



ETHNOBOTANICAL STUDIES OF *CAPPARIS DECIDUA* (FORSK.) WITH SPECIAL REFERENCE TO CHOLISTAN DESERT, PAKISTAN

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ABSTRACT

Capparis decidua (Forsk.) is an important shrubby plant of family Capparidaceae. It is reported to be used in curing various diseases and as food in various cultures. In the traditional medicinal system of Pakistan and India, it has a unique position as medicinal plant. However, the recipe and mode of utilization against different ailments varies according to the locality and culture. Cholistan desert of Pakistan is enriched equally with medicinal flora and cultural values. A study was conducted in the Department of Forestry and Range Management, University of Agriculture, Faisalabad, Pakistan during the year 2011-13 to document the traditional uses of *Capparis decidua* by the local dwellers and medicinal plant experts of Cholistan desert rangeland. Questionnaires were used to interview the local inhabitants (16 villages of 4 rural union councils) and medicinal plant experts/herbal medicinal practitioners (14 respondents) of the area. The shrub is being used as fodder, food, medicinal, firewood and as wood for making hand tools, fences for livestock and construction of 'gopas' in the area. About 25 different diseases were recorded to be cured by this shrub. Local dwellers use this shrub in 11 diseases while medicinal plant experts reported 24 diseases like cough, pains, joint pains, jaundice, intestinal pain, anemia, asthma and swellings as blister on boils and in toothache. Different plant parts were also sampled from the area to analyze chemically for various nutritive and secondary metabolite attributes. It has high amount of nitrogen, ether extractable fat, potassium in stem (3.28, 4.45 and 1.83%) and root bark (3.26, 4.68 and 1.66%) as compared to other plant parts. Crude fibre and ash were noted higher in stem (37.16 and 24.94%), higher phosphorus (P = 0.16%) in fruits while nitrogen free extract (NFE = 68.60%) was calculated more in flowers than other parts.

KEYWORDS: *Capparis decidua*; Karir; drug plant; traditional uses; diseases; Pakistan.

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INTRODUCTION

The genus *Capparis* represents about 250 species of trees, shrubs and woody climbers. *Capparis decidua* (Forsk.) Edgew, is a branchy shrub, spinous upto 4 to 5 m height, locally called as Kair, Kari, Karir or Karil in Urdu. In English it is called as leafless Caper-bush and Caper-berry. Only young twigs have leaves. It is well distributed in Pakistan, from arid plains of Punjab, Sindh and Baluchistan to north Khyber Pakhtunkhwa, and native to various countries like India, Arabian states and Tropical Africa including South Africa (Gupta, 2010; Orwa *et al.*, 2009). It is very common shrub in Cholistan desert of Pakistan.

The plant grows well in dry habitat and is considered suitable for saline/waterlogged soils and sand dunes stabilization. So, it can be a potential

plant for landscape gardening and afforestation/ reforestation programmes in arid, semi arid plains to desert areas. It coppices profusely and can be regenerated by root suckers (Rathee *et al.*, 2010). There is no commercial cultivation of this shrub anywhere in the country yet naturally grown has great impact on the locality. It also serves as wind-break and stabilizes the soil by roots with additional medicinal and nutritional benefits. It already forms an important part of rural life style of the people residing in deserts and semi-desert areas of the world including Pakistan.

It blossoms in spring to hot summer season with orange red to brick red colour. The immature fruits are pickled and cooked alongwith flower-buds and eaten as vegetable (Harsh and Tiwari, 1998; Kumar *et al.*, 2005). Ripen fruits are eaten

by local inhabitants and also equally consumed by the wild and domestic animals of the desert terrain. The fleshy fruits are also a nutritive food for birds. The young foliage serves as fodder for cattle, camels and goats. The protein contents and minerals in fruits of *Capparis decidua* are reported to be higher as compared to the common fruits. The wood of this shrub is pale brown or light yellow, smooth grain, moderately hard and heavy. It is resistant to termites and suitable for making wooden tools, tool-handles, cart-wheels, small beams, rafters and to a small extent in making huts and fences. Its wood is also used as firewood. Besides all these utilities, it is also an important medicinal plant and successfully used in folk medicine and herbalism. In herbal medicines, the bark is reported to be useful in the treatment of asthma, coughs and inflammation; roots used in fever and buds in the treatment of boils. In Unani, leaves act as appetizer, help in cardiac troubles and fruits are used in biliousness (Upadyay *et al.*, 2006). The tender leaves are applied as a poultice on boils and swellings (Upadyay *et al.*, 2011 c). They are chewed to relieve toothache. It is given in remittent fevers and rheumatism (Upadyay *et al.*, 2011a).

