Phylogenetic relationships of seed coat mucilage

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Upon imbibition of water, seeds or fruits of many species produce a pectinaceous mucilage (myxodiaspory). Mucilage has been reported to be produced by seeds or fruits of species in 37 orders, 110 families and at least 230 genera of angiosperms.

Ordinal phylogenetic position of plant families that include species with seed coat mucilage based on available data shows that seed mucilage is mainly found in phylogenetically advanced families (Figure 1). Only three families (2.7%) that produce seed mucilage are in magnoliids and Nymphaeales, and 18.2% of the families that produce seed mucilage are monocots. In contrast, most taxa (79.1% of families) that have seed mucilage are in the eudicots, especially in rosids and asterids. It is noteworthy that species producing seed mucilage are found in the two most species - rich and geographically widely distributed families Poaceae and Asteraceae. These two families alone contain > 30 000 species or > 10% of the extant angiosperms. At present, 17 genera of Asteraceae and 2 genera of Poaceae have been reported to have mucilaginous seeds; however, many species in these families need to be investigated to determine if they can produce mucilage. In gymnosperms, seed mucilage seems to have been reported only for Ceratozamia in the family Zamiaceae (Fahn et al 1972). Further inspection of phylogenetic position of plant families that include species with seed coat mucilage indicates a possible phylogenetic advantage of mucilage, because more highly advanced families with mucilage production have members growing in dry habitats (e.g. Asteraceae, Brassicaceae and Poaceae) than basal taxa (e.g. Nymphaeales and Magnolids in moist habitats). However, if a trait such as mucilage production is phylogenetically independent families with the most taxa (e.g. Rosids) will have a high number (by chance) of mucilage producing taxa compared with basal families with a low number of taxa (e.g. Nymphaeales).

The origin of seed mucilage appears to extend at least as far back in geological history as the Middle Eocene (Smith *et al* 2003). Smith *et al* (2003) identified "a probable zone of mucilage" in seeds of the extinct Araceae species Keratosperma allenbyense from the Middle Eocene Princeton Group, Allenby Formation (48.7 Ma). Our preliminary analysis may suggest that seed mucilage is an evolutionarily advanced trait. However, the evolutionary aspect of seed mucilage probably is far more complicated than we currently think.

References

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Smith S Y, Stockey R A. 2003. Aroid seeds from the Middle Eccene Princeton chert (Kerotosperma allenbyense Araceae): comparisons with extant Lasioideae. *International Journal of Plant Sciences*, 164: 239-250



Figure 1. Ordinal phylogenetic position of plan species with seed coat mucilage in angiosperms. Each filled circle represents a family in which see mucilage has been documented.

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