Evaluation of Morphological Diversity in Chota Gokhru (*Tribulus terrestris* L.) and Bara Gokhru (*Pedalium murex* L.)

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An attempt has been made to study the morphological diversity of chota gokhru (*Tribulus terrestris* L.) and Bara gokhru (*Pedalium murex* L.), collected from different geographical and agro-climatic regions of Agra and adjoining areas. Both the herbs springing up soon after the first showers in the month of June. *T. terrestris* L. abundantly found in this region. However, *P. murex* L. was rarely observed on road side as well as protected areas. The great deal of morphological diversity collected from various parts of Agra. *Tribulus terrestris* is perennial prostrate herb with spreading branches up to 100 cm. However, at the bank of river Yamuna it showed great morphological diversity in plant height as well as leaf size. *P. murex* is erect herb, 2-3 feet in height and leaves are broad in size showed the variability. The fruit of *T. terrestris* are globose, hard and brown in colour, mature fruit split into 5-segmented nutlets (seeds). Seeds are hard and bear 2-3 sharp spines, 10 mm long and 4-6 mm broad point to point. The fruits of *P. murex* are as indehiscent capsules 1-2 cm x 0.5-1 cm, hard, pyramidal, 4-angles with a spreading. It exhibits variability in fruit and seed characters, shape, size and colour. The fruits and seeds are of high medicinal value as they are used for treatment of various diseases.

Key Words: Morphological diversity, *Tribulus terrestris*, *Pedalium murex*

Introduction

Tribulus terrestris L. commonly known as chota gokhru belongs to family Zygophyllaceae and is found in Asia, Africa, Europe, America and Australia (Kostova *et al*., 2002; Topia *et al.*, 1994). It is an annual or perennial, hugging herbaceous plant that grows as a summer annual in colder climates. It is one of the major medicinal plant in India, and useful in several human diseases like, dysuria, renal, vesical calculi, anorexia, dyspepsia, helminthiasis, cough, asthma and rheumatic arthritis (Shivarajan and Balachandran, 1994; Warrier *et al*., 1996).

Pedalium murex L. is commonly known as Bara gokhru of family Pedaliaceae, it is an erect or ascending annual medicinal herb. The various parts of the plant are used in human diseases. The leaves contain mucilage, the mucilaginous water derived from leaves is used for the treatment of kidney. The leaves are also used as a vegetable in various parts of the country (Saxena, 1979). Increasing demand of herbal plants at national and international level have resulted in the over exploitation and indiscriminate over harvesting of medicinal plants. The degree of disturbance to the species population and vulnerability to over exploitation effects demand and supply (Anonymous, 1979; Robbins, 2000).

The present investigation evaluates the morphological diversity of chota gokhru (*Tribulus terrestris* L.) and bara gokhru (*Pedalium murex* L.) in the climatic conditions of Agra.

Materials and Methods

The present study was conducted at Keetham Jheel, Runkata (Reservoir) Agra, Tundla (Firozabad), and Chambal catchments area on the river bank of Yamuna and at Bateswar (Agra). The field data was recorded on five accessions of chota gokhru (*T. terrestris* L.) and Bara gokhru (*P. murex* L.) for various morphological traits viz. plant height (cm), leaf length (cm), leaf breadth (cm), petiole length (cm), leaf area (cm), flower length (cm), length of anther (cm), length of pistil (cm), length of fruit (cm), fruit breadth (cm), and seed length (cm), with help of range, mean, standard deviation and standard error (Khan, 2000).

Results and Discussion

Morphological data presented in Table 1 and 2 showed the considerable morphological diversity in all the characters but plant height, leaf size, shape, leaf area, fruit colour, shape, length and seed length in chota gokhru and bara gokhru *T. terrestris* L. is an important medicinal or perennial prostrate herb with pinnately compound leaf with leaflets. The colour and leaf area showed the maximum diversity on the Yamuna river bank at Keetham Jheel, Runkata (Agra) as well as Bateswar near Bah

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Table 1. Morphological variation in characters of *T. terrestris* L.

