A Newly Naturalized Invasive Plant of the Araliaceae in Taiwan: *Hydrocotyle ranunculoides*

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Abstract. *Hydrocotyle ranunculoides* is a newly naturalized species of the Araliaceae family in Taiwan, currently found in central and northern regions of the island. Native to the Americas, this plant grows in open streams and near irrigation channels, often floating on the water surface and extensively covering aquatic environments, making it a serious invasive species. This paper provides a description of the species, a key to the species of this genus in Taiwan, distribution maps, and photographs.

Key words: Araliaceae, *Hydrocotyle, Hydrocotyle ranunculoides,* naturalized plant, Taiwan.

INTRODUCTION

Hydrocotyle, a cosmopolitan genus, was formerly classified in the Umbelliferae (Hsu & Hsu 2012) and was moved to the Araliaceae in APG IV (APG 2016). *Hydrocotyle* consists of ca. 180 species, widely distributed in tropical to temperate regions (Sheh et al. 2005; Perkins 2019; Irsyam et al. 2022). There are seven native species recorded in the *Flora of Taiwan*, 2nd edition (Kao 1993). In the past 30 years, four species of the genus have been officially recorded as naturalized in the wild in Taiwan (Yang et al. 2001; Wu et al. 2010; Chou et al. 2015; Chang-Yang et al. 2022; Chen et al. 2023).

During a recent survey of aquatic plants in Taiwan, a newly naturalized floating herb was discovered. Upon collection and identification, it was confirmed to be *Hydrocotyle ranunculoides* (Araliaceae). This species, native to the Americas, is a creeping herb with exceptional adaptability to aquatic environments, posing significant threats to other species (Tafadzwa et al. 2017). It has now become a globally invasive aquatic plant. According to online data of iNaturalist, natural observers first recorded the species in Yuanshan Township, Ilan County on September 1, 2019 (https://www.inaturalist.org/observations/31890089). Through field investigations, we confirmed that this species has widely spread across mid- to low-elevation areas in central and northern Taiwan.

In this study, materials were collected from wild populations in Taiwan. After pressing and drying, voucher specimens were prepared and are stored in the herbarium of TNM. Portions of these collected materials were grown in a greenhouse to obtain samples at an appropriate age for photography.

SYSTEMATIC TREATMENT

Hydrocotyle L., Sp. Pl. 1: 234. 1753天胡荽屬
Hydrocotyle ranunculoides L. f., Suppl. Pl.: 177 1782漂浮天胡荽 (Fig. 1)
Type: Chile. Rancagua. 1828, Bertero C.L.G., #334 (Isotype :P!, P00115394)

Creeping perennial herb, rooting at nodes,

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with dense clusters of white rootlets; stem glabrous, slender to rather stout (up to ± 5 mm in diameter), pale-green or brownish. Leaves simple; stipules hyaline, rather large, 0.5–1 cm long, scaly; petioles ca. 3–25 cm long, green, glabrous; lamina reniform, glabrous, with 5–7 bluntly crenate lobes, cut 1/3–1/2 of the way to base, margin crenate, ca. 12–110 × 8–90 mm, wider than long. Inflorescences umbellate, containing 5–9 flowers, diameter 3–4 mm, flowers, axillary, bisexual, peduncle opposite to leaf, ca. 1–8 cm long; involucre of 3–5 obtuse to acute, shortly oblong or lanceolate-oblong. Flowers actinomorphic, star-shaped, sessile or shortly pedicellate; sepals absent; petals 5, white to greenish-yellow, narrowly triangular, ca. 0.7–0.9 mm long, apex acute; stamens 5, free, ca. 0.4 –0.6 mm long, filaments white; anthers yellow to brownish-yellow; ovary orbicular, flattened, greenish-yellow; stigma white; styles 2, 0.2–0.3 mm long, disc oblong, curled toward center. Fruits schizocarpous, strongly laterally compressed, suborbicular to wide oval, ca. 0.5 × 1 mm, yellowish-green to yellow, styles usually persistent, spreading, slender, slightly verruculose when ripe.