Cholistan is the 2nd largest desert of Pakistan with a diverse range of xerophytic flora of great importance for the local inhabitants. The local inhabitants largely depend on local plants as source of fodder for their livestock, as food for themselves during famine, as fuel source and as medicines in different human and animal ailments in various traditional recipes. *Capparis decidua* is densely populated in the area with diverse utilization in everyday life of the local communities (Azhar, 2014). Due to the versatile utility of this plant, it can be used profitably in arid/semi arid regions for rural development programmes.

Keeping in view all these facts, this study was designed to explore and document the local uses of this shrub in the Cholistan desert. Further, the medicinal plant experts of the area were also consulted for their opinion on current uses of this shrub and the chemical composition of medicinally used plant parts were also carried out to confirm the folklores.

MATERIALS AND METHODS

This study was conducted in the Department of Forestry and Range Management, University of Agriculture, Faisalabad, Pakistan during the year 2011-13. The Bahawalpur district was chosen for the study because it has the largest area of Cholistan desert. Within Bahawalpur district, four union councils of tehsil Yazman were selected purposively because these are officially declared as Cholistani union councils. These targeted union councils are located between latitudes 27°42' and 29°45' North and longitudes 69°52' and 75°24' East on geographical map (Anon, 2009). From each union council four villages (total 16) were selected randomly. From each village 20 respondents (mostly head of the family) were further randomly identified for interview. A combined qualitative and quantitative research approach was used in this study. The total number of research participants from all villages was 320. An interview schedule was also formulated with the local medicinal plant experts (key informants) to confirm the gathered ethnobotanical information from the local dwellers. Key informants (total 14) were selected by adopting the snowball method. Separate questionnaires (well equipped) were used for interview. Participant observations were also recorded from the local market for generating a general idea on use pattern of *C. decidua* and its availability. Finally, different plant parts were sampled from the study area and identified by consulting available standard literature (Shafi *et al.*, 2001). The most commonly used plant parts as medicine and food were shade dried, grinded and stored in plastic bags for laboratory analysis.

Chemical analysis

The shade dried plant parts were grinded and analyzed using standard techniques and repeated thrice in different laboratories of University of Agriculture, Faisalabad. Proximate analyses were carried out following the procedures of AOAC (1995). The PO4³⁻ (soluble phosphates) and K⁺ (potassium) were determined using the methods described by Yoshida *et al.*, (1976). The procedural method of Julkunen-Titto (1986) was followed in determining total phenolics. Harborne (1976) and colorimetric assay method (Zheshin *et*

al., 1999) was used to measure the alkaloids and total flavonoids contents in dried plant samples.

Statistical analysis

MS Excel spread sheets were prepared from the collected data and analyzed into descriptive statistics using the SPSS (Nie *et al.*, 1975). The nutritive and medicinal parameters were statistically presented by using Tukey's test in complete randomized design.

RESULTS AND DISCUSSION

All the respondents (local inhabitants and local medicinal plant experts) opined about the multipurpose uses of this plant. The shrub is being used as medicinal, food, fodder, firewood and as wood for making hand tools, fences and construction of gopas i.e. locally thatched houses (Fig.1).

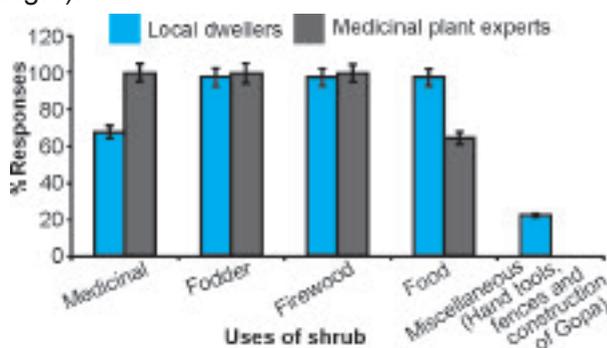


Fig.1. Common uses of *C. decidua* in the area.

