



## Taxonomic studies of trees of the cholistan desert, Pakistan

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### Abstract

The present studies were carried out to document the taxonomic studies of the tree species of Cholistan Desert of Pakistan with the aim of their precise identification and dispersal in the area. A total of ten plant species representing with six genera of *Acacia* Mill. (2 species), *Capparis* Linn. (1 species) *Prosopis* Linn. (2 species), *Salvadora* Linn. (1 species), *Tamarix* Linn. (1 species) and *Ziziphus* Mill. (3 species) were explored and studied taxonomically first time from the study area. A complete morphological taxonomic characteristics enumeration of each species with their botanical name, local name, flowering period and distribution in the project area were evaluated.

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## Introduction

Pakistan is a tropical country has a great diversity of landscapes. It is a combination of ranges of sky-scraping mountains, snow peaks, vast irrigated plains, coastal shores, high lying cold deserts and low lying hot deserts. It stretches over an area of 79.6 million hectares lying between 24 - 37° N and 61 - 75° E. The country is mostly arid and 40.9 million ha fall in the arid zones including 11 million ha of deserts. The main deserts of the country are Thar, Cholistan, Thal and Chagi-Kharan (Akram and Abdullah 1990).

The Cholistan desert covering an area of 26,000 Km<sup>2</sup> is full of natural vegetation lying between latitudes 27° 42' and 29° 45' N and 69° 52' and 75° 24' E. Cholistan desert a cradle of Hakra civilization, once a prosperous, lively, and thriving area is now a vast desolate tract of land (Akhter & Arshad 2006, Wariss *et al.*, 2013). Topographically, on the basis of geomorphology it is divided into two regions; Lesser Cholistan covering about 7,770 km<sup>2</sup> adjoining the canal-irrigated area in northern region while Greater Cholistan covering an area of 18,130 km<sup>2</sup> in southern region. The area consists of dry undulating plains and the remaining region consists of loose sand, form shifting sand dunes. The soils are classified as either saline with pH 8.2 to 8.4 or saline sodic with pH 8.8 to 9.6 (Arshad *et al.*, 2008, Wariss, 2012).

Floristic and taxonomic studies are useful for local plant identification and determining the specific species of the area, their occurrence, growing season, species hardness, distinct species and finding of new species. It is helpful in understanding the effect of climatic conditions such as drought and over-grazing on vegetation (Ahmad *et al.*, 2008; Ali, 2008).

Taxonomy is an artificial science, drawing upon data from various fields such as morphology, anatomy, cytology, genetics, chemistry and molecular biology (Stuessy, 2008). It is known as 'queen' and 'servant' of biology. It is considered as queen that it is the ultimate source of all other fields of biological research leading to the establishment or improving

the classification system. It is the servant because one of the primary functions of taxonomy is to prove a basic service of information on identity, probable close relatives and characteristic of organisms to those who require it, especially to those doing research in other areas of biology (Sivarajan, 1991).

Many botanists and plant taxonomist contributed in the flora documentation such as Stewart (1972), Radcliff (1986), Ghafoor (1974), Jafri (1966), Austin & Ghazanfar (1979), Nazim-ud-din & Naqvi (1984), Ali & Nasir (1970-2002), Ali & Qaiser (1995-2008) Qureshi (2008) Ahmad *et al.*, (2009), Marwat *et al.*, (2009) and few studies from Cholistan desert have been done by Baig *et al.*, (1975) Arshad and Rao (1994) and Arshad and Rao (1995), Arshad *et al.*, (2003, 2008) Wariss (2006). The main objective of the present study was to document the taxonomic studies of the tree species of the Cholistan desert for future authentic identification of the plants species of the study area.

## Materials and methods

### Field Survey

The detailed field studies have been made to collect plant specimens at regular intervals during 2009-2011. Field information's like micro-habitats, habit, associated plant species, status of plant, flower colour, flowering and fruiting season, fruit colour etc. has been recorded. The collected specimens were dried, preserved and deposited in the herbarium of Cholistan Institute of Desert Studies, The Islamia University of Bahawalpur.

### Plant Identification

The collected specimens were examined and microscopic studies have been done by using Stereo Microscope (USA Swift, MA2202F) and Binocular Microscope (IM-800B) in Cholistan Institute of Desert Studies, The Islamia University of Bahawalpur & (Stereo Microscope; Meiji EMZ 13-2330 Japan & Binocular Meiji ML 2200 Japan) at Centre for Biodiversity and Conservation, Shah Abdul Latif University, Khairpur (Mir's) Sind, Pakistan.

