

MORPHOLOGICAL ANALYSIS OF CYMBOPOGON SPECIES FROM KOLLAM DISTRICT

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Abstract

Cymbopogon species (Lemongrass) is a widely used herb in tropical countries, especially in Southeast Asia. It is used extensively for the manufacture of essential oil and has various ethnopharmacological properties. Even though the *Cymbopogon* species look alike in most cases, the taxonomical variation could be observed with respect to its habitat and climatic condition. Though the grass has been the subject of many studies, our study focuses on the morphological features and analysis of flowering season in five different species of the *Cymbopogon* genus.

Key words: *Cymbopogon* species, morphology, flowering season

Introduction

Plant morphology plays an important role in revealing the origins of plant organs during plant morphogenesis and investigating the effects of various external and internal factors on plant development. Detailed morphological analysis on *Cymbopogon* species helps us to study the variations between different species and the influence of the external environment on their morphological variations.

Cymbopogon belongs to the family Poaceae, which are indigenous in tropical and semi-tropical areas of Asia and are cultivated in South and Central

America, Africa and other tropical countries. It consists 55 odoriferous species. *Cymbopo-*

gon is native to warm temperate and tropical regions. The word *Cymbopogon* was introduced by Sprengalin 1815 and at that time only a few species were discovered and were moved to the genus *Andropogon*. The number of species belonging to this genus ranges from 102 to 104, 41 in India and 5 in Kerala. The name *Cymbopogon* is composed of two words “kymbe + pogon” kymbe means the boat shaped spatheoles and pogon means many awns inflorescences substantiate the very meaning of the name *Cymbopogon* (Gupta & Jaffer *et al*, 1982). Local names include lemongrass, barbed wire grass, silky head, kakkannompullu, fever grass. *Cymbopogon citratus* is a commonly cultivated species in India. These are commonly cultivated for extracting essential oil and therapeutic purposes.

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Cymbopogon plants are tall and perennial with narrow and long leaves that are mostly characterized by the presence of silica thorns aligned on the leaf edges. Leaves bear glandular hairs, usually each with a basal cell that is wider than the distal cell (Bertea Maffei *et al*, 2010). The leaf blades contain aromatic oils. The essential oils that are derived from *Cymbopogon* are of medicinal importance and the extracts are having antimicrobial and antibacterial properties the essential oils used in perfumes, flavoring, and cosmetic and pharmaceutical preparations (Bor. *et al*, 1960). The quality of lemongrass oil is determined by the content of citral. Citral is a monoterpene that gives lemon aroma in lemongrass. The percent of citral content is maximum during winter season (November- December) and minimum during monsoon season. Meanwhile the oil content was found to be highest during pre-monsoon (March-June) and the onset of monsoon.

Cymbopogon is cultivated as a rain fed crop and supplemental irrigation is formed useful & necessary during hot and dry summer months. The yield of essential oil is highly correlated with the yield of biomass. Essential oil and citral content were influenced by factors such as temperature, light intensity, soil moisture, and fertilizer & maturity stage (Miyazaki *et al*, 1965). The number of harvest in a year depends upon the climatological factors such as rain fall, humidity, temperature and level of soil fertility. Harvesting is done by cutting at 20 cm above the ground level for getting maximum essential oil content (Sugumaran *et al* , 2005).

The present investigation conducted, concern the response of morphological analysis of *Cymbopogon* species collected from different

geographical areas of Kollam district. Mainly there are 5 species of *cymbopogon* are found in Kerala. They are *C.caesius*, *C. citrates*, *C.flexuosus*, *C.martinii*, *C. travencorensis*. This genus shows considerable variation within its species and in certain cases it is quite difficult demarcate the barrier between 2 allied species. According to (Sonarkoet *al*, 1977) genus *Cymbopogon* is partitioned into five taxonomic series based upon the chemical markers and their geographical distribution .