Only local inhabitants responded about its use in making thatched houses (Gopas) and fences for their livestock. The information about the various uses of *C. decidua* disclosed by the local inhabitants and medicinal plant experts is matched with the available literature. The dwellers of Cholistan desert are confined to a few income generating sources or alternatives as livestock and in some areas with limited irrigation water to grow cash crops from small land holdings under adverse soil and climatic conditions. Therefore, relative importance of wild plant resources as food, fodder and fuel wood has increased tremendously for local communities.

Soil erosion and shifting sand dunes due to wind is the major issue in Cholistan desert. This shrub helps in soil binding with deep root system and

is common indigenous shrub of Cholistan desert. Alongwith its primary function as natural soil binder, it fulfills various other demands of the local people and their livestock (firewood, food, fodder and medicine). Camel, cattle, sheep and goats eat its young leaves and flowers but the consumption is highly seasonal because it remains leafless for most of the year.

This shrub has vast utilization as medicine and commonly used for curing a range of ailments in the area. Different parts of *C. decidua* are used for treating cough, pains, joint pains, jaundice, intestinal pain, anemia, asthma and swellings as blister on boils and in toothache. It is also used as appetizer, pickle and health tonic. Either a part or whole plant is used singly or in combination with other plant materials or mineral to enhance its effectiveness and efficacy. Data revealed that major uses of *C. decidua* are medicinal. There were 25 diseases reported to be cured by this shrub. Local dwellers use this shrub in 11 diseases while medicinal plant experts reported 24 diseases. The usage method for different ailments is also elaborated in Table 1.

These recorded uses in the area are similar to the uses in other parts of the world with some variations in the usage method. Various researchers enlisted its use in traditional and Unani medicinal systems for curing asthma, cough, hiccough, rheumatism, ulcer, gout, ear infection, as antidiabetic agent, anthelmintic, purgative, constipative, diuretic, a carminative, emmenagogue, tonic, aphrodisiac, appetizer, lumbago, in cardiac troubles and some skin disorders (Dangi and Mishra, 2010; Kirtikar and Basu, 1993; Mishra *et al.*, 2007; Ravi *et al.*, 2007; Upadhyay *et al.*, 2011a). Specifically in Ayurveda, dry top shoots with young leaves in powder shape are used as a blister in boils, swellings, eruptions and used as antidote to poison, in facial paralysis, intestinal worms and solves enlarged spleen problems in man (Upadhyay *et al.*, 2011c). Its leaves are chewed to relieve toothache (Mishra *et al.*, 2007), a decoction of arial vegetative parts is effective for pyorrhea (Upadhyay *et al.*, 2006). Its stem bark is reported to have curing

ability for asthma, boils and ulcers, vomiting, in all types inflammations and piles (Upadhyay *et al.*, 2011c) while its root bark in powder with water is taken orally in intermittent fevers, inflammations, liver problems (Upadhyay *et al.* 2011a) and

haemorrhoidal treatments (Upadhyay, 2012). Its root paste is externally applied on scorpion bites and burnt powdered stem is used for fractured bones (Upadhyay *et al.*, 2010).

Table 1. Medicinal uses of *Capparis decidua* in Cholistan desert.

S.N	Diseases / Ailments	Overall responses (%)		Part used and method of usage
		Local dwellers (n=360)	Medicinal plant experts (n=14)	
1.	Wound	0	14.3	Stem bark, roots: Burnt stem bark and roots in powder form applied externally
2.	Cough	26.6	35.7	Flower: Crushed flowers in sugar or honey are eaten
3.	Asthma	3.1	7.1	Flower: Crushed flowers in sugar or honey are eaten
4.	Pains	23.8	21.4	Fruit, flower, leaves, root: Dry form, orally used as single or in combination with other herbs
5.	Health tonic	9.7	14.3	Fruit, flower: Dry plant, orally used
6.	Appetizer	43.1	50	Fruit: Fresh fruits, unripe fruit in pickle form, orally used
7.	Joint pain	10.9	28.6	Fruit, flower, leaves, root: Dry root bark used as blister and fruits, flower and leaves, oral administration
8.	Piles	0	28.6	Flower, leaves: Fresh leaves after warming on fire used as bandages
9.	Veterinary medicine	0	21.4	Whole plant: Orally administered
10.	Skin diseases	0	21.4	Stem bark: As concoction
11.	Haemorrhoidal treatments	0	28.6	Fruit, flower: Dry powder taken orally
12.	Stomach pain	3.8	7.1	Root, fruit: Root bark grinded and fresh or dry fruits, orally taken
13.	Boils	1.3	7.1	Root bark: Grinded root bark as oral administration
14.	Pneumonia	3.8	57.1	Flower: A mixture with black pepper, orally taken
15.	Bleeding gums	1.3	7.1	Root bark, stem bark: Decoction of dried root and stem bark used as gargle
16.	liver diseases		7.1	Stem bark, root bark: Grinded root and stem bark in powder form are orally taken with water
17.	Diabetes	0	21.4	Flower, fruit: Dry leaves, root bark, dry latex in powder form externally pasted on infected spot, fresh latex is poured on sting spot
18.	Paralysis	0	21.4	Flower, leaves: Dry leaves and flowers after grinding as powder applied externally as blisters
19.	Ear diseases	0	14.3	Flower: Dry and powdered form externally applied
20.	Worms	0	21.4	Fruit: Dried fruits in shape of pills orally taken
21.	Fractured bones	0	7.1	Whole plant: Burned dry plant (coal powder) is used externally
22.	Constipation	0	14.3	Flower, shoot: Mix with sugar in a jar and place in sunlight for a week and orally used
23.	Spleen enlargement	0	28.6	Flower, leaves: Dried and grinded in powder shape, orally taken
24.	Diuretic	0	7.1	Root: Dry grinded root bark in shape of pills, orally taken
25.	Anemia	3.8	0	Fruit: Fresh fruits, orally taken

