

NEPETA WUANA (NEPETINAE, NEPETOIDEAE, LAMIACEAE), A NEW SPECIES FROM SHANXI, CHINA

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Nepeta wuana H. J. Dong, C. L. Xiang & Z. Jamzad, (Lamiaceae), a new species found in Shanxi Province, China, is described and illustrated. The closest relative of the new species is the Chinese endemic *N. sungpanensis* C.Y. Wu but it clearly differs from it in the prolonged middle lobe of the lower corolla lip, as well as the much larger leaves, and sharper calyx lobes. Microfeatures of leaf epidermis, pollen grains, and nutlets of the new species are also explained.

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گونه *Nepeta wuana* گونه ای جدید از خانواده نعنا، زیر خانواده **Nepetoideae** زیرقبیله **Nepetinae** از چین

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گونه جدید *Nepeta wuana* از استان شانکهای چین شرح داده می شود و تصویر آن ارایه می گردد. نزدیکترین گونه خویشاوند به آن گونه انحصاری *N. sungpanensis* C.Y. Wu است ولی مشخصا از آن با داشتن لوب میانی لبه پایینی بلند تر، برگهای خیلی بزرگتر و دندانه های کاسه گل تیز تر متفاوت می باشد. صفات میکرومورفولوژیکی اپیدرم برگ، دانه گرده و فندقه گونه جدید شرح داده می شود.

INTRODUCTION

Nepeta L. is the one of the most diverse genera within the tribe Menthae (Lamiaceae, Nepetoideae, Nepetinae) with over 300 species, most of which are herbaceous perennials. The genus is mainly distributed in the mountains, semi-deserts and steppes of Eurasia, extending into North Africa (Li & Hedge 1994, Harley & al. 2004), of which two regions, southwestern Asia and the western Himalayas, were considered to be the greatest diversity and species richness areas (Jamzad & al. 2003a, b). It is remarkable that the genus has considerable variation in morphological characters, which caused very few traits as useful diagnostic characters for its infra-generic classifications (Bentham 1848, Briquet 1896, Budantsev 1993).

In a recent phylogenetic analysis of *Nepeta*, based on nrITS sequences, the genus was resolved as being

monophyletic, and five lineages were recognized (Jamzad & al. 2003a). Besides, some characters, i.e. floral characters, including corolla shape, bract texture and color and pollen exine ornamentation are congruent with this result, showing a close relationship with the distribution of these characters across the five clades.

Wu & Li (1977) recognized 38 species and one variety from China, and divided them into eleven sections, four subsections and sixteen series. Li & Hedge (1994) raised the number of species to 42 in the updated edition of the English *Flora of China*. During a taxonomic revision for *Nepeta* in China, one unidentified collection deposited at the herbarium KUN attracted our attention. It was collected from Shanxi Province in 1960. However, a label annotated as "*Nepeta* sp. nov." in September 1982 by Professor Cheng-Yi Wu, a renowned Chinese botanist on the

taxonomy of Lamiaceae as well as phytogeography. To clarify the identity of this collection, we undertook a field investigation of Yuncheng City in September 2013. After careful observations of *in situ* plants, comparison with herbarium specimens, as well as reviewing relevant literatures (Wu & Li 1977, Wu & al. 1977, Li & Hedge 1994), we concluded that these specimens represent a new species of *Nepeta*. In this paper, we describe and illustrate it (fig. 1) and compare it morphologically to its nearest ally.

MATERIALS AND METHODS

Microfeatures of leaf epidermis, pollen grains and nutlets of the new species were investigated using scanning electron microscopy (SEM) and light microscopy (LM). Methods for examining trichome micromorphology follow Xiang & al. (2010). Materials for SEM and LM studies were all taken from our specimens (*H.J. Dong & J.J. Yu 916*). Pollen and nutlet samples were prepared as described by Chen & al. (2014). Micromorphological observations were conducted using a Hitachi-S4800 scanning electron microscopy (Hitachi Ltd., Tokyo, Japan). Measurements of sizes of 20 pollen grains and 10 nutlets were made under a Leica DM2500 light microscope (Leica Microsystems GmbH, Wetzlar, Germany).

New species

Nepeta wuana H.J. Dong, C.L. Xiang & Z. Jamzad, **sp. nov.** (figs. 1 & 2).