Materials and Method

Different species of *Cymbopogon* found in Kollam district of Kerala is collected and preserved to conduct various morphological analysis. Inflorescence of *Cymbopogon* species were collected, dried and then preserved in a herbarium. A herbarium is a permanent record or document of dried and pressed plant specimens collected from different places , mounted on herbarium sheets, arranged according to an accepted system of classification and kept in wooden cupboards for future reference.

The specimens for herbarium are collected from different localities. The plant parts collected include stem, leaves, inflorescence and roots. The specimens are poisoned immediately after collection for avoiding the infection. The poisoned specimens are the pressed in a plant press by using blotting papers or newspapers. The press is then opened and the newspapers are changed and covered with new papers. This process is continued till the specimen is completely dried.

After a few days, the pressed specimens are mounted on sheets of standard size called herbarium sheets. To protect the herbarium -

specimens from fungal infection, 1 percent of mercuric chloride solution should be sprayed. To protect them from insect attack, the use of repellants or insecticides is recommended. The commonly used repellants are Naphthalene balls and Para Dichloro Benzene (PDB). The Insecticides are sources of heavy metal pollutants, such as Mercury and Arsenic. The mounted specimens are to be stored in the herbarium cases. Here we have stored it in the college herbarium.

Result and Analysis

Morphological analysis of different species of *Cymbopogon* revealed certain differences in their habitat and morphological characters. Hence the difference in their morphology and taxonomy are listed below. The result regarding their morphological characters are listed in the table (Table 1) is based on the comparative study done in 5 species of *Cymbopogon* collected from different localities of Kollam district.

From our study on the 5 different species of *Cymbopogon*, we have found that there are similarities and dissimilarities in their morphological characteristics. It shows certain variations in their morphological characters due to different ecological adaptations resulting in genetic variation. The difference in the height of culms, the shape and size of the leaves, the length of spikelets, the length of the ligules etc in various species may be due to the change in their ecological adaptations.

The major difference was witnessed in their flowering season, it varies in different species. The flowering season in *C.caesius* is from August – September, in *C.citratus* it is from July-September, in *C.flexuosus* it is from June-December, in *C.martini* it is from November-

January and in *C.travancorensis* it is from December-February.

Conclusion

The genus *Cymbopogon* consisting of large number of odoriferous species belongs to family Poaceae. It consists of more than 180 species. Some of the *Cymbopogon* species found in India are *Cymbopogoncitratus* (common in South India), *Cymbopogon gidarba*, *Cymbopogon martini*, *Cymbopogon jwarancusa*, *Cymbopogonmicrostachys*, *Cymbopogon smastonii*, *Cymbopogon polyneuros*..etc.

For our study we have selected 5 different species of *Cymbopogon* namely *C. citratus*, *C.caesius*, *C.flexuosus*, *C.martini*, *C.travancorensis* commonly found in Kerala. Flowers and leaves of *Cymbopogon* species were collected from different localities of the Kollam district for our study. We have conducted a detailed study on the selected species and it shows certain variations in their morphological characters due to different ecological adaptations resulting in genetic variation. The height of culm shows a slight variation in different species which can be considered as an easily identifiable variation. It has a complex leaf structure mostly adapted to xerophytic conditions. The leaf structure possesses various types of appendages like prickly hairs and hooks, macro hairs, and papillae. It is mostly linear or linear-lanceolate in shape. The number of stamens remained same in all the species. The flowering season varies in different species may be responsible for the difference in morphology of their spikelets and flowers. The flowering season in *C. caesius* is from August – September, in *C.citratus* it is from July

Table 1a. *Cymbopogon* species are collected for our study showing morphological differences

