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Hydrocotyle changanensi (Araliaceae), a new species from Shaanxi, China

Xi-Chun Du[1,2] & Yi Ren[1,*]

[1)] *School of Life Sciences, Shaanxi Normal University, 710062, Xi'an, China*
[2)] *School of Life Sciences, Xi'an University of Arts and Science, 710061, Xi'an, China (*corresponding author's email: renyi@snnu.edu.cn)*

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Hydrocotyle changanensis X.C. Du & Y. Ren *sp. nova* (Araliaceae) is described from Shaanxi Province, northwestern China. The simple scapes of *H. changanensis* have 2–5 layers of flowers in their umbels, different from all other Chinese *Hydrocotyle* species. It is morphologically similar to *H. sibthorpioides*, however it differs from the latter by its narrower and longer styles, depressed stylopodia and longer pedicels. We present a key for identification, a line drawing of *H. changanensis* and a plate of SEM micrographs of *H. changanensis* and *H. sibthorpioides*. We discuss the relationships among *H. changanensis* and all species currently recognized in this genus in China.

Key words: angiosperms, micromorphology, morphology, new species, taxonomy

Hydrocotyle is a tropical and temperate genus in Araliaceae (subfam. Hydrocotyloideae), containing some 75(–130) species worldwide. Shan and Sheh (1979) recognized 17 species in eastern, southern and southwestern parts of China: *H. nepalensis*, *H. pseudoconferta*, *H. sibthorpioides*, *H. benguetensis*, *H. dichondroides*, *H. dielsiana*, *H. handelii*, *H. wilsonii*, *H. burmanica*, *H. forrestii*, *H. chinensis*, *H. wilfordi*, *H. setulosa*, *H. ramiflora*, *H. hookeri*, *H. salwinica*, and *H. podantha*. Li (1989) added *H. calcicola*. In the recent revision of the Chinese Apiaceae, Sheh *et al*. (2005) considered that *H. burmanica* is a narrow endemic species of S Myanmar and it does thus not occur in China. Actually, '*H. burmanica*' *in* FRPS 55(1) published in 1979 was misapplied to Chinese plants that are in fact attributable to *H. hookeri;* several other taxa such as *H. handelii*, *H. forrestii* and *H. chinensis* have been assigned an infraspecific status under *H. hookeri*. *Hydrocotyle podantha* is in fact a synonym of *H. himalaica*. Accordingly, 14 species of *Hydrocotyle* are currently recognized in China.

While the first author was carrying out a survey of spermatophyte diversity across Shaanxi Province of China in 2004, he discovered some *Hydrocotyle* herbs in damp or slightly moist areas in the Chang'an district, Xi'an at an altitude between 400–600 m. The inflorescences and infructescences were very different from those of the other species of *Hydrocotyle* in China. In the following year, we collected more flowering and fruiting specimens. These specimens shared similarities with *H. sibthorpioides*, but their scapes, styles, stylopodia, pedicels and

fruits were different and very small, so we used scanning electron microscope (SEM) images for further comparisons. The results indicated that these specimens belong to a hitherto undescribed species that is morphologically close to *H. sibthorpioides*.

We collected fresh material of the new taxon (Xi-chun Du 20050620, 20050621, and 20050629, SANU) and *H. sibthorpioides* (Xi-chun Du 20050727, SANU) for measurements and scanning electron microscope (SEM) studies from June to August in 2005. We fixed the specimens in FAA, dehydrated them in an alcohol–isoamyl acetate series, critical point-dried them in CO_2, mounted them on aluminum stubs, sputter-coated them with gold, and comparatively observed them with a Hitachi S-570 SEM. We also collected inflorescence-bearing and infructescence-bearing specimens of the new taxon (Xi-chun Du 20050620, 20050621, and 20070615, SANU) and *H. sibthorpioides* (Xi-chun Du 20050727, 20070622, SANU) for comparative observations from the southern suburb region of Xi'an, Shaanxi Province, China, at alt. 400–600 m. We drew figures based on the herbarium specimens. We also compared all the specimens of *Hydrocotyle* in SANU, WUK and CVH with the new taxon.

Hydrocotyle changanensis X.C. Du & Y. Ren, *sp. nova* (Figs. 1 and 2)

Differt a H. sibthorpioidi scapis umbelis 2 ad multi-stratis, pedicellis floris et fructuum longioribus, stylis longioribus et tenuis, stylopodiis discorideis, depressis.

