

Some Threatened Medicinal Plants of Beer Jhunjhunu Conservation Reserve of Rajasthan, India

Manju Chaudhary

Department of Botany, S.R.R.M. Govt. College Jhunjhunu

Abstract: Plant diversity remains essential for human beings, providing numerous modern and traditional remedies to the healthcare system. The vast land of Rajasthan together with its vegetation and flora has a variety of medicinal plants growing in different habitats. The present study aimed to document the preliminary analysis of rare and threatened medicinal plants of Beer Jhunjhunu Conservation Reserve of Rajasthan. The study area is a protected forest area and considered as important in terms of biodiversity. The area harbors rich flora and fauna. However, the rich resources including medicinal plants are disappearing at an alarming rate due to over-exploitation. Therefore, the management of traditional medicinal plant resources has become a matter of urgency. Conservation of the species in natural habitat and artificial regeneration would be the best opinion to recover the species from near extinction.

Keywords: Threatened, Endangered, Extinct, Conservation Reserve, *in-situ* and *ex-situ* conservation

Introduction

Plants containing medicinal and other beneficial properties have been known and used in some form or other since time immemorial in the traditional system of medicines (Jain and Saklani, 1991). The WHO estimates that, at present, more than 80% of the world's population relies on traditional healing modalities and herbals for primary healthcare and wellness. Demand of more and more drugs from plant sources is increasing specially from developed countries during the past decade. More than 1600 plants species have known used as medicinal plants out of 17500 flowering plants found in India (BSI-MoEF, 1993). However, with the socio-economic development, the anthropogenic pressures have led to the degradation of natural resources, including medicinal plants, all over the globe. Habitat destruction and unsuitable harvesting due to overexploitation have led to the extinction of more than 150 species in the wild. Illegal trade of rare and endangered medicinal plants and loss of regeneration potential of the degraded forests have further accelerated the current rate of extinction of plants, particularly medicinal plants.

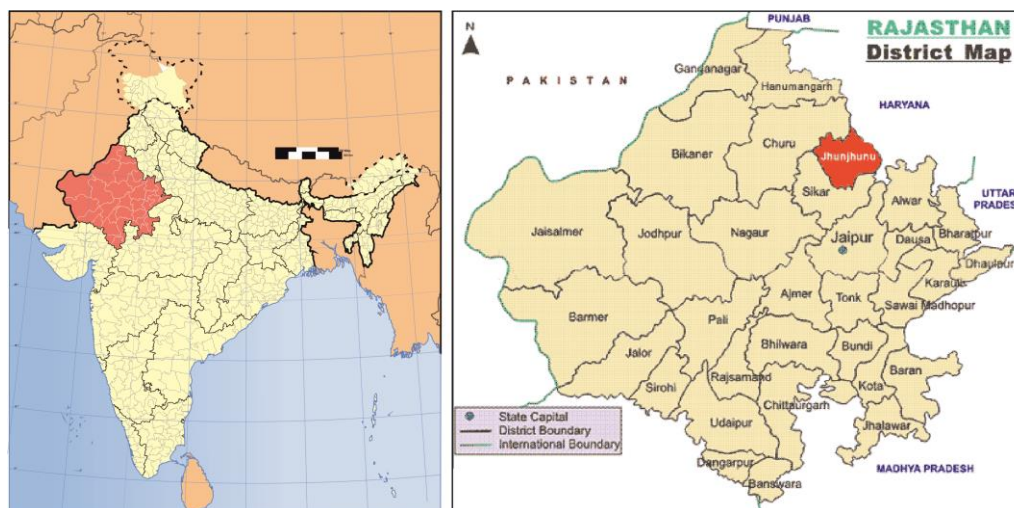
The floristic diversity of Rajasthan has documented by many workers (Singh and Pandey (1998); Shetty and Singh (1987-1993). Due to increase in population of the region, the pressure of disappearances of the valuable species is one of the crucial issues for the social as well as scientific community (Singh, 2004). Loss of biodiversity may trigger large unpredictable change in an ecosystem. Protected areas (PAs) such as Biosphere Reserves, National Parks, Wildlife Sanctuaries and Conservation Reserves are the most suitable places on this earth for conservation of biodiversity. According to Goel and Mitru (2000) wildlife sanctuary plays a vital role in *in-situ* conservations. Pandey et al. (2012) gave emphasis for the establishment of national parks and sanctuaries where threatened plant species can multiply freely. Beer

