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A comprehensive review on ecology and ethnobotany of *Acacias* and *Acacia jacquemontii* Benth in dry environment

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Abstract
The main objectives of the present study were to determine the growth behavior, chemical composition, ethnobotanical uses and the density of neighboring plant species of *Acacia* species and *Acacia jacquemontii* Benth at in desert environment. This is generally associated with flora of desert landscape. This is a medium shrubby species with formation of extensive branching from the base and root system. It is a good forage species and a preferred firewood shrub in the Thal desert. This species has been endangering on account of uncontrolled grazing, improper land use, mismanagement, shifting agricultural crops and due to mechanical damages to plants. Poor seed germination and biotic interference have caused depletion of this shrub in Thal desert rangelands. Therefore, it is dire need of the time to study the species for its natural conservation in this area. The species produced high concentrations of secondary compounds like alkaloids, flavonoids, saponins, tannins, total phenolics and hydrogen cyanides in the leaves. The plants produced these compounds for defending themselves from herbivores. The ethnobotanical use of this species was largely prevailing in the area. Due to the prevalence of acute poverty, rural people of the desert used to purchase preserved the plant parts (at lower prices) of the species from Greek Practitioners (Herbal Medicinal Experts) for the treatment of their common ailments.

Keywords: Acacias, growth behavior, ecology, ethnobotany, common uses

Introduction

Distribution and multipurpose leguminous general *Acacias*

The genus *Acacia* is from an ancient Greek word “akakia” commonly known as hard or sharp pointed (Allred, 2000) [2]. It is the most significant genus of family Fabaceae, first of all described by Linnaeus in 1773. It is estimated that there are roughly 1380 species of *Acacia* found worldwide. About two-third of *Acacia* species are native to Australia and rest of the species spread around the tropical and subtropical regions of the world (Maslin *et al*., 2003; Orchard and Maslin, 2003; Gamble, 1993) [24, 31, 13].

The foliage color of *Acacia* ranges from light or dark green to blue or silver-grey. The plants often bear spines, especially those species growing in arid regions. These sometimes represent branches or twigs that have become short, narrow, hard, and pungent (Clemens *et al*., 1977) [9]. The "leaves" on many of the species are not leaves at all. They are modified petioles, which are the parts of the stem that attach the leaves to the branch. When the petioles form in this manner, they are called phyllodes. The leaves of the *Acacia* are alternate and pinnated. The individual leaflets form a feather shape. The *Acacia* leaves drop when provoked with severe drought. This protective adaptation is called semi-deciduous. The loss of leaves prevents evaporation and slows plant growth. This conserves moisture and plant energy until rains come and then the plant can resume growth. This is also a common desert plant adaptation where they will cease growth until resources are available (Singh and Gurcharan, 2004) [43].

Acacia flowers are typically small, yellow and fragrant with many stamens, giving the flower a fuzzy appearance. Flower heads are actually lots of little flowers bundled together. Most species have clusters of flowers that are yellow or cream in color. Some may be white or

pink. They feature long stamens that can make it difficult to observe the small petals. Individual flowers are arranged in inflorescences that may be either globular heads or cylindrical spikes. The flowers of the species do not produce any nectar. However, the leaf and phyllode glands secrete a nectar or sugary substance which attracts ants, bees, butterflies and other insects. These plants are mostly insects pollinated. The color of flowers in each species is fairly consistent and can aid in identifying different species (Palmer *et al*., 2008) [32].

After the flowers are spent, *Acacia's* plants form seed pods that look like dry and long capsules. The pods stay on the tree for some time and drop when conditions are favorable. The heavy, thick pod protects the seeds and the germination only occurs when the rainy season appears. This allows the seedling the best chance of surviving. Temperatures need to be above 7-8 ^{0}C and there must be at least 25-50 mm of rainfall to initiate seed germination (Clemens *et al*., 1977) [9].

The *Acacia* tree and shrubs grows to a height of 30-31 meters, wood is used for furniture, cabinet wood and craft wood, and musical instruments (Holmes, 1981) [17]. Wood of the *Acacias* species is highly resistant to fungi and insects. The color of the plant wood is influenced by its growing conditions. It has a yellow to white sapwood while the heartwood has light brown to darker brown color. The wood may also have irregular streaks of red or golden brown. The wood of the plants has no noticeable taste or odor but it imparts a distinctive flavor when used in food preparation. Pulpwood is suitable in lightweight offset papers. It is also used in paper tissue where it improves softness (Sorensson 1997, Zobel, 1984) [47, 50]. Timber of some species is used in local buildings, sawn for railway sleepers, railway carriages, for local furniture and is one of the best sources of tannins, gums and charcoal (AbdEl-Hafiz, 2001) [1].