TYPE: China. Shaanxi Province: Chang'an district, Xi'an, 400–600 m, in damp or slightly moist areas, 8.II.2005, *Xi-chun Du 20050629* (holotype and isotype SANU). — PARATYPES: Same locality, *Xi-chun Du 20050620, 20050621, 20070615* (SANU).

Perennial herbs. Stem weak, slender, creeping, diffusely branched; rhizome tuberous, intumescing and rooting from nodes. Petioles 2.5–13 cm, distally pubescent; stipules present, lobed, membranous; leaf blade reniform-rounded, 0.5–1.5 × 0.8–2.5 cm, thin-papery; adaxially surface sparsely strigose and abaxially surface densely strigose along veins, base cordate, palmately 3–5-nerved, lobes triangular to rounded, deeply 5–7-lobed. Scapes with 2–5 umbels of flowers, each umbel layer 2–7 flowered, opposite to leaves at nodes, gradually elongating during anthesis, with sparse hairs, 1.5–8.5 cm, mostly shorter than petioles; bracts ovate-lanceolate, 1–1.5 mm, membranous; pedicels as long as or longer than flowers and fruits. Flowers bisexual; petals 5, white, glabrous, ovate to broadly ovate, 4–8 mm; filaments as long as petals, anthers hemispherical, yellow, ca. 1 mm long, dehiscing through slits along sides; styles incurved during anthesis, spreading in fruit, stylopodia flat. Fruits 1–1.2 × 1.2–1.5 mm; globose or ellipsoid, strongly flattened laterally; base cordate, dorsal surface rounded, glabrous; dorsal ribs and lateral ribs usually conspicuous, slender, acute, vitta inconspicuous. Seed face plane; endocarp woody. Carpophore absent.

Hydrocotyle changanensis grows only in shady and wet, grassy places. It is known only from Chang'an district, Xi'an, Shaanxi Province at the altitude of 400–600 m. *Hydrocotyle changanensis* flowers between July and August, and the fruits ripen between late August and early September, generally one month earlier than those of *H. sibthorpioides* in the same area.

Hydrocotyle changanensis differs from all the other species of *Hydrocotyle* in China in its inflorescence. *Hydrocotyle changanensis* has solitary scapes and the umbels have 2–5 layers of flowers. *Hydrocotyle nepalensis* has several to numerous dense scapes, with umbels fascicled in the axils and stem tips, but each umbel has only one layer of flowers. *Hydrocotyle calcicola* has 2–3 scapes, the umbels are fascicled in axils, the scapes of the middle umbels are 1–2 mm long, and the scapes of the lateral umbels are 1 cm long. *Hydrocotyle pseudoconferta* has sessile solitary scapes at the nodes and binate pedunculate scapes at stem tips, each umbel also has one layer of flowers. *Hydrocotyle benguetensis*, *H. dichondroides*, *H. dielsiana*, *H. hookeri*, *H. wilsonii*, *H. wilfordii*, *H. ramiflora*, *H. himalaica*, *H. salwinica* and *H. setulosa* all have solitary scapes, and each umbel has just one layer of flowers.

Morphologically *Hydrocotyle changanensis* resembles especially *H. sibthorpioides*. However,

