

*Ethnobotanical Leaflets 11: 247-257.*  
2007.

## **Aquatic Plants of District Dera Ismail Khan, Pakistan**

**Sarfraz Khan Marwat, Mir Ajab Khan, Mushtaq Ahmad, Muhammad Zafar  
and Shazia Sultana**

Department of Plant Sciences, Quaid-I-Azam University Islamabad, Pakistan  
mirajab@qau.edu.pk

**Issued 9 December 2007**

### **ABSTRACT**

In this taxonomic account 18 aquatic plants, which are reported for the first time from Dera Ismail Khan District are presented. The species were *Alternanthera sessilis* (Linn.) DC., *Azolla pinnata* R. Br., *Bacopa moneiri* (Linn.) Pennell., *Ceratophyllum demersum* Linn., *Eleocharis palustris* (Linn.) R. Brown., *Hydrilla verticillata* Royle., *Marselia quadrifolia* Linn., *Nelumbium nelumbo* (Linn.) Druce., *Nymphoide cristata* Roxb.) O.Ketze., *Phragmites karka* (Retz.) Trin., *Pistia stratiotes* Linn., *Polygonum barbatum* Linn; *Polygonum flaccidum* Meissn., *Potamogeton crispus* Linn., *Potamogeton nodosus* Poiret, *Spirodela polyrrhiza* (Linn.) Schield, *Typha domenginsis* Pers., *Typha elephantia* Roxb.

**Key words:** Aquatic Plants and Dera Ismail Khan Pakistan.

### **INTRODUCTION**

Dera Ismail Khan is the southern most district of N.W.F.P. lying between 31.15 and 32.32 north latitude and 70.11 and 71.20 east longitude with an elevation of 600 meters from the sea level. It has a total geographical land of 0.896 million hectares (2214060 acres) out of which 0.300 m.ha. (741315 acres) is cultivated (Khan, 2000).

The only hills, within the district, are those of Khaisore Range which lies in the north - eastern part of the district. The Khaisore Range is also known as the *Ratta Koh* or *Koh-e- Surkh*, meaning the red mountain. It runs close to Indus river, in north- east to south- west direction. The summer season is dry and hot. June is the hottest month during which the mean maximum and minimum temperature is recorded around 42 c and 27 c respectively. December, January and February are the cold months. In January the mean maximum and minimum temperature is around 20 c and 40 c respectively (Anonymous, 1998).

A diversity of aquatic plants is necessary in water- ways for preventing excessive erosion and turbidity, and for maintaining the delicate nutrient balance in water, hydro-soil and plants. Pond side vegetation provides habitat for water fowl, cover for certain species of fish, and increases the density of planktons, the basis of fish production.

The aquatic plants are of various types, some are rooted in bottom and are emergent, and others are submerged. Still others are free floating, and some are rooted on the bank of the impoundments, adopting semi aquatic habitat. Some of the plants have a profuse growth pattern, propagate with such rapidity, and infestation is so high that unless timely action is taken it is extremely difficult to keep them under control. It has been observed that in some cases the growth is so luxuriant and thick that weeds occupy the entire water surface.

Some aquatic weeds are quite useful, particularly for aquatic animals, like fishes. If not profusely grown some weeds serve as food to the fish, source of oxygen for respiration and provide protection against hot and cold weather. This is the case where the weeds have not densely grown and leave certain areas for fishes to propagate. In case of highly infested areas hardly any wildlife of importance exists.

Submerged pond vegetation is normally beneficial to the growth of fish in maintenance of healthy aquatic life. The aquatic vegetation is of different types. Some are very minute, while others have well differentiated parts with big herbaceous leaves of different shapes. In order to distinguish between one weed from the other it necessary to the scientific names of such plants. In this short paper to distinguish one plant from another and to achieve the object a field key has been included. This is to enable the person concerned to recognize the imported aquatic plants. To make it more useful of each plant is given and some photographs have also been provided (Ahmad, 1979).

## **MATERIALS AND METHODS**

**Materials:** The equipments used during the research work, were previous literature, maps, pencil, rubber, field note book, scale, polythene bags, old newspapers, blotting papers, camera, color films etc.

**Methods:** The method included the following steps:

**1. Collection and preservation of plants:** Frequent field trips of the area were conducted. Throughout the field trips general collection of plants were made. Blotting papers & old newspapers a plant presser were used for the preservation of the specimens. Newspapers were changed from time to time. The fully dried specimens were poisoned and then mounted on the herbarium sheets.

