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Pharmacognosy, phytochemistry and pharmacological use of *Dipcadi erythraeum*: Noteworthy ethno medicinal plant of Indian Thar desert

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Abstract

This ethno-botanical study describes the traditional knowledge related to the use of *Dipcadi erythraeum* used by the tribes and communities reside in the Great Indian Desert or Indian Thar Desert. *Dipcadi erythraeum* (synonym- *Dipcadi unicolor*, *Ornithogalum erythraeum*, *Uropetalon erythraeum*, *Uropetalon unicolor*, *Uropetalum unicolor*) also known for Jangli Dungri is recently belonging to the subfamily *Scilloideae* of the family *Asparagaceae* and mainly found in rocky and gravelly habitats having greater medicinal values such as leaves are laxatives, used as an ointment for wounds, while whole plant is used for cough, biliousness, diabetes, urinary and discharge. This paper also deals with the focus on conservation of *Dipcadi erythraeum* because Due to soil erosion, over exploitation of rocks and hills, over grazing, habitat loss *Dipcadi erythraeum* is recently categorized as rare, endangered and threatened plant by IUCN (International Union for Conservation of Nature) and WCMC (World Conservation Monitoring System).

Keywords: Thar desert, ethno-botany, *Dipcadi erythraeum*, conservation, medicinal plants

Introduction

Ethno botany is science that includes direct relationship between human being and plants. This direct relationship is divided into two parts such as abstract and concrete. The medicinal value of plants is one of the concrete relationship among them. The Thar Desert of India is well-known for its diversity^[1]. The Thar Desert of India is called as Great Indian Desert and makes an important segment of western India and inhibit an area of about 278330 km². 70% of this area (196150 km²) lies in Rajasthan, 23% (62180 km²) in Gujarat and 7% (about 20000 km²) extends in Punjab and Haryana states. The desert also spread into Pakistan and known as the Cholistan desert. The whole desert in the Indian subcontinent (India and Pakistan) covers an area of almost half of the Arabian desert and 7th part of the Sahara desert^[2]. This Thar desert creates the eastern extremity of the great arid and semi-arid belt of the world^[3]. (Fig.1). Plants are used by human race since the dawn of the history of human civilization. Currently 30% to 40% of the available drugs are based on the medicinal values and therapeutic properties of various plants and are used in the form of herbal supplements, botanicals and nutraceuticals.

Medicinal plants have great importance not only for their biologically active secondary metabolites like alkaloids, glycosides but also for their primary metabolites such as carbohydrates, proteins and lipids.

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Fig 1: *Dipcadi erythraeum* plant.

These primary metabolites are essential for the growth and development of a plant and are carriers of chemical energy to the successive trophic levels of the food chain. They make the major portion of diet of herbivores and omnivores. On the other hand, secondary metabolites are formed as by-products of metabolic pathways and though not essential for the survival of the plants but are essential in their defence system. Their medicinal properties have been utilized since long and research is still in progress to explore their applications as medicines [4]. Due to the socio-economic backwardness in the life-style of people, they depend heavily on the available natural resources to fulfil their day to day needs. Thar Desert is home of several tribes and communities who have got a rich culture heritage and colourful traditions. Various tribes and communities such as Bhils, Sansis, Kalbelias, Raikas, Banjara, Sindhis, Gadolia lohars and Bolochis live in Indian Thar Desert. The natural flora, hide and wool are subsistence and earning sources for communities in Thar Desert. Thus they constantly bank upon their traditional knowledge and constantly re-invent it too, based on their needs. For example, traditional methods which are used to fulfil their basic needs such as medicine, clothing, raw materials for house, food etc. In certain ethnic communities, this traditional knowledge is transmitted orally but in the modern era of technology, this knowledge in depleting i.e. new generation is least interested in it. Due to few or sometimes in-existent opportunities to access modern healthcare facilities, the use of effective herbal resources through generations of old traditional knowledge is applied. Recognizing the vital importance of flora of the Thar Desert, it is imperative to review the conservation status of the precious plant resources of the area [3, 5]. Zietsman *et al.* (2008) stated that small and isolated populations often suffer from disrupted biological interactions. Nearly 1500 species of higher plants in India are listed as threatened, most of which are angiosperms. These plants have their own ecological role in the ecosystem and therefore, the conservation status of lesser known plant species and isolated populations need to be assessed both within individual populations and at the metapopulation level. There is reported work in the past in Tapkeshwar Hill Range (THR) on threatened species, especially their

