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Research article

STUDIES ON PHYTOLITHS IN SOME MARINE PLANTS

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ABSTRACT: Phytoliths are silica bodies found within or outside the cells of various tissues of plants. The present study is about the morphology of phytoliths found in twelve marine angiosperms. The phytoliths are extracted from the plant using wet-digestion method. Most of the plant having rod-shaped phytoliths. Along with rods, tracheidal type, characteristic of *Excoecaria agallocha, Bruguiera cylindrica* and *Aleuropus lagopoides*; fusiform type, characteristic of *Lumnitzera racemosa*; bilobate and circular forms in *Aleuropus lagopoides* were also observed. From this observations it is concluded that the phytoliths produced by marine plants possess low taxonomic value, but they play a major role in past-environmental reconstruction.
Key words: Phytoliths, morphology, marine plants

INTRODUCTION

Phytoliths are microscopic amorphous silicon di oxide ($SiO_2 \cdot H_2O$) particles occurring in almost all parts of the plant body. It is found prominently in monocotyledones, but also found in dicotyledones, gymnosperms, and pteridophytes in comparatively low quantities. [1-5]. Phytolith production is abundant in epidermal cells of leaves and stems but in woody portions of trees it occurs in trace amounts [6]. Many morphologically distinct phytoliths have been reported in monocotyledons and dicotyledones. Silica enters the plant body through rootsystem and gets deposited within the cells and found in and around the tissues, hence it gets the shape of the cells in which it was accumulated. Phytoliths show resemblance in its shape and size of related genera and species [7] and it is used as a tool in the identification and classification of plants like the pollen grains. Studies on soil phytoliths also used in palaeoecological studies from many parts of the world in monitoring climate changes and reconstructing past vegetation [8-10]. The present study is about the study of phytoliths accumulated in some mangrove plants.

MATERIALS AND METHODS

The plant species for the present study were collected from the mangrove forests at Pitchavaram located about 15 kms from Chidambaram, Cuddalore district, Tamilnadu between latitude 11°20' to 11°30' north and longitudes 79°45' to 79°55' east. It is an estuarine mangrove situated at the confluence of Uppanar, a tributary of Coleroon river. About twelve species of marine plants were selected and analysed for phytoliths. The species selected are *Aleuropus lagopoides, Lumnitzera racemosa, Rhizophora mucronata, Rhizophora apiculata, Suaeda maritima, Suaeda monoica, Bruguiera cylindrica, Ceriops decandra, Aegiceros corniculatum, Arthrocnemum indicum, Sesuvium portulacastrum* and *Excoecaria agallocha*.

Phytoliths were extracted from the leaf samples by wet digestion method [11]. The leaf samples were thoroughly washed in distilled water and then immersed in a detergent solution for overnight, then it is again washed in distilled water and dried in hot air oven at 52°C. The dried sample was then weighed and digested with concentrated sulphuric acid. After the materials get completely digested, 30% hydrogen peroxide was added to the sample. Then it was washed several times with distilled water till the acid contents were exhausted. Then the residue was collected, dried, weighed and mounted using Canada balsam. Phytoliths morphotypes were classified and described using the international code of phytolith nomenclature [12]. Measurements were made along the longest axis of the phytoliths. Slides were observed under light microscope and photographed using Olympus digital camera attached with Olympus trinacular microscope.

RESULTS

Aleuropus lagopoides

In this species four different morphotypes were observed. Tracheidal type is of the predominant type and accounts for about 40% of total forms present. It originates from tracheids with annular thickenings and size of this phytolith was 14.5 micron to 63.8 microns. The next frequent types is the bilobate ones which constitutes 30% of total morphotypes. It is bilobed in structure and is 14.5 to 23.0 microns. About 20% of phytoliths were of circular type and it measures from 9.0 to 17.4 microns. About 10% of morphotypes observed were of cylindric type and it possess some invaginations. Its size varies from 34.0 to 37.0 microns.(Plate-1 and 2).