Jhunjhunu Conservation Reserve of Rajasthan is such an area which was declared as conservation reserve by the State Government on 9 March, 2012 for the purpose of protecting landscapes, flora and fauna and their habitat. The area has a rich floristic diversity and contributed many economic and medicinal plants. However, the region is subjected to enormous anthropogenic pressure such as over exploitation of wild medicinal plant, unchecked livestock grazing, alien species invasion and deforestation. There is an urgent need to conserve the rich biodiversity of Beer Conservation Reserve, Jhunjhunu before the treasure is lost.

Study Area

Jhunjhunu district, a part of Shekhawati region of Rajasthan, is located in the north-eastern part of the state (Map 1). The district is irregular hexagon in shape in the northeastern part of the state and lies between 27° 38' and 28° 31' North latitude and 75° 02' and 76° 06' East longitude. The Aravali ranges are embracing the south-eastern part of the district. These ranges have immense influence on the vegetation of the area. Most part of the district is semi-arid. Beer Jhunjhunu Conservation Reserve is situated about 3 km from Jhunjhunu city and known as 'lungs of city'. Besides, floral and faunal wealth, the study area has important ancient places such as Baba Khetanath Ashram and a beautiful pond situated behind it.

It is almost plain area including sand-dunes with little slopes at some places. The vegetation of the area is composed of Tropical thorn forest and dry deciduous forest type. It is characterised by very hot summers and very cold winters with poor rainfall during south-west monsoon period. January is the coldest month when the minimum temperature drops up to 4°C and the May and June are the hottest months, when maximum temperature reaches up to 47°C.



Map-1: Key Map showing Location of Jhunjhunu District in Rajasthan and India .

Material and methods

The present work, based on extensive survey conducted during 2012-2014, describes the richness of medicinal plants in the forest area and also discusses the issues of the conservation problems associated with these resources. An extensive survey of the Beer protected forest area reveals that the area is luxuriant in vegetation and enriched with many medicinal, threatened categories of plants. The collected plant species were identified taxonomically with the help of published regional flora (Bhandari, 1990; Shetty and Singh, 1987-1993; Sharma, 2002).

During the field survey various criteria of IUCN for categorizing threatened plants, viz. extent of occurrence, area of occurrence, number of individuals, probability of extinction etc. were measured. Rarity of species was determined by field study, ocular estimation, literature and herbaria and from discussions with the traditional healers, tribals and the old aged citizens. The recorded plants are enumerated in alphabetical order with local name, family, habit, conservation status, major threats and present status in the study area (Table1). Using current international union for conservation of nature (IUCN) and natural resources red list criteria plants are categorized as Extinct (EX), Extinct in the Wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Rare (R), Near threatened (NT) and Least concern (LC) threatened at regional and global levels. The threatened status of the plant species was determined according to IUCN Red List Category Strategies and Criteria version 3.1 (IUCN Red List Category Strategies and Criteria, 2001) and also with the help of using available Red Data book and standard publications (Walter and Gillet, 1998; Rao *et al.*, 2003). The medicinal value was determined by using scientific literature and discussion with traditional healers.

Observation and Results

Present study reveals that the Beer Jhunjhunu Conservation Reserve is rich in floristic and faunal wealth. Table 1 provides information about the endangered medicinal plant species in the study area. General information regarding to taxonomy, ethnomedicinal uses and existing threats are as follows:

1. *Acacia catechu* (L. f.) Willd. (Fabaceae)

Deciduous, gregarious tree, 3-6 m high, grayish brown bark that exfoliates into long and narrow strips. Prickles are hooked, brown or grey. Leaves are bipinnately compound with almost 10-30 pairs of leaflets. The flowers are pale yellow in color and have cylindrical spikes. The pods are flattened, oblong and glabrous. The heartwood extract of *A. catechu*, called “Katha” has been widely used in traditional Indian medicinal system. The plant is used as a natural chemical free birth control agent. This therapeutic plant helps in clotting blood in case of excessive bleeding. Its extract is used for the purpose of gargling to relieve the problem of gingivitis, sore throat and mouth ulcers. The bark relieves psoriasis, anemia, ulcers, gum issues. *Acacia catechu* liquid is very good for people suffering from obesity. In veterinary folk medicine, both the extracts of bark and heartwood are used for broken horn.

