



Orchid diversity in shoolpaneshwer wildlife sanctuary, Gujarat, India

S L Meena¹, P Harikrishna^{2*}

¹ Department of Botanical Survey, Arid Zone Regional Centre, Jodhpur, Rajasthan, India

² Department of Botanical Survey, Deccan Regional Centre, Hyderabad, Telangana, India

Abstract

Shoolpaneshwer Wildlife Sanctuary (SWLS), situated within the Satpura Range of Gujarat, India, is a vital biodiversity hotspot primarily characterized by dry and moist deciduous forests. While its diverse fauna is well-documented, the orchid flora of this sanctuary has remained relatively unexplored. This study presents an assessment of orchid diversity in SWLS, derived from fieldwork conducted between 2012 and 2016, encompassing extensive field observations. Our findings reveal the presence of 14 orchid species belonging to 6 genera within the protected area, representing significant orchid diversity. This includes both epiphytic and terrestrial species adapted to the unique ecological conditions of the region. Three endemic orchid species were recorded. This study underscores the importance of SWLS as a refuge for orchids in Gujarat.

Keywords: Orchidaceae, Shoolpaneshwer Wildlife Sanctuary, Gujarat, Biodiversity, Conservation, Flora, India, Western Ghats influence.

Introduction

Orchidaceae, the orchid family, comprises an estimated 25,000 to 35,000 species across 800 genera, making it one of the largest families of flowering plants globally (Christenhusz & Byng, 2016^[7]; Govaerts *et al.*, 2018^[9]; POWO, 2025). Renowned for their remarkable floral diversity and intricate ecological relationships, orchids represent a highly evolved group within the plant kingdom (Christenhusz & Byng, 2016)^[8]. India, with its diverse biogeographical zones, harbors a substantial portion of this global orchid wealth, estimated to include approximately 1,200 to 1,300 species (Singh *et al.*, 2019). While orchid diversity is often associated with the evergreen forests of the Himalayas and the Western Ghats, recent research has increasingly highlighted the orchid richness of other regions, including drier deciduous forest ecosystems (Bhatt, 2014, 2015, 2016; Kulloli & Purohit, 2020)^[12].

Gujarat, known for its arid and semi-arid landscapes, is home to four National Parks, 23 Wildlife Sanctuaries, and one Biosphere Reserve (<https://wiienvis.nic.in/>). Among these, SWLS, located in the western Satpura Range south of the Narmada River, shares borders with Madhya Pradesh and Maharashtra. This study provides a preliminary overview of the orchid diversity within SWLS, based on extensive field surveys, serving as a baseline for future in-depth orchid research and conservation planning in this significant protected area.

Materials and Methods

Gujarat, primarily known for its arid and semi-arid terrain, also features pockets of relatively moist deciduous forests in its eastern regions, bordering Madhya Pradesh and Maharashtra. These areas, representing the northernmost extension of the Western Ghats and the Satpura Range, are characterized by high rainfall gradients and varied topography, providing suitable habitats for a range of orchid species adapted to these unique environmental conditions.

Study Area

SWLS, established in 1989, is situated in the Rajpipla (East) division of the Narmada district, Gujarat. It covers an area of 607.7 km², located between 21°03'N to 21°59'N latitude and 73°05'E to 74°10'E longitude, with an altitude ranging from 800 to 900 meters above sea level (**Figure 1**).

The sanctuary comprises five distinct ranges: Gora, Piplod, Fulsar, Sagai, and Dediapada. The region experiences a tropical climate, with mean summer temperatures reaching 43°C and mean winter temperatures dropping to 10°C. The majority of the rainfall, averaging around 1000 mm, occurs between mid-June and mid-October. During the monsoon season, numerous streams and rivulets traverse the sanctuary, supporting both aquatic and terrestrial ecosystems. According to Champion and Seth (1968)^[6], the dominant vegetation types in SWLS include Slightly Moist Teak forests (3B/C1b), Southern Moist mixed deciduous forests (3B/C1c), dry deciduous scrubs (5/DS1), dry bamboo brakes (5/E9), and dry tropical riverine forests (5/IS1).

