White-flowered Cat' s-ear and Yellow-fruited Nightshade —Two Newly Naturalized Plant Species in Mainland China (Postprint)

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Date: 2018-12-19T00:00:00+00:00

Abstract

This paper reports two newly discovered naturalized plant species in mainland China: the Asteraceae species 白花猫儿菊}Hypochaeris albiflora (Kuntze)Azevedo-Gonr}.& Matzenb] and the Solanaceae species 黄果龙葵 [(Solanum diphyllum Linn.)]. 白花猫儿菊 is native to South America and was found naturalized in Panlong District, Kunming City, Yunnan Province; it differs from congeneric species by having basal leaves that are entire or sharply toothed, sometimes pinnately lobed to deeply divided, stem leaves that are linear, capitula that are cylindrical or narrowly campanulate, florets that are white, and achenes that are 4-ribbed. 黄果龙葵 is native to Mexico and Central America and was found naturalized in Mengla County, Yunnan Province; its main diagnostic characteristics include being a perennial evergreen shrublet, having upper leaves that are often paired and significantly unequal in size, and producing mature berries that are bright yellow. Additionally, this paper briefly evaluates the potential harm and invasion risk posed by these two naturalized plant species.

Full Text

Preamble

DOI: 10.11931/guihaia.gxzw201809012
Title: *Hypochaeris albiflora* and *Solanum diphyllum*—Two Newly Naturalized Plants in Mainland China
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Abstract: This paper reports two newly naturalized plant species discovered in mainland China: *Hypochaeris albiflora* (Kuntze) Azevêdo-Gonç. & Matzenb

(Asteraceae) and *Solanum diphyllum* Linn. (Solanaceae). *Hypochaeris albiflora*, native to South America, was found naturalized in Panlong District, Kunming, Yunnan Province. It differs from congeneric species by having basal leaves that are entire or dentate, sometimes pinnately lobed to deeply lobed, cauline leaves that are linear, capitula that are cylindrical or narrowly campanulate, florets that are white, and achenes with four ribs. *Solanum diphyllum*, native to Mexico and Central America, was discovered naturalized in Mengla County, Yunnan Province. Its key diagnostic features include being a perennial evergreen shrub, with upper leaves commonly paired and markedly unequal in size, and mature berries that are bright yellow. Additionally, this paper briefly assesses the potential harm and invasive risks posed by these two naturalized species.

Keywords: mainland China, newly naturalized, *Hypochaeris albiflora*, *Solanum diphyllum*
Chinese Classification Code: Q949.752.1
Document Code: A

Introduction

Naturalization refers to the process by which a species expands from its native range into a new region, where it can reproduce, disperse, and maintain self-sustaining populations under wild conditions (Richardson et al, 2000). This represents a critical stage in biological invasion. Some naturalized plants possess strong reproductive capacity and adaptability, leading to rapid population growth and continuous expansion that negatively impacts native biodiversity and agricultural and forestry economies, ultimately developing into invasive plants. Therefore, strengthening monitoring and research on naturalized plants is of great significance. China has a vast territory with complex topography, diverse climate types, and varied ecological environments, providing suitable habitats for the naturalization and invasion of numerous alien plants, making it one of the countries most severely affected by alien plants. While the exact number of naturalized plants in China has not been precisely documented, the *Checklist of Chinese Invasive Plants* alone records as many as 806 invasive species (Ma, 2013).

During recent plant resource surveys in Yunnan Province, we discovered two alien naturalized plant species previously unrecorded in mainland China: *Hypochaeris albiflora* (Kuntze) Azevêdo-Gonç. & Matzenb (Asteraceae) and *Solanum diphyllum* Linn. (Solanaceae). These findings are reported as follows.

1. *Hypochaeris albiflora* [FIGURE:1:A,B,C]

Hypochaeris albiflora (Kuntze) Azevêdo-Gonç. & Matzenb in Compositae Newslett. 42: 3. 2005. −*H. brasiliensis* (Less.) Benth. & Hook. f. ex Griseb. var. *albiflora* Kuntze in Revis. Gen. Pl. 3(3): 159. 1898. −*H. microcephala*

(Sch.Bip.) Cabrera var. *albiflora* (Kuntze) Cabrera in Notas Mus. La Plata, Bot. 2 (16): 200-201.