Species	<i>Cymbopogon caesius</i> S	<i>Cymbopogon citratus</i>	<i>Cymbopogon flexuosus</i>
Culms	50-200 cm high and erect	50-200cm high	60 -300 cm high
Nodes	Glabrous	Glabrous	Glabrous
Leaves shape And Size	Linear – lanceolate 10-30 x 0.3-0.8cm auminate	Linear-lanceolate or lanceolate 15-60 x 0.8- 1.5 cm Narrowed at base glaucous	Linear 15-60 x 1-2 cm Rounded at base
Ligules	Ovate, acute, membranous 3-5 mm long	Membranous	Ovate, membranous
Panicle lax	Narrow, contracted 15-40cm long	10- 50 cm long	15-80 cm long
Racemes	1-1.5 cm long ; Joints 1.5-2mm long Densely villous, abscission cupuliform	1-1.5 cm long Joints 2.5-3 mm long, slender densely villous	1-1.5 cm long Joints 2mm long Densely villous, abscission cupuliform
Spikelets	Sessile, linear oblong 3.4 x 0.75 mm Callus hairy	Sessile, linear-lanceolate or lanceolate 5-6 x 0.75 mm Callus shortly bearded	Sessile, elliptic- lanceolate 4-5 mm long
Lower glume	Oblong 3.4 x 1 mm Acute or slightly notched at apex Keels narrowly winged in the upper half	Ovate or lanceolate 5 x 1 mm Chartaceous 5- nerved	Elliptic-lanceolate 4 x 1 mm Sub-Coriaceous Faintly 5-7 nerved Keels winged towards apex
Upper glume	Elliptic-lanceolate 3.4x1 mm Dorsally keeled	Lanceolate 4-5 mm Coriaceous 3 – nerved Margins ciliate	Ovate-lanceolate Chartaceous Margins ciliate
Floret	Upper floret bisexual Lower floret empty	Upper floret bisexual Lower floret empty	Upper floret bisexual Lower floret empty

First Lemma	Oblong-elliptic 3-3.5 mm, 2-nerved, delicate, hyaline, mar- gins ciliate	Oblong 2-3 x 0.5- 0.75 mm elliptic	Lanceolate 3-3.5 x 1mm, delicate, hyaline, purplish
Palea	Absent	Absent	Absent
Second Lemma	Notched 1.5-2 x 0.25mm, 1 nerved, Awn 10-12 mm long, geniculate, column 5 mm long, brownish	Lanceolate 4 x 1 mm , delicate 2- nerved , hyaline Mar- gins ciliate	Deeply notched 2 x 0.4 mm, awned delicate, hyaline Awns 8-12 mm, geni- culate Column 3-5 mm, brownish
Ovary Style	Oblong 0.5 x 0.15mm long 1mm, feathery	Oblong 0.5 mm long 0.5-1mm	Oblong 0.5 x 0.1 mm long 0.5-1 mm
Stamen Anther size	3 1.5-3 mm long	3 1-2 mm long	3 1-2 mm long
Pedicelled spikelets	3-4 x 1 mm, glabrous	Linear- lanceolate or lanceolate 4-6 x 1 mm	Lanceolate or elliptic- lanceo- late 3-4 mm long
Pedicel	1.2mm long Densely long-villious	2-4 mm long Densely villous	2mm long Densely villous, ab- scission cupuliform
Lower glume	Elliptic or ob- long 3-4 x 1-1.5 mm, chartaceous 11-13 nerved keels scaberulous	Oblong 2-4 x 1-1.5 mm, chartaceous 11nerved	Ovate-lanceolate 3-3.5 x 1 mm , charta- ceous 9-11 nerved Margins ciliate
Upper glume	Elliptic- lanceo- late 3-4 x 1mm, delicate Faintly 2- 3 nerved Margins ciliate	Elliptic-lanceolate 3.5-4 x 1.5 mm, chartaceous	Elliptic-lanceolate 3 x 1 mm, charta- ceous 3-nerved Margins hyaline, ciliate
Stamen, Anther	3, 2-3mm long	3, 1.5-2mm long	3, 1.5-2mm long
Habit	Common along the hilly slopes and fringes of forests	Frequent along grassy hill slopes, margins of forests and in grasslands	Common in forests as secondary formations, in scrub jungles, hill- slopes, grasslands ; frequently seen in as- sociation with grasses like <i>Themeda-</i> <i>cymbaria</i> And <i>Pennisetum</i> <i>polystachyon</i>
Flowering season	August -December	July - September	June - December