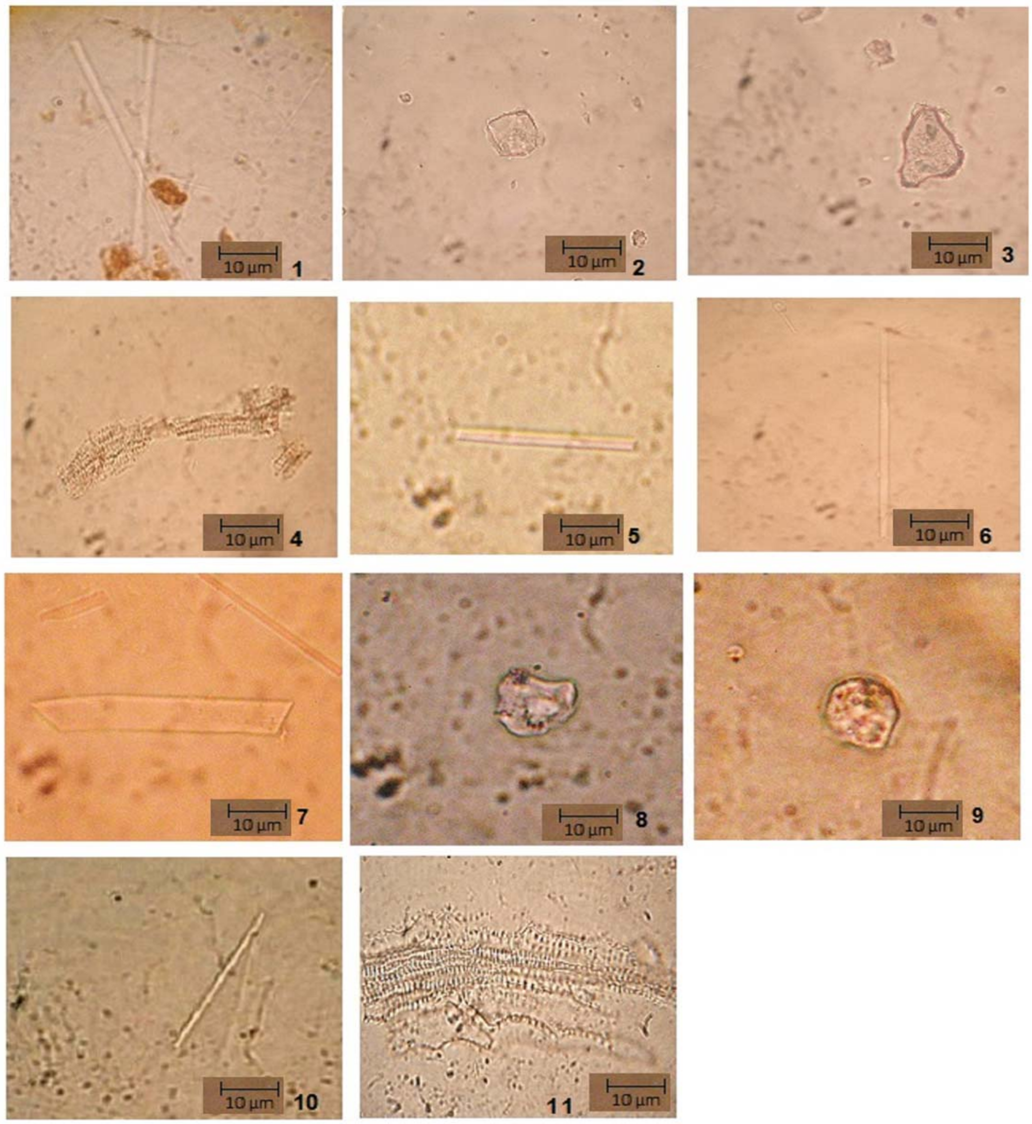

Plate 1

I. Rod Shaped phytolith of *Aegiceros corniculatum* (Fig. 1), *Ceriops decandra* (Fig. 5), *Arthrocnemum indicum* (Fig. 6), *Suaeda maritima* (Fig. 7) and *Bruguiera cylindrica* (Fig. 10).
II. Tracheidal type phytolith of *Excoecaria agallocha* (Fig. 4) and *Bruguiera cylindrica* (Fig. 11)
III. Irregular shaped phytolith in *Suaeda monoica* (Fig. 2)
IV. Multiangled irregular shaped phytolith in *Sesuvium portulacastrum* (Fig. 8, 9)
v. Conical shaped phytolith in *S. maritima* (Fig. 3)

Lumnitzera racemosa

Various morphotypes were observed in this genus. Cylindric type constitutes 20% of total forms and size ranges from 44.0 to 64.0 microns. About 60% of phytoliths were of fusiform type and its size ranges from 9.0 to 26.0 microns. The remaining 20% constitutes irregular scrobiculate forms ranging from 9.0 to 17.0 microns.

Arthrocnemum indicum

Long cylindrical forms were frequently observed in this species. Their size ranges from 55.0 to 101.0 microns.

Aegiceros corniculatum

Only cylindrical forms noted and possess varying sizes ranging from 44.0 to 92.0 microns.

Excoecaria agallocha

Tracheidal forms are distinctly observed in this species. Jointed tracheidal elements were also observed. It is of 41.0 to 198.0 microns in size.

Ceriops decandra

The only morphotype observed here was the short cylindrical forms of sizes ranging from 20.0 to 29.0 microns.

Suaeda monoica

Irregular shaped structures noticed frequently and their size ranges from 23.0 to 35.0 microns.

Suaeda maritima

Cylindrical forms were of frequent occurrence and its size range from 29.0 to 52.0 microns. Conical bodies were also observed in this species (15.0-20.0 microns).

Bruguiera cylindrica

In this plant the Phytoliths were observed in low quantity. It is of tracheidal forms having a size of 17.4 to 81.2 microns. Cubical forms were rarely detected, which varies about 12.0 to 38.0 microns. Cylindric forms ranging from 20.0 to 35.0 microns were also found.

Sesuvium portulacastrum

Multiangled irregular bodies of size varying from 15.0 to 29.0 microns were observed abundantly.

Rhizophora mucronata

Irregular spherical bodies which range from 26.0 to 41.0 microns were abundantly seen in this species.

Rhizophora apiculata

Prominent phytoliths were not observed in this species.