Nomenclature has been followed from flora of Pakistan, identified and described with most recent techniques and with the help of various floras, illustrations & monographs (Ahmad, 1954; Kashyap, 1936; Hutchinson, 1937; Jaffari, 1966; Chaudhary, 1969; Stewart, 1972; Matthew, 1981-83; Bhandari, 1978; Hayward, 1987; Chaudhary, 1989; Shetty & Singh, 1987 & 1991, Nasir & Rafiq, 1995; Ali & Nasir, 1970-2002, Ali & Qaiser, 1995-2008).

### Results and discussion

In the present study, a total of 10 plant species of trees from the study area have been recorded belonging as 2 species of *Acacia* of Mimosaceae family, 1 species of *Capparis* of Capparidaceae family, 2 species of *Prosopis* of Mimosaceae family, 1 species of *Salvadora* of Salvadoraceae family, 1 species of *Tamarix* of Tamaricaceae family and 3 species of *Ziziphus* of Rhamnaceae family during 2009-2011. Their detailed taxonomic account is given as follow:

**1. *Acacia jacquemontii* Benth.,** Ali in Nasir and Ali, Fl. Pak. 36: 13-14 (1973).

**Local Name:** Banwali

A much branched, small erect bushy shrub, up to 1.5-2.5(3.5) m tall, branches zigzag, with stiff, bark greyish brown, young shoots slightly puberulous. Stipular spines straight, white, slender, connate at the base, 1-3 cm long. Rachis 0.5-4 cm long; Leaves bipinnate; pinnae 2-4 pairs; glabrous, usually with a gland between the upper pair of pinnae. Leaflets 5-10 pairs, sessile, 2.5-5 mm long, 1-1.2 mm broad, oblong, obtuse, glabrous. Inflorescence heads in peduncle, in axillary fascicles of 2-5, flowers yellow, fragrant, peduncle 1.5-3.4 cm long, bracts 2-3, about the middle of the peduncle. Calyx campanulate, 1.2-1.5 mm long, teeth short, 0.5 mm long. Corolla 2-3 mm long, lobes ovate-oblong, acute. Stamens filament 2-4 mm long. Ovary; 1-2 mm long, style; 3 mm long. Pods glabrous, reticulately veined, 5-7.5 cm long, 0.6-1.7 cm broad, seeds 5-6, stipe 3-5 mm long, compressed.

**Flowering period:** October-December

**Distribution:** India (Madhya Pradesh, Punjab, Rajasthan), Pakistan (Sind, Punjab, Baluchistan), Cholistan Desert (Mooj Garh, Shadi Wali Dahar).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 130 (HERB. CIDS).

**2. *Acacia nilotica* (Linn.) Delile,** Ali in Nasir and Ali, Fl. Pak. 36: 9-12 (1973).

**Local Name:** Kikar

A perennial tree up to 1.2-18 m high, variable in shape; bark on trunk rough, fissured, blackish, grey or brown; young branches almost glabrous to pubescent. Stipules spinescent, up to 5-6 cm long. Leaf often with 1-2 petiolar glands and others between all or only the topmost of the 2-11 pairs of pinnae; bipinnate; leaf 8.5 cm long. Pinnae 3-2 cm long. Leaflets 10-26 (-27) pairs, 4 mm long, 1.5 mm broad, pinnae ending with bristle or stipular spines, sessile, oblong, subobtusate, glabrous to pubescent. Pedicel pubescent. Inflorescence pedunculate heads in axillary, peduncle 1.5-2 cm long, in fascicles of 2-7, bracteoles 2 above the middle of the peduncle, 1-1.5 mm long, broadly ovate, acute, pubescent; flowers yellow, involucrel from near the base to half way up the peduncle. Calyx campanulate, 1-1.5 mm long, pubescent or subglabrous, with short teathed. Corolla 2 mm long, glabrous, margin pubescent; lobes ovate-acuminate. Stamens indefinite; filament 3-5 mm long, anthers yellow, dorsifixed. Ovary oblong, greenish, 1-1.5 mm long; style 2.2.5 mm long. Fruit variable, indehiscent, straight or curved, tomentose, constricted at sutures between seeds, moniliform, compressed, 5-16 cm long, 1-1.6 cm broad, persistently grey-downy. Seeds blackish brown, 5-9 mm long, 3-6 mm broad, suborbicular, compressed, smooth, areole 6-7 mm long, 4-4.5 mm broad, wooly or tomentose on margins.