Between 2012 and 2016, seven plant exploration tours were conducted during various seasons to document the full spectrum of phenological events. A total of 20 randomly collected orchid plant specimens were gathered throughout the sanctuary. These specimens were processed following the methodology outlined by Jain and Rao (1976)^[11] and identified using existing literature (Shah, 1978^[20]; Meena & Pandey, 2004; Meena, 2011, 2012, 2014; Krishna *et al.*, 2014; Meena *et al.*, 2021). Consultations with herbaria, including BSJO, BSI, CAL, and BARO, were also conducted. The herbarium specimens were deposited at the Botanical Survey of India (BSJO), Jodhpur.

Results and Discussion

The extensive explorations revealed 14 orchid taxa, representing 6 genera (Table 1 & Plate 1), within SWLS. This significant diversity, constituting 46.6% of the known orchids of Gujarat (Bhatt, 2018) within just 0.4% of the state's total geographical area, underscores the sanctuary's importance as an orchid-rich region. Of the 14 taxa, 4 are

epiphytes and 10 are terrestrial. Three endemic orchid species were recorded: *Dendrobium barbatulum* Lindl., *Dendrobium microbulbon* A. Rich., and *Habenaria gibsonii* Hook.f., representing a significant portion of the 10 endemic orchids found in Gujarat.

The orchid flora of SWLS is likely influenced by its geographical location at the northern edge of the Western Ghats and within the Satpura Range. This transitional zone may foster a unique orchid assemblage, potentially including species with affinities to both the Western Ghats and the drier peninsular Indian flora. Further research is needed to understand the precise species composition and biogeographic relationships of the orchids in SWLS.

This study's preliminary findings highlight the conservation significance of SWLS for orchids in Gujarat. As a primarily

dry state, Gujarat harbours fewer orchid species compared to wetter regions of India. Therefore, protected areas like SWLS are critical refugia for orchid diversity within the state.

However, SWLS, like many protected areas in India, faces anthropogenic pressures, including invasive alien species, habitat degradation, forest fires, and domestic cattle grazing (Nirmal *et al.*, 2005 [18]; Gupta & Sharma, 2020 [10]; Rakholia *et al.*, 2020) [19]. The Gujarat State Forest Department is actively engaged in conservation efforts, including the declaration of eco-sensitive zones in 2016 and the promotion of ecotourism, aimed at improving the socio-economic conditions of local communities while involving them in forest resource protection and conservation.