2. *Argyria nervosa* (Burm. f.) Boj. (Convolvulaceae)

A large climbing shrub grown as an ornamental in the garden. Stem tomentose white. Leaves ovate, cordate, glabrous with lower surface white tomentose. Flowers are silky pubescent funnel shaped and purple, fruit globose and apiculate with black seeds. The roots are diuretic, aphrodisiac and used as a tonic. The decoction of roots purifies the blood and cures rheumatic pain. The lower hairy surface of leaves is tied over tumor, boils and wounds for early suppuration and healing. Poultice of leaves is used to reduce the swelling. The upper surface of leaves has cooling properties. It is used to heal the inflammation. It is potent in healing fungal infection due to the antifungal properties. It is extinct in the wild but planted in the Baba Khetanath Ashram of the Beer forest area.

3. *Calligonum polygonoides* Linn. (Polygonaceae)

It is a perennial shrub and locally known as Phog. It is slow growing, branching shrub and 1-2m in height with very deep penetrating roots. Stem is modified into phylloclade and leaves are reduced, few or none, linear sublet, flowers are light pink, sweet scented in axillary fascicles, nuts are oblong, densely clothed with reddish brown bristles (Pullaiah, 2006). The thick branching stem and roots are used as a fuel due to less smoke and good burning quality. Flower buds are effective in treating sunstroke (Singh *et al.* 1996). These buds are consumed with curd based preparation in the study area. The plant has been quoted in Red Data Book of IUCN as endangered plant species due to its large scale exploitation (Singh, 2004). The old age people reported its wide occurrence in the study area in the past but in the present investigation, it was observed critically rare in the study area (Plate 2 g).

4. *Ceropegia bulbosa* Roxb. (Asclepiadaceae)

Two varieties of *Ceropegia bulbosa* were observed in the study area i.e. *Ceropegia bulbosa* var. *bulbosa* and *Ceropegia bulbosa* var. *lushii*; locally known as 'khadulo'. The former is characterized by broad leaves and later is narrow leaved variety (Cooke, 1958). It is small perennial twining herb with a spherical or oblong turnip like root tuber and observed at few sites of the study area. Among different species, *Ceropegia bulbosa* is one of the widely distributed species but still threatened (Yadav and Kamble, 2008). *C. bulbosa* var. *lushii* is considered as endemic (Nayar and Sastry, 1987-1989). The plant is considered as vulnerable in the red data book of IUCN and in the present study also. It was observed at Morchhala and Nahran ki Johdi study sites in the present investigation. It has high medicinal importance in the present study area. Tubers are edible and eaten by herders and local communities. Rural ladies used them to promote fertility and vitality. Leaves and tubers are eaten orally to get rid of urinary bladder stones (Plate 1 a).

5. *Citrullus colocynthis* (L.) Kuntze (Cucurbitaceae)

Common on sandy tracts in the desertic zone, it is a perennial, tender climbing monoecious plant. Fruit globular variegated dark green with yellowish blotches. When ripe it is filled with a dry spongy very bitter pulp. Seed compressed, pale brown and smooth.

The fruit is bitter, pungent, cooling, purgative, antipyretic, anthelmintic and used for gaseous problem. In large doses it is toxic. 2-3 drops of root extract in the ear cures earache. Root powder is effective in jaundice, urinary diseases and rheumatism. Root extract is an antidote to scorpion bite. The commercial drug "colocynth" from dry pulp of fruit is cathartic. The inhalation of smoke of fruit kills the germs found in tooth. Poultice of fruit is applied on tumour and boils. It is overexploited for medicinal purposes (Plate 2 h).

