicuous internodes, not rosette leaves, subtetragonous inflorescence axis and branches, narrowly infundibuliform corolla and stamen position in the flower (Chen 2008, 2012). My field observation and examination on the populations in the type localities of both species showed that the internode length varies from very short when growing in dry and open habitats to long in humid and shady places. The stamen position in long- and short-styled flowers is not so clearly distinguished because of the very small size of the flowers. The previous molecular analyses also indicated that the two species had very close relationship all the time (Guo *et al.* 2011, Wang *et al.* 2015, Wang *et al.* 2018). In addition, the type localities of the two species are not so far away from each other. They are therefore recognized as conspecific.

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References

Bentham, G. (1852) Florula Hongkongensis. *Hooker's Journal of Botany and Kew Garden Miscellany* 4: 155–172.

Bentham, G. (1861) Rubiaceae. *Flora Hongkongensis: A description of the Flowering Plants and Ferns of the island of Hongkong.* L. Reeve, London, pp. 144–164.
https://doi.org/10.5962/bhl.title.21052

Blume, C.L. (1826) Rubiaceae. *Bijdragen tot de Flora van Nederlandsch Indië* 16: 943–1018.
https://doi.org/10.5962/bhl.title.395

Bremekamp, C.E.B. (1939) Pleiocraterium genus novum Rubiacearum Hedyotidearum. *Recueil des Travaux Botaniques Néerlandais* 36: 438–445.

Bremekamp, C.E.B. (1952) The African species of *Oldenlandia* L. sensu Hiern et K. Schumann. *Verhandelingen der Koninklijke Nederlandse Akademie van Wetenschappen, Afd. Natuurkunde* 48 (2): 1–297.

Chamisso, A. & Schlechtendal, D. (1829) De plantis in expeditione speculatoria Romanzoffiana observatis. Rubiaceae. *Linnaea* 4: 129–202.

Chao, J.M. (1978) *Hedyotis* L. *In*: Li, H.L., Liu, T.S., Huang, Z.C., Koyama, T. & Devol, E.C. (Eds.) *Flora of Taiwan*, vol. 4. Epoch Publishing Co., Ltd., Taipei, pp. 271–281.

Chen, T. (2007) A new species in the genus *Hedyotis* (Rubiaceae) from South China. *Edinburgh Journal of Botany* 64 (3): 331–334.
https://doi.org/10.1017/S0960428607004805

Chen, T. (2008) Notes on the identity of *Hedyotis yangchunensis* (Rubiaceae) in Hong Kong. *Harvard Papers in Botany* 13 (2): 283–288.
https://doi.org/10.3100/1043-4534-13.2.283

Chen, T. (2012) *Hedyotis* L. *In*: Li, P.Q. (Ed.) *Flora of Shenzhen*, vol.3. China Forestry Publishing House, Beijing, pp. 468–480.

Chen, T. & Taylor, C.M. (2011) *Hedyotis* L. *In*: Wu, Z.Y., Raven, P.H. & Hong, D.Y. (Eds.) *Flora of China*, vol. 19. Science Press, Beijing & Missouri Botanical Garden Press, St. Louis, pp. 147–174.

Chen, W.Q. *Hedyotis* L. (2003) *In*: Wu, Z.Y. (Ed.) *Flora Yunnanica*, vol. 15. Science Press, Beijing, pp. 30–46.

Chun, W.Y. (1934) Contributions to the flora of Kwangtung and South-Eastern China. *Sunyatsenia* 1 (4): 209–313

Craib, W.G. (1932) *Florae Siamensis Enumeratio: a list of the plants known from Siam, with records of their occurrence*, vol. 2. The Bangkok Times Press, Bangkok, pp. 36–52.

Dunn, S.T. (1909) New Chinese Plants. *Journal of Botany, British and Foreign* 47 (10): 375–377.

Dunn, S.T. (1912) A Contribution to the Flora of Hainan (China). *Bulletin of Miscellaneous Information* 1912 (8): 366–368.
https://doi.org/10.2307/4111793

Gray, A. (1853) Plantae Wrightianae, Texano-Neo-Mexicanae. Part II. *Smithsonian Contribution to Knowledge* 5 (6): 1–119.

Guo, X., Simmons, M.P., But, P.P.H., Shaw, P.C. & Wang, R.J. (2011) Application of DNA barcodes in *Hedyotis* L. (Spermacoceae, Rubiaceae). *Journal of Systematics and Evolution* 49 (3): 203–212.
https://doi.org/10.1111/j.1759-6831.2011.00130.x

Guo, X., Wang, R.J., Simmons, M.P., But, P.P.H. & Yu, J. (2013) Phylogeny of the Asian *Hedyotis-Oldenlandia* complex (Spermacoceae, Rubiaceae): evidence for high levels of polyphyly and the parallel evolution of diplophragmous capsules. *Molecular Phylogenetics and Evolution* 67 (1): 110–122.
https://doi.org/10.1016/j.ympev.2013.01.006

Hitchcock, A.S. & Green, M.L. (1929) Standard species of Linnean genera of Phanerogamae (1753-54). *In*: International Botanical Congress Cambridge (England) (Ed.) *Nomenclature proposals by British botanists*. His Majesty's Stationary Office, London, pp. 111–195.