**Identification and voucher specimens:** Plants were identified with the help of previous literature (e.g. Fl. Pak., Fl. Kar., Aq.Pl. Lhr. etc.). Confirmation of plants were done by comparing with the already identified specimens of the herbarium, Quaid-i-Azam University, Islamabad. After correct identification the plants were given voucher numbers and deposited as voucher specimens in the herbarium for future references.

**KEY TO THE AQUATIC PLANTS OF D.I.KHAN DISTRICTS**

1. +Plants fixed, rooted in the bed of water bodies (i.e. pond, irrigation channels etc.)----- 2  
-Plants not fixed, rootless or with roots, free floating or submerged-----  
----- 12
2. +Plants completely submerged.----- 3
3. Plants not completely submerged.----- 4
4. +Leaves opposite or whorled, small, less than  
2.5 cm. long.----- *Hydrilla verticillata*  
-Leaves alternate, 2.5-10 cm long, broadly linear to oblong.-----  
*Potamogeton crispus*
5. +Plants with well developed leaves ----- 5  
-Leaves reduced to sheaths --- *Eleocharis palustris*
6. +Stem compressed rhizomatous-----6
7. -Stem well developed.----- 8
8. +Leaves peltate; flower solitary, torus 5-10 cm in diameter-----*Nelumbium nelumbo*  
-Leaves linear, spongy in texture, up to 3 meter high; flower unisexual, torus not present-----  
----- 7
9. +Leaves semi-cylindrical above the sheathing base ----- *Typha domingensis*  
-Leaves trigonous above the sheathing base  
angularly keeled dorsally-----*Typha elephantia*
10. +Stem erect-----9  
-Stem more or less spreading ----- 11
11. +Leaves sheathed, lamina elongated; infl. terminal, panicle----- *Phragmites karka*  
-Leaves not sheathed, ochreate; infl. Spike--- 10
12. + Ochrea smooth or minutely hairy; flowers 2-3 styled; nut flattened in 2-styled fl. And trigonous in  
3-styled fl.----- *Polygonum flaccidum*  
-Ochrea ciliate, cilia upto 2cm.long; fl. 3-styled; nut trigonous.-----  
*Polygonum barbatum*
- 11 +Infl. heads of white flowers, sessile -----  
*Alternanthera sessilis.*  
-Flowers white ,solitary, pedicillate, axillary. -----  
--- *Bacopa moneiri*
- 12 +Roots or root like structures present. ----- 13  
-Roots or root like structure not present -----  
*Ceratophyllum demersum.*
- 13 +Leaves tufted. Plants float freely on the surface of water----- 14  
-Leaves not tufted. ----- 16
14. +Flowering plants. ----- 15  
-Non- Flowering plants.----- *Azolla pinnata*
- 15 +Plants with a rosette of leaves, forming a cup shaped structure -----*Pistia stratiotes*  
-Plants without a rosette of leaves, very small in the form of fronds.-----*Spirodela polyrrhiza*
- 16 +Leaves simple; flowering plants.----- 17  
-Leaves tetrafoliate; non-flowering plants -----  
*Marselia quadrifolia*
- 17 +Leaves orbicular, cordate at the base-----  
*Nymphoides cristata*  
-Leaves not orbicular, elliptic-oblong -----  
*Potamogeton nodosus*

**AIZOACEAE**

***Alternanthera sessilis*** (Linn.) DC.

(Syn: *Gomphrena sessilis* Linn.).

Annual, or usually perennial, marginal weed rooted in the mud, submerged, floating or prostrate herb. Stem with cluster of whitish rootlets at the nodes, more or less fistular with numerous lateral branches, green or purplish. Leaves opposite, shortly petiolate, 1-5cm. long, 3-20mm. broad, linear-oblong, lanceolate or elliptic, blunt to shortly acuminate, glabrous or thinly pilose on the lower surface of the midrib. Inflorescence sessile, axillary, solitary or in clusters of up to 5 subglobose heads. Flowers sessile, shining. Perianth segments 5, white, oval-elliptic, acuminate, equal. Stamens 5, Ovary compressed; style short. Fruit cordate or cordate-orbicular. Seeds discoid, brown, shining.