Key to Taiwanese taxa of *Hydrocotyle*

1. Peltate leaves 2
1. Reniform leaves 3
2. Peduncle about as long as petiole ..... *H. verticillata*
2. Peduncle shorter than petiole ..... *H. vulgaris*
3. Peduncle sessile or nearly sessile .....

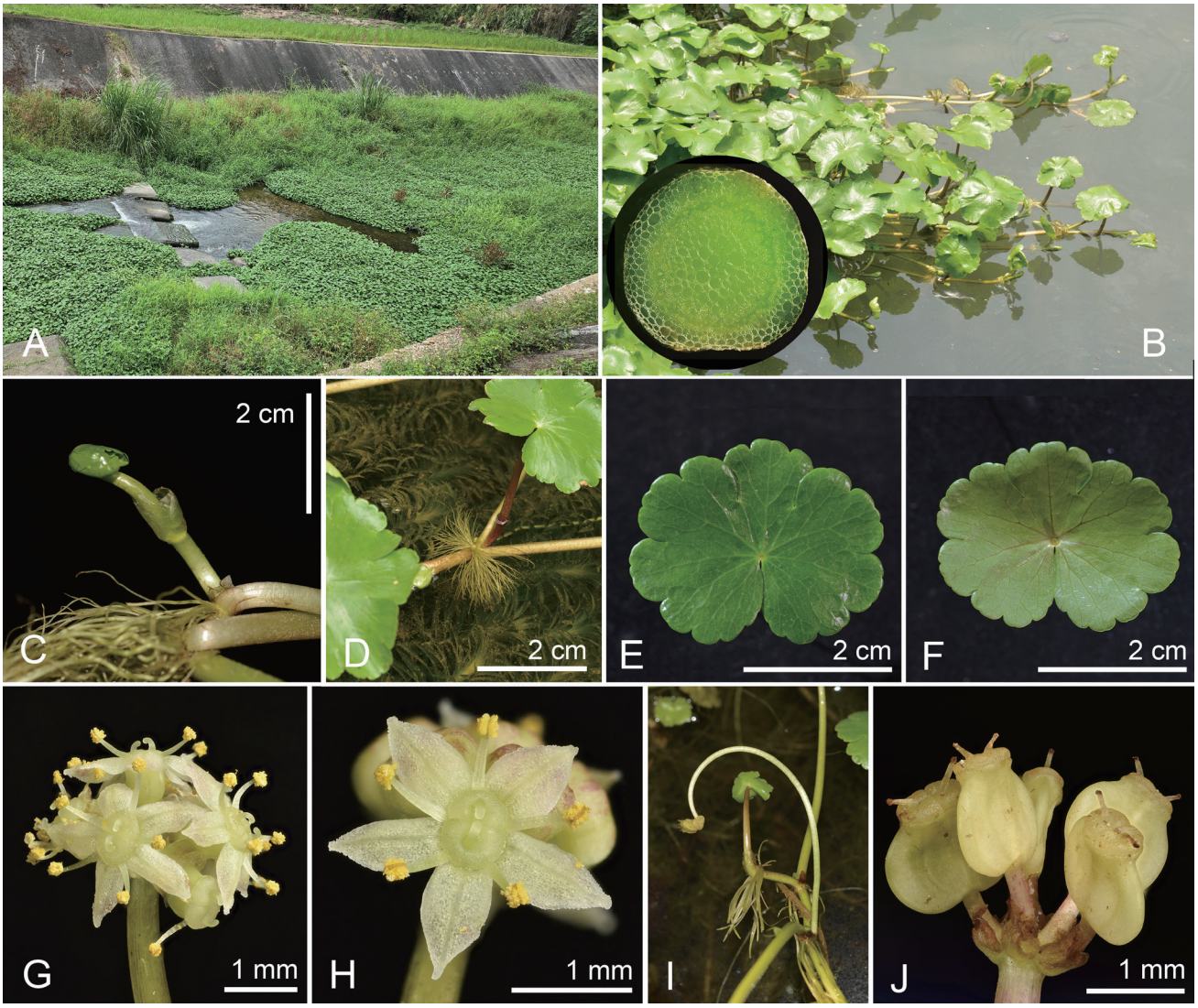

Fig. 1. *Hydrocotyle ranunculoides*. A. Floating ecology. B. Habit, and cross section of stem (lower left corner). C. Stipule. D. Stem, with dense clusters of rootlets on node. E. Leaf, upper surface. F. Leaf, lower surface. G. Inflorescence. H. Flowers. I. Peduncle. J. Fruits. (*C.H. Chen 13321*).