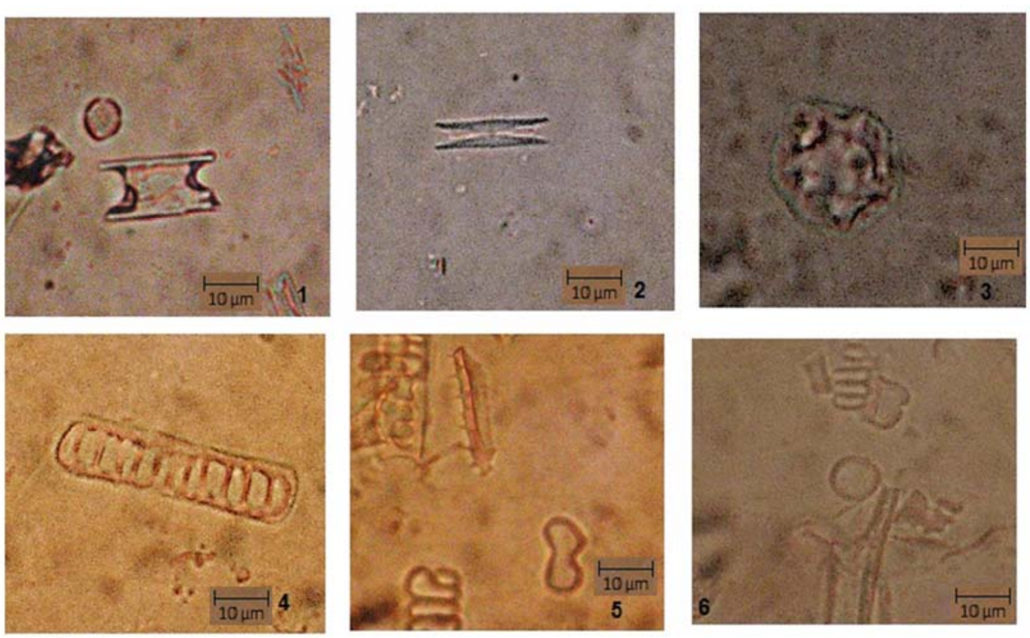

Plate 2

Fusiform type of *Lumnitzera racemosa (Fig.* 1, 2), Irregular spherical body of *R. mucronata* (Fig. 3), Tracheidal (Fig. 4), Bilobate (Fig. 5) and Circular (Fig. 6) of *Aleuropus lagopoides.*

DISCUSSION AND CONCLUSION

The present study is about the phytolith assemblages of twelve species of mangrove vegetation.

In this observations, the phytoliths content of *Rhizophora mucronata* shows irregular spherical shaped bodies but in *Rhizophora apiculata* phytoliths were not prominently seen but few irregular structures noticed whereas in other members of Rhizophoraceae *Ceriops decandra* showed mainly rod shaped phytoliths and in *Bruguiera cylindrica* apart from tracheidal type, rod shaped forms and cubical type were also recovered. In the recent report of non grass phytoliths in Sunderbans by Das et al. [13] revealed that in *Ceriops decandra* and *Rhizophora apiculata* phytolithmorphotypes were of globular lacunose bodies wheras in *Bruguiera cylindrica* various types such as cylindric tracheids, irregular spheres, stomate, and epidermal cell were observed.This strong variation may be due to the environmental influences prevailed in the region. In *Lumnitzera racemosa* the morphotypes present were mainly of fusiform type which were found elsewhere .Besides this, irregular scrobiculate bodies and rod shaped structures were also noticed. Earlier report of opal phytoliths in south east Asian flora by Kealhofer and Piperno [14] suggests that although phytoliths were produced by Combretacean members, leaves of *Lumnitzera racemosa Willd* . do not produce any phytoliths. In *Excoecaria agallocha,* the phytoliths are of large tracheidal type and this is found to be distinct for this species. Diagnostic phytoliths are reported in Euphorbian members like *Manihot esculentus* and *Phyllanthus* species [14]. In *Suaeda monoica* the phytoliths are of irregular shaped spheres whereas in closely related species *Suaeda maritima* they are like rod and conical. In *Arthrocnemum indicum* the phytoliths are of rod shaped. Phytoliths were not reported so far in other members of Chenopodiaceae. In *Aegiceros corniculatum* phytoliths are rod shaped. In other Myrsinaceaen members phytoliths are not yet reported. In *Sesuvium portulacastrum*, multiangled phytoliths were noticed and so far there was no report found in related species.

In grass, *Aleuropus lagopoides* the different morphotypes seen are tracheidal type, bilobate, globular and rod with serrations. Normally grasses produce bilobates, saddles, crosses, elongate etc. Unlike other Poacean members *Aleuropus* showed tracheidal forms and globular forms which are typical characteristic of woody dicotyledonous plants. These variations may be due to the impact of environment on plant habitat. Mangrove sediments have a high capacity for absorbing and holding heavy metals thereby preventing the spread of metal pollution in coastal areas. Silicon di oxide may ameliorate the toxic effects of aluminium and other heavy metals such as manganese which are ingested by plants [15,16]. Hence it can be assumed that presence of phytoliths in mangroves may help protect the plants to some extent by ameliorating the toxic effects of these heavy metals.

From this study it was evident that although phytoliths produced by marine plants possess low taxonomic value, but they play a major role in environmental reconstruction and may help in future phytolith studies of the deltaic environments.

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