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RESEARCH ARTICLE

MORPHOLOGICAL AND PHYLOGENETIC ANALYSIS OF THE LEAF OF *ALTERNANTHERA TENELLA* COLLA

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ABSTRACT

Local medicinal plants and wild herbs are of great significance to the sustainable health of individuals and its geo-communities. The *Alternanthera tenella* Colla (Amaranthaceae) is one of the popular herbal drugs. It is also used as food by tribal and ethnic communities. The morphological characters were efficient tools for the authentication and identification of plants. The phylogenetic analysis was used to resolve relationships within family members and revealed that presence of precious unknown clade. The present study is to characterize the plant accurately and identify using barcode. It is used to enrich the literature on the systematic taxonomy and anatomy of this plant.

INTRODUCTION

Nature has a very rich botanical wealth with diverse types of plants which are grown in various parts of the country. Plants are used as food, drug and medicinal extracts from dates back to the modern day of man on earth. The *Alternanthera tenella* is a semiaquatic weed along canals, ditches, fallow fields and on barren land which are locally abundant (Mayurnathan *et al.,* 2004). The morphological characters are efficient tools for the authentication and identification of plants. The phylogenetic analysis is used to resolve relationships within Amaranthaceae members and reveals the presence of precious unknown clade (Kai Müller and Borsch, 2005). Recently, the consortium for the Barcode of life adopts a two-locus barcode for land plants are comprising portions of the *rbc*L and *mat*K coding regions. The combination *rbc*L-*mat*K is adope as a core barcode, with the recognition in some circumstances and other supplementary regions like *trn*K will be necessary to provide the desired level of species resolution.

MATERIALS AND METHODS

Plant collection

The fresh leaves of *A. tenella* collected from Thiruneermalai and various locations in Chennai.

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Morphological studies

The *A. tenella* leaves were collected in fresh. The external morphological characters were carried out by simple determination techniques using standard books.

Phylogenetic analysis

The forward and reverse sequence of *rbcL* gene compared against the sequences available from Gen Bank using the BLASTN program (Altschul *et al.,* 1990) and aligned using CLUSTAL W software (Thompson *et al.,* 1994). The distances were calculated according to Kimura's two-parameter correction (Kumura, 1980). The phylogenetic trees were constructed using the Neighbor-Joining method (Saitou and Nei, 1987). The bootstrap analysis was done based on 1000 replications (Felsenstein, 1985). The MEGA4 package (Kumar *et al.*, 2007) was used for all analyses.

RESULTS

Prostrate branched herb (Fig.1) and rooting at nodes branches. Stem greenish, simple, sparingly branched, generally pilose above and in leaf-axils, hollow with septation at nodes. The leaves are greenish, the lower surface is conspicuously paler, simple, opposite decussate, linear, lanceolate, sub acute to obtuse, entire, base truncate to acute, apex sub acute, exstipulate, strigose, glabrate most densely along the veins,

Fig.1. Alternanthera tenella plant

lineolate with raphides, densely marked with cystoliths and narrow along poorly defined petiole. The venation pattern is reticulate, with one mid vein and a network.

Floral characters

Small axillary racemose head inflorescence has numerous sessile flowers. Small white monochlamydeous flowers with perfect, bisexual, regular, actinomorphic, trimerous and radial symmetry. Each flower subtent by single membranous, persistent ovate bract and two boat shaped bracteoles with midrib excurrent in a sharp point as long as tepals. Five tepals are equal, distinct, often spiny, membranous jointed, acuminate with scaberulous trichomes. They became tough and hardened in fruit with three prominent raised ribs, two innermost tepals keeled and narrowly boat-shaped, up to 1 mm shorter than outer ones. Five epipetalous stamens with dorsifixed filaments below into a cup and alternate with strap shaped apically dentate pseudostaminodes. The staminal tube cleft to three fourth of its length, opposite to tepals, inserted from a hypogynous disc. The oblong, entire unilocular anther with two monothecous pollensacs has vesicular appendages and line of dehiscence. Spherical pollen grains with many pores. Monocarpellary, unilocular, globose roundly obtriangular, superior ovary, glabrous have one amphitropous ovule with basal placentation, short style with capitate stigma. The flowers are produces nectar and insects pollinated. The mature ovule is covered with pericarp, dry membranous globose urticle fruit is compress, breaks irregularly and indehiscence. The perianth and bracts are persists and modify into fruit. The single minute, flattened, sub globose, shiny, brown to black seeds with thickened seed coat. White annular embryo is surrounds with endosperm. Flowering and fruiting in February to July. Propagated with seeds and rooting at nodes. Cultivated as a border plant and sometimes escaped and grown as a weed.

Phylogenetic analysis

The evolutionary history was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 1.72661183 was shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) were shown next to the branches. The evolutionary distances were computed using the Jukes-Cantor method and were in the units of the number of base substitutions per site. All positions contained gaps and missing data were eliminated from the dataset.