Acacia species have the most obvious characteristic of drought-resisting plants. Stems are often heavily waxed to reduced cuticular water loss. Typical leaves of warm desert *Acacia* plants are small and narrow that enables them to maintain their leaf temperature near to the ambient temperature. Such leaves help the species to avoid lethal summer time temperatures during summer drought. Leaves are often reduced to spines, and this increases the volume to surface ratio. Spines also help to reduce heat load, and dissipate heat (Barr and Atkinson, 1970) [6].

Acacia species are extremely drought-tolerant and are very important for soil conservation. The plants species reproduces naturally by seed germination. Most of the *Acacia* species grow in the arid and semi-arid regions, with an average temperature of 40-45 °C in summer and less than 5 °C in winter. These plants species are equipped with most of the features required to withstand severe climatic conditions, therefore they are considered as the most successful "survivors" in the arid regions (Ibrahim and Aref, 2000; Aref, 2000) [18, 4]. Being prickly or Thorne in nature, these species are generally drought resistant and are native to arid zones. The plants can also survive drought conditions because of their long tap roots which reach deep ground water sources (Heil *et al*., 2004) [16].

The *Acacia* plants developed very useful physical and behavioral adaptations to discourage animals from eating their leaves. They develop long, sharp thorns and a symbiotic relationship with stinging ants (Clemens, 1977) [9]. The ants live in *Acacia* thorns by making holes in them and then feed on the nectar produced by these plants. When an animal takes a bite of leaves (and thorns), it also gets a mouthful of angry stinging ants. The ants defend their homes from other insects as well, thus protecting the *Acacia* species (Heil *et al.,* 2004) [16]. Another behavioral adaptation of the species aimed at preventing grazing animals is a chemical defense system that is triggered when the animals begins to munch on the leaves. A poisonous alkaloid that tastes nasty is pumped into the plant leaves which make these leaves inedible for the browsing animals. In some *Acacia* species, the plants emit a chemical into the air during their browsing which makes other associated *Acacia* plants to pump alkaloid into their leaves (Palmer *et al*., 2008) [32]. These species have remarkable resistance to the fire and have the quality of re-sprouting and even recovering after their burning by the natural fires (Sorensson, 1997) [47].

The trees and shrubs of these species are of central importance in the rural economy of many of the world's arid and semi-arid areas. Since the earlier times, all *Acacia* plants are suitable materials for timber, fuelwood, forage, soil fertility through nitrogen fixation and soil conservation by wind or water erosion and sand dunes stabilization (AbdEl-Hafiz, 2001) [1]. *Acacia* plants are considered as erosion-control plants, with their easy spreading and adaptation nature while some *Acacia* plants are potentially invasive species (Barr and Atkinson, 1970) [6].

The plants of the *Acacia* species are very suitable for the production of paper and have similar pulping properties to a range of other tropical timbers (Nasroun, 1992) [29]. The dark brown wood is strong, durable, nearly twice as hard as teak, very shock resistant and is used for construction, tool handles and carts. Leaves and pods contain highly digestive proteins and are rich in minerals and generally used for feeding sheep and goats in certain parts of South Asia. The plant species also have a wide range of secondary compounds including tannins, oxalates, cyanides, saponin, amines, alkaloids, fluoroacetate and other toxins. The leaves of many species have usually large amounts of tannins and are commercially important for tanning leather (Pandey and Sharma, 2005) [33].

Acacia plants have significant pharmacological and toxicological effects. The decoction of the leaves is used for astringent to the bowels, cure of bronchitis, heals fracture and is good for eye diseases (Rushd and Kulliyat, 1987) [39]. Bruised leaves of the plants are applied to sore eyes in children. Paste of burnt leaves is effective ointment for itching. Tender leaves beaten into a pulp are used as a gargle in spongy gums, sore throat and as wash in hemorrhagic ulcers and wound (Said, 1997) [40]. Leaves extract is an astringent and injected to allay irritation in acute gonorrhea and leucorrhoea. Further, bruised leaves formed into a poultice and applied to ulcer act as a stimulant and astringent. The tender leaves growing tops rubbed into a paste with sugar and water act as a demulcent useful in coughs. The tender leaves beaten into a pulp are given in diarrhea as astringent (Nadkarni, 2005) [28].

