



Article

SHAHEEN, H.^{1*}

POTTER, D.²

QASEEM, M.F.³

QURESHI, R.³

Heliotropium pakistanicum SP. NOV. (BORAGINACEAE) FROM PAKISTAN

Heliotropium pakistanicum sp. Nov. (Boraginaceae) identificada no Paquistão

ABSTRACT - *Heliotropium pakistanicum* Shaheen sp. nov., has been described as new species to science. This taxon has been collected from Thal Desert, Punjab province, Pakistan. This species is closely associated with *H. cabulicum* Bunge. However, It differs from *H. cabulicum* in its leaf shape, inflorescence and glabrous corolla tube and bulbous base hairs. Taxonomic details of *Heliotropium pakistanicum* have been provided in this article.

Keywords: pakistani flora weed, Punjab, Thal Desert.

RESUMO - *Heliotropium pakistanicum* Shaheen sp. nov. é descrita como uma nova espécie para a ciência. Este táxon foi coletado no deserto de Thal, província de Punjab, Paquistão. Esta espécie está intimamente associada à *H. cabulicum* Bunge. No entanto, difere de *H. cabulicum* no que diz respeito à forma da folha, inflorescência e tubo da corola glabro e pelos de base bulbosa. Detalhes taxonômicos de *Heliotropium pakistanicum* foram fornecidos neste artigo.

Palavras-chave: planta daninha da flora Paquistanesa, Punjab, deserto de Thal.

INTRODUCTION

Boraginaceae (Synonym: Lennoaceae, Hydrophyllaceae) family comprises about 135 genera and 2,600 species mostly distributed in tropical, subtropical and temperate regions of the world (Retief and Van Wyk, 2008). This family is characterized by a scorpioid cymose inflorescence (Buys and Hilger, 2003), a gynobasic style, and a two-part ovary that breaks into four nutlets. This circumscription is equivalent to, and has in the past been referred to as, Boraginaceae s.s. or Boraginoideae (Small, 1903; Diane et al. 2002; Weigend et al. 2010). This broader circumscription has included four taxa treated as either subfamilies (Boraginoideae, Cordioideae, Ehretioideae, and Heliotropioideae) or families that are characterized by a scorpioid cyme and two-parted gynoeceum (style position and fruit type vary) (Lawrence, 1937; Cronquist, 1981; Al-Shehbaz, 1991; Takhtadzhian, 1997).

From Pakistan, 32 genera and 135 species are so far identified for Boraginaceae family. *Heliotropium* (add authority) is a large and complex genus with about 270-300 species occurring in temperate and tropical regions of both the hemispheres in the world (Ali and Nasir 1989; Nasir, 1989; Forther, 1998). *Heliotropium* is known as the largest genus of the family for the Flora of Pakistan (Ali and Nasir, 1989). General characteristics of genus *Heliotropium* are annual or perennial, prostrate to erect herbs or undershrubs with usually vinous to

* Corresponding author:

<humaira.shaheen@comsats.edu.pk>

Received: February 11, 2017

Approved: March 3, 2017

Planta Daninha 2019; v37:e019175697

Copyright: This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original author and source are credited.



¹ COMSATS Institute of Information Technology, University Islamabad, Islamabad, Pakistan; ² University of California, Davis, United States of America; ³ Pir Mehr Ali Shah Arid Agriculture University Rawalpindi, Punjab, Pakistan.

scabrid indumentum, rarely glabrous. Leaves alternate, entire. Inflorescence usually of terminal or axillary scorpioid cyme. Flowers small, white, bracteate or not. Calyx usually 5-partite into linear or lanceolate lobes, persistent. Corolla 5-lobed, tubular to infundibuliform, hairy on the outside and sometimes variously so within; lobes \pm erect or inflexed, obtuse to linear, with dentations or lobed between them or not. Stamens 5, free, included and attached to the corolla tube; anthers elongated, subsessile, sometimes apiculate. Ovary 4-locular or incompletely 2-locular. Style erect. Stigma \pm conical or elongated. Stigmatic disc usury present. Fruit comprising of 2-4 nutlets.

In this paper, a new species *Heliotropium pakistanicum* Shaheen has been described for science from the Thal Desert, Punjab Province of Pakistan. It was collected in 2010-2015 during undertaking floristic surveys the area in question and this appears to be the first new species.