S.No	Characters	Mean	Range	Standard Deviation	Standard Error
1.	Plant height (cm)	90.00	20.0	8.94	4.00
2.	Leaf length (cm)	5.64	1.00	1.26	0.56
3.	Leaf width (cm)	3.56	0.70	7.96	3.56
4.	Petiole length (cm)	0.60	0.02	1.52	0.68
5.	Leaf area (cm)	16.20	20.80	2.23	16.30
6.	Flower length (cm)	2.50	0.10	5.50	2.50
7.	Length of anther (cm)	0.47	0.20	1.05	0.47
8.	Length of pistil (cm)	0.50	0.15	1.30	0.58
9.	Fruit length (cm)	0.72	0.50	1.60	0.70
10.	Fruit width (cm)	0.91	2.00	0.92	0.05
11.	Seed length (cm)	0.73	0.10	1.60	0.70

Table 2. Morphological variation in characters of *P. murex* L.

S.No.	Characters	Mean	Range	Standard Deviation	Standard Error
1.	Plant height (cm)	67.00	17.0	29.90	5.90
2.	Leaf length (cm)	5.40	0.9	2.40	0.48
3.	Leaf width (cm)	5.00	0.5	2.20	0.40
4.	Petiole length(cm)	1.50	0.4	3.40	0.69
5.	Leaf area (cm)	1.08	0.2	2.86	0.57
6.	Flower length (cm)	2.38	0.2	5.32	2.38
7.	Length of anther (cm)	1.24	0.1	2.77	1.24
8.	Length of pistil (cm)	1.48	0.1	3.30	1.40
9.	Fruit length (cm)	1.36	0.3	3.041	0.60
10.	Fruit width (cm)	1.06	0.1	2.30	1.06
11.	Seed length (cm)	0.68	0.3	1.50	0.68

(Agra). It produces flowers from May to October, the flower are hermaphroditic, small lemon yellow in colour and solitary. The fruit is woody with sharp, rigid spines that easily fall apart into four or five seeded nutlets. The nutlets are seeds which are hard and bear two or three sharp spines.

P. murex is a member of family Pedaliaceae, it is an erect tall herb, slightly succulent with much branching stem. The variability in height and thickness of the stem has been also observed in the various places of Agra. The stem is very smooth and hairy types have also been recorded on the river bank of Yamuna. However, in the plains, stem is very tough. The leaves are opposite simple, fleshy, base narrow, lower surface with small scales and about 1-5 cm long. The flowers are bisexual, solitary, regular, pentamerous and white-yellow in colour. The fruit an indehiscent capsule and pyramidal in shape with 0.5-1.00 cm in size. Seeds are hard with horizontal spines, there are three to twelve seeds in a fruit. Study of diversity of morphological characters based on various parameters revealed that maximum diversity in the leaf area, fruit and seed size and number of seeds per fruit have been recorded in chota gokhru and Bara gokhru at Agra and their adjoining area. A great deal of diversity occurs in fruits of *T. terrestris* and *P. murex* in this region, The leaf as well as fruit of both chota gokhru and bara gokhru are medicinally important. The fresh leaves and stem of *P. murex* is a good source of mucilage. A single plant can produce 300-400 fruits and 600-1200 seeds in chota gokhru. However, *P. murex* produced 50-100 fruit plant. Such morphological diversity have been used significantly towards the adaptability, divergence of the species and selection of superior accessions leading to their use in plant breeding, conservation and commercial value.

Rengalakshmi, (2005) suggested that morphological characters, *viz.*, plant height, hairiness, ear head shape and structure, seed colour, shape and lusture, and stem colour are used in the functional classification is a special purpose taxonomy that utilizes the practical knowledge on the landraces. Similarly, the morphological characters, such as stem juiciness, midrib colour, grain shape, plumpiness, covering and size, as well as glume colour and hairiness, are used to classify the sorghum landraces among the Ethiopian tribes (Teshome *et al.*, 1997). On the basis of present investigation it may be concluded that the morphological diversity of *T. terrestris* and *P. murex* shows rich diversity in fruits on the banks of river Yamuna and Chambal catchment area. The seeds also show great morphological diversity. Therefore, there is need of biochemical and molecular characterisation, evaluation and breeding programmes.

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