**Flowering period:** September-December

**Distribution:** India (Punjab, Uttar Pradesh, Bengal, Madhya Pradesh, Madras, Bombay); Tanganyika and Pakistan (Punjab, Sind). It is distributed in the Cholistan desert throughout the area near Tobas.

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 131 (HERB. CIDS).

**3. *Capparis decidua* (Forssk.) Edgew.,** Jafri in Nasir and Ali, Fl. Pak. 34: 11 (1973).

**Local Name:** Karir

A much branched, shrubs or small trees with leafless green zigzag, terete, spiny branches, up to 5 m high. Leaves present on young twigs, caducous, linear, 4-20 mm long, 1-3 mm broad, spinous-tipped, subsessile; stipules thorny, 1-5 mm long, straight or slightly curved, yellow or brown. Inflorescence few to many flowered, without bract, corymbs on short lateral shoots. Flowers 1-2 cm across on 1-1.5 cm long slender pedicel, usually brick red. Sepals petaloid, dirty orange or scarlet, usually 5.5-7 mm long, 3-4.5 mm broad, ovate-oblong, upper one distinctly saccate, often with floccose-ciliate margins, enclosing the floral parts. Petals about as long as the sepals, puberulous, upper pair slightly larger and hidden in the saccate sepal, obliquely ovoid with one, pocket like nectar at the base of each. Stamens generally 10-15, 8-18 mm long, filaments red, glabrous, unequal; anther basifixed. Ovary on 10-15 mm long gynophores; ovary about 2 mm in diam. with a beak about 1 mm long. Fruit berry, ovoid to subglobose, 10-15 mm in diam., glabrous, beaked, smooth, scarlet red when ripe and with thin pericarp; seeds reniform, 2-5 mm in diam.

**Flowering period:** March-October

**Distribution:** N. and Tropical Africa, Arabia, eastward to India, Pakistan (Jafari, 1973b) and Cholistan (Throughout the area).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 6 (HERB. CIDS).

**4. *Prosopis cineraria* (Linn.) Druce,** Ali in Nasir and Ali, Fl. Pak. 36: 29 (1973).

**Local Name:** Jand, Kandi.

A large much branched shrub or a small tree up to 10 m tall. Branches slender, glabrous, prickly, prickles curved, compressed; 2-5 mm long. Leaves alternate, bipinnate, rachis 1.2-5 cm long; pinnae 1-2 pairs, 2.5-8.0 cm, long, leaflets 7-12 pairs, more or less sessile, c. 3-5 mm long and c. 2-4 mm broad, oblong, oblique, apex usually mucronate, base rounded, 3 nerved. Flowers creamy white in pedunculate spikes, nearly 5-

12.5 cm long, peduncle 1.0-2.5 cm long. Calyx c. 1-1.5 mm long, cup-shaped, truncate or obscurely 5 toothed. Petals 3-4 mm long, oblong, tips recurved. Stamens 10, free, shortly exerted, anthers tipped with deciduous glands. Pods 12.5-25 cm long, c. 5-8 mm broad, slender, pendulous, cylindric, turgid, exocarp coriaceous, mesocarp pulpy, endocarp papery. Seeds 10-15, oblong, compressed.

**Flowering period:** March-June

**Distribution:** Pakistan (Punjab, Sind, Baluchistan); India (Punjab, Rajputana, Bombay, Madras); Afghanistan; Persia; Arabia. (Cholistan desert; Mooj Garh, Haider Wali, Fort Morot, Deen Garh, Bijnot, Channan Peer, Shadi Wali Dahar, Derawar Fort).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 93 (HERB. CIDS).

**5. *Prosopis juliflora* (Swartz) DC.,** Ali in Nasir and Ali, Fl. Pak. 36: 31 (1973).

**Local Name:** Vailati kikar, Maskit.

A much branched, large shrub or tree, 5-7 m tall, armed with stipular spines. Branches long, straggling or pendulous, glabrous. Leaves alternate, bipinnate, with 1-3 pairs of pinnae, rachis 1-10 cm long, prolonged, base pinnae as a soft bristle. Leaflets 10-20 pairs, 8-18 mm long, 2-3.5 mm broad, entire, oblong, obtuse, slightly mucronate, base oblique, margins slightly scabridulous or small hairy, glabrous, subsessile. Stipules spiny, 0.5-1 cm long, whitish, in pairs. Inflorescence dense axillary pedunculate spikes 4-8.5 cm long, peduncle 6-11 mm long. Flowers greenish yellow, pedicel 1 mm. Calyx c. 1 mm long, cup-shaped, 5 toothed, teeth small. Petals 5, free, c. 3 mm long, tip and margin hairy. Stamens 10, free, exerted, c. 4 mm long, anthers tipped with deciduous glands. Ovary 3 mm long, densely hairy, oblong, style 2 mm long. Pods pedicellate; pedicel 1-1.2 cm long. Pods 16-23 cm long, 10-12 mm broad, almost straight to semi-circular, light yellow, glabrous, ending into bristle shape. Seeds 10-18, oblong.

