SALVIA SUBVIOLACEA, A NEW SPECIES FROM THE HIMALAYAS–HENGDUAN MOUNTAINS, CHINA

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Salvia subviolacea Y.K.Wei & Pendry, a new species from China, is described. Salvia subviolacea belongs to Salvia subg. Glutinaria (Raf.) G.X.Hu, C.L.Xiang & B.T.Drew, sect. Eurysphace E.Peter, and is distinguished from morphologically similar species by differences in its habit, leaves, inflorescences and flowers. It has a disjunct distribution in Sichuan and Xizang, and its IUCN Red List conservation assessment is Endangered. The Xizang population is under extreme threat and rapid conservation measures need to be taken.

Keywords. China, new species, Salvia subviolacea, Salvia.

Received 28 October 2019   Accepted 13 July 2020   Published 09 March 2021

Introduction

The Hengduan Mountains are the easternmost extension of the Himalayas and are located in the Sichuan, Xizang and Yunnan Provinces of China. More than half of China’s 83 species of Salvia L. are found in these provinces, and 23 species are endemic to the Hengduan Mountains (Wei et al., 2015). The diversity of this region has still not been fully explored, and further investigations are much needed (Li & Hedge, 1994; Wei et al., 2015), because new species of Salvia are still likely to be found there (Wang et al., 2016). In this paper, we describe a new species of Salvia from Sichuan and Xizang and present a key to related species. Future papers will describe and document the ongoing research programme.

In 2011 and 2014, we collected a Salvia in Sichuan and Xizang that showed similarities to Salvia dolichantha E.Peter, S. hians Royle ex Benth., S. przewalskii Maxim. and S. wardii E.Peter but proved to be different from all these species. Further investigations in the field and comparison with herbarium specimens and living plants of these species have confirmed that our collections represent a new species, which is described and illustrated below.

Two subsequent surveys of the Xizang population in 2019 and 2020 found evidence of serious disturbance at the collecting locality, and no living plants could be located. It is evident that immediate measures need to be taken to protect this species.

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Species description

Salvia subviolacea Y.K. Wei & Pendry, sp. nov.

*Salvia subviolacea* is distinguished from *S. dolichantha* E.Peter by its smaller flower and crenate leaf margin. *Salvia subviolacea* differs from *S. hians* Royle ex Benth. in its calyx and corolla; the former has a longer, narrower, uniformly deep violet to black calyx compared with the bicoloured green and deep violet, broadly campanulate calyx of the latter; furthermore, in the former the corolla tube is adnate to the calyx, whereas in the latter it is completely free. *Salvia subviolacea* differs from *S. przewalskii* Maxim. in its denser inflorescence and calyx that is much larger in relation to its corolla. It differs from *S. wardii* E.Peter in its smaller habit and smaller flowers, cordate leaves, and pale blue-purple to light purple corolla, in contrast to the deep blue flowers of *S. wardii*. – Type: China, Sichuan, Yanyuan, 3336 m, 27°40′21.34″N, 101°13′08.81″E, 28 vii 2014, Y. K. Wei, H. Xu & Y.B. Huang S0617 (holotype CSH [CSH0042695]; isotype CSH, E). Figures 1, 2A,B.

Perennial taprooted herb, 25–60 cm. Stem unbranched. Leaves almost all basal, occasionally with a pair of cauline leaves, all simple, papery, cordate to narrowly cordate, 7–20 × 5–15 cm, apex attenuate, acute or obtuse, base cordate, occasionally hastate, margin crenate. *Petiole* usually purplish, 5–15 cm. *Inflorescence* 20–35 cm, a relatively lax, pubescent raceme of 2- to 6-flowered verticillasters, simple or with up to 3 short branches at the base. *Calyx* uniformly violet or deep violet to black, tubular-campanulate, 12–21 mm, bilabiate to half its length, upper lip rounded, without an annulus, calyx and base of corolla tube adnate. *Corolla* pale blue-purple to light purple, tube curving slightly upwards at base, straight, with a lanate annulus at one-third above the base, upper and lower lips concolorous or white with concolorous spots, 26–40 mm. *Stamens* included in the corolla, filaments 5.1–8.1 mm, connective 4.5–6.5 mm, upper arm twice as long as lower arm, upper and lower thecae fertile, lower thecae coherent. *Pistil* 33–43 mm, stigma included within the upper lip. *Nutlets* subglobose, yellow-brown, c.2.8 × 2.3 mm. *Indumentum* of leaves puberulent or pubescent; petioles, stem, inflorescence and corolla pubescent, glandular pubescent only on the outside of the calyx.