Description: Perennial herb, 20–60 cm tall, with white latex throughout. Taproot cylindrical, with few lateral roots and fibrous fine roots. Stem erect, branched or unbranched, glabrous or sparsely spreading villous. Basal leaves in a rosette, subsessile; leaf blade lanceolate, narrowly oblanceolate, elliptic-lanceolate, or narrowly elliptic, 4–10 cm × 1–5 cm, both surfaces glabrous or sparsely pubescent, base narrow, apex acuminate to long acuminate, margin entire or dentate, sometimes pinnately shallowly to deeply lobed, with or without ciliate margins; cauline leaves fewer and smaller than basal leaves, linear-lanceolate, entire or dentate, occasionally pinnately lobed. Capitula solitary or arranged in corymbose synflorescences at stem and branch apices, peduncle ca. 2–4 cm; capitula cylindrical to narrowly campanulate, 8–12 mm × 3–4 mm; involucre 2-seriate, outer phyllaries lanceolate, 3–7 mm, glabrous or arachnoid tomentose, inner phyllaries linear-lanceolate, 7–12 mm, apex obtuse, margin membranous. Capitula with 40–60 ligulate florets, white, slightly shorter than phyllaries at anthesis, ligule apex obtuse, 5-dentate. Phyllaries spreading or reflexed in fruit; achene fusiform, brown, ca. 4 mm, 4-ribbed, apex attenuate into a beak, beak 4–5 mm; pappus white, 7–8 mm, plumose. Flowering April–July, fruiting June–October.

Specimen examined: China, Yunnan: Kunming, Panlong District, near Feicuiwan residential area along Panlong River, growing on roadside, elevation 1,880 m, 102°42’ 57.56” E, 25°04’ 13.84” N, 10 May 2017, Huanchong Wang et al., KM1913 (YUKU); same locality, 10 August 2018, Huanchong Wang et al., KM3169 (YUKU).

Geographic distribution: *Hypochaeris albiflora* is native to South America and has become naturalized in Australia, southern Africa, and in the U.S. states of Texas, Louisiana, and Oklahoma, where it has become an invasive weed (Pruski, 2011). The species was recorded in Taiwan in 2009 (Jung et al, 2009); this survey represents its first record in mainland China, discovered in Kunming, Yunnan Province.

Discovery and naturalization status: In April 2016, the corresponding author encountered an Asteraceae species with lanceolate leaves at the aforementioned location during an alien plant survey. Lacking reproductive structures, it was initially misidentified as the invasive plant *Aster subulatus* Michx. In May 2017, a follow-up survey coincided with the species’ flowering and fruiting period, revealing clear differences from *A. subulatus* and indicating an unfamiliar taxon. After careful verification, it was confirmed as the newly naturalized *H. albiflora* in mainland China. To determine whether this represented a casual occurrence, a third survey was conducted in August 2018, which found the species flowering and fruiting normally in Kunming and producing numerous seedlings. Further investigation revealed that despite regular urban sanitation and cleaning activities that disturb the naturalized population, both individual numbers and distribution area have steadily increased since 2016, demonstrating that the

species has become fully naturalized in Kunming.

Taxonomic notes: The genus *Hypochaeris* L. (Asteraceae) comprises approximately 50–100 species distributed primarily in the Mediterranean region and South America (Tomb et al, 1978). China records six species, of which *H. maculata* and *H. ciliata* are native, while the remaining four are alien naturalized species (Peng et al, 1998; Jung et al, 2010; Shi et al, 2011). *Hypochaeris albiflora* was first described as a variety of *H. brasiliensis* (Less.) Benth. & Hook. f. ex Griseb. (now a synonym of *H. chillensis* (Kunthze) Britton) by German botanist Kuntze in 1898 (Kuntze, 1898). Argentine botanist Cabrera later recombined it as a variety of *H. microcephala* (Sch.Bip.) Cabrera in 1937 (Cabrera, 1937). Azevêdo-Gonçalves & Matzenbacher (2005a, b) subsequently determined that *H. microcephala* is actually a hybrid of *H. chillensis* and *H. albiflora*, and consequently elevated *H. albiflora* to species rank with a designated lectotype. While leaf shape and pubescence vary considerably in *H. albiflora*, capitulum morphology and corolla color remain relatively stable. Among *Hypochaeris* species, this newly naturalized taxon is most similar to *H. chillensis*, but the latter has campanulate capitula with yellow flowers, whereas *H. albiflora* has cylindrical or narrowly campanulate capitula with white flowers, providing clear distinction.