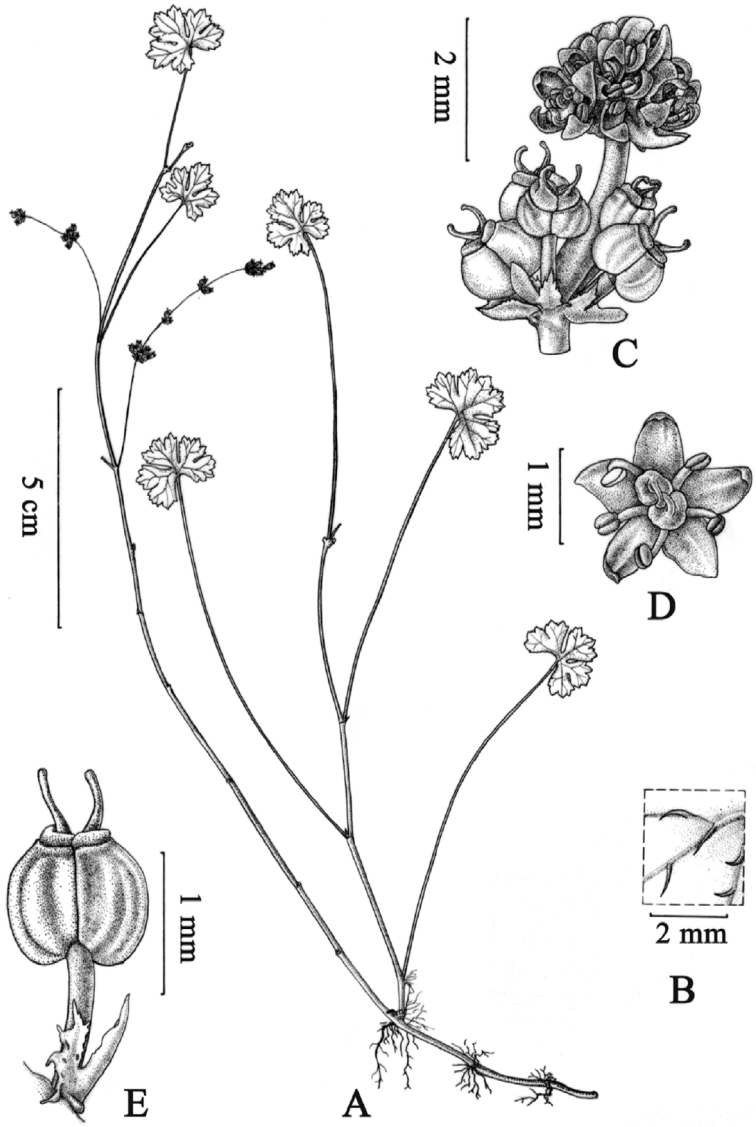

Fig. 1. *Hydrocotyle changanensis* (from the holotype). — **A**: Fruiting branch. — **B**: Strigose veins on abaxial surface of leaf. — **C**: Inflorescence. — **D**: Flower. — **E**: Fruit.

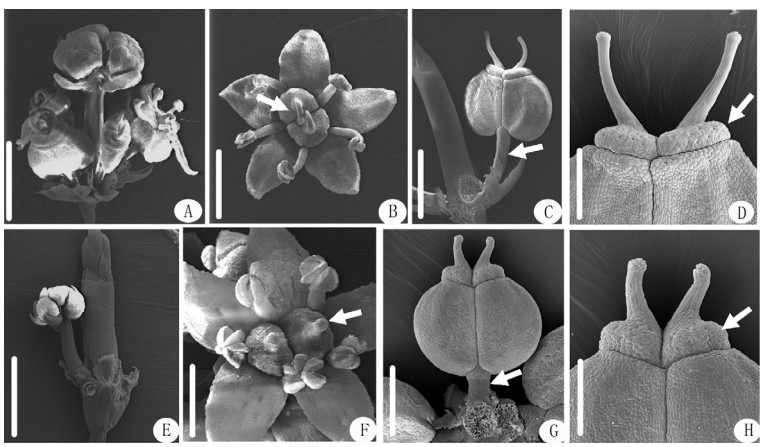

Fig. 2. Flowers and fruits of *Hydrocotyle changanensis* (**A**–**D**) and *H. sibthorpioides* (**E**–**H**) under SEM. — **A**: Umbel inflorescences. — **B**: Styles during anthesis. — **C**: Fruit and pedicel. — **D**: Fruit, stylopodium flat. — **E**: Umbel inflorescence. — **F**: Styles during anthesis. — **G**: Fruit and pedicel. — **H**: Fruit, stylopodium conic. Scale bars: A = 1 mm; B = 0.6 mm; C = 1 mm; D = 0.4 mm; E = 1.2 mm; F = 0.46 mm; G = 0.4 mm; H = 0.24 mm.

there are differences in their scape, style, stylopodium, pedicel and fruit characters. Instead of the 2–5 layers of flowers on the scapes of *H. changanensis*, *H. sibthorpioides* has simple umbel flowers. The styles of *H. changanensis* are slim and long, incurved during anthesis, and spreading in fruit, while the styles of *H. sibthorpioides* are strong and short and spreading whether flowering to fruiting. *Hydrocotyle changanensis* has a flat stylopodium, while that of *H. sibthorpioides* is conic (Fig. 2). *Hydrocotyle changanensis* has no glands on the bracts and petals, while *H. sibthorpioides* has bright yellow glands. Finally, the pedicels of *H. changanensis* are as long as or longer than its fruits, while the pedicels of *H. sibthorpioides* are obsolete.