Table 1b: Cymbopogon species are collected for our study showing morphological differences

Species	<i>Cymbopogon martinii</i>	<i>Cymbopogon travencorensis</i>
Culms	60-250 cm high	60-300 cm high
Nodes	Glabrous	Glabrous
Leaves shape And Size	Lanceolate- acuminate 10-40 x 0.5-1.5 cm Cordate at base	Linear 15-60 x 0.6-1.5 cm Margins serrulate
Ligules	Ovate, acute, membranous 3-6 mm	Ovate, acute, membranous 5-8 mm long
Panicle lax	Narrow, contracted 5-60 cm long	15-50 cm
Racemes	1-1.5 cm long, Joints 1.5-2 mm Densely villous, abscission cupuliform	0.8-1.2 cm long Joints, 2mm densely ciliate
Spikelets	Sessile, oblong or elliptic 3-4 x 1mm, Callus hairy	Sessile, oblong, acute, awned, 3-4 x 0.75 mm, Callus shortly bearded
Lower glume	Oblong, 3-3.5 x 1 mm Sub-coriaceous, With a slit-like groove in the lower half, Infolded, keels narrowly winged in the upper half	Oblong, 3-3.5 x 0.75 mm, With or without a slot in the lower half Chartaceous, Keels narrowly winged in the upper half
Upper glume	Elliptic-lanceolate 3-3.5 x 1mm, Sub-coriaceous, Dorsal side keeled and winged in the upper half	Boat-shaped or ovate- lanceolate when spread 3 x 1 mm, chartaceous 3-nerved, Margins hyaline, ciliate
Floret	Upper floret bisexual Lower, floret empty	Upper floret bisexual Lower, floret empty
First Lemma	Oblong, 2-3 x 0.5- 0.75 mm Delicate, hyaline Margins ciliate	Oblong-acute 3 x 1mm, Delicate, hyaline 2-nerved Margins ciliate
Palea	Absent	Absent
Second Lemma	Notched 2 x 0.5 mm , delicate, hyaline, awned Awns 10-15 mm Column 4-5 mm , brownish	Notched, awned, 2-3 x 0.5 mm, delicate Awn 8-10 mm Column 3-4 mm , brown Margin ciliate
Ovary Style	Oblong 0.5 mm long 1-1.5 mm	Oblong 0.5mm long 1-1.5 mm
Stamen Anther size	3 1-2 mm long	3 1.5-2 mm long
Pedicelled spikelets	Oblong-lanceolate 3.5-4 x 1 mm	Elliptic-lanceolate 3-4.5 mm

Pedicel	1-2 mm Densely villous, abscission cupuliform	1.5-2 mm Densely ciliate Lowest one in the sessile ra- ceme swollen
Lower glume	Elliptic-lanceolate 3.5-4 x 1.5 mm, chartaceous 11-13 nerved	Ovate-lanceolate 3-4 x 1 mm, Chartaceous 11-nerved
Upper glume	Elliptic-lanceolate 3.5-4 x 1.5 mm, chartaceous faintly 3- nerved Margins ciliate	Lanceolate 3-3.5 x 1 mm, chartaceous 3-nerved Margins hyaline, ciliate
Stamen	3	3
Anther	1.5-2mm long	1.5-2mm long
Habit	Common along the hilly slopes	Common along the hilly slopes
Flowering season	November – January	December - January

- September, in *C.flexuosus* it is from June-December, in *C.martini* it is from November-January and in *C.travancorensis* it is from December-February. We have also prepared a medicinal garden for protecting the *Cymbopogon* species for further study.

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