ecological requirements. This study is intended to highlight the status and distribution of the species in the study area, the ecological characteristics necessary for their survival, and the threats faced by some of the species designated by following the criteria devised by WCMC and IUCN [6].

IUCN-RET (International Union for Conservation of Nature – Rare, Endangered and Threatened Plants) Plants reports

Thirteen plant species categorized as threatened by the World Conservation Monitoring Centre (WCMC 1994) and also listed under various threat categories in the Red Data Book of Indian Plants were surveyed in the Tapkeshwari Hill Ranges [7]. In many rare species classifications, including the Red Book listings of the International Union for Conservation of Nature, two types of rarity—natural and induced—are not always clearly distinguished. Some species that are naturally rare are also ranked as threatened with extinction. While naturally rare species can be more vulnerable to extinction than common ones, rarity in itself is not synonymous with extinction threat. Understanding the difference between natural and induced rarity is important for focusing conservation efforts.

Out of the 19 RET plants recorded so far from Kachchh (Shah 1978; Nayar & Sastry 1988; Raole 1993; WCMC 1994; GES *et al.* 2002), 13 taxa were located in the study area: six herbs, four undershrub, two shrubs and one climber. Among these, *Dipcadi erythraeum*, *Dactyliandra welwitschii*, *Indigofera caerulea* var. *monosperma* and *Pavonia ceratocarpa* had very low numbers, i.e. 9, 13, 16 and 19 individuals, respectively, and had highly restricted distribution in THR. *Commiphora wightii*, *Ipomoea kotschyana*, *Helichrysum cutchicum* and *Campylanthus ramosissimus* showed wider distribution and had 612, 440, 245 and 235 individuals, respectively (Table 1). The details on abundance, habitats and threats of each taxon with their present status mentioned by different authorities are given in Table 1.

Dipcadi erythraeum and *Ephedrafoliata* were threatened by habitat degradation and soil erosion in the study area [7, 8, 9]. These species require site-specific conservation strategies with the help of the forest department for their long term survival in the study area [10].

Ethno-botany of *Dipcadi erythraeum*

Common Name/Local Name

Jangli Dungri, Jangali Bussur [11, 12].

Synonym

Dipcadi unicolor, *Ornithogalum erythraeum*, *Uropetalon erythraeum*, *Uropetalon unicolor*, *Uropetalum unicolor* [13].

Geographical Indication

It comprised about 40 species, distributed in Southern Europe, most area of Africa, the Middle East and East to South Asia. The greatest diversity is found in South Africa (13 species) and India (9 species). In Egypt, the genus *Dipcadi* is a member of family *Hyacinthaceae* and is represented by two species: *Dipcadi erythraeum* (*D. erythraeum*) and *Dipcadi unifolium* [12, 14, 15].

Morphological Character/Description of Plant

It is a bulbous, scapigerous herb, 15-18cm high, bulb tunicated, and 13-20mm in diameter. Leaves 15-20x4-5mm,

narrow linear, scape up to 20cm long, Flowers greenish in a lax raceme, bracts 1-2cm long, gradually smaller upwards, ovate finely acuminate, pedicle 4-6mm long. Perianth campanulate, 15mm long, outer lobes 9x3mm, elliptic oblong, obtuse with tips recurved from the middle, 7 nerved inner lobes, 5 nerved, reflexed from the tips only. Ovary elliptic-ovoid, 6mm long, sessile. Fruit a capsule, 12-15mm long, slightly narrowed at base, orbicular, flat, black. (Fig. 2) [16].