6. *Cordia sinensis* Lam. (Ehretiaceae)

It is a compact densely growing shrub, usually reaching a height of up to 4 meters, though it sometimes becomes a bushy

tree up to 12 meters. The plant utilized locally as food, medicine and source of various materials. The orange-red ovoid fruits are edible and used raw or in cooked form and also used in pickles. The roots are used to induce abortion. A decoction of the root and bark is used to treat stomach disorders. Roots are boiled and the decoction used for the treatment of malaria. Habitat fragmentation and overexploitation has brought its population in threatened condition in the study area (Plate 1 f).

7. *Enicostemma hyssopifolium* (Willd.) Verd. (Gentianaceae)

It is very useful medicinal herb which has been in regular demand amongst practitioners of medicines. It is an erect glabrous herb, branching from the base with quadrangular stems, sessile, linear oblong 3-nerved leaves, white small flowers in axillary clusters and an ellipsoidal capsule containing many globose seeds. The plant is used as a substitute for 'Chirayata' and locally known as "Kutakrayacho". It has a lot of medicinal value in the study area. Local people exploit it to cure fever, joint pain and diabetes (Plate 1 b).

8. *Ephedra foliata* Boiss. ex C.A. Mey (Gnetaceae)

Only gymnosperm in the Thar Desert, known as untphog. It is an evergreen perennial woody evergreen climber. In India, it is distributed in drier parts of Punjab, Haryana and Rajasthan. It is abundant in the study area climbing on *Salvadora oleoides* and *Capparis decidua*. It is a well known medicinal plant and used to treat allergies, bronchial asthma, cold, cough and fever. It is a source of alkaloids such as ephedrine and pseudoephedrine. It was reported as critically rare in the list of endangered plants of state Rajasthan (Plate 1 e).

9. *Leptadenia reticulata* R.Br. (Asclepiadaceae)

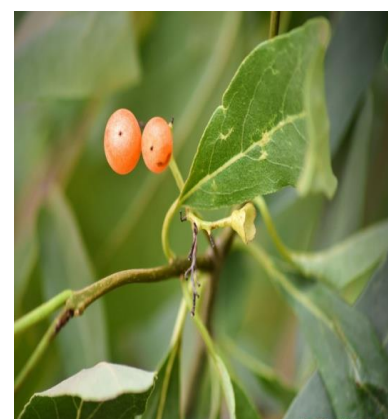
Leptadenia reticulata is known as Jiwanti means that the plant is considered to have the capacity of bestowing good health as well as vigor in a person. It is a much branched twining shrub with yellowish deeply cracked bark.

Jiwanti (*L. reticulata*) is an important medicinal plant used in Ayurveda (Kasera and Shukla, 2003). The mention of jiwanti is even found in Athrva Veda. It promotes vitality and life. Jiwanti is considered a stimulant and tonic in Ayurvedic literature. It is described as an herb with sweet, cold, aphrodisiac, light to digest and rejuvenile properties. It enhances life vigour and fertility (Plate 1 c).

10. *Maerua oblongifolia* (Forsk.) A. Rich. (Capparaceae)

It is a large, scabrous, unarmed, woody climbing shrub with pale-brown smooth bark. Leaves are elliptic-oblong, obtuse, mucronate and glabrous. Flowers are greenish-white; aromatic corymbs. Fruit is moniliform berry. Seeds are globose, minute.

