Amorphous silica biomineralizations in species from Argentina: content, morphologies and tissue location, systematic and ecological relations

Mariana Fernández Honaine *† [1,2,3], Maria Laura Benvenuto [1,2,3], Stella Maris Altamirano [1,2,3], Mara De Rito [3,4], Margarita Osterrieth [1,2]

[1] Instituto de Geología de Costas y del Cuaternario, Universidad Nacional de Mar del Plata-CIC – Mar del Plata, Argentina
[2] Instituto de Investigaciones Marinas y Costeras, Universidad Nacional de Mar del Plata-CONICET – Mar del Plata, Argentina
[3] Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) – Argentina
[4] Facultad de Ciencias Agrarias, Universidad Nacional de Mar del Plata – Balcarce, Argentina

Silicification of plants is a widespread process and involves a high amount of plant families. The study of the content and distribution of amorphous silica biomineralizations in plant tissues has been approached by diverse disciplines, due to the relevance and applications that silicophytoliths have on different research areas. The knowledge of the plant production in a specific area, has multiple applications from anatomical/functional, through ecological up to palaeobotanical and palaeoenvironmental. The present study aimed to compare the content, morphologies and tissue distribution of silicophytoliths in leaves of species from different communities of Argentina. We evaluated how silica content varied according to systematic, life cycles (perennials vs annuals), habit (herbs vs arboreals) and status (native vs exotic), and compared with results obtained by other researches. We analyzed at which level the phytolith morphologies can discriminate between plant groups, and which morphologies may be more relevant for taxonomy. Leaves from at least 3 individuals of 92 species, grouped in 26 families, representing some of the main communities of Buenos Aires, Misiones, and Tierra del Fuego provinces, were collected. Silicophytoliths were extracted through a calcination technique, and silica content was measured as % dry weight. Silicophytoliths were counted and described under optical microscope following specific literature. Data of silica content was subjected to Kruskal Wallis and Mann-Whitney tests, depending on the hypothesis evaluated. Morphology data was subjected to Principal Component Analysis. Fifteen species do not produce silicophytoliths. The silica content ranged between 0.38% (*Ranunculus apiifolius*) and 19% (*Chusquea ramossisima*) and varied according to systematic. However, it was possible to observe that two species of a same genera had different behavior (producer and not producer). At family level, the highest media content was observed in Urticaceae and the lowest in Ranunculaceae. Differences were detected between Poaceae vs Asteraceae, Juncaceae, Rosaceae and Solanaceae ($p< 0.01$). Within Poaceae, Asteraceae and Cyperaceae families, no silica content differences were detected among species. There were no statistical differences between annuals and perennials, and natives and exotics (except within Poaceae family), contrary to what it was reported previously by other researchers. Leaf silica content content in herbs was higher than in trees and shrubs ($p< 0.01$); however, families with higher silica accumulation are mostly herbaceous (grasses, sedges). The main silicified tissue is epidermis, but also xylem and parenchyma became silicified. PCA showed that it is possible to

*Speaker
†Corresponding author: fhonaine@mdp.edu.ar

differentiate some families based on their phytolith assemblages. Poaceae (short cell phytoliths), Cyperaceae (cone shaped phytoliths), Urticaceae, Moraceae and Cannabaceae (cystoliths) are clearly differentiated from other groups. The redundancy of some morphologies such as tabular polygonal (derived from epidermis) and cylindrical sulcate xylem, makes difficult the discrimination of some groups. Finally, a detailed morphometric study will probably allow some additional differentiation, also within the groups already differentiated. However, besides the diagnostic character of the phytolith morphologies of specific taxa, it is relevant to increase our knowledge about the distribution of the silicification process among plants, not only for palaeobotanical but also for anatomical, physiological and ecological purposes. Acknowledgments: PICT 2036, PICT 1583, EXA 741/15

Keywords: leaf silicophytoliths, silicophytolith content, Argentina