Nutritive value and secondary metabolite concentrations of different plant parts is given in Table 2. It has high amount of nitrogen (N), ether extractable fat (EEF), potassium (K) in stem and root bark as compared to other plant parts (3.28

& 3.26, 4.45 & 4.68, 1.83 & 1.66% respectively). Crude fibre (CF) and ash is calculated high in stem (37.16 and 24.94%) while phosphorus (P = 0.16%) is higher in fruits and nitrogen free extract (NFE = 68.60%) was calculated more in flowers

than other parts. Phenolic contents were higher in flowers while fruits and stem bark possess

more flavonoids and alkaloids (0.07, 0.06% and 0.05, 0.04%) (Table 2).

Table 2. Nutritive composition and secondary metabolite compounds [Mean \pm SE] of different plant parts of *Capparis decidua*.

Plant part	Nutritive value (%)							
	N	CF	CP	Ash	EEF	P	K	NFE
Fruit	2.26 \pm 0.088b	24.11 \pm 0.266d	14.72 \pm 0.442d	18.64 \pm 0.337c	3.90 \pm 0.030b	0.16 \pm 0.120a	0.52 \pm 0.049b	51.83 \pm 1.162b
Flower	2.66 \pm 0.084b	29.15 \pm 0.352c	17.02 \pm 0.343c	15.70 \pm 0.403d	3.79 \pm 0.058b	0.04 \pm 0.011b	0.82 \pm 0.066b	68.60 \pm 1.263a
Stem bark	3.28 \pm 0.079a	37.16 \pm 0.365a	19.27 \pm 0.285b	24.94 \pm 0.320a	4.45 \pm 0.075a	0.03 \pm 0.006b	1.83 \pm 0.034a	32.49 \pm 1.312c
Roots and root bark	3.26 \pm 0.114a	33.54 \pm 0.320b	21.36 \pm 0.378a	21.67 \pm 0.272b	4.68 \pm 0.066a	0.02 \pm 0.014b	1.66 \pm 0.048a	37.62 \pm 0.64c

Secondary metabolite compounds (mg g ⁻¹ dry weight)		
Phenolic	Flavonoids	Alkaloids
0.55 \pm 0.073b	0.07 \pm 0.002a	0.05 \pm 0.003a
0.86 \pm 0.04a	0.04 \pm 0.012b	0.03 \pm 0.003b
0.46 \pm 0.062c	0.06 \pm 0.006a	0.04 \pm 0.005a
0.25 \pm 0.034d	0.04 \pm 0.002b	0.016 \pm 0.003c

*All analyses are mean of triplicate measurements. Means with similar letters in column are statistically non-significant ($P < 0.05$).