The root is traditionally used to treat fever, epilepsy, piles, typhoid, sterility, stomachache and some skin diseases. The tubers and roots are found to be used in general debility. The raw root bulb along with pepper was taken orally to treat diabetes (Ratna Raju *et al.*, 2014)

(a) *Ceropegia bulbosa* var. *bulbosa* Roxb.(b) *Enicostemma hyssopifolium* Willd. Verd. (Retz.) Wt. & Arn.(c) *Leptadenia reticulata*(d) *Peganum harmala* L.(e) *Ephedra foliata* Boiss. & Kotschy ex Boiss(f) *Cordia sinensis* Lam.**PLATE 1: THREATENED MEDICINAL PLANT SPECIES OF THE STUDY AREA****11. *Peganum harmala* Linn. (Zygophyllaceae)**

It is a branched, perennial shrub restricted on the margin of saline water bodies or on calcareous soil. Stem is dichotomously branched and sulcate. Leaves are divided into several narrow segments up to 5-8 cm long. Flower appears single from the axil of the leaves and white in colour. Fruit is a globose capsule with many angled seed. Local rural and tribal people used it in the treatment of jaundice and rheumatism. Smoke of whole plant relieves toothache and also in asthma. They used its powdered roots mixed in mustard oil to kill lice in hair. Plants kept in house to repel mosquitoes. It was observed behind the Forest Chowki restricted to Khadans in the study area (Plate 1d).

12. *Salvadora persica* Linn. (Salvadoraceae)

It is widely distributed in the arid regions of India and often on saline soils. It is an upright evergreen small tree or shrub and known as Miswak or Toothbrush Tree. Roots and tender twigs of *S. persica* are used for making *Miswak* which is used for cleaning teeth. Its importance has been mentioned in the *Holy Quran*.

It is used for centuries as a natural toothbrush; its fibrous branches have been promoted by the World Health Organization for oral hygiene (Bairwa et al., 2012). The plant

has been used for the preparation of a number of medicinally important products such as abrasives, antiseptics, astringent, detergents, enzyme inhibitors and fluorides. It is used traditionally in the treatment of rheumatism, leprosy, gonorrhoea, ulcers, scurvy, tumors and dental diseases. It was observed occasionally in the Beer area (Plate 2 i).

13. *Sarcostemma viminale* Linn. (Asclepiadaceae)

The plant is almost leafless, straggling shrub with many branches and an important medicinal plant known as 'Khirkhimp' in the study area. 'Sarco' is a Greek word meaning fleshy, while 'Stemma' refers to the fleshy inner corona. The caustic vine is the common name referring to the burning power of released latex. It has rich medicinal value and infusion of whole plant is applied by the rural people on wound of snake bite. Plant paste is also applied externally to cure fractured bones. Plant extract is given in digestive disorders. This plant is typically endangered in the study area and needs most care and conservation (Plate 2 j).

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

Commonly found in plains on sandy hummocky grounds and known as 'Marwar teak'. A medium sized tree with slightly hairy drooping branches. Leaves are simple, glabrous, oblong, undulating with entire margins. Flower arranged in racemose inflorescence, campanulate and yellow to orange colored. Fruit

is falcate to circinate smooth capsule consisting of reniform seeds.

Paste of leaves, stem and root bark is used in the treatment of various skin diseases. Leaves and inner bark of stem extract obtained by heating them is used in

eczema, psoriasis. Leaf juice is mixed with water and used in pneumonia and typhoid. Warmed leaves tied over swellings to remove guinea worm. Root bark is used in leucorrhoea. Flowers give orange colour herbal dye (Plate 2 k).



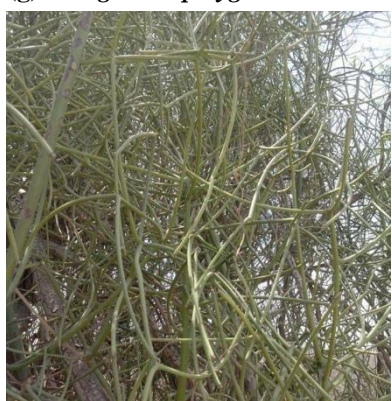
(g) *Calligonum polygonoides* L.



(h) *Citrullus colocynthis* (L.) Kuntze



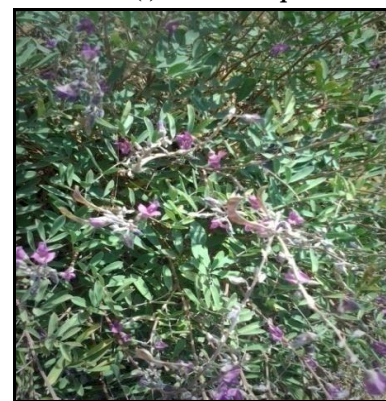
(i) *Salvadora persica* L.



