Calcium oxalate crystal production in different plant communities of the Pampean Plain: a comparative analysis

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Calcium oxalate crystals (COC) are the most prevalent and widely distributed mineral deposits throughout the families of higher plants. COC were analyzed in vegetative organs and fruits of 13 species from different plant communities of the Pampean Plain: forests (*Acacia melanoxylon*, *Celtis ehrenbergiana*, *Eucalyptus globulus*), agroecosystems (*Glycine max*), and wetlands (*Alternanthera philoxeroides*, *Bidens laevis*, *Hydrocotyle bonariensis*, *Ludwigia peploides*, *Mikania parodii*, *Polygonum hydropiperoides*, *Ranunculus apiifolius*, *Rumex crispus* and *Typha latifolia*). Organs were placed in an ultrasound bath and washed with distilled water to remove possible mineral contaminants. Afterwards, diaphanization, clearing of tissues with 50% sodium hypochlorite and cross sectioning were realized. The material was mounted with gelatin-glycerin and COC were identified and described with optical, polarization and scanning electron microscopes. Crystal density was calculated and the composition of the crystals was analyzed by X-ray dispersive spectroscopy (EDS). Statistical analyses (Kruskal-Wallis test and Principal Component Analysis) were made in order to compare COC size and production between communities, species and organs. Druses were observed in *C. ehrenbergiana*, *E. globulus*, *A. philoxeroides*, *H. bonariensis*, *L. peploides*, *P. hydropiperoides*, and *R. crispus*. Raphide bundles were present in *L. peploides* and *T. latifolia*; and prismatic crystals in *A. melanoxylon*, *E. globulus*, *H. bonariensis*, *L. peploides* and *R. crispus*. Calcification mainly occurred in parenchymatous tissue. No COC were observed in *B. laevis*, *M. parodii* and *R. apiifolius*. A single crystal morphology was observed per organ, except in leaves of *L. peploides* and *E. globulus*, which present both druses and raphides, or druses and prismatic crystals, respectively. In fruits, only prismatic crystals were observed independently of the morphology produced in the vegetative organs. The species analyzed had significant differences in the size of the COC (H: 443.5, $p < 0.001$). Particularly, some aquatic species (*A. philoxeroides*, *L. peploides*, *P. hydropiperoides* and *R. crispus*), given the great size of their druses (36-58μm), could not be differentiated among them ($p > 0.05$). Considering each species, the fruits had smaller COC (5-11μm) than the vegetative organs (14-210μm, $p < 0.001$). The COC density was significantly different between communities, species and organs, and allowed to distinguish the community and the organs with greater production of COC. Thus, the tree species were grouped together with the fruits of the species analyzed given their greater COC density: 9167-28308 and 1112-18531 crystals/mm2, respectively. Inside this group, *C. ehrenbergiana* and *E. globulus* have more affinity because they produce druses, unlike *A. melanoxylon* and the fruits analyzed that

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produce prismatic crystals. It was not possible to discriminate between the aquatic community (7-250 crystals/mm2) and the crop (340 crystals/mm2). The description and quantification of COC allowed to distinguish among different plant communities, species and organs. The fruits showed the smallest size and the highest density of crystals. This particular pattern ensures the normal growth and development of the embryos, since crystals act as a calcium source, prevent damage from insects and allow reproductive success of the species. Acknowledgments: PICT 2036, PICT 1583, EXA 741/15

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