



16.0 Semiarid Region of India: Vegetation Characteristics and Threatened Plants

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Introduction

The arid and semiarid region of India covers *ca.* 3,17,090 km² area and is mainly spread over seven states *viz.*, Rajasthan, Gujarat, Haryana, Maharashtra, Karnataka, Andhra Pradesh and portions of Jammu & Kashmir. Climatically, the semi-arid region (annual rainfall 400 – 1000 mm) is further divisible into two zones (Rodgers & Panwar 1988). The first zone lies in Rajasthan, Gujarat, Western Madhya Pradesh, Punjab and Haryana, immediately west of which lies the Indian Desert. The second zone extends to the rain-shadow area of Western Ghats in Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. The former zone has been recognized as Zone 4 (semiarid) while the latter forms a part of Zone-6 (the Deccan Plateau). Zone 4 is further divisible into 4A (The Punjab Plains) and 4B (Gujarat-Rajputana) (Plate 16A). The semiarid region in the country is generally demarcated based on 400mm isohyets.

The semiarid zone in India represents 'Savannah' vegetation and extensive xerophilous grasslands rich in legumes and shrubs. Some of the wildlife protected areas in this region attain very high ungulate biomass *e.g.*, Ranthambore, Sariska, Gir, Velavadar, Nalsarovar, Jessore, National Chambal Sanctuary, Karera Sanctuary, Kuno - Palpur Sanctuary, Mount-Abu Sanctuary, Sitamata and Kumbalgarh Sanctuary. *Dicliptera abuensis*, *Strobilanthes hallbergii*, *Berberis asiatica*, *Ceropegia odorata*, *C. hirsuta*, *Ceropegia vincaefolia* are some of the interesting plants of this zone. In this article we discuss salient features of semiarid vegetation in Rajasthan, Gujarat and Madhya Pradesh along with description of special habitats and some examples of threatened plants.

Vegetation Characteristics

In Rajasthan, Aravalli Hill range separates semiarid tract from the arid zone. The average annual rainfall to the east of Aravalli ranges between 525-675 mm and reaches 1000 mm at some location. Eastern Rajasthan has rich alluvial soil that supports good forests and agricultural crops. The vegetation comprises Tropical Dry Deciduous Forests, Savannah woodland and Tropical Thorn Forest. *Anogeissus pendula* is the dominant species. Other associates are *Buchanania lanzan*, *Diospyros melanoxylon*, *Mitragyna parvifolia*, *Cassia fistula*, *Schrebera swietenioides*, *Pterocarpus marsupium*, *Holoptelea integrifolia*, *Butea monosperma* and *Mallotus philippensis*. *Boswellia serrata* occupies hill crests of Aravallis, *Terminalia arjuna* forms riparian forests. *Sterculia urens* is distributed throughout Aravalli range and *Anogeissus latifolia* is mainly found in open forest of Aravallis range in southern Rajasthan. Other locally common species in the region are *Kydia calycina*, *Mangifera indica*, *Woodfordia fruticosa*, *Lannea coromandelica*, *Cochlospermum religiosum*, *Flacourtia indica*, *Tectona grandis* and species of *Bauhinia*, *Albizia*, *Acacia*, *Ziziphus*, *Capparis*, and *Ficus* (Sharma & Tiagi 1979, Shetty & Singh 1987).

The Gujarat state is divided into six geomorphologically distinct regions *viz.*, South Gujarat, Central Gujarat, Aravalli and adjoining tract, Kathiavad Peninsula, the Kutchh Peninsula with the Rann (true saline desert) and the Coastal tract. The semiarid region in the state is formed by Central Gujarat, Aravalli and adjoining tracts, Kathiavad Peninsula, with an average rainfall of 250mm to 1250mm. According to Champion & Seth (1968) four different forest types are found in this region *viz.*, Tropical Moist Deciduous Forest, Littoral and swamp Forest, Tropical Dry Deciduous Forest and



Northern Tropical Thorn Forest. *Tectona grandis*, *Anogeissus pendula*, *Boswellia serrata*, *Acacia nilotica*, *Euphorbia caducifolia*, *Flacourtia indica*, *Helicteres isora*, *Holarrhena antidysentrica*, *Bridelia squamosa*, *Embllica officinallis*, *Butea monosperma*, *Diospyros melanoxylon*, *Anogeissus latifoia*, *Lannea coromandelica*, *Sterculia urens*, *Mitragyna parviflora* and species of *Wrightia*, *Carissa*, *Zizyphus*, and *Capparis* are common woody elements. *Heteropogon contortus*, *Aristida* spp., *Eragrostis* spp., *Chloris* spp., and *Aeluropus* spp., are the common grasses (Shah 1978, Patel 1971).