**Flowering period:** September-December

**Distribution:** West Indies, Mexico and Pakistan. (Cholistan desert; Deen Garh, Channan Peer, Fort Morot, Derawar Fort).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 94 (HERB. CIDS).

**6. *Salvadora oleoides* Decne.** Qureshi in Nasir and Ali, Fl. Pak. 29: 3-4 (1972).

**Local Name:** Jal, Wan, Pilu.

A much branched, evergreen shrub or a tree, rough, bench trunk, whitish-grey, 5-8(10) m high. Leaves whitish-green, coriaceous; or somewhat fleshy, leathery, petiole 0.2-1.2 cm long; leaf blade 1.5-5 cm long, 0.4-1.5 cm broad, linear-lanceolate, or elliptic-lanceolate, mostly acute, rarely obtuse or mucronate glabrous with obscure lateral veins. Inflorescence axillary panicles, or branched spikes, 2.5-4 cm long. Flowers greenish white, often clustered and shorter than leaves, 2-3 mm across; pedicel c.1 mm long or absent. Calyx cup shaped, 1.5-2 mm long, divided nearly half way down into 4, rounded, obtuse lobes, glabrous. Corolla 1.5-2.5 mm long, deeply cleft; lobes obovate or oblong or lobes sub-acute and recurved. Stamens 4, epipetalous, alternating with corolla lobes, inserted at the base of the corolla tube. Style absent, stigma peltate. Fruit a drupe, 5 mm in diameter, ovoid-globose, yellow when ripe, dark brown or red when dry, supported by persistent calyx. Seed 1, erect.

**Flowering & fruiting period:** March-July

**Distribution:** India (Gujrat, Junagarh, Rajputana) and Aden Pakistan. (Cholistan desert; greater cholistan, Mooj Garh, Fort Morot, Dodhlan Plantation).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 119 (HERB. CIDS).

**7. *Tamarix aphylla* (Linn.) Karst. Deutsche,** Qaiser in Nasir and Ali, Fl. Pak. 141: 31-35 (1982).

**Local Name:** Ukhan, Farash, Shokana

A tree or large shrub, up to 10-13 m tall with reddish brown to grey bark, entirely glabrous. Branches slender, hoary, with deep, punctate glands. Leaves vaginate, abruptly mucronate 3 mm long, hoary with deep punctate glands, base with short sheath.

Inflorescence a racemes mostly aestival, hermaphrodite, compound or pedunculate containing up to 20-25 racemes, usually interrupted spikes. Racemes 5-11.5 cm long, 7 mm broad, spirally curved, subsessile, pinkish-white, pedicel less than 1 mm long, 2-3 mm long flowers. Bracts sheathing acute, vaginate, ovate, acuminate, 1 mm long, 1.5 mm broad. Sepals 5, free, 1.5 mm long, 1 mm broad, centrally pinkish-white margins, entire, ovate to elliptic, base greenish, obtuse, outer 2 smaller than the inner 3 slightly. Petals 5, filaments filiform, 2 mm long, anthers cordate, somewhat apiculate. Disc deeply 5 lobed, filaments inserted in between the lobes of the disc, insertion peridiscal. Stigmas discoid, 3 or 4, styles half the length of the ovary, ovary conical, 1.75-2 mm long. Capsule rounded at the tip, 2.5-3.5 mm long, c. 1.5 mm broad, pyramidal.

**Flowering period:** August-November

**Distribution:** Africa (Morocco, Algeria, Tunisia, Libya, Egypt, Senegal, Sudan, Abyssinia, Eriterea, Somaliland, Kenya), Middle East (Israel, Jordan, Saudi Arabia, Yemen, Iraq, Kuwait, Iran) India, Afghanistan and Pakistan. (Cholistan; Derawar Fort, Thandi Khoi, Mansoor Check Post, Deen Garh, Mooj Garh, Fort Morot, Channan Peer, Bijnot).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 16 (HERB. CIDS).