..... *H. nepalensis*
3. Peduncle petiolate 4
4. Leaves deeply lobed, cut at least 2/3 to base 5
4. Leaves slightly lobed, cut less than 2/3 to base 6
5. Leaves densely pubescent ..... *H. benguetensis*
5. Leaves glabrous ..... *H. batrachium*
6. Leaves densely pubescent 7
6. Leaves glabrous 8
7. Peduncle pubescent ..... *H. setulosa*
7. Peduncle glabrous ..... *H. acutiloba*
8. Stem and petiole pubescent 9
8. Stem and petiole glabrous 10
9. Inflorescence with 4–10 flowers ..... *H. dichondroides*
9. Inflorescence with 18–26 flowers ..... *H. leucocephala*
10. Usually > 10 flowers in an inflorescence ..... *H. sibthorpioides*
10. Fewer than 10 flowers in an inflorescence 11
11. Not dilated at stem nodes ..... *H. ranunculoides*
11. Usually dilated at stem nodes ..... *H. keelungensis*

Specimens examined: **Taipei City**: Daan Dist., National Taiwan University (NTU), Zuiyue Lake, 21 Feb. 2024, *C.M. Wang 20152* (TNM); **Taoyuan City**, Guishan Dist., Nankan River, 7 Nov. 2023, *C.M. Wang 20075* (TNM); **Taichung City**, Heping Dist., Wuling Farm, 29 Feb. 2024, *C.M. Wang 20210* (TNM); **Nantou Co.**: Puli Dist., Zhuge Vill., 17 Feb. 2024, *C.M. Wang 20122* (TNM); Pipa Vill., 19 Apr. 2024, *C.H. Chen 13306* (TNM); Shuitou Vill., 17 Feb. 2024, *C.M. Wang 20123* (TNM); Yuchi Dist., Xincheng Vill., 31 Oct. 2023, *C.M. Wang 20062* (TNM); 17 Feb. 2024, *C.M. Wang 20118* (TNM); Dongchi Vill., 17 Feb. 2024, *C.M. Wang 20119* (TNM); 17 Feb. 2024, *C.M. Wang 20120* (TNM); 17 Feb. 2024, *C.M. Wang 20121* (TNM); Zhongming Vill., 31 Oct. 2023, *C.M. Wang 20063* (TNM); Nankang Stream, 19 Apr. 2024, *C.H. Chen 13321* (TNM); **Ilan Co.**: Ilan City, Hebin Park, 20 Feb. 2024, *C.M. Wang 20124* (TNM); Datong Dist., Taiping Vill., 20 Feb. 2024, *C.M. Wang 20136* (TNM); Dongshan Dist., Kelin Vill., 20 Feb. 2024, *C.M. Wang 20138* (TNM); Yuanshan Dist., Shangde Vill., 20 Feb. 2024, *C.M. Wang 20143* (TNM); 20 Feb. 2024, *C.M. Wang 20144* (TNM); 20 Feb. 2024, *C.M. Wang 20145* (TNM); 20 Feb. 2024, *C.M. Wang 20146* (TNM); Neicheng Vill., 20 Feb. 2024, *C.M. Wang 20147* (TNM); Yixian Vill., 20 Feb. 2024, *C.M. Wang 20148* (TNM); Sanxing Dist., Dazhou Vill., 20 Feb. 2024, *C.M. Wang 20149* (TNM).

Distribution and note: *Hydrocotyle ranunculoides* is believed to be native to the southern United States and Central and South America, but has been widely introduced to Europe and Australia. It is a species well-adapted to growing in wetlands, sometimes forming floating mats that often become entangled with other plants (Harms et al. 2012). This species is capable of reproducing by seed or vegetatively by fragmentation. Ecologists have provided crucial evidence that this species, as an invader in freshwater ecosystems, has significant negative impacts, leading to the loss of local plant species richness (Stiers et al. 2011). Additionally, it has been legislated in several countries as an invasive species that requires rapid eradication or control (Ghiani et al. 2023). While there are few reports of this invasive species in Asia, it has rapidly expanded its population in lowland water bodies from central to northern Taiwan (Fig. 2). Relevant government agencies should take serious measures against this invasive species, given its significant environmental impacts.