Perennial; stems erect, ca. 100 cm high, ascending, white pubescent. Stem leaves petiolate, petioles 0.5-3 cm, internodes 2-5 cm long; blade ovate to triangular-cordate, 4-7 × 3-5 cm, adaxially yellow-green, hirtellous, abaxially whitish pubescent, cuneate at base, attenuate-acuminate at apex, margin coarsely crenate to dentate; floral leaves similar, smaller, ± sessile. Cymes axillary, upper ones in loose or compact, interrupted terminal panicles; bracts and bracteoles, minute. Bracts 1 × 2 mm, lanceolate acuminate. Calyx campanulate, ca. 6 × 9 mm, white pubescent, urceolate in fruit; throat straight, upper teeth subulate to triangular, 1-1.5 mm, lower teeth 1-1.5 mm. Corolla white with purple lower lip, white villous; throat pubescent inside, ca. 7-8 mm wide; tube slender, ca. 0.3 mm in diam., abruptly dilated into broad throat; upper lip ca. 2 × 3 mm, apex emarginate; middle lobe of lower lip sub-circular, ca. 3 × 4 mm, concave, margin undulate. Stamens included. Nutlet 1.5 × 1 mm, ovoid trigonous; surface smooth, reticulate; attachment scar obscurely bilobed.

Type: China, Shanxi Province: Yuncheng City, Xiyao, Feng-huang-gu, 870 m, 30 September 2013, *H. J. Dong*

& *J. J. Yu 916* (holotype KUN; Isotypes KUN, TARI).
Distribution: Till now only known from the type locality.

Trichome morphology: Two types of trichomes, eglandular and glandular were observed. Unicellular eglandular hairs are observed on the surfaces of leaves and calyces (fig. 3, A-B, D, E-H). Peltate glandular trichomes are restricted to abaxial leaf surfaces (fig. 3C).

Pollen morphology: Pollen grains of *N. wuana* are prolate spheroidal (P/E=1.14) and hexacolpate (fig. 3, I), consistent with the most members of subtribe *Nepetinae* (Moon & al. 2008), and share the bi-reticulate sexine ornamentation (fig. 3, J). Polar length (P) = 36.82 μm, equatorial diameter (E) = 32.27 μm.

Nutlet morphology: The nutlets size in *N. wuana* is 2.14 × 1.50 mm. According to Kaya & Dirmenci (2008) and Hassan & Dar (2012), nutlet of *N. wuana* should be described as ovoid trigonous (fig. 3K). The surface, made up deep rounded or polygonal cells, is smooth, reticulate, with straight anticlinal walls and the external periclinal walls are flat, striate-furrowed or depressed; attachment scar obscurely bilobed with oblique lobes (fig. 3L).

Habitat: The new species grows in Shanxi Provinces on Mt. Zhongtiaoshan, on dry valley in a community dominated by *Quercus* L., *Betula* L., *Populus* L., *Salvia umbratica* Epling, *Caryopteris terniflora* Maxim., *Rubus phoenicolasius* Maxim., *Elaeagnus umbellata* Thunb., *Lespedeza bicolor* Turcz. are common in the same ecological habitat.

Systematic position: The new described species should be attributed to clade II B according to Jamzad & al. (2003a), but a broader sampling for molecular research is still needed.

Etymology: The specific epithet is in honor of Professor Cheng-Yi Wu (1916-2013), a famous botanist from Kunming Institute of Botany, Chinese Academy of Sciences, to honor his contributions to our knowledge of Lamiaceae since the 1960s. He first noted the specimen as probably representing a new species but did not describe it.

Phenology: Flower from July to September, fruit from September to October.

Additional collection (paratype): China. Shanxi: Yuncheng City, Xiyao Town, Biankongao Village, 800 m, 9 August 1960, *C.G. Li 98* (KUN).

The new species is morphologically close to *N. sungpanensis* C.Y. Wu from Sichuan. *Nepeta wuana* shares a campanulate calyx and not-cordate leaf with *N. sungpanensis*, but differs in the remarkable prolonged and concave middle lobe of lower corolla lip, as well as in the size of leaves (4-7 × 3-5 cm in



Fig. 1. Diagnostic morphological features of *Nepeta wuana*. A, habit; B, flower; C, calyx; D, calyx dissected; E, nutlet (scale bar = 2cm).



Fig. 2 Photos of *Nepeta wuana*. A. Branch; B. Inflorescence; C Habitat; D. Abaxial surface of leaf.

N. wuana vs. $1.5-3 \times 1-2$ cm in *N. sungpanensis*), shape of calyx lobes (subulate or triangular vs. triangular), color of flowers (white but purple in lower lip vs. blue).

N. cataria is a more distant relative, *N. wuana* differs from *N. cataria* in a cuneate leaf base (vs. cordate to truncate) and undulate margin in middle lobe of lower corolla lip (vs. margin with incurved lobes or teeth), nutlet with reticulate-sculptured surface (vs. tuberculate surface). Attachment scar is probably another character to distinguish them. Pădure & al. (2005) reported that the scar of *N. cataria* is varied from obscurely to distinctly bilobed and sometimes with horizontal lobes, while attachment scar of *N. wuana* is obscurely bilobed with oblique lobes.

Detailed morphological differences between the three species are listed in table 1.

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Table 1. Diagnostic character differences among *Nepeta wuana*, *N. cataria* and *N. sungpaensis*.