MATERIALS AND METHODS

The Thal Desert was explored for the floristic enumeration during 2010-2015 for collecting plant species. The collected specimens were pressed, dried and mounted on standard herbarium sheets along with liquid collection in Copenhagen mixture (Moore, 2010). Both the dried and liquid specimens were properly examined by using stereoscope (WILD M5) with a camera lucida attachment. Using the relevant characteristics, each specimen was identified with the Flora of Pakistan (Boraginaceae) and other relevant floras (add references other flora you have consulted).

RESULTS AND DISCUSSION

Key to species

This is key of only those species, which were collected and identified from Thal Desert:

- | | |
|---|---------------------------|
| 1a. Calyx shallowly 5-lobed, completely enclosing the fruit | <i>H. supinum</i> |
| 1b. Calyx 5-partite; not completely enclosing the fruit: | 2a |
| 2a. Plants glabrous | <i>H. curassavicum</i> |
| 2b. Plants vinous to scabrid: | 3a |
| 3a. Stigmas 2, linear-recurved, exserted | <i>H. ophioglossum</i> |
| 3b. Stigma solitary, minutely 2-fid or capitate, included. | 4a |
| 4a. Stigma capitate, entire | <i>H. rariflorum</i> |
| 4b. Stigma conical, entire or not: | 5a |
| 5a. Flowers bracteates: | 6a |
| 6a. Effect semi-shrubby herbs; leaves linear, 25-50 mm long | <i>H. zeylanicum</i> |
| 6b. Prostrate to decumbent herbs; leaves linear lanceolate to elliptic: | 7a |
| 7a. Inflorescence compact, 20-40 mm long; leaves lanceolate to elliptic; flowers sessile | <i>H. marifolium</i> |
| 7b. Inflorescence lax, 20-100 mm long; leaves linear-lanceolate | <i>H. strigosum</i> |
| 5b. Flowers ebracteate: | 8b |
| 8a. Corolla lobes caudate-acuminate | <i>H. subulatum</i> |
| 8b. Corolla lobes obtuse to ovate or caudate: | 9a |
| 9a. Corolla hairy within: | 10a |
| 10a. Hairs within corolla in two distinct zones. | <i>H. baluchistanicum</i> |
| 10b. Hairs not present in zones: | 9b |
| 9b. Corolla glabrous within: | 11a |
| 11a. Corolla 4-8 mm long: | 12b |
| 12a. Corolla lobes linear, inflexed. Stigma 1.5-1.8 mm long | <i>H. gillianum</i> |
| 12b. Corolla lobes \pm ovate, obtuse. Stigma 0.7-0.8 mm long: | 11b |
| 11b. Corolla 2-3 mm long: | 13a |
| 13a. Hairs-arising from a swollen base: | 14a |
| 14a. Leaves ovate-lanceolate to lanceolate, margin entire to \pm undulate; inflorescence up to 9 flowered; corolla uniformly hairy within | <i>H. cabulicum</i> |
| 14b. Leaves lanceolate, margin deeply undulate; inflorescence up to 15-flowered; corolla glabrous within . | <i>H. pakistanicum</i> |

13b. Hairs without a swollen base.	<i>H. biannulatum</i>
15a. Leaves elliptic to obovate, 10-25 mm long; flowers close set; anthers 0.5-0.6 mm long, narrow, attached c. 0.5 mm from corolla base; stigma 0.4 mm long	<i>H. ovalifolium</i>
15b. Leaves ovate, 7-10 mm long; flowers distantly placed; anthers c. 1 mm long, \pm ovate, attached c. 0.9 mm from corolla base; stigma 1 mm long	<i>H. remotiflorum</i>
16a. Plants annual:	17a
17a. Corolla lobes sublinear, inflexed	<i>H. alii</i>
17b. Corolla lobes ovate to oblong, obtuse:	18a
18a. Plants greyish-white. Flowers uniseriate. Calyx deciduous at length	<i>H. calcareum</i>
18b. Plants green to greenish-grey. Flowers biseriata. Calyx persistent at length	<i>H. europaeum</i>
16b. Plants perennial:	19a
19a. Corolla lobes ovate to oblong, obtuse:	20a
20a. Leaves ovate to oblong-ovate; anthers oblong, 1.8-2 mm long	<i>H. ulophyllum</i>
20b. Leaves lanceolate to linear-lanceolate; anthers narrow ovate, 0.8-1 mm long:	19b
19b. Corolla lobes sublinear, inflexed:	21a
21a. Plants erect to suberect, stems up to 5 mm thick at base; leaf margin crisp-undulate; nutlet margin not-winged	<i>H. crispum</i>
21b. Plants decumbent to procumbent; stems up to 15 mm thick at base; leaf margin revolute or indistinctly undulate; nutlet margin winged	<i>H. bacciferum</i>
22a. Anthers connectives not produced	<i>H. dasycarpum</i>
22b. Anthers connectives produced:	23a
23a. Sinuses of corolla lobes without dentitions or lobes; anthers 1.0 mm long	<i>H. aucheri</i>
23b. Sinuses of corolla lobes with dentitions or lobes	<i>H. lamondiae</i>