The semiarid tract in Madhya Pradesh is represented by Chambal catchment extending up to Narmda and Betla Rivers. The forest types of the region are Tropical Dry Deciduous and Tropical Thorn Forests where more than 1000 flowering plants have been reported. The common tree species include *Anogeissus latifoia*, *A. pendula*, *Tectona grandis*, *Lannea coromandelica*, *Diospyros melanoxylon*, *Sterculia urens*, *Mitragyna parviflora*, *Butea monosperma*, *Embllica officinallis*, *Boswellia serrata*, *Bridelia squamosa* and *Hardwickia binata*. Species composition at shrub and ground layer is similar to that of semiarid regions of Gujarat. A few climbers of this area include species of *Rhynchosia*, *Atylosia*, *Cocculus*, *Cissampelos*, *Ipomoea*, *Pergularia daemia*, *Pueraria tuberosa* and *Tinospora cordifolia* (Verma *et al.* 1993).

Special Habitats

Sambhar Lake

Sambhar, the largest salt lake of the India, has been recognized as a wetland of international importance *i.e.*, Ramsar site (Plate 16A). The length is 32 km from northeast to southwest, while the width varies between 3-2 km. The wetland area is a key wintering area for tens of thousands of flamingos and other migratory birds from northern Asia. The different group of algae (Cyanophyceae and Rhodophyceae) and bacteria growing in the lake provide striking water colour and support the lake ecology that, in turn, sustains the migrating wetland birds. Distinguished among the species are halophytes, which can be seen in this area. *Salsola baryosoma*, *Suaeda fruticosa*, *Haloxylon recurvum*, *Sesuvium sesuvioides*, *Chenopodium album* and *C. murale*. The other species of interest around Sambhar lake include *Portulaca oleracea*, *Trianthema portulacastrum*, *T. triquetra*, *Zaleya govidea*, *Aeluropus logopoides*, *Tamarix troupii*, *Acacia nilotica*, *Calotropis procera*, *Capparis deciduas*, *Salvadora oleoides* and *Prosopis juliflora*.

Rocky outcrops of Aravalli Ranges

The metamorphic rocks of Aravalli generally support poor soil and sparse vegetation. The dominant species being *Anogeissus pendula*, commonly associated with *Diospyros melanoxylon*, *Acacia leucophloea*, *Bauhinia racemosa* and *Wrightia tinctoria*. In parts of Jaipur and Ajmer districts, *Acacia senegal* is common on the upper slopes with different plant associates *e.g.* *Sterculia urens*, *Boswellia serrata* and *Lannea coromandelica* and along the foothills with *Butea monosperma*. The other species found are *Dichrostachys cineraria*, *Balanites aegyptiaca*, *Maytenus emarginata*, *Rhus mysurensis*, *Securinga leucopyrus*, *Grewia flavescens* and *G. tenax*. *Acacia catechu* forests are common in the south-eastern regions of Rajasthan *e.g.* Baran, Jhalawar, Kota, Swaimadhapur, Chittorgarh and Alwar. The area under this type covers roughly 3% of the total forest area (Sharma & Tiagi 1979).

Mount Abu

Mount Abu, situated on the south western border of Rajasthan, is the highest peak between western Himalayas and Nilgiri hills with a maximum height of 1727m. The vegetation is peculiar due to relatively high altitude together with climatic and edaphic factor for semiarid habitat and again highlights this area as a hotspot due to the presence of some endemic and threatened plants *viz.* *Dicliptera abuensis*, *Strobilanthes hallbergii*, *Bonnaya bracteoides*, *Oldenlandia clausa*, *Veronica anagallis* var. *bractea*, *Ceropegia odorata*, *C. hirsuta*, *C. vincaefolia*, *Ischaemum kingii*, *Rosa involucrate*,



Sterculia villosa, *Eulophia ochreatea*, *Aerides crispum*, *A. multiflora*, *A. maculosum* and *Vanda testacea* and associated with common plants *Carvia callosa*, *Erythrina* sp., *Kydia calycina*, *Mangifera indica*, *Mallotus philippensis*, *Lannea coromandelica*, *Jasminum humile*, *Flacourtia indica*, *Crateva nurvala* and *Ficus* spp. (Mehta 1979, Sharma & Kotia 2008).