Institute of Botany, Chinese Academy of Sciences (1959) *Zhongguo Zhiwu Zhaopian Ji*, vol. 2. Science Press, Beijing, p. 1615.

Jarvis, C.E. (1992) Seventy-two proposals for the conservation of types of selected Linnaean generic names, the report of Subcommittee 3C on the lectotypification of Linnaean generic names. *Taxon* 41: 564.
https://doi.org/10.2307/1222833

Ko, W.C. (1974) *Hedyotis* L. *In*: Guangdong Insititute of Botanical (Ed.) *Flora Hainanica*, vol. 3. Science Press, Beijing, pp. 296–308.

Ko, W.C. (1995) Materials for Chinensis Rubiaceae. *Journal of South China Agriculture University* 16 (4): 41–46.

Ko, W.C. (1999) *Hedyotis* L. *In*: Lo, H.S. (Ed.) *Flora Republicae Popularis Sinicae*, vol. 77 (1). Science Press, Beijing, pp. 32–77.

Ko, W.C., Chen, W.C. & Ruan, Y.Z. (2005) *Hedyotis* L. *In*: Wu, T.L. (Ed.) *Flora of Guangdong*, vol. 6. Guangdong Science and Technology Press, Guangzhou, pp. 108–248.

Kuntze, O. (1891) Rubiaceae. *Revisio Generum Plantarum*, vol. 1. A. Felix, Leipzig, pp. 276–302.

Léveillé, H. (1912). XII. Decades plantarum novarum. XC-XCII. *Repertorium Specierum Novarum* 11 (274–278): 64.

https://doi.org/10.1002/fedr.19120110405
Linnaeus, C. (1753) *Species Plantarum.* vol. 1. Imprensis Laurentii Salvii, Holmiae, 560 pp.
Liu, H.Y. & Yang, T.Y.A. (1998) *Hedyotis* L. *In*: Huang, T.C. (Ed.) *Flora of Taiwan* (ed.2), vol. 4. Editorial Committee of the Flora of Taiwan,Taipei, pp. 265–273.
Meisne, C.D.F. (1839) *Plantraum vascularium genera*. Libraria Weidmannia, Lipsiae. 402pp.
https://doi.org/10.5962/bhl.title.44043
Merrill, E.D. (1922) The Flora of Southeastern China. *Philippine Journal of Science* 21 (5): 510–511.
Michaux, A. (1803) *Houstonia* L. *Flora Boreali-Americana*, vol. 1. Apud fratres Levrault, Parisiis et Argentorati, pp. 84–86.
Schumann, K. (1891) Rubiaceae. *In*: Engler, A. & Prantl, K. (Eds.) *Die naturlichen Pflanzenfamilien*, vol. 4 (4). Verlag von Wilhelm Engelmann, Leipzig, pp. 1–156.
Terrell, E.E. & Robinson, H. (2003) Survey of Asian and pacific species of *Hedyotis* and *Exallage* (Rubiaceae) with nomenclatural notes on *Hedyotis* types. *Taxon* 52: 775–782.
https://doi.org/10.2307/3647351
Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W-H., Li, D.Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F. (2018) *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China*, July 2017. Regnum Vegetabile 159. Koeltz Botanical Books,Glashütten.
https://doi.org/10.12705/Code.2018
Tutcher, W.J. (1915) *Report of the Botany Department, Hong Kong* 1914: 32.
Wang, G.T., Zhang, Y., Liang, D., Chen, Y.Q. & Wang, R.J. (2018) *Hedyotis taishanensis* (Rubiaceae): A new species from Guangdong, China. *Phytotaxa* 367 (1): 38–44.
https://doi.org/10.11646/phytotaxa.367.1.4
Wang, Q.L., Yuan, L.X., Tang, H., Wang, Z.N., Wang, M.Y. & Yang, Q. (2019) *Hedyotis dinganensis*, a new species of Rubiaceae from Hainan, China. *Phytotaxa* 399 (1): 44–48.
https://doi.org/10.11646/phytotaxa.399.1.5
Wang, R.J., Deng, S.J. & Huang, X.X. (2015) *Hedyotis nanlingensis* (Rubiaceae), a new species from South China. *Phytotaxa* 206(1): 37–42.
https://doi.org/10.11646/phytotaxa.206.1.6
Wang, R.J., Deng, S.J. & Liao, Q. (2014) Nomenclature clarification of the traditional Chinese medicine Baihuasheshecao and its adulterants based on molecular and morphological evidence. *Journal of Tropical and Subtropical Botany* 22 (5): 431–442.
https://doi.org/10.3969/j.issn.1005-3395.2014.05.001
Wang, R.J. & Xing, F.W. (2003) Two new species of the genus *Hedyotis* (Rubiaceae) from China. *Acta Phytotaxonomica Sinica* 41:85–88.
Wight, R. & Arnott, G.A.W. (1834) Subtribe II. Hedyoteae DC. *Prodromus Florae Peninsulae Indiae Orientalis Parbury*, vol. 1. Allen & Co., London, pp. 405–418.
Wikström, N., Neupane, S., Kårehed, J., Motley, T.J. & Bremer, B. (2013) Phylogeny of *Hedyotis* L. (Rubiaceae: Spermacoceae): redefining a complex Asian-Pacific assemblage. *Taxon* 62 (2): 357–374.
https://doi.org/10.12705/622.2