Taxonomic details

***Heliotropium pakistanicum* Shaheen sp. nov. (Figure 1)**

Perennial semi-erect herb about 60 cm tall. Stem much branched at the base, woody below, herbaceous above, circular, green, densely villous; internodes ca. 1.5-2.5 cm. Leaves alternate, spirally arranged, succulent, ca. 1-3 x 0.3-0.5 cm, linear-lanceolate or oblong; apex broadly acute; base cuneate, margin dentate-undulate; midrib prominent, diffusely strigose; hairs 1-celled,



Figure 1 - *Heliotropium pakistanicum* sp. nov.

bulbose based, 1mm long; petiole 1 mm, densely strigose. Inflorescence ca. 0.5-2.5 cm long, forked, 6-15 flowered; peduncle ca.0.5-1.5 cm, circular, green, villous. Flowers sessile, complete, campanulate, creamy. Sepals ca. 4 x 3 mm, green, persistent; lobes 5, elliptic; apex obtuse; margin entire, densely villous. Petals lobes 5, yellow, ovate-oblong; apex obtuse; margin undulate, ca. 1-1.5 mm long, abaxially sparsely hairy; tube ca. 3 mm. Stamens 5, epipetalous, ca. 3 mm; anthers elliptic-lanceolate, base rounded, apex subacute; filaments small. Ovary globose, ca. 1 mm across; style filiform, ca. 2 mm; stigma 4-fid, conical, glabrous. Nutlets 4, whitish grey, hairy, depression on the inner side, ca. 3 mm across.

Etymology: Pakistan: Punjab, Thal Desert

Holotype: Pakistan, Punjab, Thal desert, 03-04-2010, Humaira Shaheen, Collector No (1886-PMAS-AAUR)

Other specimen examined: Pakistan, Punjab, Thal desert, 31-03-2013, Humaira Shaheen, Collector No (2605- PMAS-AAUR); Pakistan, Punjab, Thal desert, 16-08-2014, Humaira Shaheen, Collector No (3319 - PMAS-AAUR);Pakistan, Punjab, Thal desert, 02-04-2015, Humaira Shaheen, Collector No (4309 - PMAS-AAUR).

Flowering Period: April.


Collector Name: Humaira Shaheen

Distribution: Currently endemic to Thal desert, Punjab Pakistan.






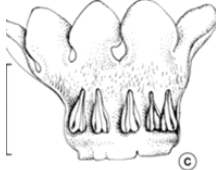
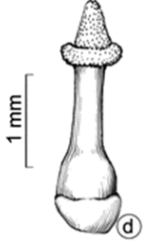


Resemblance with other species (Affinities)

Heliotropium pakistanicum Shaheen sp. nov., has been described as new species to science. The species is closely associated with *H. cabulicum* Bunge as close sympatric relative which occurs in Baluchistan, Pakistan. It differs from *H. cabulicum* in its leaf shape, inflorescence and glabrous within the corolla tube, however resembles it in bulbose base hairs. This species is widely distributed in Thal Desert (Punjab). This species differs from *H. cabulicum* in floral as well as vegetative characters. This is a perennial, semi-erect herb up to 60 cm tall. Leaves distinctly lanceolate, deeply undulate, villous. Anthers elliptic, apex subacute, 3 mm across. Ovary globose, style filiform, ca. 2 mm. Nutlets whitish grey, hairy, depression on the inner side. (Shown in Table 1).