The bark contains a large quantity of tannin and is a powerful astringent; its decoction is largely used as a gargle and mouth wash in cancerous and syphilitic affections. Infusion of bark is given in chronic diarrhea and diabetes. The juice of the bark mixed with milk is dropped into the eye in conjunctivitis (Nadkarni, 2005) [28]. Decoction of bark is largely used as an astringent douch in gonorrhoea, cystitis, vaginitis, leucorrhoea and prolapse of uterus (Said, 1997) [40]. It is used for a tonic in diarrhea and dysentery and

good cure for insanity. The flowers are reported to reduce body temperature (Rushd and Kulliyat, 1987) [39]. The pods of these plants species are reported helpful in removing catarrhal matter and phlegm from bronchial tubes African Zulu tribes use the bark of these species for treatment of cough (Sonibare and ZO, 2008) [46]. The fruits are found to be useful in diarrhea, dysentery and diabetes (Anonymous, 2003).

Powder of root is useful in leucorrhoea, (Gilani *et al*., 1999) [14] in wound healing and useful in burning sensation (Rao *et al*., 1967) [36]. Various plants parts used in hair-fall, ear-ache, syphilis, cholera, dysentery and leprosy (Asolkar *et al*., 2005) [5]. The powdered gum mixed with quinine is useful in fever cases complicated with diarrhea and dysentery (Nadkarni, 2005) [28]. It stops bleeding and is also useful in diabetes (Asolkar *et al.,* 2005) [5]. Various parts of *Acacia plants* are useful for antimicrobial activity in humans (Saini *et al.,* 2008). These species form a good habitat for the honey bee that produces good quality honey that is commercially known as *Acacia* honey (Elkhalifa, 1996) [11]. Ethno medicinally the species have long been used for the treatment of skin, sexual, stomach and tooth problems. Many herbal products derived from these species are sold in market in their pure or mixed form such as, Babool tooth paste, Ayur Shampoo, Nyle Shampoo in India (Maslin *et al.,* 2003) [24, 31].

Acacia jacquemontii Benth Taxonomy

Scientific name: *A. jacquemontii* Benth (Fabaceae), common name "Bable" or "Kikri" in Pakistan. In India, this shrub is called as "bhu-banwali", "gulli bouli" and "ratabouli" (Mertia *et al*., 2009) [26].

Distribution

This plant species mainly occurs in desertic regions of Australia and Africa. In Asia it is widely distributed in Pakistan, India, Afghanistan, Iran and Iraq (Mertia *et al*., 2009) [26]. On sand dunes and interdunal sandy plains, it naturally distributes in patches, but on bare undulating sand dunes its frequency and density is more. It is a potential but lesser known multipurpose shrub of arid and semi-arid regions (Singh *et al*., 2003) [45].

Description of plant

This *Acacia* is an erect, multi-stemmed, and small to large shrub. It can attain a height ranging from 1.5 to 4.5 m in different habitats and soil types. The crown is variable in size, flattened, spreading and erect. The number of stems or branches on the individual plant varies from 4 to 46. Due to multi-stem growth characteristics, the plants attain a good canopy spread within 4 to 5 years. The growth of shrub is very fast in early stage while it slows down after 5 to 6 years. Plant stems are stiff, smooth and brown in color (Rasool *et al.,* 2016ab) [37, 38]. Thickness of stem varies from 1.0 to 5.9 cm. Twigs are zigzag with grayish brown bark. Young shoots of the stems are slightly short and soft. Spines are arranged in paired, straight, slender and 2.0 to 5.0 cm long. They are white in color and most often smooth. Leaves are bipinnate 2.5-5.0 cm long with 2-4 pairs of pinnae. The Leaflets of this species are in 5-10 pairs, sessile, 2.5-3.0 mm long, linear oblong, obtuse, and glabrous. Common petiole is 2.5 to 5.0 cm long with small or indistinct glands between the upper pair of pinnae (Mertia *et al*., 2009) [26].