Fl. Per.: Almost throughout the year.

**Local Distribution:** Common in damp places, irrigation channels, **Dappan Wali Basthi**, 6.5.2005 (voucher no.33).

General Distribution: Wide spread in tropical and subtropical regions.

**ARACEAE*****Pistia stratiotes*** Linn.

A perennial, stem less, stoloniferous, free floating herb bearing a tuft of rosette form of leaves. Leaves light green, sessile, roundish or spatulate, up to 10cm. long, the outer of which lie on the water while the inner stand erect. Stolons grow out from the leaf axils which give rise vegetative to new plants. Inflorescence a spadix, subtended by a yellowish - green spathe, 1.5 cm. long, monoecious consisting of male flowers above female flowers below. The male flower has only 2 stamens; the flower has an ovary from a single carpel, there is no perianth. Fruit small, globose; seeds oval, 10 - 20 in each fruit. Fl. Per.:

**Local Distribution:** Common in ponds near **Dhappan Wali Basti** about 1kilometer eastward, in the river bed, 28.8.2005 (voucher specimen no.632).

General Distribution: Asia and Europe.

**CERATOPHYLLACEAE**

*Ceratophyllum demersum* Linn.

Perennial, much branched, rootless, free floating, submerged, aquatic herb, up to 60cm. or more long. Leaves whorled, 1-4 times dichotomously branched, deep green to pale brown in colour, rough to touch, minutely toothed at irregular intervals, often terminated by 1 or 2 sharp bristles. Flowers minute, solitary, axillary, unisexual, male and female flowers at different nodes. Perianth segments 6-15, each segment terminated by 2 bristles. Stamens 8-30, spirally arranged on a convex receptacle. Carpel one, sessile, ovary 1-celled, 1-ovuled. Fruit a small nutlet, ovoid, compressed, provided with 3 spines. Fl. Per.: March - June.

**Local Distribution:** Very common in water canal near **Awan Petrol Pump**, on D. I. Khan Pahar Pur road, 18.9.2005 (voucher no. 749)

General Distribution: Cosmopolitan.

**CYPERACEAE**

*Eleocharis palustris* (Linn.) R. Brown.

(Syn: *Scirpus palustris* Linn.)

Perennial herb, with creeping rhizome. Aerial stem 9-26cm. long, terete. Leaves reduced to sheaths; sheath up to 5cm. long with truncate mouth, reddish brown. Spikelets 8-22mm. long, ovoid-oblong, sterile glumes 2x1.5mm., obtuse, each glume surrounding one-half of the spikelet at the base; fertile glumes 3-3.5 x 1.5-2mm, ovate - lanceolate, obtuse, membranous, margin hyaline; keel green; perianth bristles 4 in number, unequal in length retrorsely scabrid; stamens 3; style 2-branched, villous, style base swollen and persistent. Nut obovoid, compressed, smooth, brown at maturity.

Fl. & Fr.: 4 - 6.

Described from Europe (Type in Linn.)

**Local Distribution:** Very common in **Badri Dam** (large pond like body) at Khaisore Range, 13.6.2005 (v.sp.no.605)

General Distribution: Temperate and Subtropical regions Northern Hemisphere.

### HYDROCHARITACEAE

*Hydrilla verticillata* Royle.

Perennial, a leafy submerged fresh water dioecious herb, forming large masses,, rooted at the nodes in the pond bed; roots fibrous in clusters, Stem slender, soft, filiform with many branches and distinct nodes and internodes. Leaves small 1.5-2cm. long, 2.5-5mm. broad, sessile, in whorl of 3-8, oblong, oblong-linear, entire or serrulate, apex acute. Leaf form, number of leaves per node, and general appearance of the plant vary in different bodies of water. Flowers very small, dioecious. Male flowers perianth 6, stamens 3. Female flower perianth 6, small, stigma 3, style long, ovary elongated, half inferior, produced behind the spathe.

Fl. Per.: September - March.

**Local Distribution:** Common in still and slowly running water in irrigation channels about 2 kilometers to north of the **Mandra Kalan**, 25.5.2005 (voucher no. 335).

General Distribution: Central Africa, South & North America and Asia.

### LEMNACEAE

*Spirodela polyrrhiza* (Linn.) Schleid.

(Syn: *Lemna polyrrhiza* Linn.)

