Volume : 2 | Issue : 8 | Aug 2013 • ISSN No 2277 - 8160

Research Paper | Botany

Studies on Phytolith Morphology of Crescentia Cujete L.

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ABSTRACT *This study is about phytolith morphology of Crescentia cujete. Four different morphotypes of phytoliths were observed from this plant. They are cubic tabular, epidermal cell type, stellate radiating hair base type, polygonal favose trichome base type and reniform psilate stomata type.*

KEYWORDS:

Introduction

Phytoliths refers to any mineral deposited within a plant that precipitate in or between cells of living plant tissues and are widespread in all types of plants and all their different organs and structures. Phytoliths containing silica (opal phytoliths) are created from hydrated silica dissolved in ground water that is absorbed through a plant's roots and carried through vascular system. Silica is precipitated anywhere significant amounts of water are used or lost. Although produced in living plants they contain no carbon but comprised of amorphous opal A (Jones and Segnit, 1971) with trace mineral in varying amounts.

Production of phytolith silica bod ies is generally heaviest in the epidermal tissue of the stems and leaves in herbaceous plants, especially in monocots. In conifers and deciduous trees, most silica bodies occur in needle and leaf tissue respectively (Geis, 1973; Klein & Geis, 1978). Significant levels of silica have also been found in woody portions of many species (Amos, 1952). Many morphologically distinct phytoliths have been reported in monocotyledones than in dicotyledones. Geis (1973) expects taxonomic group at the levels of family, genera or even species in some instances using tree leaf phytolith assemblages. So phytolith taxonomy like pollen will probably be more discriminating in some taxonomic categories than others.

Because of their consistent shape within species, phytoliths provide significant taxonomic information (Jones and Handreck, 1965; Blackman, 1969; Raven, 1983; Piperno, 1988). Moreover since these resistant siliceous structures can remain stable in the soil for hundreds and even millions of years after plant tissues decay (Rovner, 1983; Twiss, 1987; Piperno, 1988; Carter, 1999). They are important in palaeoecological studies (Gallego, 2004). So it has been used as an indication of past climatic conditions. Another promising use of phytoliths in palaeoecological research involves the comparative study of plant groups with C_3 or C_4 photosynthetic pathways (Rovner, 1983). Phytolith analysis has been suggested as a means for investigating the origin and development of irrigation agriculture (Miller, 1980). The existence of opal silica in the plant tissues has structural and protective role against fungi, insects and herbivores as well as various biotic and abiotic stresses giving strength to plants by increasing heavy metal tolerance (Birchall *et al.,* 1989; Neumann *et al.,* 2001; Liang, 2005, Da Cunha, 2009, Chauhan, 2011).

In the present study phytolith morphology of *Crescentia cujete* which belongs to the family Bignoniaceae was described.

Materials and Methods

The leaves of *Crescentia cujete* were cleaned extensively by washing in distilled water in a sonicator to avoid contamination from phytoliths of other plant adhering to their surfaces. Then it was allowed to dry in hot air oven at about 50-70°C. Dried sample is weighed and then put into wet digestion. In this method the sample was treated with concentrated sulphuric acid and (30%) H_2O_2 and then centrifuged at 3000 rpm for 10 minutes. The supernatant was discarded and then the precipitate is repeatedly washed in distilled water till acid contents are totally exhausted. This contributes the acid insoluble fraction (AIF) which also reflects the yield of silica in plants. The AIF fractions were then dried and weighed; slides were prepared using Canada balsam (natural) as mountant.

The slides were observed under light microscope and they are photographed using a Olympus digital camera attached with Olympus trinocular microscope.

For describing phytoliths morphology the terms found in International Code for Phytolith Nomenclature was used (Madella *et al.,* 2005).

For comparison the phytoliths data provided by Smithsonian tropical research institute and published phytolith atlases and keys were used (eg. Bozarth, 1992; Kondo *et al.* 1994, Kealhofer and Piperno, 1998, Runge, 1999, Piperno, 2006, Iriarte, 2009) were used.

Observations (Fig 1- a, b & c)

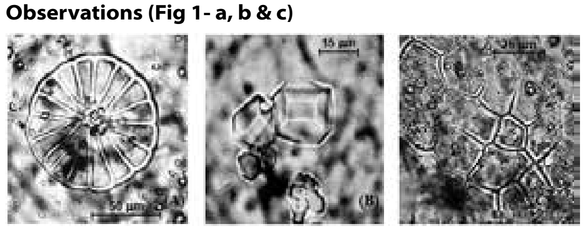

Fig. 1. A. Phytolith - Stellate radiating hair base type
B. Phytolith - Cubic tabular epidermal cell type
C. Phytolith - Polygonal favose trichome base type

In the leaves of *Crescentia cujete* four different morphotypes of phytoliths were observed.

Cubic tabular epidermal cell type

It is cubical in shape and size of square may vary from 8-20 µm in size. About 40% of the total morphotypes observed were of this type.

Stellate radiating hair base type

It is circular in shape with 16-18 radiating segments. The diameter of circle ranges from 49-75 µm. About 30% of the total morphotypes were of this type.

Polygonal favose trichome base type

It is polygonal in shape size ranges from 20-35 µm. About 25% of the total morphotypes were of this type.

Reniform psilate stomata type

It occurs less than 5% of the total morphotypes and they are around 14 µm in size.

Apart from these four types, tracheidal forms derived from xylem also have been noticed rarely.

Discussion

Members of Bignoniaceae generally doesn't produce phytoliths. But those plant in which the phytoliths were reported are of hair base type.

In *Catalpa bignonioides* apart from hair base phytoliths, tissue clump type, segmented hair cell type and tracheidal forms were also observed (Lisakealhofer *et al.,* 2012).

The hair base type phytoliths reported from the leaves of *Crescentia cujete* is peculiar and it is probably species specific. So this report gives supplementary evidence to the identification of this species and gives clues about the interrelationship of the various taxa of Bignoniaceae.

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