Photo 1: Distribution of *Acacia jacquemontii* plants During Dormant season in Desert Landscape

Photo 2: Distribution of *Acacia jacquemontii* plants During Peak Growing season in Desert Landscape

Growth pattern

Flower, pod and seed production

This shrub produces yellow sweet scented flowers, inflorescence globose heads, 12-16 mm in diameter, peduncles 2-3, slender, axillary, close cluster, bracts 2-3, about the middle of the peduncle. Calyx campanulate, 1.2 to 1.5 mm long; the teeth short, deltoid and corolla 3 mm Long, lobes ovate-oblong, acute. Stamens indefinite, anthers are not gland tipped (Parveen and Qaiser, 1998) [34]. Pollens are 12-16 celled polyads, and tectum subpsilate. Length, breadth and exine thickness of pollens are 39.40, 50.26 and 1.79, um, respectively and ovary included in calyx tube or inferior. This species produces sweet scented flowers and attracts birds and insects toward extra floral nectories. The yellow sweet scented flowers of this shrub make the birds and insects main vectors of pollination (Ford and Forde, 1976) [12]. Pods of this shrub show considerable variation in shape, size and color. They are stalked ovate oblong, round at base, flat, straight, transversely veined, glabrous and 4 to 6 seeded. The length of the pod of this shrub varies from 5.2 to 10.0 cm, and 1.0 to 1.7 cm in width while weight of individual pod ranges from 0.2 to 0.6 gram. The pods of this species are pinkish-white in color with prominent pink colored lining. Seeds are brown to dark brown in color, smooth, compressed and 5.5 to 7.5 mm in diameter. The individual seed weight ranges from 0.03 to 0.06 g while the weight of its100 seeds is about 4.9 g (Mertia *et al*., 2009) [26].

The seed setting is mainly controlled by evaporation of this shrub (Khan, 1970) [21]. Seed setting is poor if windy days are prolonged. Pods are dehiscent and burst on drying. Fallen seeds are blown by wind to distant places. Some seeds are also buried in the ground with deposition of windblown sand on them. Seed of this species dispersal also takes place by animals, which pass out undamaged seeds through the digestive tract (Rasool *et al.,* 2016b) [38]. The phenological behavior of this shrub is mainly influenced by rainfall, temperature and evaporation. Rainfall usually affects leafing while temperature influences flowering and fruiting. The time of flowering varies at different locations. In hyper arid conditions, the flowering on the plants initiate in middle February while the pods mature either at the end of April or early May the year (Bhandari, 1990) [7].

Seed germination and root development

The seeds of this shrub start germinating when favorable conditions are available. The germination of seed is epigeal. The radicle emerges and moves downward. The growth and elongation of roots is faster than of shoot. The primary tap root is long and thick (Mertia and Prasad, 2005) [25]. Young seedlings of the shrub are relatively more susceptible to frost than the mature plants (Joshi *et al*., 1983). Young plants developing from seedlings oftenly grow very fast and can attain a height of 32 to 70 cm in a year after transplanting in the field. In shallow and gravely soils the growth of seedlings are slow and poor (Sharma *et al.,* 1984) [10, 41]. This species develops profuse root system. Main root divides into several sub roots called lateral roots which combine and make a strong root network that binds sand in the rhizosphere. Normally its root penetrate 4 to 6 meter deep in search of water, whereas in sand dunes the roots may penetrate even deeper in search of water (Mertia *et al*., 2009) [26]. This species starts coppicing either after the period of every 5 to 6 years or when its plants attains a height of about 4 meters (Mertia and Prasad, 2005) [25].

Ecological adaptation for survival in dry conditions

Plants of this species have small and waxed leaves which help the shrub to reduce its transpiration rate and survive in dry conditions. Long tap roots of the plants can reach deep ground water sources which are helpful for the shrub to utilize ground water and remain green during the water shortage in the dry environment (Rasool *et al*., 2016a) [37]. Plants develop long, sharp thorns and a symbiotic relationship with stinging ants. When an animal takes a bite of leaves (and thorns), it also gets a mouthful of angry, stinging ants. The ants defend their homes from other insects as well, thus protecting this shrub (Choudhary *et al*., 2009) [8]. Like several other *Acacia* species, this shrub accumulates free amino acids including specially proline during moisture stress which helps this shrub to with stand drought conditions (Singh *et al*., 1972) [42].

Biomass production

Production of above ground biomass in this species depends on site, habitat and climate of the area. The plants growing in deep soils yield highest above ground biomass as compared to plants growing in shallow soils. Soil conditions had no significant bearings on proportionate allocations of different components of total accumulated biomass i.e. twigs, branches, leaves, seed and stem wood. It exhibits maximum biomass of stem wood and twigs production in deep soils followed by medium and shallow soils (Kunhamu *et al*., 2005) [23].