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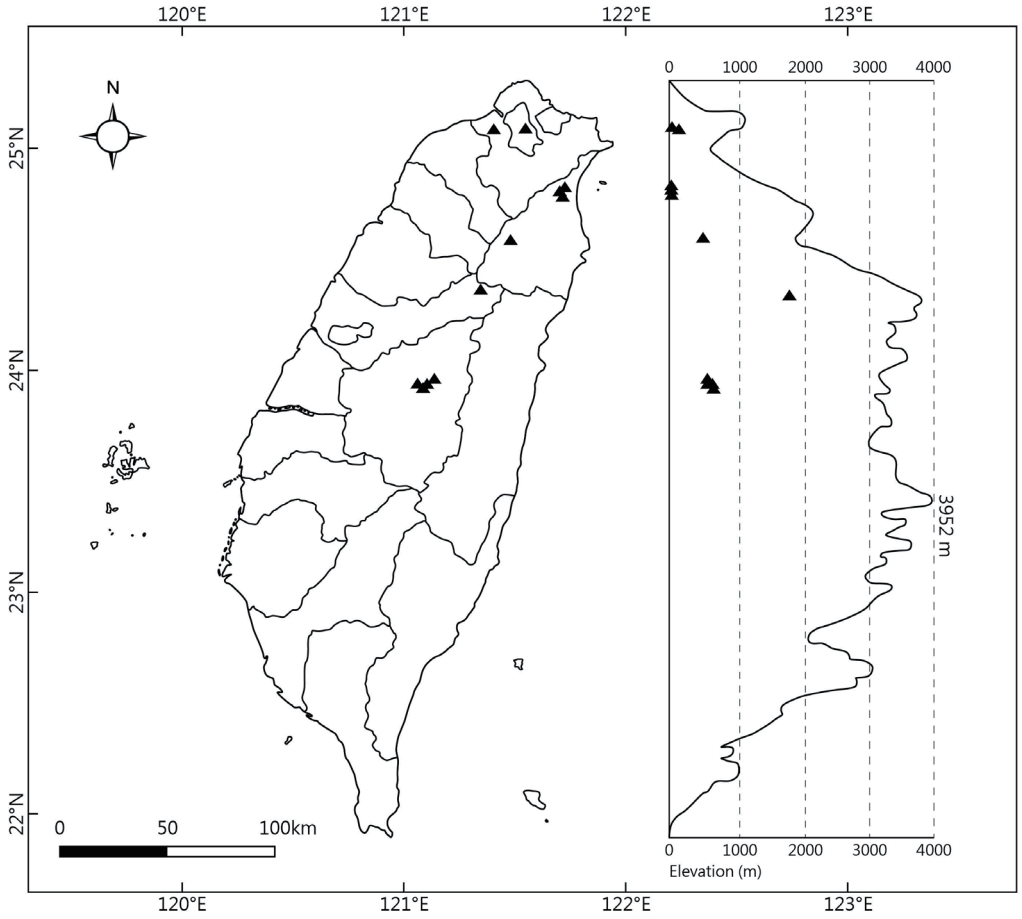

Fig. 2. Distribution map of *Hydrocotyle ranunculoides* in Taiwan (triangles).

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臺灣新歸化的五加科(**Araliaceae**)入侵植物—漂浮天胡荽(***Hydrocotyle ranunculoides***)

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漂浮天胡荽為台灣新歸化的五加科植物，目前在台灣的中部以北發現蹤跡。此物種原產於美洲，生長在開闊的溪流或灌溉渠附近，時常漂浮在水面上生長，且大面積覆蓋水域環境，是入侵型的植物。本文提供了該物種的描述、台灣本屬物種的檢索表。並提供分布圖及照片，以供鑑定參考。

關鍵詞：五加科，天胡荽屬，漂浮天胡荽，歸化植物，臺灣