Risk assessment: *Hypochaeris albiflora* has naturalized in multiple countries and regions beyond its native range and has become invasive in some areas (Pruski, 2011). Among invasive plants in China, Asteraceae species from Central and South America have caused the most severe damage, including *Ageratina adenophora*, *Chromolaena odorata*, *Mikania micrantha*, *Ageratum houstonianum*, and *Ageratum conyzoides*, which have extensively invaded southern Chinese provinces, causing serious harm to agriculture and forestry and impacting biodiversity with substantial socioeconomic and ecological consequences (Shi et al, 2011; Yan et al, 2012). In recent years, increasing numbers of Asteraceae species from Central and South America have naturalized in China, such as *Gymnocoronis spilanthoide*, *Austroeupatorium inulifolium*, *Tagetes minuta*, and *Acmella ciliata* (Shi et al, 2011). *Hypochaeris albiflora* shares the same origin as these highly damaging species and likely exhibits similar climatic adaptability. Field surveys indicate that it grows and reproduces very successfully under Yunnan' s typical subtropical climate. As a perennial herb with a well-developed, deep root system that is difficult to eradicate, and with strong reproductive capacity producing numerous wind-dispersed seeds per individual, *H. albiflora* poses significant invasion risk. Research and management efforts should be strengthened to monitor its population dynamics, enhance early warning systems, and reduce its invasion potential.

2. *Solanum diphyllum* [FIGURE:1:D,E,F]

Solanum diphyllum Linn. in Sp. Pl. 1: 184. 1753.

Description: Perennial evergreen shrublet. Stem erect, glabrous or slightly pubescent, 0.5–2 m tall, young stems angled. Leaves alternate, upper leaves

commonly paired and markedly unequal in size; larger leaves obovate to long-elliptic, entire, base cuneate and attenuate into petiole, 4–9 cm × 2–3.5 cm, petiole 1–1.5 cm; smaller leaves subsessile, entire, ovate, 1.5–3 cm × 1.2–2.2 cm. Flowers solitary or in subumbellate scorpioid inflorescences of 5–10 flowers, axillary or opposite leaves; peduncle 3–12 mm, pedicel 5–12 mm, erect at anthesis; calyx small, pale green, shallowly 5-lobed, lobes triangular, not enclosing fruit, ca. 1 mm, minutely ciliolate. Corolla white, 3.5–4.5 mm, 5-lobed, lobes ovate to narrowly ovate; stamens 5, filaments short, anthers 1–1.5 mm, yellow; ovary glabrous, style 3–4 mm, stigma indistinct. Fruiting pedicel erect, 0.8–1.4 cm. Berry green when young, bright yellow at maturity, globose, slightly 2-lobed, 7–12 mm in diameter. Seeds yellow or brownish, flattened, reniform, ca. 3 mm × 2.5 mm, margin thickened.

Specimen examined: China, Yunnan: Mengla County, Menglun Town, along Luosuo River, riparian shrub-grassland, elevation 550 m, 101°14’ 51.3” E, 21°55’ 53.6” N, 14 July 2017, Huanchong Wang et al., ML2088 (YUKU).

Geographic distribution: *Solanum diphyllum* is native to Mexico and Central American countries including Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua (Hamada et al, 2010; Zhang et al, 1994). It is widely cultivated as an ornamental in Italy and France (Daisie, 2009) and has naturalized extensively in North America (Texas and Florida), India, and Taiwan (Medal et al, 2002; Knapp, 2009; Zhang et al, 1994). This survey discovered the species in Xishuangbanna, southern Yunnan Province, representing its first record in mainland China.

Taxonomic notes: *Solanum diphyllum* L. is a Solanaceae species published by the renowned Swedish botanist Carl Linnaeus in 1753 (Linnaeus, 1753). The specific epithet *diphyllum* means “two types of leaves,” referring to the dimorphic paired leaves of different sizes (Knapp, 2008). As a perennial evergreen shrublet with dimorphic leaves and bright yellow mature berries, it is clearly distinguished from other *Solanum* species.

Risk assessment: Field surveys found over 50 mature individuals of *S. diphyllum* in a riparian shrub-grassland approximately 100 meters long along the Luosuo River in Xishuangbanna, with normal flowering and fruiting occurring annually. In India, the species was first recorded in 1995 and by 2015 had spread throughout the entire country, becoming a pernicious weed that is difficult to eradicate (Kumari, 2013; Singh & Garg, 2015; Sahu et al, 2015). The seeds are commonly dispersed by birds that feed on the small berries (Singh & Garg, 2015), and because most birds have large activity ranges and long-distance dispersal capabilities, the risk of species spread is increased. Furthermore, as an evergreen shrublet with attractive, colorful fruits, *S. diphyllum* is often introduced for ornamental cultivation, which increases opportunities for escape and naturalization. With its strong dispersal ability and multiple vectors, this newly naturalized species in mainland China could easily become invasive and should be closely monitored with enhanced management to prevent further spread.

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Note: A, B, C. *Hypochaeris albiflora*: A. Habit; B. Capitulum (vertical view); C. Capitulum (side view). D, E, F. *Solanum diphyllum*: D. Habit; E. Inflorescence; F. Infructescence.

Plate I. Two newly naturalized plants in mainland China

Note: Figure translations are in progress. See original paper for figures.