	<i>N. wuana</i>	<i>N. cataria</i>	<i>N. sungpaensis</i>
Leaf size	4-7 × 3-5 cm	2.5-7 × 2-5 cm	1.5-3 × 1-2 cm
Petiole	2-2.5 cm	0.5-2.5 cm	2-10 mm
Leaf base	cuneate	cordate to truncate	rounded to truncate
Calyx shape	campanulate	tubular	campanulate
Calyx lobe	subulate or triangular	narrowly subulate	triangular
Calyx throat	straight	oblique	straight
Inflorescence	pedunculate lax cyme in upper leaves axils	paniculate, dense cymes 2-4 mm	dichotomous cyme in upper leaves axils
Peduncle	2-3 cm		2-10 mm
Flower color	White, lower lip purple	white with purple spots on lower lip	blue
Upper corolla lip	emarginate	emarginate	entire
Middle lobe of the lower lip of corolla	concave, margin undulate	concave, margin with incurved teeth	concave, margin undulate
Nutlet	ovoid-trigonous	oblong	ovoid
Nutlet surface ornamentation	smooth	smooth or tuberculate	tuberculate

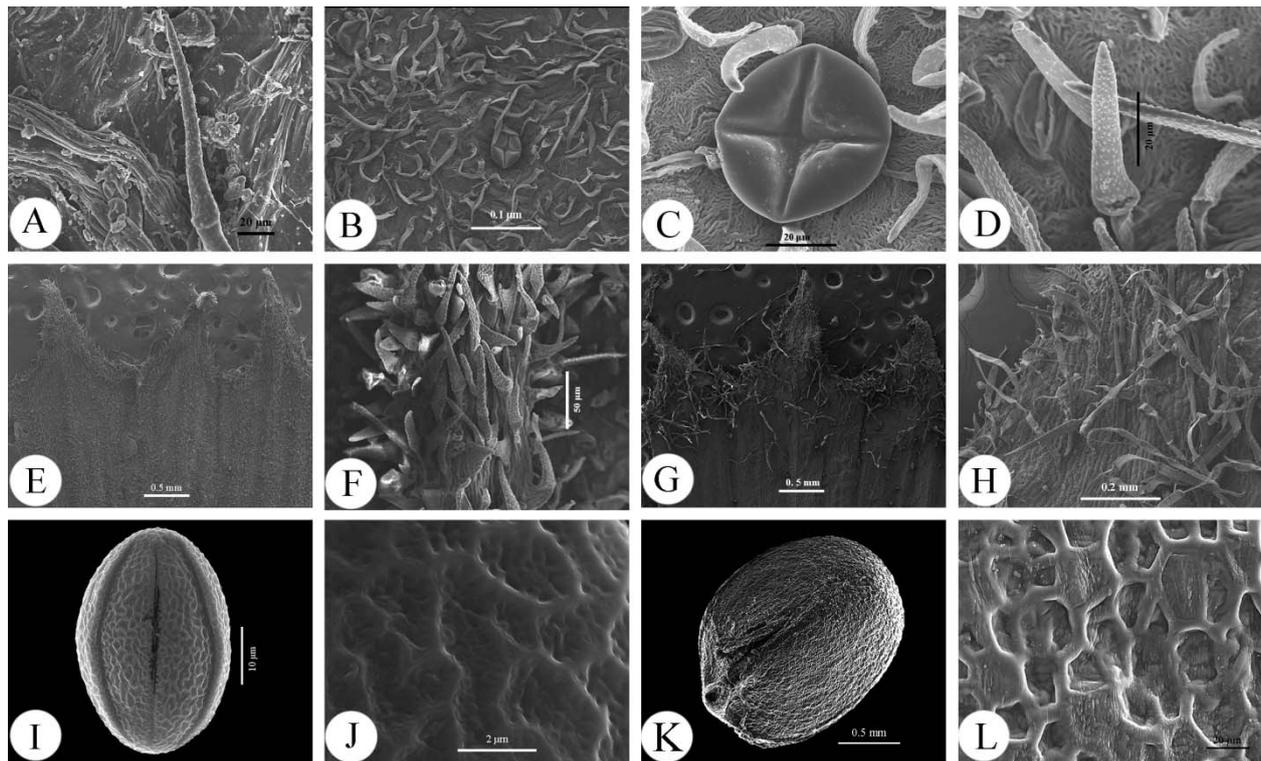


Fig. 3. SEM micrographs of *Nepeta wuana*. A, simple eglandular trichome adaxially; B, hairs abaxially; C, peltate glandular trichome abaxially; D, unicellular eglandular trichome adaxially; E, outside surface of calyx; F, simple eglandular trichome outside surface of calyx; G, inside surface of calyx; H, multicellular eglandular trichome on edges of calyx teeth; I, pollen (equatorial view); J, exine ornamentation; K, nutlet; L, nutlet surface ornamentation (dorsal view).

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