*Altitudinal range*. 3000–4000 m.

*Ecology*. Forest margins and understorey, roadsides. It is apparently well adapted to various habitats. Flower colour is apparently influenced by environment, with a deeper colour in drier, sunnier locations.

*Phenology*. Flowering June to July, fruiting July to August.

*Distribution*. *Salvia subviolacea* is endemic to China and is currently known only from the type locality at Yanyuan, Sichuan Province, and Linzhi, Xizang Province.

*Conservation status*. *Salvia subviolacea* has been observed at only two sites, which are
Figure 1. *Salvia subviolacea* sp. nov. A, Habit; B, flower (side view); C, flower (longitudinal section); D, corolla with stamens reflexed; E, ovary and style; F, dissected calyx (outer view). Scale bars: A, 3 cm; B–F, 1 cm. Drawn by Claire Banks from Y. K. Wei, H. Xu & Y. B. Huang S0617 (E).
A new species of *Salvia* from Sichuan and Xizang

Figure 2. *Salvia subviolacea* and morphologically similar species: A and B, *S. subviolacea*; C, *S. wardii*; D, *S. dolichantha*; E, *S. przewalskii*; and F, *S. hians*.

about 360 km apart, among 403 localities surveyed for *Salvia* across Sichuan (83), Xizang (49) and Yunnan (271). Whereas the Sichuan population appears for now to be relatively steady, with between 250 and 2500 mature individuals, the Xizang population is under extreme threat. In 2019 this location was revisited but no living plants were found. The conservation assessment is therefore EN B2ac(iii) or C2b (IUCN Standards and Petitions Subcommittee, 2017).

*Etymology.* The epithet refers to the pale violet colour of the corolla.

*Vernacular name.* 川藏鼠尾草 (‘Chuanzang sage').

*Additional specimens examined.* Sichuan: Yanyuan, Pass of Mianbu, 3240 m, 30 vii 2011, E. D. Liu, C. L. Xiang, W. Fang, W. Z. Ma, G. X. Hu, Z. H. Wang & X. Nong 2994 (PE, KUN [two duplicates]).

Xizang: Linzhi, 3937 m, 29°34'11.75"N, 94°34'31.82"E, 16 vii 2011, Y. K. Wei, B. J. Ge, L. J. Cui & G. Xu S0239 (CSH [five duplicates]); Linzhi, Demula, 3900 m, 12 vii 2012, C. Wang LZ067 (BNU [one duplicate]).
Similarities and differences between these species are summarised in the Table, and their comparative morphology is shown in Figure 2.

Living material was collected but the plants have not survived at Shanghai Chenshan Botanical Garden. We will attempt to set up ex situ collections at the Kunming Institute of Botany, Yunnan.

**Discussion**

Wu & Li (1977) placed the Chinese species of *Salvia* in three subgenera (i.e. subg. *Allagospadonopsis*, subg. *Salvia* and subg. *Sclarea*) based on stamen structure and whether their lower arms are fertile and united. However, this classification has some obvious discrepancies, such as *Salvia nipponica* Miq. being placed in subg. *Salvia* despite its sterile lower arms, which place it in subg. *Sclarea*. Similarly, *Salvia substolonifera* E.Peter was incorrectly placed in subg. *Allagospadonopisis* when it actually belongs to subg. *Salvia* because of its fertile lower arms. A comprehensive re-examination of the Chinese *Salvia* was clearly much needed, with a particular emphasis on flowers from living plants.

Hu et al. (2018) established a new subgenus, *Glutinaria* (Raf.) G.X.Hu, C.L.Xiang & B.T.Drew, based on molecular evidence, and treated eight major subclades within it as sections. Section *Eurysphace*, with 45 species, is the largest of these sections and the vast majority of its species have a Sino-Himalayan distribution and are found at high elevations. These species were divided into two subsections: subsect. *Annuae* and subsect. *Perennes*. Subsection *Annuae* comprises three annual or biennial species (*Salvia roborowskii* Maxim., *S. tricuspis* Franch. and *S. umbratica* Hance), and subsect. *Perennes* includes 42 species (Hu et al., 2018).

The species of subsect. *Perennes* can be divided into two groups – short connective and long connective – based on the relative ratio of connective to filament. In the short-connective group, the connective is obviously shorter than the filament, whereas in the long-connective group the connective equals or is longer than the filament. Within the short-connective group, there is a clear distinction between the species with smaller corollas (never exceeding 3 cm; mean, 2.5 cm) and of small stature (height less than 30 cm) and larger plants with corollas that exceed 3 cm (mean, almost 4 cm).