Annual. A small, free floating herb; plant body not differentiated into stem and leaves; fronds orbicular-ovate, 3 - 10 cm. long, asymmetrical, obtuse or rounded at the apex, entire, 3-15-veined, green above usually purplish beneath. Roots 3-18 per frond. Flowers in small pockets on the margin of fronds, usually 2 male and female together enclosed in a transitory membranous spathe, bilipped. Stamens 2.

**Local Distribution:**Very common in ponds near Dhappan **Wali Basti**, 1kilometer east ward in river bed, 28.5.2005(voucher specimen no. 634).

General Distribution:Tropical America, Europe, Asia.

### MARSILEACEAE

*Marsilea quadrifoliata* Linn.

Perennial, rooted at the bottom of the soil. Rhizomatous, leafy, heterosporous floating fern. Roots adventitious arising from the stout rhizome. Stem filiform, spreading on the surface of water. Leaf with 10-20cm. long petiole projecting above water; leaflets 4, sessile, deep green; young leaves arising from the rhizome are circinate. Sporocarp reniform, produced on a short stalk at the axil of leaf. Plant produces sporocarp in winter months.

**Local Distribution:** Very common in water channels. **Jhoke Qureshian** on way to Bhakkar, 12.5.2005(v.no.98).

General Distribution: Cosmopolitan.

### MENYANTHACEAE

*Nymphoides cristata* (Roxb.) O. Ktze.

(Syn: *Menyanthes cristata* Roxb. )

Annual, with long floating stem, rooting at the nodes. leaves floating, lamina, broad, orbicular, cordate at base, with dense brown glands on the under surface, margin entire or wavy, petiole long. Inflorescence an axillary in umbellate clusters. Flowers white, pedicel 0.5-5cm. long. Calyx deeply 5-lobed, oblong, rounded. Corolla deeply 5-lobed. Stamens 5. Ovary unilocular, superior. Capsule ellipsoid, 10- 20. Seeded tuberculate. Fl. Per.: March - June.

Type: Described from India, Coromandel.

**Local Distribution:**Common in water channels 2kilometer to the north of the **Mandra kalan**, 21.9.2005(v.no.758).



General Distribution: Malaya, China, India and Pakistan.

### **NYMPHAEACEAE**

*Nelumbium nelumbo* (Linn.) Druce.

Perennial, large herb, with milky latex; rooted in the pond bed. Leaves long petioled, arise from the rhizomes and possess large, broad and floating lamina, peltate; petiole long smooth or with scattered prickles. Flowers 10-25cm. in diameter, rose red or white, above water, bisexual; sepals 4-5, caducous; petals hypogynous, many seriate, caducous; stamens numerous; anther with club shaped appendages; carpel many; fruiting carpel ovoid loose in the cavities of the enlarged spongy receptacle, 1-seeded; fruiting torus 5-10cm. in diameter. Fl. Per.: September - November.

**Local Distribution:** Found in standing water, 2 kilometer from **Qureshi More** on way to Bhakkar, 21.9.2005(v.no.757).

General Distribution: north Temperate Zone, Europe and Asia.

### **POACEAE**

*Phragmites karka* (Retz.) Trin.

(Syn: *Arundo karka* Retz.)

Perennial reed, with creeping rhizomes. Culms erect, up to 10meter high. Leaf-blades 30-80 cm.long and 12-40mm wide, glabrous, rough to the touch beneath, the tips attenuate and stiff. Panicle 30-50 cm long, the lowest node often many branched in a whorl, the branches bare of spikelets for some distance from their base. Spikelets 9-12 mm long lower glume just over half as long as the upper. Fl. Per.: April - November.

Type: India, Koenig (LD).

**Local Distribution:** Common in water canal near **Awan Petrol Pump**, on D.I.Khan- Pahar Pur road, 21.9.2005 (v. no. 736).

General Distribution: Pakistan, Tropical Africa, Polynesia, Northern Australia and tropical Asia.

### **POLYGONACEAE**

#### ***Polygonum barbatum*** Linn.

An erect, annual herb; stem with striate internodes. Ocreae 0.6 -1.3cm long, brownish, tubular, strigose, ciliate, cilia 0.7 - 1.9 cm. long, longer than the tube. Leaves sessile or subsessile, 2.5-14.5 x 0.5-2cm, lanceolate to linear - lanceolate, entire, acuminate, margin and midrib ciliate on the underside. Inflorescence a spicate raceme; peduncle up to ca. 10 cm long, glabrous. Flowers sessile, bracteate. Perianth segments 5. Stamens 5. Style 3. Nut trigonous. Fl. Per.: Almost throughout the year. Quite common near water.