Fig 2: *Dipcadi erythraeum* plant with different stages- A. Bulbous development Stage B. Seeds development Stage

Cultivation

It is a very rare plant, which is observed only once, when 4-5 plants are found on rocky substratum near guptaganga, sursagar, Jodhpur. A scape bearing fruits, probably belonging to this plant may collected near Barmer. The plants produce flowers immediately after first few rains [16].

Flowering & Fruiting

August to September [16].

Taxonomy [17].

Kingdom	Plantae
Super division	Spermatophyta
Division	Angiospermae
Class	Monocotyledon
Family	Asparagaceae
Subfamily	Scilloideae
Genus	<i>Dipcadi</i>
Species	<i>Dipcadi erythraeum</i>

Chemical Constituents

The phytochemical screening of aqueous methanol extract of *Dipcadi erythraeum* was analysed by LC-ESI-MS system [High Performance Liquid Chromatography and Mass Spectroscopy] revealed the presence of alkaloids, tannins, saponins and flavonoids. The *Dipcadi erythraeum* bulb extract revealed 22 phenolic compounds characterized for the first time, fourteen of them were identified as C-glycosyl

flavonoids. The phenolic compound were identified as Gluconic acid, Shikimic acid hexoside, Coumaric acid di hexoside, Caffeic acid di hexoside, Quinic acid, Malonyl coumaroyl quinic acid, Ferulic acid hexoside, Isoorientin-7-O- β -glucopyranoside (lutonarin), Apigenin 6,8-di-C-rhamnoside, Apigenin 6,8-di-C-glucoside, Isoorientin X''-O-acetyl, Apigenin 6-C-pentoside-8-C-hexoside X''-O-acetyl, Delphinidin-O-hexoside X''-O-acetyl-O-pentoside, Luteolin 6-C- β -glucopyranoside-8-C- α -arabinopyranoside (Carlinoside), Apigenin 6-C- β -glucopyranoside-8-C- α -rhamnopyranoside (Violanthin), Apigenin 6,8-di-C-pentoside-O-rhamnoside, Apigenin 6-C-hexoside-8-C-pentoside, Luteolin-O-methyl ether 6-C-pentoside-8-C-hexoside, Apigenin 6-C-pentoside-8-C-rhamnoside, Apigenin 6-C-pentoside-8-C-rhamnose-O-rhamnoside, Apigenin 6-C- α -rhamnopyranoside-8-C- β -glucopyranoside (isoviolanthin), Apigenin-O-methyl ether 6-C-hexoside-8-C-rhamnoside-O-hexoside. It also contains kaempferol, quercetin, quercetin 3-O-(6''-a-rhamnopyranosyl)-B-glucopyranoside-7-O-a-rhamnopyranoside, vitexin, isovitexin, orientin and isoorientin. The highest values of total chlorophylls and carotenoids were observed during flowering stage which was ranged from 0.473 -0.860 and 0.000261-0.000426 mg/gm freshly weighted respectively. The proline values ranged from 0.406 to 1.213 μ g g-1 freshly weighted during three stages, being maximum in vegetative stage. Total sugar values ranged from 27.28 to 38.24 mg g-1 dried weight during three phases, being maximum in vegetative stage. Crude protein was observed highest (4.882% dried weight) during vegetative phase followed by flowering (4.650) and lowest at fruiting phase (3.022% dried weight). The phosphorus content was highest during vegetative stage followed by flowering and minimum at fruiting stage. Total alkaloid and phenol contents were found to be maximum during flowering stage and values ranged from 2.1 to 3.7 % dried weight and 976.66 to 1198 mg 100 g-1 dried weight, respectively [2, 14, 15, 18].