The group of small-flowered species includes *Salvia brachyloma* E.Peter, *S. brevilabra* Franch., *S. evansiana* Hand.-Mazz., *S. lankongensis* C.Y.Wu, *S. mairei* H.Lév., *S. schizochila* E.Peter and *S. wuana* C.L.Xiang. *Salvia subviolacea* belongs to the group with the larger flowers, which consists of almost 20 species including *S. dolichantha*, *S. przewalskii* and *S. wardii*. A key to this group is presented here.
| Character                        | *Salvia subviolacea* | *Salvia dolichantha* | *Salvia hians* | *Salvia przewalskii* | *Salvia wardii* |
|---------------------------------|----------------------|----------------------|----------------|-----------------------|-----------------|
| **Habit**                       | Small to medium      | Small to medium      | Medium to large| Medium to large       | Large           |
| **Plant height (cm)**           | 27–57 (mean, 44.4; n = 10) | 29–56 (mean, 44.0; n = 13) | 40–120 (mean, 63; n = 4) | 21–88 (mean, 58.4; n = 37) | 43–90 (mean, 65.9; n = 7) |
| **Indumentum**                  | Leaves puberulent or pubescent. Petioles, stem, inflorescence and corolla pubescent. Calyx glandular. | Leaves puberulent. Petioles, stem and inflorescence densely villose, calyx shortly villose, corolla puberulent. | Leaves, petioles, stem, inflorescence and flower sparsely pubescent. Glandular hairs present on calyx and inflorescence. | Indumentum dense throughout. Petioles, stem and inflorescence pubescent, tomentose or villous. Upper surface of leaves densely puberulous, lower surface more or less lanate. Inflorescence, calyx and corolla glandular hairy. Corolla white villous. | Leaves puberulent. Petioles, stem and inflorescence pubescent. Corolla glandular pubescent, calyx with longer, glandular hairs. |
| **Leaf size (cm)**              | 7–20 × 5–15 (mean, 12.4 × 9.9; n = 22) | 6–24 × 6–22 (mean, 11 × 9.4; n = 31) | 5–18 × 4–11 (mean, 11.6 × 7.1; n = 6) | 5.5–20 × 3–13 (mean, 11.6 × 6.3; n = 58) | 10–18 × 7–11 (mean, 13 × 8.2; n = 8) |
| **Leaf shape**                  | Cordate to narrowly cordate | Cordate to narrowly cordate | Cordate to narrowly cordate, lanceolate to broadly lanceolate | Lanceolate, ovate, subhastate and subsagittate | Lanceolate to broadly lanceolate |
| **Leaf margin**                 | Crenate              | Dentate or incised   | Crenate        | Crenate              | Crenate         |
| **Leaf apex**                   | Acuminate, acute or obtuse | Acuminate            | Acuminate or acute | Crenate              | Acute or obtuse |
| **Leaf base**                   | Cordate, occasionally hastate | Cordate or hastate | Cordate to hastate | Hastate, subhastate or subcordate | Subcordate or subhastate |
| **Leaf colour**                 | Dark green above, a little lighter below | Light green | Green above, a little lighter below | Green above, grey-green to grey-white below. Petioles, veins and margin usually violet. | Green above, a little lighter below. Base of veins occasionally violet. |
| **Underside of leaf**           | Puberulent to pubescent | Puberulous            | Sparsely pubescent | More or less lanate-felted | Puberulent |
| **Inflorescence length (cm)**   | 20–35 (mean, 27.9; n = 10) | 8–24 (mean, 15; n = 15) | 9–30 (mean, 22.3; n = 8) | 11–53 (mean, 28.6; n = 29) | 7.5–54 (mean, 34.3; n = 13) |
| **Inflorescence density/spacing of verticillasters** | Relatively lax/medium to long | Dense/short | Lax/medium to long | Lax/long | Relatively dense/medium |
| **Calyx shape**                 | Tubular-campanulate | Tubular-campanulate to campanulate | Broadly campanulate | Tubular to tubular-campanulate | Campanulate to broadly campanulate |
| Character | Salvia subviolacea | Salvia dolichantha | Salvia hians | Salvia przewalskii | Salvia wardii |
|-----------|-------------------|-------------------|-------------|-------------------|-------------|
| Colour    | Violet or deep violet to black, uniform | Deep violet to violet-green, bicoloured, variable | Green and deep violet bicoloured, variable | Deep violet or bicoloured, variable | Green to deep violet or bicoloured, variable |
| Length (mm) | 12–21 (mean, 15.7; n = 22) | 13–20 (mean, 17.7; n = 28) | 11–16 (mean, 13.7; n = 6) | 10–16 (mean, 12.3; n = 27) | 12–17 (mean, 14.6; n = 27) |
| Calyx indumentum on throat inside | Scabrid, without annulus | Glabrous | Subglabrous to sparsely sericeous, without annulus | Glabrous, occasionally scabrid | Sericeous, without annulus |
| Adhesion between calyx and base of corolla tube | Adnate | Adnate | Free | Adnate | More or less free |
| Corolla | | | | | |
| Colour | Pale blue-purple to light purple; upper and lower lips concolorous or white with concolorous spots | Deep violet | Purple to light purple; lower lip white | Purplish red, pale purple, pale blue-purple, bluish purple | Deep blue |
| Length (mm) | 26–40 (mean, 32.3; n = 20) | 36–50 (mean, 41.0; n = 28) | 27–35 (mean, 32.3; n = 6) | 34–41 (mean, 36.5; n = 10) | 33–50 (mean, 42.7; n = 30) |
| Ratio of calyx to corolla length | 0.49 | 0.43 | 0.42 | 0.34 | 0.34 |
| Position of lanate annulus within corolla tube | 1/3 above tube base | 1/5 above tube base | 1/6 above base, rarely exannulate | 1/4 above tube base | 1/3 above tube base |
| Filament length (mm) | 5.1–8.1 (mean, 7.3; n = 4) | 9 (mean, 9.0; n = 2) | 6–7 (mean, 6.3; n = 6) | 7.7–9.5 (mean, 8.6; n = 10) | 6.1–8.3 (mean, 7.4; n = 30) |
| Connective length (mm) | 4.5–6.5 (mean, 5.1; n = 4) | 5 (mean, 5.0; n = 2) | 3.5–8 (mean, 6.6; n = 6) | 4.4–7.6 (mean, 5.7; n = 10) | 3.8–5.9 (mean, 4.9; n = 30) |
| Pistil length (mm) | 33.2–43.1 (mean, 38.4; n = 4) | ND | 33–44 (mean, 36.4; n = 7) | 28.7–39.4 (mean, 36.0; n = 10) | 34.3–48.5 (mean, 41.9; n = 29) |
| Nutlet shape | Subglobose | ND | Obovoid | Obovoid to prolate | Obovoid |
| Nutlet size (mm) | 2.7–3.1 × 2.1–2.4 (mean, 2.8 × 2.3; n = 8) | ND | 4 × 3 (mean, 4 × 3; n = 1) | 3.1–4.4 × 2–2.7 (mean, 3.8 × 2.5; n = 46) | 3.7–5.2 × 2.4–3.8 (mean, 4.3 × 2.9; n = 14) |