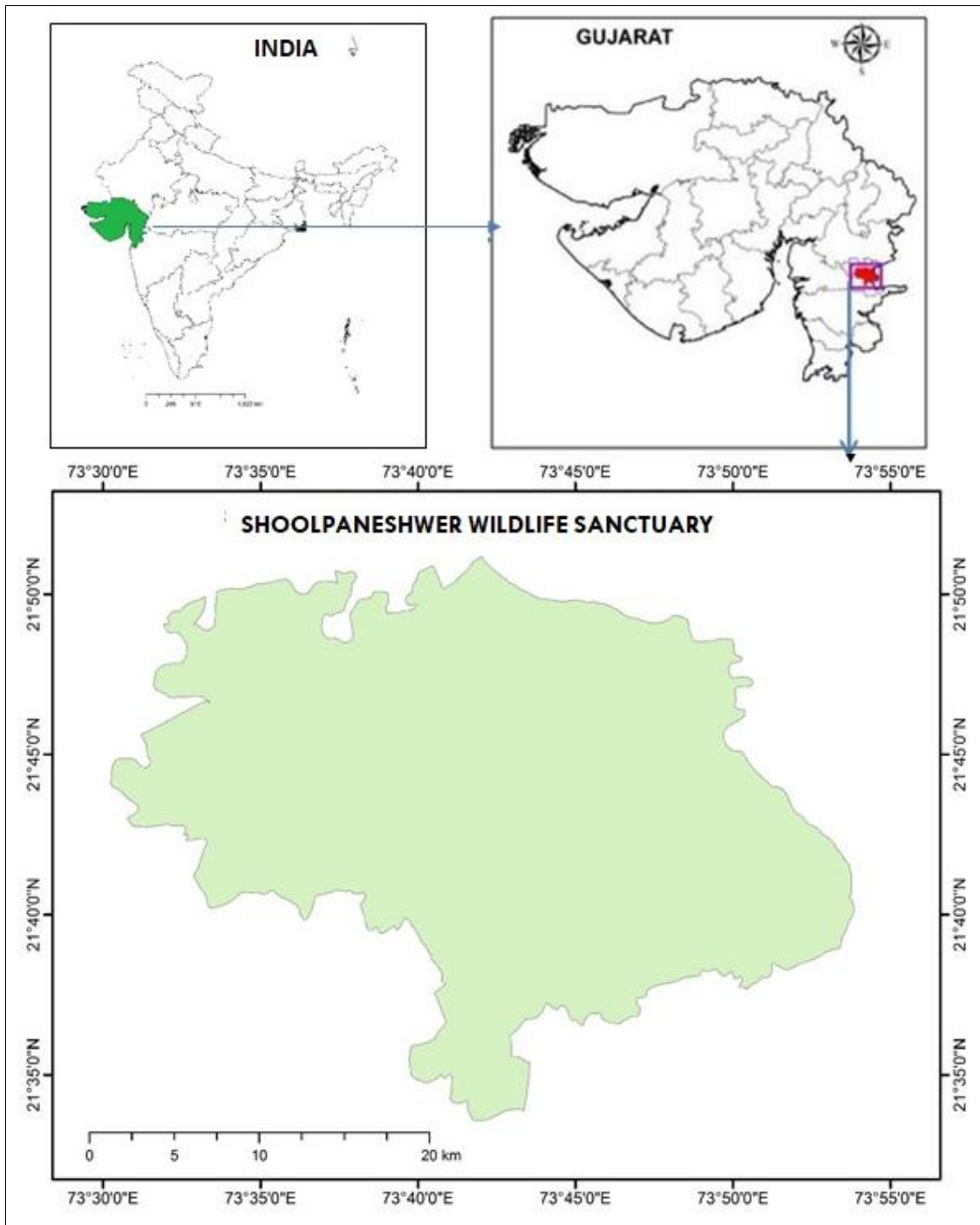


Fig 1: Study area map - Shoolpaneshwer Wildlife Sanctuary



Plate 1: A. *Habenaria digitata* Lindl.; B. *Habenaria longicorniculata* Graham; C. *Habenaria frucifera* Lindl.; D. *Nervilia concolor* (Blume) Schltr.; E. *Nervilia plicata* (Andrews) Schltr.; F. *Peristylus plantagineus* Lindl.; G. *Vanda tessellata* (Roxb.) Hook. f. ex G. Don.