Table 1 - Diagnostic characters of *Heliotropium pakistanicum*

Plant part	Character	Illustration
Habit	Semi-erect	

To be continued ...

Plant part	Character	Illustration
Leaves shape	Lanceolate	
Leaves margin, texture	Deeply undulate and Villous	
Inflorescence	Forked	
Corolla	Glabrous inner side (bulbose base hairs)	 
Anthers	Elliptic, subacute apex	
Style	Filiform at tip	
Ovary	Globose	
Nutlets	Hairy, depression on inner side	

Heliotropium pakistanicum much resemble to *Heliotropium cabulicum* but have following distinguish characters (Table 2).

Table 2 - *Heliotropium pakistanicum* comparison with *Heliotropium cabulicum*

S. No.	<i>Heliotropium pakistanicum</i>	<i>Heliotropium cabulicum</i>
1	Semi-erect herb about 60 cm high	Erect up to 40 cm
2	Stem densely Villous hairy	Stem antrorsely hairy
3	Leaves succulent	Leaves not succulent
4	Diffusely strigose hairs at the midrib and densely strigose hairs at entire leave	Scabrid with short strigose Hairs on leaves
5	Leaves linear-lanceolate or oblong	Leaves ovate-lanceolate or lanceolate
6	Inflorescence fork shape	Inflorescence
7	Sessile flower	Pedicel from 2-5 mm long
	6-15 flowered in each fork	3-9-flowered in a inflorescence
8	Petels lobes ovate-oblong	Petels lobes lanceolate
9	Anther elliptic, apex subacute and sessile	Anther elongate and subsessile
10	Style filiform	Style multifurcated
11	Ovary ovate	Ovary compressed
12	Nutlets whitish grey, depression on the inner side	Nutlets glabrous, dark brown

This species is common in plan sandy area of Thal Desert (Punjab). This plant is not reported before any area of the world we reviewed different literature such as Flora of China, Flora of Pakistan, Flora of America etc. This description is also verified by different taxonomist in Pakistan and USA (University of California Davis).

ACKNOWLEDGMENTS

This research article is the part of my Ph.D. work, I highly grateful to Higher Education Commission (HEC) for the Ph.D. Indigenous scholarship. I am also thankful to Pakistan Science Foundation for providing project on Thal Desert, this project give financial support for conducting survey.

REFERENCES

- Al-Shehbaz I.A. The genera of Boraginaceae in the southeastern United States. **J Arnold Arboretum. Suppl Series.** 1991;1:1-169.
- Ali S., Nasir Y. **Flora of Pakistan.** Karachi: University of Karachi, 1989.
- Buyts M.H., Hilger H.H. Boraginaceae cymes are exclusively scorpioid and not helicoid. **Taxon.** 2003;52:719-24.
- Cronquist A. **An integrated system of classification of flowering plants.** Columbia: Columbia University Press, 1981.
- Diane N., Hilger H., Gottschling M. Transfer cells in the seeds of Boraginales. **Bot J Linnean Soc.** 2002;140:155-64.
- Forther H. Die infragenerische Gliederung der Gattung *Heliotropium* L. und ihre Stellung innerhalb der subfam. Heliotropioideae (Schrad.) Arn.(Boraginaceae). **Sendtnera.** 1998;5:35-241.
- Lawrence J.R. A correlation of the taxonomy and the floral anatomy of certain of the Boraginaceae. **Am J Bot.** 1937;24:433-44.
- Moore S. Preservation of botanical specimens in fluid. **NatSCA News.** 2010;19:85-8.
- Nasir Y.J. **Boraginaceae.** Karachi: University of Karachi, Department of Botany, 1989.
- Retief E., van Wyk A. The genus *Wellstedia* (Boraginaceae: Wellstedioideae) in southern Africa. **Bothalia.** 2008;38:57-63.
- Small J.K. Flora of the southeastern United States. New York: 1903.

Takhtadzhian A.L. **Diversity and classification of flowering plants**. Columbia: Columbia University Press, 1997.

Weigend M. et al. Fossil and extant western hemisphere Boragineae, and the polyphyly of “Trigonotideae” Riedl (Boraginaceae: Boraginoideae). **Syst Bot.** 2010;35:409-19.