Ravines of Chambal

Around 4.5 lakh hectares area in Madhya Pradesh and Rajasthan falls under ravines. These areas face a continuous threat of human encroachment for reclamation and habitation. Thorny bushes or small trees commonly found in this area include *Capparis deciduas*, *Capparis sepiaria*, *Balanites aegyptiaca*, *Acacia senegal*, *A. nilotica*, *A. leucophloea*, *Prosopis juliflora*, *Butea monosperma*, *Maytenus emarginata*, *Tamarix* sp., *Salvadora persica*, *S. oleoides*, *Crotalaria medicaginea*, *C. burhia*, *Clerodendrum phlomidis*, *Calotropis procera*, *Xanthium indicum* and *Leptadenia pyrotechnica* associated with climbers such as *Maerua oblongifolia*, *Pergularia daemia*, *Ceropegia bulbosa*, herbs e.g., *Argemone mexicana*, *Farsetia hamiltonii*, *Tephrosia purpurea*, *Cleome viscosa*, *Tribulus terrestris*, *Glinus lotoides*, *Sericostoma pauciflorum*, *Rivea* sp., *Ipomoea* sp., *Petalium murex*, *Sesamum mulayanum*, *Lepidagathis* sp., *Boerhavia diffusa*, *Chrozophora* sp., and grasses like *Cyprus* sp., *Fimbristylis* sp., *Brachiaria* sp., *Cenchrus* sp., *Dichanthium* sp., etc.

Malwa plateau

The south-eastern part of Rajasthan, eastern part of Gujarat and western MP come under Malwa plateau. *Anogeissus pendula*, *Acacia catechu*, *Boswellia serrata*, *Tectona grandis*, *Aegle marmelos*, *Madhuca indica*, *Mitragyna parvifolia*, *Butea monosperma*, *Cassia fistula*, *Terminalia tomentosa*, *T. bellirica*, *Diospyros melanoxylon* are the common species associated with various shrubs and grasses. Moist areas have good abundance of *Syzygium* sp., *Terminalia arjuna*, *Mitragyna parvifolia*, *Hiptage bengalensis*, *Ixora arborea*, *Mangifera indica*, *Carissa congesta*, *Cissus* sp. and *Pueraria tuberosa* among others.

Threatened Plants

According to Puri (1952), Pandey *et al.* (1983), Sabnis & Rao (1983), Shah (1983), Shetty & Singh (1991) and Pandey & Teotia (2000) following plants have been recognized as typical and threatened species of semiarid zone: *Dicliptera abuensis*, *Strobilanthes hallbergii*, *Bonnaya bracteoides*, *Oldenlandia clausa*, *Veronica anagallis* var. *bractea*, *Ceropegia odorata*, *C. hirsuta*, *C. vincaefolia*, *Ischaemum kingii*, *Rosa involucrata*, *Sterculia villosa*, *Eulophia ochreatea*, *Aerides crispum*, *A. multiflora*, *A. maculosum*, *Nervilia oragonna*, *Vanda testacea*, *Anogeissus sericea* var. *nummularia*, *Blumea bovei*, *Chlorophytum bharuchae*, *Commiphora wightii*, *Convolvulus auricomus*, *C. stockii*, *Gloriosa superba*, *Heliotropium rariflorum*, *Tribulus rajasthanensis*, *T. jamnagarensis*, *Butea monosperma* var. *lutea*, and *Cochlospermum religiosum*. Main threats for these plants include degradation of forests due to excessive biotic pressure including livestock grazing. Besides, invasive species like *Prosopis juliflora* and *Lantana camara* are big competitors and inhibitors for native flora as they occupy continuously major portion of habitat. Some of the threatened plants of the semiarid region which need immediate conservation attention (Plate 16B) are as follows:

***Berberis asiatica* Roxb. ex DC. (Berberidaceae)**

Local name : *Kantela*, *Kamadi*

Erect, spiny bush with pale bark. Leaves unifoliolate, leaflets in fascicles, 2.5-7.5 cm long, obovate or orbicular, sub-entire or with large distant spinose teeth, whitish beneath, rigidly coriaceous. Flowering in short corymbose racemes. Berries 8 mm ovoid or subglobose, red or black, glaucous. *Fl.*: Feb.-April & *Fr.*: May-June.



Commonly found in the Himalayan region but a small isolated population can be seen in Mount Abu. This species has declined rapidly in Mount Abu due to habitat loss and over exploitation for its medicinal values.