**8. *Ziziphus mauritiana* Lam.,** Qaiser and Nazimuddin in Nasir and Ali, Fl. Pak. 140: 10 (1981).

**Local Name:** Ber, Beri

A large shrub or 5-15 m tall evergreen tree, much branched, spreading and drooping, young branches softly tomentose, longer stipular spine, 4-6 mm long, sometime without spines. Leaves 2-5 cm long, 1.5-4 cm broad, ovate, oblong, elliptic-ovate, or sub-orbicular, slightly oblique at base, obtuse, rounded shortly acuminate at apex, rounded or sub-cordate or entire, serrate, glabrous and dark green above, greyish pale-coloured and densely tomentose beneath; strongly 3-nerved from base; petiole 6-12 mm long, tomentose. Inflorescence axillary cymes, tomentose. Flowers 2-3 mm across, greenish yellow. Calyx 5, hairy out-side, glabrous within, cleft about

half way down 1.5 mm long, ovate, acute. Petals 5, spoon like or clawed, deflexed within calyx lobes, 1-2 mm long. Stamens 5, enclosed in the petals; up to 1 mm long; filaments slightly dilated at base. Ovary 2-celled, styles 2, connate for half the length. Fruit a drupe 1.5-3.5 cm long, 1.5-2.5 cm broad, globose to ovoid, fleshy-smooth, yellow or orange when ripe; bilocular; pyrene tubercled and irregularly furrowed. Seeds stony, 1-2 celled.

**Flowering & fruiting period:** September-April

**Distribution:** India, Afghanistan, Ceylon, China, Australia, Trop. Africa and Pakistan. (Cholistan desert; Mooj Garh, Toba Shah Sultan, Shadi Wali Dahar, Fort Morot, Derawar Fort, Bijnot, Channan Peer).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 58 (HERB. CIDS).

**9. *Ziziphus nummularia* (Burm. f.) Wight & Arn.,** Qaiser and Nazimuddin in Nasir and Ali, Fl. Pak. 140: 12-14 (1981).

**Local Name:** Beri

A much branched shrub, geniculately branches near the base, flexuous, tomentose, young branches puberulous, grey, spines in unequal pairs, bigger straight 1.5 cm long, smaller recurved, whitish tomentose when young, bark light colour. Leaves 1-8 cm long, 8-10 mm broad, orbicular or ovate-orbicular to elliptic, dark green and densely pubescent above, densely woolly beneath, entire or serrate, apex obtuse apiculate or mucronate, base round to sub cordate, lateral nerves prominent, pedicel 2-4 mm long. Flowers in axillary, sessile pubescent cymes; 3-4 mm in diameter. Calyx pubescent outside, cleft about half-way down; lobes 1 mm, ovate lanceolate. Petals cuneate longer than stamens c. 1.25 mm long, rounded or truncate at apex. Stamen included c. 1 mm long. Disc. 10-lobed, pitted opposite each lobe. Styles 2, united to above the middle. Drupe globose, reddish brown-black when ripe, 2 celled, 2 seeded, 5-10 mm long.

**Flowering & fruiting period:** September-March

**Distribution:** Palestine, Iraq, Iran, Afghanistan, India and Pakistan. (Cholistan; Fort Morot, Khipli, Dodhlan Plantation).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 59 (HERB. CIDS).

**10. *Ziziphus spina-christi* (L.) Willd.,** Qaiser and Nazimuddin in Nasir and Ali, Fl. Pak. 140: 15-16 (1981).

**Local Name:** Beri

A perennial, small tree, glabrous or slightly pubescent, many spreading, greyish white branches. Stipular spines in pairs, one erect, c. 2 cm long, the other recurved 5-8 mm long, sometimes spines absent. Leaves 2-6 x 1-4 cm ovate-elliptic or suborbicular, glabrous or pubescent on nerves beneath, rounded to subcordate at base, obtuse or shortly acuminate, margin entire or obsolete crenate, 3-nerved; petiole 3-12 mm long, glabrous or puberulous. Inflorescence axillary tomentose, pedicel woolly, c. 3-5 mm long. Flowers 4-6 mm across, greenish yellow. Calyx c. 1 mm long, keeled within, pubescent, ovate, ± acute, petals spatulate; 1.25 mm long. Disc prominently 10-lobed, glabrous, grooved. Fruit a drupe, small in size, reddish brown on ripening. Seeds stony.

**Flowering period:** September- March

**Distribution:** N. & E. Africa, Arabia, Egypt, Syria, Palestine, Lebanon, Iraq, S. Iran, Eastern Afghanistan, India and Pakistan. (Cholistan; Mooj Garh, Deen Garh, Bijnot, Shadi Wali Dahar).

**Specimens examined:** Cholistan Desert: Hafiz Muhammad Wariss, 90 (HERB. CIDS).

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