**Local Distribution:** Paniala, 15.5.2005 (voucher no. 129); Mochi Wala, 13.5.2005 (voucher no. 118).

General Distribution: Tropical Asia and Africa.

#### ***Polygonum flaccidum*** Meissn.

Annual, a medium-sized herb. Stem erect, sometimes prostrate, rooting at the joints, often glandular; joints often swollen; branched. Leaves 5-11 cm., lanceolate or oblong-lanceolate, apex pointed, midrib with minute hairs; stipules 1cm., tubular, swollen near the middle, fringed with short bristles. Flowers pink or red, in very slender, 5-8 cm. long racemes; calyx 5, segmented, glandular; stamens 6; style 2-3, free; nuts circular and flattened in 2-styled flowers, and 3-angled in 3-styled flowers. Fl. Per.: March - October.

**Local Distribution:** Found in water pond near Dappan Wali Basti, 14.9.2005 (voucher no. 723).

General Distribution: Tropical Africa and tropical Asia.

**POTAMOGETNACEAE*****Potamogeton nodosus*** Poiret(Syn: *Potamogeton indicus* auct. non. Roth.)

Perennial, rhizomatous, aquatic herb. Stem terete, branched, leafy. Leaves heterophyllous, submerged leaves petiolate, lanceolate or broadly lanceolate-oblong, thin, translucent, 6-10.5cm. long; floating leaves, broadly ovate, elliptic, corcious, of firm texture, 4-16cm. long, 2-5cm broad, entire. Stipule free, keeled, lanceolate. Spikes, cylindric, 4.5- 11cm. long; peduncle 7-11cm long. Flowers in whorls, sessile, small. Perianth segments small, obtuse. Fruitlets shortly beaked, spongy, ventral margins convex. Fl. Per.: April - August.

Type: Caranary islands, Broussonet.

**Local Distribution:** Common in **Badri Dam** (large pond ) at Khaisore Range, 13.6.2005 (voucher specimen no. 613).

General Distribution: Warmer regions of Europe, North & Central America, Africa and Asia.

***Potamogeton crispus*** Linn.

Perennial, submerged, rhizomatous aquatic herb, rooted in bed. Stem slender, compressed. Leaves submerged, sessile, broadly linear to oblong, undulate, translucent, 3-5 veined, usually obtuse, 4-8 mm. broad. stipules free. Spike 5-8cm. long, ovoid-oblong, lax. Fruitlets 4-5mm. long, 2.5-3 mm. broad, ovoid, beaked, decurrent.

Fl. Per.: Plant flowers in March - April.

Type: "Habitat in Europae fossis & rivulis".

**Local Distribution:** Found in **Badri Dam** ( Large pond like body ) at Khaisore Range, 13.5.2005 (**v.sp.no. 620**).

General Distribution: Europe, Asia, Africa and Australia.

**SALVINIACEAE*****Azolla pinnata*** R. Br.

Free floating, heterosporous, small aquatic fern. Roots few, fibrous. Stem branched; the whole plant appears to be triangular in shape. Frond oblong, 1.2-1.9cm., with many crowded branches. Leaves sessile, very small, 2mm. in diameter, more or less alternate, tapeziform, lobes firm in texture, dark green. When the plant matures, it looks like reddish-brown and sometimes brownish. Sporocarp arises between the roots.

**Local Distribution:** Common in water canal near **Awan Petrole Pump** c. 30kilometer from D.I.Khan towards north-east,  
**General Distribution:** Asia, Tropical America, Tropical Africa and Australia.

**SCROPHULARIACEAE*****Bacopa moneiri*** (Linn.) Pennell  
(Syn: *Lysimachia monnieri* Linn.)

A glabrous, somewhat succulent, creeping perennial herb; stems 10-30cm. long, rooting at nodes, much branched, branches at length ascending; leaves sessile, obovate-cunneate to spatulate, small, decussate, obtuse or rounded at apex, entire, nerves obscure, decussate; flowers axillary, solitary, bluish, about 7mm. long, lobes sub- irregular; capsule about 5mm. long, oblong, many seeded.