***Ceropegia odorata* Nimmo. ex Hook.f. (Asclepiadaceae)**

Local Name : *Khilodia, Khadulia*

Slender, tuberous twiner. Stem mostly glabrous. Leaves hairy above. Cymes few to many-flowered, peduncles hirsute, pedicels usually glabrous. Corolla 3-4 cm long, bright yellow, fragrant, tube 1.8-20cm corona of 5 entire lobes, glabrous, inner linear or elongate- triangular, erect, divergent at apex. *Fl. & Fr.*: Aug.-Sept.

An endemic plant of India, distributed in Mount Abu (Rajasthan), Gujarat, Konkan and Maharashtra (Ansari 1984). Over exploitation of tubers, over grazing and rapid invasion by *Lantana camara* are the major causes for its decline.

***Ceropegia vincaefolia* Hook. f. (Asclepiadaceae)**

Local Name : *Khilodia, Khadulia*

Tuberous twiner. Branches glabrous. Leaves 5-10cm, narrowly lanceolate or ovate-cordate, obtusely acuminate to acute. Flowers in few-umbellate cymes, peduncles hirsute, pedicels glabrous. Corolla 3-8 cm long, greenish. Blotched with purple, tube inflated at base, funnel-shaped at mouth, lobes pubescent inside. Follicles linear-lanceolate, finely pointed glabrous. *Fl. & Fr.*: July-Oct.

A threatened plant for Maharashtra (Jain & Sikarvar 2004). It is distributed in Maharashtra and Rajasthan (Ansari 1984). It grows in the similar areas as *Ceropegia odorata* and has similar threats.

***Cordia crenata* Delile. subsp. *crenata* (Boraginaceae)**

Local Name : *Gundi*

According to Pandey & Teotia (2000) this taxon is almost extinct in wild. Small tree, wholly glabrous except minutely hairy inflorescence. Leaves alternate or subopposite, 2.5 - 7.5 cm long, elliptic or elliptic-lanceolate, rounded, sub-acute or shortly acuminate at the apex, obliquely rounded or crenate at the base, margins crenate- dentate or deeply dentate at least towards the apex. Flowers in small, compact, pendunculate cymes from the axils of the uppermost leaves. Drupes *ca.* 8 mm long, ovoid, acute. *Fl. & Fr.*: Jan.-April.

***Dicliptera abuensis* Blatter (Acanthaceae)**

Much Branched, stragling shrubs. Leaves up to 5 x 2.75 cm, ovate, acute, subentire, sparingly hairy. Flowers in dense axillary cymes, white with deep pink tinge. Bracts 2, ovate-lanceolate, unequal, with densely ciliate and scarious margins. Calyx-lobes 5, subulate. Corolla glabrous. Stamens 2. Capsules *ca.* 4.0 x 1.5 mm, yellowish. Seeds 4, *ca.* 1 mm across, suborbicular, compressed, brown, covered with many capitate hairs. *Fl. & Fr.*: Nov. - March.

First Type collection of this species was made from Mount Abu by Hallberg in 1916. After this, there is no collection recorded and population status in the wild has not been assessed. It is possible that its taxonomic status may be ambiguous.

***Strobilanthes hallbergii* Blatter (Acanthaceae)**

Shrubs, up to 3 m high. Leaves 2.5 cm long, ovate-elliptic, acuminate, with dentate-ciliate margins. Flowers in spike, purple. Bracts 2, opposite, ovate, obtuse, entire. Calyx 5 partite, hairy. Corolla bearded at the throat with yellow hairs. Stamens 4, longer filaments bearded. Capsules *ca.* 0.75 x 0.5 cm, compressed, 2-seeds, flattened, rectangular, glabrous. *Fl. & Fr.*: Oct.-March.



Plate 16A **Important Habitats of Botanical Interest in Semi-arid Zone**



Malwa Plateau



Sambhar Lake



A Deep Valley



Ravines near the Chambal River



The Aravalli Range



Plate 16B
Threatened Plants of Semiarid Zone



Tecomella undulata



Ceropegia vincaefolia

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Cordia crenata subsp. *crenata*



Ceropegia odorata

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Tribulus rajasthanensis



Berberis asiatica



According to Shetty & Singh (1991) and Pandey *et al.* (1983) it is an endemic and threatened plant of Mount Abu. Over exploitation for fuel wood, overgrazing and intention of *Lantana camara* are the main causes of its decline.