Local herbalists use both *H. changanensis* and *H. sibthorpioides* as traditional Chinese medicine for urethral lithiasis. Another potential threat is that both species are very attractive and of considerable horticultural usage. A third threat is that the swamp habitat has declined due to drought and lowered water table in the recent years. At the same time, sand has been removed from the area for the purposes of construction industry, aggravating the habitat destruction. We suspect that *Hydrocotyle changanensis* is critically endangered. Up to now, we have failed to find further populations of the new species, so further surveys are required before anyone can make a confident conservation assessment. We did not give the precise locality of *Hydrocotyle changanensis* in this paper, because we are concerned that this species could become a target for illegal plant collecting. To preserve this new species, we have cultivated it in the Botanic Garden of the Xi'an University of Arts and Science as well as Chang'an Normal School.

Identification key* to the Chinese species of *Hydrocotyle*

1. Umbels more than one in axils and stem tip 2
1. Umbels solitary in axils, sometimes several at stem tip 3
2. Umbels 2–3, 2–5-flowered; petioles 0.7–3 cm, glabrous; leaf blade 0.5–1.5 × 0.7–2.5 cm ..... *H. calcicola*
2. Umbels several to numerous, each umbel densely capitate, 20–60 flowered; petioles 4–27 cm, distally densely pubescent; leaf blade 2–5 × 3.5–9 cm ..... *H. nepalensis*
3. 2–5 layers of flowers in solitary umbels ..... *H. changanensis*
3. One layer flowers in solitary umbels 4
4. Leaf blade 0.5–2.5 × 0.8–5 cm; umbels sessile or peduncle distinctly shorter than petiole 5
4. Leaf blade 1–8 × 2–11 cm; peduncle longer or about equaling petiole 8
5. Axillary umbels sessile, apical umbels often with peduncles to 1 cm; fruit with white hairs or glabrous ..... *H. pseudoconferta*
5. All umbels pedunculate, peduncle 0.5–3.5 cm; fruit glabrous 6
6. Petiole glabrous or distally sparsely pubescent ..... *H. sibthorpioides*
6. Petiole densely pubescent or hirsutulous throughout ... 7
7. Petiole 3–15 cm, pubescent; leaf blade 3(–5)-parted, segments 3-lobed ..... *H. benguetensis*
7. Petiole 0.5–3 cm, densely hirsutulous; leaf blade shallowly 5–7-lobed or nearly entire, lobes inconspicuously crenulate (Taiwan) ..... *H. dichondroides*
8. Umbels not densely capitate in fruit; pedicels elongate, 2.5–8 mm 9
8. Umbels densely capitate in fruit; pedicels to 2 mm ... 12
9. Leaf blade shallowly to moderately (to near middle) 5–7-lobed 10
9. Leaf blade 5–7-divided, usually parted to middle or near base 11
10. Stems, petioles and peduncles glabrous or moderately hairy with white or brown hairs; leaves angular in outline, with 5 to 7 deep, usually triangular lobes ..... *H. hookeri*
10. Stems, petioles and peduncles densely dark purple-brown hairy; leaves round in outline, with many very shallow, rounded lobes ..... *H. himalaica*
11. Leaf blade parted to near base; segments cuneate at base ..... *H. dielsiana*
11. Leaf blade parted to 1/2–3/5; lobe base as broad as the middle ..... *H. wilsonii*
12. Stems, petioles and peduncles moderately to densely hairy with purple-brown hairs; leaves shallowly lobed or cleft to middle, lobes deltoid, apex acute ... *H. salwinica*
12. Stems, petioles and peduncles essentially glabrous, occasionally hairy at nodes or near distal ends; leaves very shallowly 5–7-lobed, lobes rounded-obtuse ..... 13.
13. Petioles short, 0.8–2.5 cm; leaf blade small, 0.7–1.3 × 0.8–1.6 cm, adaxially surface setulose, abaxially surface pubescent or hispid ..... *H. setulosa*
13. Petioles (1–)15–19 cm; leaf blade larger, 1.5–3.5 × 2–7 cm, glabrous on both surfaces or sparsely hirsute along veins 14
14. Leaf blade glabrous on both surfaces or abaxially surface sparsely hirsute on veins, peduncles equaling or slightly longer than petioles ..... *H. wilfordi*
14. Leaf blade sparsely hirsute on both surfaces; peduncles 1–2 times longer than petioles ..... *H. ramiflora*

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* Characters for the ten species from couplet 7 onwards are taken from Sheh *et al*. (2005).

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