It is a rich source of alkaloids, sterols, phenols, glycosides, terpenoids, flavonoids, different oils, steroids and fatty acids (Baby and Jini, 2011; Mishra *et al.*, 2007; Neelkamal, 2009; Rajni and Rajbala, 2010). The innumerable therapeutic uses and medicinal properties/phytochemical investigations of *C. decidua* proved it as a valuable medicinal plant (Singh *et al.*, 2011). A sulphur compound (0.4%) is present in flowers of this plant, which is useful against numerous microbial disorders (Upadhyay *et al.* 2006). The green flower buds and immature fruits are cooked as vegetables and also used as pickles (Harsh and Tiwari, 1998; Kumar *et al.*, 2005). The ripened fruits contain 55% pulp, 8.6% protein, 1.1% reducing sugars, 1.8% total sugars, 0.057% P, 1.026% K, 0.055% Mg, 0.055% Ca and 7.81 mg per 100 g ascorbic acid of total fruit weight (Singh *et al.*, 2011). Unripe green fruits contain 14.88% crude protein, 12.32% crude fibre, 7.43% ether extract, 0.18% P, 0.09% Ca and 0.01% Cu (Chouhan *et al.*, 1986). Another study (Rai and Rai, 1987) reported that *C. decidua* (whole plant) contains 15.1% protein and 42.88% fibre and 8.6% proetins, 1.7% sugars and 20% oil in seeds of *C. decidua* of Indian origin. The results of field observations and dwellers responses showed that vegetation of the area (including *C. decidua*) has been decreased during last 5 years (Fig. 2).

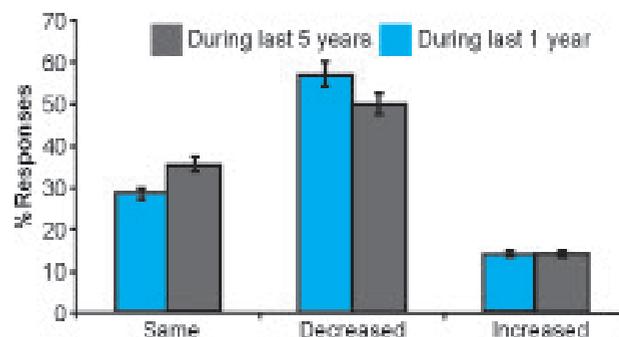


Fig. 2. Availability of *C. decidua* in the area.

The major reasons of decline of this shrub were recorded as over exploitation (nomadic/unplanned grazing), uncertain rain and agriculture. Among other factors, kiln use, population pressure, increase in demand, extraction method and commercial use are other significant reasons of decline (Table 3).

Previous work in other parts of the world also supported these findings. Overuse and or commercial sale of medicinal flora significantly decreases their populations. Increased consumption (as food, fodder or medicine) and overexploitation by ever-increasing human population needs an expansion of agriculture on the loss of natural vegetation (Kiringe and Okello, 2005). Major causes of the extinction of wild medicinal and aromatic plants in all over the

Table 3. Respondents opinion (Mean \pm SD and rank order of reasons) about the degradation reasons of medicinal shrubs in the Cholistan Rangeland.

Reasons of degradation	Mean	Rank order
Over exploitation	4.36 \pm 0.66	1
Uncertain rain	3.99 \pm 0.31	2
Agriculture	3.79 \pm 0.68	3
Kiln use	3.73 \pm 0.66	4
Population pressure	3.21 \pm 1.92	5
Increase in demand	2.73 \pm 2.12	6
Method of extraction	1.71 \pm 2.12	7
Commercial use	1.33 \pm 1.99	8

world are mainly over-exploitation combining with unscientific extraction methods, commercial trade, increasing human population, urbanization (uncontrolled) and agricultural expansion, industrialization which extensively destruct plant habitats and overgrazing (Haq *et al.*, 2011; Zenebe *et al.*, 2012).

The shrub has proven to be an economically important plant in Cholistan. It provides varied food and medicinal uses for human and livestock, fuel wood, and other income-generating opportunities. It contributes to environmental sustainability due to its soil-binding capacity. Extensive research and support activities are thus needed to maximize the sustained utilization of this species to help contribute to rural livelihood and enhancement of desert lands. At present, the immature fruits continue to have high economic value. Hence, these are often harvested and sold at high prices. This practice puts seed production and propagation of *C. decidua* (Karir) at risk. Poor or lack of seed production continues to be the major cause for Karir's declining population. If proper selection is made from available variability, *C. decidua* can come up an excellent crop for Cholistan desert and other arid zones of Pakistan where a few species can survive and can be domesticated.

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Abida Aziz	Secondary metabolite analysis
Mubshar Hussain	Proximate analysis and review
Saeed Ahmad Pirzada	Field data collection
Irfan Ahmad	Data analysis in SPSS
Faiz Rasool	Collected plant samples