Ethno-medicinal uses

Dipcadi erythraeum is a wild medicinal plant which has great folk medicinal use. Its bulb and capsule are edible especially in Pakistan. In Bahrain, the leaves are used as a laxative and as an ointment for wounds. While whole plant is used for cough, biliousness, diabetes and urinary discharge. Chopped bulbs are fed to animal against stomach pain, scorpion stinging & sweating. Bulbs are also used as remedy for bronchial troubles, cardiac trouble and anticancer [2, 14, 15, 18].

Table 1: Ecology and distribution of RET plants in various habitats [16].

Species	Family	No	Preferable habitat	Threats	Remarks	Status
<i>Campylanthus ramosissimus</i>	Scrophulariaceae	235	Open scrub	Habitat loss	Restricted to certain sandstone formations and lime stone hills	Rare Endangered
<i>Citrullus colocynthis</i>	Cucurbitaceae	65	Thorn mixed forest	Habitat loss	Recorded on sand dunes and sandy grounds	Rare Common
<i>Commiphora wightii</i>	Burseraceae	612	Thorn mixed scrub	Over exploitation	Dominant on rocky hillocks and hard gravelly soils	Threatened Not Evaluated Indeterminate Common
<i>Convolvulus stocksii</i>	Convolvulaceae	127	Thorn mixed forest	Over grazing	Mostly restricted to loamy and gravelly soils with moderate soil depth	Threatened Rare Indeterminate Common
<i>Dactyliandra welwitschii</i>	Cucurbitaceae	13	Thorn mixed forest	-	Mostly associated with Euphorbia cactus	Common Data Deficient
<i>Dipcadi</i>	Liliaceae	9	Open scrub	erosion	Site specific and require moist soil	Rare Indeterminate

<i>erythraeum</i>					substratum	Common
* <i>Ephedra foliata</i>	<i>Ephedraceae</i>	55	Thorn mixed forest	Cutting associated plants	Mainly found on sandy, gravelly or even rocky areas	Rare Not Evaluated Vulnerable
<i>Helichrysum cutchicum</i>	<i>Asteraceae</i>	245	Acacia senegal forest	Habitat degradation	Prefer undulating terrain and sand stone with sparse grasses cover	Rare & Endemic Lower Rick
<i>Indigofera caerulea</i>	<i>Fabaceae</i>	16	Open scrub	Over grazing	Found on pebbly and gravelly substrate with sandy substratum	Rare and Endemic Vulnerable
<i>Ipomoea kotschyana</i>	<i>Convolvulaceae</i>	440	Thorn mixed forest	Sand mining	Sandy substratum and site specific	Common Not Evaluated Indeterminate Common
<i>Pavonia ceratocarpa</i>	<i>Malvaceae</i>	19	Euphorbia scrub	-	Loamy soil with moderate soil depth	Rare Indeterminate Endangered
<i>Sida tiagii</i>	<i>Malvaceae</i>	37	Acacia senegal forest	Habitat loss	Found mainly on open sandy ground with sparse vegetation cover	Common Indeterminate
<i>Tribulus rajasthanensis</i>	<i>Zygophyllaceae</i>	43	Euphorbia scrub	Habitat degradation	Rocky plateau and sandstone hills	Rare Indeterminate Endangered

*- Wild gymnosperm species

Pharmacological Activity

Dipcadi erythraeum plant has not been studied extensively, despite of the various medicinal values, only anticancer activity of phytoconstituents present in *Dipcadi erythraeum* has been evaluated [18].

Conclusion

Due to fast eroding of traditional knowledge system in India. It is very necessary to invent and record all ethno-medicinal information of important medicinal plant *Dipcadi erythraeum* from tribal peoples and communities before the traditional culture is completely lost. According to literature review *Dipcadi erythraeum* has great medicinal use in Indian traditional knowledge for treating various disorder and also due to soil erosion, over exploitation this plant is categorized as rare endangered and threatened plant by IUCN and WCMC, but the awareness about rarity and conservation significance of *Dipcadi erythraeum* plant is not known in tribal peoples and communities, this plant require conservation strategies for their long time availability.

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