***Tecomella undulata* Seem. (Bignoniaceae)**

Local Name : *Rohida, Marwar Teak*

A small tree. Leaves simple, with undulating margin. Corymbs few flowered. Corolla tubular, orange - yellow. Stamens scarcely exerted. Seeds winged. *Fl. & Fr.*: Dec.-May.

Its distribution is restricted to the drier parts of the Arabia, southern Pakistan and northwest India. In India, it occurs naturally in Maharashtra, Gujarat, Rajasthan, Punjab and Haryana. The species is mainly found in western Rajasthan. As *Tecomella undulata* wood is strong and durable, it forms a source of timber. It is also used widely in various Ayurvedic medicines. Hence, overexploitation is the reason for its decline.

***Tribulus rajasthanensis* Bhandari & Sharma (Zygophyllaceae)**

Local Name : *Marwadi Gokharu*

Prostrate to procumbent, annual herb, branches hirsute. Leaves 1.5-4.5 cm, leaflets 4-7 pair, elliptic-oblong to ovate-oblong, pubescent above, villous beneath. Flowers yellow, Stamens 10, 5mm long, Fruits c. 15mm across, mericarp densely hispid. *Fl. & Fr.*: Aug.-Nov.

It is distributed in southern Rajasthan to North Gujarat and west Rajasthan to Pakistan. According to Jain & Sikarvar (2004) habitat loss is the major cause of threat.

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References

- Ansari, A. S. 1984. Asclepiadaceae: Genus-*Ceropegia*. In: *Fascicles of Flora of India*. Vol. 16. Botanical Survey of India, Calcutta, India.
- Champion, H.G. & S.K. Seth. 1968. *A Revised Survey of the Forest Type of India*. Manager of Publications, Government of India, New Delhi.
- Jain, S.K. & S. L. Sikarvar. 2004. *Bharat Ke Durlabh Podhe*. National Book Trust of India.
- Mehta, M. R. 1979. *The Flora of Mount Abu*. Ph.D. Thesis, University of Jodhpur, Jodhpur, Rajasthan.
- Panday, R.P., B. V. Shetty & S. K. Malhotra 1983. A preliminary census of rare and threatened plants of Rajasthan. pp. 55-69. In: *An assessment of threatened plants of India*. Naba Mudran Private Limited, Calcutta, India: Director, Botanical Survey of India.
- Pandey, R.P. & P. Teotia. 2000. *Cordia crenata* Delile. subsp. *crenata*- a taxon almost extinct in wild. *Indian J. Forestry* 23(1): 129-134.
- Patel, R. I. 1971. *Forest Flora of Gujarat state*. Gujarat Forest Dept., Baroda, Gujarat.
- Puri, G.S. 1952. Present position of plant ecology of the desert of Rajasthan and Saurashtra. *Bull. Nat. Inst. India* 1: 233-241.



- Rodgers, W.A & H.S. Panwar. 1988. *Planning a Wildlife protection area Network in India*. Vol.I & II. Wildlife Institute of India, Dehra Dun.
- Sabnis, S.D. & K.S.S.Rao. 1983. Observations on some Rare or Endangered, Endemics of Southeastern Kutch. pp. 71 – 77. *In: An assessment of threatened plants of India*. Naba Mudran Private Limited, Calcutta, India: Director, Botanical Survey of India.
- Shah, G. L. 1978. *Flora of Gujarat State*. Sardar Patel University, Vallabh Vidhyanagar, Gujarat.
- Shah, G.L 1983. Rare Species with Retriected Distribution in South Gujarat. pp. 71-77. *In: An assessment of threatened plants of India*. Naba Mudran Private Limited, Calcutta, India: Director, Botanical Survey of India.
- Sharma, S. & B. Tiagi. 1979. *Flora of Northeast Rajasthan*. Kalyani Publishers, New Delhi.
- Sharma, S. K. & A. Kotia. 2008. Orchids of Rajasthan. pp. 432-438. *In: A. Verma (ed.) Conservation of Biodiversity of Rajasthan*, Himanshu Publications, New Delhi, India.
- Shetty B. V. & V. Singh. 1987, 1991. *Flora of Rajasthan*, Vol. I & II . Botanical Survey of India, Calcutta, India.
- Verma, D. M., N. P. Balakrishnan & R. D. Dixit. 1993. *Flora of Madhya Pradesh*. Botanical Survey of India, Calcutta, India. 472 pp.