(j) *Sarcostemma viminale* (L.) R. Br.



(k) *Tecomella undulata* (Sm.) Seem.



(l) *Tephrosia falciformis*

Ramaswami

PLATE 2: THREATENED MEDICINAL PLANT SPECIES OF THE STUDY AREA

15. *Tephrosia falciformis* (Pers.) Ramaswamy

It is commonly known as rati biyani. It is 3-4 feet high much branched under shrub grown in sandy plains. It is a rare and threatened plant species of Rajasthan. The leaves are imparipinnate with 7-9 pairs of leaflets. Both surfaces of leaflets are densely covered with silky hairs. This plant is medicinally unexploited, but rich in secondary metabolites. The plant is used for relieving pain in inflammatory pathological conditions like fracture and dissolution (Plate 2 l).

16. *Withania somnifera* (Linn.) Dunal (Solanaceae)

A much branched perennial undershrub from a more or less tuberous root. It is a wonder shrub used traditionally as a folk medicine for several remedies. The roots are considered aphrodisiac, diuretic and germicidal. Powder of roots is a tonic in debility, nervous diseases, leucorrhoea and arthritis. Root effective in digestive disorder, rheumatic affections, tuberculosis, insomnia, cold and cough. The dried root powder can promote growth in children and retard the ageing process in older people. Dried roots after grinding and bruised leaves are applied to painful swellings. Leaves are beneficial in skin diseases, wounds and tumors. Infusion of leaves is given to relieve fever. Fruits and seeds are diuretic.

Discussion

All forests are islands of biodiversity protecting a good number of plant and animal species including some rare, endemic and threatened one. However overall developmental activities, overexploitation of natural resources and change in climatic conditions during last one and half decade has brought about a substantial depletion in the forests in general and the medicinal plants in particular. As a result of extensive field surveys and plant exploration trips, 16 medicinal plant species belonging to 16 genera and 13 families have been reported as threatened in the present study. Among these, *Ephedra foliata* was the only gymnosperm and the rest were angiosperms.

During the study, occurrence of some rare plants like *Calligonum polygonoides*, and *Tecomella undulata* were recorded at a few sites. However, the local people reported their wide occurrence in the area quite some time ago. It is an alarming situation where threatened plants require more and more attention for preserving their genetic diversity. Special protective measures are needed to ensure their long term survival in the area. Medicinal plants are now under great pressure due to their exploitation. Unplanned collection, loss of habitat, increased exploitation, unsustainable harvesting, intensive grazing, deforestation and attack of the pathogens were the major

threats to the medicinal plants. *Enicostemma hyssopifolium*, *Ceropegia bulbosa*, *Sarcostemma viminalis*, *Withania somnifera* were widely used in medicines by rural and tribal people of the study area. Destructive harvesting has brought about depletion and scarcity of medicinal plants e.g. the roots of

Salvadora persica were exploited for its commercial use as miswak. The habitat loss by export of medicinal plants collected from wild sources finally lead to severe and irreplaceable loss of genetic stock of many of these species.

Table 1: Threatened Plant Species and Their Conservation Status in the Study Area