Economic importance

Chemical composition

This plant species was assessed for active principles to ascertain the rationale for its use in traditional medicine. Preliminary phytochemical screening of the stem bark extracts showed that it possessed the active principles alkaloids, glycosides, saponins, terpenoids and tannins. The antimicrobial activity of the extracts was assayed against pathogenic strains of *Bacillus cereus, Bacillus pumilus, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, S. pyrogenes,* and *Candida albicans* using the agar diffusion method. The plant extract exhibited antimicrobial activity against all the test microorganisms. *B. cereus* and *B. pumilus* were the most susceptible to the plant extract while *Candida albicans* was the most resistant. The minimum inhibitory concentration of the stem bark extract of the plant ranged between 30 and 50 mg/ml while the minimum bactericidal concentration ranged between 35 and 60 mg/ml. This species could be a potential source of antimicrobial agents (Choudhary *et al*., 2009) [8]. This plant is rich in primary metabolites as protein, fats, and fibers (Harsh and Bohra, 2006) [15] and has been used industrially to prepare biodegradable plastics (Pataeu *et al*., 1994) [35], oils, gums, dyes and inks (Morris, 1997) [27].

Medicinal uses

Leaves and branches of this species are used to cure diarrhea, dysentery, stomachache and astringent (Khan *et al*., 2013) [22]. The bark of the root is used as inocula for fermentation and making local spirit (Al-Mosawi, 2006) [3]. The bark of tree is used to induce spontaneous abortion in women in any stage of pregnancy. The bark of tree is also used for snake bites. The dried bark is converted in form of paste with water. The paste is applied on cut by snake bite. Fibers extracted from bark are also used to tie on the spot where scorpion has stung. This is supposed to give relief to the poison (Choudhary *et al*., 2009) [8]. Gum of the shrub is a complex and variable mixture of arabinogalactan, oligosaccharides, polysaccharides and glycoproteins. It has been extensively used by tribal communities for kidney, asthma, and renal disorder. Gum produced by this species is edible and highly priced in pharmaceutical industries (Harsh and Bohra, 2006) [15]. Gum of this plant is also added in various food preparations to serve as health tonic. Especially such food preparation is used by patients in case of fatal illness, accidents leading to severe injury or by women after child birth (Al-Mosawi, 2006) [3]. It is believed that incorporation of gum helps in fast recovery from such conditions. Gum also has demulcent and astringent properties and often added for medicine for this purpose. For curing asthma gum of the plant is boiled and given once a day for one month duration. Gum is also eaten in sores of mouth (Choudhary *et al*., 2009) [8].

Common uses poles and fuel wood

Depending on length and thickness of poles (stems), local inhabitants of Jodhpur use the stem of this shrub for various purposes (Mertia *et al*., 2009) [26]. The stems with a height of 3 meter and thickness of about 40 mm are preferred by villagers for making frames thatched houses and huts. Poles of medium height (2-3 m) and moderate thickness (20-40 mm) are preferably used for making household granaries, baskets and other household articles and are a good source of income for sustenance of poor desert dwellers particularly in the periods of drought and famines (Bhandari, 1990) [7].

As a fuel wood this species is an excellent material that yields high quality charcoal which is used in making gunpowder. It has a gradual burning property which enables the fire wood to burn for longer duration. During burning its wood releases intense heat and therefore this plant is preferred by goldsmiths, silversmiths and ironsmiths (Dhir *et al*., 1984) [10, 41].

Forage and bark

This shrub provides good browse for goats and camels. The camels browse leaves, pods and green tender branches. During scarcity in drought years the foliage and pods are threshed out and used as fodder for goats (Bhandari, 1990) [7]. The foliage of this species is fairly rich in all micro and macro mineral nutrients and can sustain feeding animals during scarcity of fodder (Sharma *et al.,* 1984) [10, 41]. Bark of this shrub is a good source of tannin, used in small size tanneries to impart brown to black color to the leather. The bark of the root is used in distillation of spirit (Al-Mosawi, 2006) [3]. The bark is obtained as a by-product by felling of plant either for poles or fuel wood. It is separated by heating the poles or roots with wooden mallets and peeling of the stripes. The separated stripes are dried in open and chipped into smaller pieces for use in tanneries (Dhir *et al*., 1984; Choudhary *et al*., 2009) [10, 41, 8].