Table 1: List of Orchids of Shoolpaneshwer Wildlife Sanctuary

S.No.	Scientific Name	Habit	Flowering & Fruiting	Locality	Date of collection	Longitude	Latitude	Altitude (m)	Distribution	Vegetation types	Field Collection Number
1	<i>Dendrobium barbatulum</i> Lindl.	Epiphyte	January-March	Chopdi forest	21.09.2014	73 41 48.8	21 46 01.8	497	Rare	Moist deciduous	S.L. Meena 30263 (BSJO)
2	<i>Dendrobium microbulbon</i> A. Rich.	Epiphyte	December – March	Near Mosjda	31.8.2013	73 43 20.2	21 41 22.8	295	Rare	Dry deciduous	S.L. Meena 27730 (BSJO)
			December – March	Near Mosjda	23.8.2014	73 42 45.9	21 41 40.7	270	Rare	Dry deciduous	S.L. Meena 27967 (BSJO)
3	<i>Habenaria digitata</i> Lindl.	Terrestrial	July - October	Near Kanjaifadi	21.8.2014	73 46 57	21 39 41	514	Occasional	Dry deciduous	S.L. Meena 30263 (BSJO)
4	<i>Habenaria foliosa</i> A. Rich.	Terrestrial	July - September	Namgir forest	01.09.2013	73 41 15.9	21 42 52.7	311	Occasional	Dry deciduous	S.L. Meena 27734 (BSJO)
5	<i>Habenaria frucifera</i> Lindl.	Terrestrial	August-November	Namgir forest	01.09.2013	73 41 07.8	21 42 53.5	307	Common	Dry deciduous	S.L. Meena 27738 (BSJO)
			August-November	Near Sagai	04.09.2013	73 47 42.9	21 39 53.9	391	Common	Moist deciduous	S.L. Meena 27803(BSJO)
			August-November	Near Namgir	14.09.2015	73 41 31.8	21 42 59.6	400	Occasional	Moist deciduous	S.L. Meena 30409(BSJO)
6	<i>Habenaria longicorniculata</i> J. Graham	Terrestrial	July – October	Ringha padhar-Gichad	14.09.2015	73 40 22.2	21 45 26.4	398	Occasional	Moist deciduous	S.L. Meena 30418 (BSJO)
7	<i>Habenaria gibsonii</i> Hook.f.	Terrestrial	July - September	Chopdidara	14.09.2015	73 40 23.4	21 45 27.1	408	Rare	Dry deciduous	S.L. Meena 30416 (BSJO)
8	<i>Habenaria marginata</i> Colebr	Terrestrial	August – November	Davmogra forest	06.09.2016	73 43 57.8	21 35 48.5	425	Common	Dry deciduous	S.L. Meena 30559(BSJO)
9	<i>Nervilia concolor</i> (Blume) Schltr.	Terrestrial	June – September	Chopdi forest	12.09.2016	73 40 35.6	21 47 00.1	342	Rare	Moist deciduous	S.L. Meena 30634 (BSJO)
10	<i>Nervilia plicata</i> (Andrews) Schltr.	Terrestrial	July - September	Near Village Kanjaifadi	21.8.2014	73 47 03	21 39 43	497	Rare	Dry deciduous	S.L. Meena 27937 (BSJO)
11	<i>Peristylus lawii</i> Wight	Terrestrial	July – October	Davmogra forest	06.09.2017	73 43 57.0	21 35 49.6	132	Common	Dry deciduous	S.L. Meena 30561 (BSJO)
			July – October	Near Dav Mogra	06.09.2016	73 43 57.0	21 35 49.6	422	Rare	Dry deciduous	S.L. Meena 30561 (BSJO)
12	<i>Peristylus plantagineus</i> Lindl.	Terrestrial	July – November	Kokti area	23.08.2014	73 49 39.2	21 38 41.8	517	Rare	Moist deciduous	S.L. Meena 27981 (BSJO)
13	<i>Rhynchosyilis retusa</i> (L.) Blume	Epiphyte	July – September	Near Piplod	15.09.2015	73 46 48.8	21 43 03.7	339	Occasional	Dry deciduous	S.L. Meena 30424 (BSJO)
14	<i>Vanda tessellata</i> (Roxb.) Hook. ex G.Don	Epiphyte	May – August	Near Samot	24.8.2014	73 40 42.4	21 45 11.0	109	Common	Dry deciduous	S.L. Meena 27984 (BSJO)
			May – August	Near gate of Sanctuary	20.09.2015	73 39 42.4	21 39 52.6	215	Common	Dry deciduous	S.L. Meena 30494 (BSJO)
			May – August	Near Piplod	4.6.2012	73 46 00.8	21 42 33.5	309	Occasional	Dry deciduous	S.L. Meena 27317 (BSJO)

Conclusion

Gujarat is represented by 30 orchid species under 13 genera. Of these, SWLS harbours 14 species under 6 genera (Bhatt, 2018), indicating its importance and suitability for orchid growth. This study highlights SWLS as a potentially important site for orchid diversity in a region not typically considered orchid-rich. The sanctuary likely harbours a mix of epiphytic and terrestrial orchid genera adapted to the deciduous forest ecosystem.