**Local Distribution:** Found in water with *Typha sp.*, near Jhoke **Qureshi**, 12.5.2005 (voucher no. 83).  
**General Distribution:** Widespread in almost all warm countries.

**TYPHACEAE*****Typha elephantia*** Roxb.

Perennial, 1.4 - 4.0 m. tall. Leaves linear or broadly linear, trigonous above the sheath, angularly keeled dorsally; lamina

25-40mm. broad. Inflorescence a terminal, cylindrical, superposed spike; male above and female below, parts separate; axis of the male flower covered with hairs; female spike cylindrical, blackish brown or brown; pistillodes present; female flowers bracteates, bracts spatulate and longer than the hairs; stigma lanceolate.

Fl. Per. March - August.

Type: Described from Bengal-Hogla.

**Local Distribution:** Common in the district. **Dappan Wali Basti**, 28.8.2005 (voucher no. 633).

General Distribution: Africa, Bangladesh, India, Nepal, Pakistan, Iran and Turcomania.

*Typha domingensis* Pers.

(Syn: *T. australis* Schum. & Thonn.

*T. angustata* Bory & Chaub.)

Perennial, partly submerged, rooted in the mud. Herb with a creeping root system. Stem rhizomatous, cloth with distichous scales. Leaves radical, erect, distichous, elongated, linear, usually 5-6, upto 3 meter or more long, 2-2.5cm. broad, semi-cylindrical above the sheathnig base, thick and spongy in texture. Flowering stem equal or somewhat smaller than the leaves; male & female spikes are separated by a long interval; male spike covered with pointed or linear hairs; female spikes pale-brown, up to 1.5 cm. in diameter in the fruit. In male flower the stamens usually 3, rarely 1-6; filament free or variously connate. In female flower, the ovary unilocular, stipitate, narrowed in a slender style. Fl. Per.: Most of the year.

Type: Described from the Dominican Republic.

**Local Distribution:** Common in the district. Near **Baloch Nagar**, 11.5.2005 (voucher no. 45).

General Distribution: Almost throughout India and Pakistan.

**REFERENCES**

1. Ahmad, N. and M. Younis. (1979). Aquatic plants of Lahore. Pakistan association for advancement of science. 12: 1-24.
2. Anonymous. 1998. District Census Report of Dera Ismail Khan. Population Census organization Statistic division Government of Pakistan Islamabad.1-2
3. Bhopal, F.G. & Chaudhri, M. N. (1977): "Flora of Pothohar and Adjoining Areas Part-II" in Pakistan Systematics, **1(2)**: 78. Quaid-i-Azam University, Islamabad.
4. Cope, T.A. (1982): "*Poaceae*" in E. Nasir & S.I. Ali, Flora of Pakistan, **143**: 26-27. Karachi.
5. Hashmi, Rizwan, Y. & Saood U. (1986): "*Lemnaceae*" in E. NASIR & S.I. ALI, Flora of Pakistn, **173:2** Karachi.
6. Jafri, S.M.H.(1966): "The Flora of Karachi" p. 306. The Book Corporation, Karachi.
7. Khadija, A. (1974): '*Ceratophyllaceae*' in E. Nasir, & S.I. Ali, Flora of Pakistan, **70**: 1-3. Karachi.
8. Khadija, A., & S.M.H. Jafri.(1975): "*Potamogetonaceae*" in E. Nasir & S.I. Ali, Flora of Pakistan, **79**: 3-4,7. Karachi.
9. Khan, R. U. (2000): Facts about AZRI, Pakistan Agricultural Research Council, Arid Zone Research Institute Ratta Kulachi, D.I.Khan. pp..2-4.
10. Marwat, S. K., R. A. QURESHI & M. A. Khan. (1996): "The *Cyperaceae* of Rawalpindi District" in Pakistan Systematics, **6(1-2)** : Quaid-i-Azam University, Islamabad.
11. Omer, S. & Rizwan Y. H. (1987): "*Typhaceae*" in E. Nasir & S.I. Ali, Flora of Pakistan, **177**: 5-7 Karachi.
12. Qaiser, M. (1977): "*Menyanthaceae*" in E. Nasir & S.I. Ali, Flora of Pakistan, **111**: 4. Karachi.