Agro-forestry and shelterbelts use

Due to fast growth habit, this *Acacia* species is suitable for planting at field boundary in single or double row as bio-fence. It develops dense canopy in 2-3 year which acts as a barrier for any biotic interference. Studies conducted at Cazrirrs, Jaisalmer, revealed that when planted on field bund, it attained height of 2.5 m in 3 years with 16 stems per plant. This shrub is used for shelterbelts with pyramidal shape and reduce the speed of wind and interception of blown sand (Kaul, 1969; Choudhary *et al*., 2009 [8]: Sharrow and Ismail, 2004). Because of its multiple uses, it is viewed as potential species for alternate land use system or agroforestry. In a study, conducted in sandy soil in Bikaner, this species has been integrated in agri-silvi-pasture system along with other woody perennials like, *Calligonum polygonoides*, *Tecomella undulata* and *Prosopis cineraria*. It showed relatively fast growth and attains an average plant height of 19.3 and 149 cm after 12 and 36 months, respectively after planting (Mertia *et al.,* 2009) [26].

Planting for sand dune stabilization

This plant species is one of the most important arid shrubs for sand dune stabilization in Thar Desert. It is an excellent sand binder on bare sand dunes and improves the soil conditions (Singh *et al.,* 2006) [44]. It is evident that soil pH and electrical conductivity (EC) in soil samples collected from below plant canopy and open field are comparable. However, a significant increase in soil organic carbon at 15 cm depth in samples collected from below canopy area as compared to open field indicates that the species has got the ability to improve soils (Yasin, 2013) [49]. Vigorous growth due to its efficient moisture utilization makes it a promising species for planting on sand dunes due to its extensive root system (Tewari *et al.,* 2000) [48].

Coppicing behavior

Mertia *et al*. (2009) [26] reported that this shrub coppiced well when cut at ground 1evel in Thar Desert of India. The growth of coppice in terms of height and stem diameter became profuse. Young new coppice shoots regenerated up to three months as evident by increase in their number. After three months, number of coppice/thicket declines due to mortality of some of the tender shoots and became immobile after five months.

Effect of *Acacia jacquemontii* on soil characteristics

Noureen, (2007) [30] studied the effect of plant cover of this shrub on the physiochemical properties of soils in the Cholistan desert. She reported that the amounts of moisture content, organic matter, nitrogen, calcium, phosphorous, potassium, Sulphur, carbonates/bicarbonates of the soil were higher under the plant canopies of this shrub than in the open areas. She also reported a lower soil pH under the canopies of the shrub than in the soils of open areas. The findings of this researcher indicated overall an increased soil improvement because of the plant canopy of this shrub.

Yasin, (2013) [49] studied the influence the plant canopy *A. jacquemontii* Benth on soil composition properties of soils in the Thal desert. He reported that Soil moisture contents, Organic matter, Carbonates, Bicarbonates, pH, Ec, N, Na, K, Ca, Mg, S, Cl, P and heavy metals i.e. Fe, Cu, Zn and Ni were higher under the plant canopies of this shrub than in 150 and 300 cm away from the canopy. He analyzed these soil composition properties under and away from the canopy at two depths 0-15 cm and 15-30 cm and reported that the mean values of above mentioned elements were higher under the canopy while lower away from the canopy at both depths respectively. The findings of this researcher indicated overall an increased soil improvement because of the plant canopy of this shrub.

Conclusion

Acacia jacquemontii Benth. is one of the most important shrubs of arid region. Due to its multiple uses for fuel, fodder/ browse, poles, gum, etc. the plant has been overexploited and its existence in natural habitat is threatened. This research article revelations will have significant practical implications in conservation and preservation of not only *A. jacquemontii* but whole desert ecosystem, so that it remains sustainable for livelihood of future generations. It has got multiple uses and almost every part of plant is useful. It yields small poles that are used for making frames of thatched houses and huts. Its young shoots / branch1.s are used for making baskets, granaries and other household articles. The wood is good fuel and yields good quality charcoal which is used in making gun powder. On burning, the wood gives out intense heat and therefore, preferred by gold, silver and iron smiths. The plant yields 100-150 g/plant edible gum which is highly priced in pharmaceuticals. The tender green branches and leaves are used as fodder and provide good browse for camel and goat. The dried thorny branches are used as fence. The bark is used in small sized tanneries, imparting brown or black color to the leather.

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