S. No	Botanical name	Local name	Family	Habit	Major Threats	Status in the present study
1.	<i>Acacia catechu</i> (L.f.) Willd.	Khairi	Fabaceae	Tree	Habitat loss	LC
2.	<i>Argyrea nervosa</i> (Burm.f.) Boj.	Ghav-bel	Convolvulaceae	Climber	Habitat loss	EW
3.	<i>Calligonum polygonoides</i> L.	Phoglo	Polygonaceae	Shrub	Habitat degradation	CR
4.	<i>Ceropegia bulbosa</i> Roxb.	Khadula	Asclepiadaceae	Climber	Exploited for medicine	CR
5.	<i>Citrullus colocynthis</i> (L.) Schard.	Tumba	Cucurbitaceae	Trailing herb	Exploited for medicine	LC
6.	<i>Cordiasinensis</i> Lam.	Gundi	Ehretiaceae	Tree	Exploited for medicine	NT
7.	<i>Ephedra foliata</i> Boiss. & Kotschy ex Boiss.	Unt phog	Gnetaceae	Climber	Exploited for medicine	LC
8.	<i>Enicostemma hyssopifolium</i> (Willd.) Verdoon	Kutak-rayacho	Gentianaceae	Herb	Exploited for medicine	VU
9.	<i>Leptadenia reticulata</i> (Retz.) Wt. & Arn.	Jiwanti	Asclepiadaceae	Climber	Habitat loss	EN
10.	<i>Maerua oblongifolia</i> (Forsk.) A. Rich.	Hemkand	Capparaceae	Climbing Shrub	Habitat loss	NT
11.	<i>Peganum harmala</i> L.	Harmal	Zygophyllaceae	Herb	Over-exploitation	NT
12.	<i>Salvadora persica</i> Linn.	Jal, Pilu	Salvadoraceae	Tree	Exploited for medicine, fuel	VU
13.	<i>Sarcostemma viminalis</i> (L.) R. Br.	Khair-khimp	Asclepiadaceae	Shrub	Exploited for medicine	EN
14.	<i>Tecomella undulata</i> (Sm.) Seem.	Rohida	Bignoniaceae	Tree	Exploited for timber	EN
15.	<i>Tephrosia falciformis</i> Ramaswamy	Bansa	Fabaceae	Shrub	Habitat loss	EN
16.	<i>Withania somnifera</i> (L.) Dunal	Aksan, Asgandh	Solanaceae	Undershrub	Exploited for medicine	LC

Abbreviations: EW- Extinct in wild, CR- Critically Endangered, EN- Endangered, VU- Vulnerable, NT- Near threatened, LC- Least concern

Climbers like *Leptadenia reticulata*, *Sarcostemma viminalis*, *Ceropegia bulbosa* var. *bulbosa* and *C. bulbosa* var. *lushii* were recorded critically endangered in the study area. Among these *Ceropegia bulbosa* is particularly vulnerable owing to its edible tubers, which is often eaten by herders and local communities and for its highly medicinal value. During the study it was noted that plant

species like *Enicostemma hyssopifolium* and *Tephrosia falciformis* were drastically reduced population in the area.

From the enumeration of the plant species collected from Beer Jhunjhunu Conservation Reserve, it can be inferred that many threatened plants were being routinely used by the rural people of the area for the treatment of ailments and their daily needs. The natural resources of this area have been depleting fast during the last few decades due to destruction of habitat. *Tephrosia falciformis*, *Tecomella undulata*, *Ceropegia bulbosa* etc. which are reported as threatened from the sandy habitat of Thar desert (Pandey et al., 1983; Bhandari, 1990)

were present but struggling hard for survival in study area. It is necessary to initiate systematic cultivation of medicinal plants in order to conserve biodiversity and protect endangered species.

Conclusion

Medicinal plants are recognized as a major but increasingly threatened global resource. The present observation showed that the many plant species e.g. *Ceropegia bulbosa*, *Enicostemma hyssopifolium*, *Sarcostemma viminalis* and *Salvadora persica* are heavily exploited in the study area for the local medicine. These species need to be conserved along with their habitats. Conservation efforts in such areas cannot be achieved without involvement of the local communities, who are directly dependent on these resources for their livelihood. There is an urgent need for developing programmatic conservation strategies for rare and threatened medicinal plants in Beer Jhunjhunu area, which may lead to their effective protection. The documentation of the traditional knowledge of local communities is also being taken up to *in-situ* conservation of medicinal plants with community participation and conservation measures. Government should encourage the traditional methods of conservation of forests. Conservation of the species in natural habitat and artificial regeneration would be the best opinion to recover the species from near extinction. National parks, botanical gardens, wildlife sanctuaries and conservation reserves are essential efforts to conserve the rare and threatened species. They can play a vital role in *ex-situ* and *in-situ* conservation of the threatened plants.

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