ND, no data.

*Means have been calculated from measurements obtained from different plants.
Key to the Chinese species of the short-connective and big-flower group of Salvia subsect. Perennes

1a. Corolla straight or curving slightly upwards, tube almost equally wide at middle and mouth

2b. Corolla more than 1/2 the length of the filament

3a. Corolla blue

4a. Corolla length shorter than 3 cm

5a. Leaves ovate with cordate base, pubescent above. Corolla curving slightly upwards, blue to white

6a. Calyx campanulate. Corolla blue

7a. Corolla yellow. Leaf orbicular

8a. Inflorescence dense with short internodes, densely villose. Corolla deep purple

9a. Plant 20–30 cm tall and usually unbranched. Corolla curving upwards

10a. Leaf elliptic. Corolla pale purple or pink

11a. Leaf tomentose

12a. Corolla pale yellow. Leaf oblong

13b. Leaf sparsely pubescent

12b. Corolla purple, pale purple or purplish red. Leaf broadly lanceolate, hastate or ovate

S. przewalskii
13a. Cauline leaves present  

S. atrorubra C.Y.Wu

13b. Leaves all basal

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14a. Bracts prominent, orbicular. Inflorescence compacted, usually green  

S. kiaometiensis H.Lév.

14b. Bracts small, lanceolate. Inflorescence lax, usually purple  

S. castanea Diels.

Acknowledgements

This work was supported by Specific Project for Strategic Biological Resources and Technology Supporting System from the Chinese Academy of Sciences (grant no. ZSZY-001) and Chenshan Special Foundations from Shanghai Municipal Administration of Forestation and City Appearances (grant nos. G172410 and G182409).

The Royal Botanic Garden Edinburgh is supported by the Scottish Government’s Rural and Environment Science and Analytical Services Division. We are also grateful for the support of players of People’s Postcode Lottery towards our scientific research.

We wish to thank Claire Banks for her excellent illustration, and the editors and reviewers for their helpful comments.

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