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References

- Bhatt MR. Systematic studies on Orchidaceae of Gujarat [PhD thesis]. Vadodara: Sayajirao University of Baroda, 2018.
- Bhatt MR, Jalal JS, Nagar PS. Extended distribution of *Geodorum laxiflorum* (Orchidaceae) in Gujarat, India. *Richardiana*, 2015;33:333–341.
- Bhatt MR, Nagar PS. *Aerides ringens* (Lindl.) C.E.C. Fisch: A new addition to the orchid flora of Gujarat, India. *Journal of Orchid Society of India*, 2014;28:115–117.
- Bhatt MR, Nagar PS. *Oberonia mucronata* (D. Don) Ormerod & Seidenf. (Orchidaceae), new addition to the flora of Gujarat, India. *Journal of Threatened Taxa*, 2016;8:8412–8414. <https://doi.org/10.11609/JoTT.17apr15.7047-7088>
- Bhatt MR, Nagar PS, Singh AP. *Peristylus constrictus* (Orchidaceae) - A new addition for Gujarat, India. *Indian Forester*, 2016;143:1140–1141.
- Champion HG, Seth SK. A Revised Survey of the Forest Types of India. Delhi: Manager of Publications, 1968.
- Christenhusz MJM, Byng JW. The number of known plant species in the world and its annual increase. *New Phytologist*, 2016;209(3):925–944.
- Christenhusz MJM, Byng JW. The number of known plants species in the world and its annual increase. *Phytotaxa*, 2016;261:201–217. <https://doi.org/10.11646/phytotaxa.261.3.1>
- Govaerts R, Bernet P, Kratochvil K, *et al.* World Checklist of Orchidaceae. Kew: Royal Botanic Gardens, 2018. URL: <http://wcsp.science.kew.org>
- Gupta R, Sharma LK. Efficacy of Spatial Land Change Modeler as a forecasting indicator for anthropogenic change dynamics over five decades: A case study of Shoolpaneshwar wildlife sanctuary, Gujarat, India. *Ecological Indicators*, 2020;112:106171.
- Jain SK, Rao RR. A Hand Book of Field and Herbarium Methods. New Delhi: Today and Tomorrow's Printers and Publishers, 1976.
- Kulloli RN, Purohit CS. *Habenaria gibsonii* var. *foetida* (Orchidaceae): An addition to the flora of Rajasthan. *Species*, 2020;21(67):202–207.
- Meena SL. Flora of Balaram-Ambaji Wildlife Sanctuary (BAWLS), Banaskantha District, Gujarat, (India). *Journal of Economic and Taxonomic Botany*, 2011;35(4):737–793.
- Meena SL. Floral Diversity of Bhavnagar District, Gujarat State (India) - A Checklist. *Nelumbo*, 2014;56:183–224.
- Meena SL. Floristic diversity of Jessore Sloth Bear Wildlife Sanctuary, Gujarat, India. *Biological Forum*, 2012;4(1):180–212.
- Meena SL, Mishra S, Krishna PH. An outline of Angiospermic Diversity of Gujarat State, India. In: Singh LJ, Ranjan V, editors. *New vistas in Indian Flora*, Vol. II. Dehradun: Bishen Singh Mahendra Pal Singh, 2021. p. 541–564.
- Meena SL, Pandey RP. A reassessment of the Phytodiversity of Gujarat state: Floristic composition and floristic analysis, vegetation, threatened and rare taxa and their conservation strategies. *Journal of Economic and Taxonomic Botany*, 2004;28(4):867–894.
- Nirmal Kumar JI, Soni H, Kumar RN. Assessment of anthropogenic interventions in Shoolpaneshwar Wildlife Sanctuary, Gujarat, India. *International Journal of Nature and Conservation*, 2005;17(1):1–25.
- Rakholia S, Mehta A, Suthar B. Forest fire monitoring of Shoolpaneshwar wildlife sanctuary, Gujarat, India using geospatial techniques. *Current Science*, 2020;119(12):1974–1981.
- Shah GL. The Flora of Gujarat State. Anand: Sardar Patel University Press, 1978, 1-2.