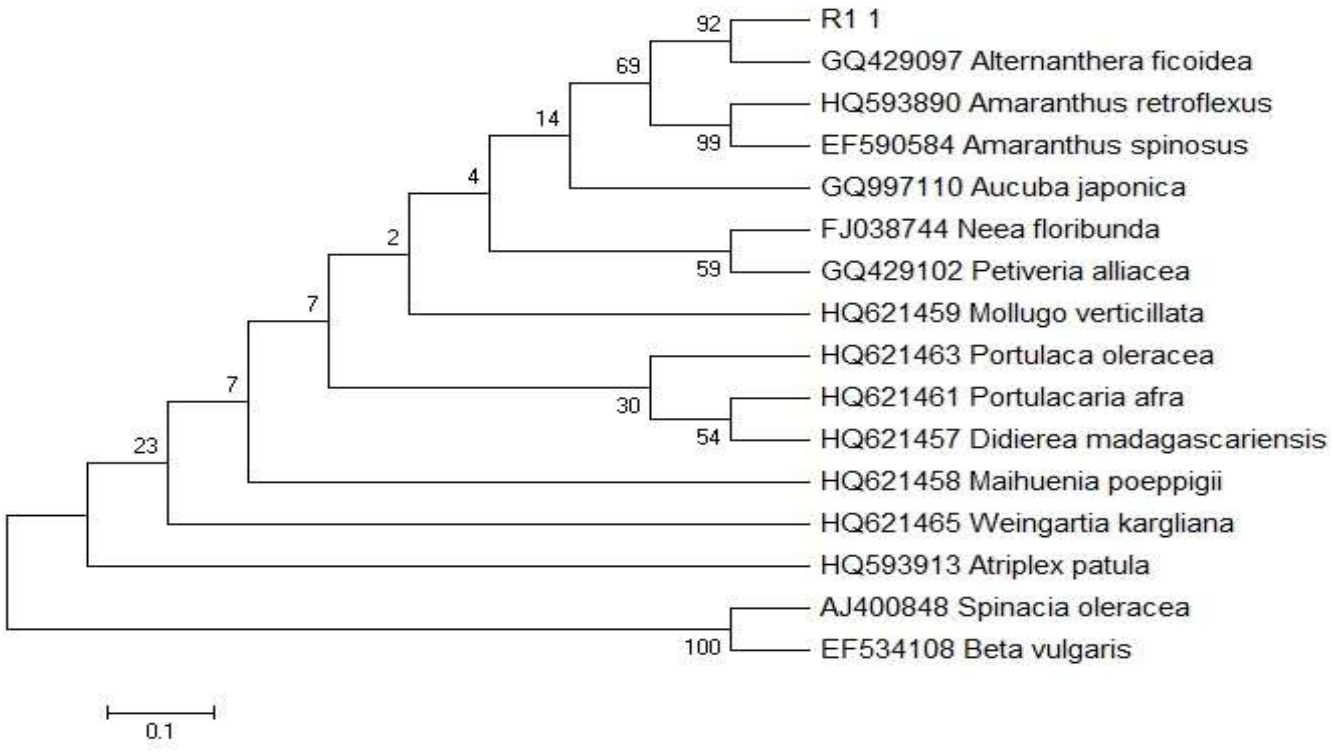

Fig.2. Phylogeny tree analysis of R1_rpoC1

There were a total of 506 positions in the final dataset. Phylogenetic analyses were conducted in MEGA4. Based on the BLAST analysis and phylogeny analysis clearly revealed that the given sample R1_rpoC1 was belongs to the genus *A. ficoidea*.

DISCUSSION

The Amaranthaceae have been a large group of dicotyledonous with 180 genera and about 2,500 species (Kai Müller and Thomas Borsch, 2005). They are mostly annual herbs. The 65 genera of Amaranthaceae and its 850 species were grown in tropical and temperate regions (Babu, 1977). The family is characteristic which correlate to the wide distribution of the Amaranthaceaen lifespan, plants habit, structures of leaf and venation types (Judd *et al.,* 1999). The genus *Alternanthera* contains 80-200 species (Snchez-Del Pino *et al.,* 2012). The morphological character of the genus was identified by capitate stigma and druses. This family is allies to Chenopodiaceae and Nyctaginaceae. The Amaranthaceae and Chenopodiaceae family would form two distinct monophyletic groups and treated as two separate families. The Amaranthoideae and some genera of Gomphrenoideae were found to be polyphyletic (Ivonne Sánchez del-Pino *et al.,* 2009). Amaranthaceae was placed under the order Chenopodiales. Preliminary, the Amaranthaceae was divided into 10 subfamilies. The monophyly of this new, broadly defined Amaranthaceae has been strongly supported by both morphological and phylogenetic analyses (Judd *et al.*, 2008). Amaranthaceae included the former families Achyranthaceae, Atriplicaceae, Blitaceae, Celosiaceae, Chenopodiaceae, Corispermaceae, Deeringiaceae, Dysphaniaceae, Gomphrenaceae, Polycnemaceae, Salicorniaceae, Salsolaceae and Spinaciaceae.

Conclusion

The phylogeny of *A. tenella* strongly supports its systematic position. This study helps in the identification of taxon based on phylogeny in addition to morphological characters which could be further utilized the plant as herbal drug.

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