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Comparative study of foliar appendages and leaf flavonoid pigments in basal angiosperms and their evolutionary significance

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Phylogeny of angiosperms can be discussed under three major groups; basal angiosperms, monocots and eudicots according to the APG (III) system. Distribution and evolutionary significance of foliar appendages and leaf flavonoid pigments of basal angiosperms have attracted relatively little attention. The aim of this study was to interpret phylogenetic relationships of basal angiosperms based on foliar appendages and leaf flavonoid pigments. *Nymphaea stellata* (Family: Nymphaeaceae), *Aristolochia indica* and *Apamasiliquosa* (Family: Aristolochiaceae), *Cinnamomum verum*, *Neolitsea cassia* and *Perseaamericana* (Family: Lauraceae), *Annona muricata* (Family: Annonaceae), *Piper betle*, *P. longum*, *P. nigrum* (Family: Piperaceae) were selected as basal angiosperms for this study. Mature leaves were sampled from two populations for each taxa.

Twenty four leaf anatomical characters were investigated using light and scanning electron microscopy. Leaf flavonoids were separated by paper chromatographic procedures. Characters of the foliar appendages and leaf flavonoid glycosides, flavonoid aglycones and anthocyanidins were subjected to cluster analysis and principal component analysis to interpret phylogenetic relationships using SYNTAX 2000 software package. The stomatal architectural characters and the pattern of leaf flavonoids indicated significant differences within the selected taxa. Non glandular and glandular trichomes were found in most of the taxa and have shown great structural variation among them.

Based on the analysis of the distribution of foliar appendages and leaf pigments, it was observed that the families; Annonaceae, Lauraceae and Piperaceae share more similarities. Annonaceae seems to be more related to Lauraceae than Piperaceae. These three families belong to the magnoliid clade according to the APG system. Therefore, these findings are in agreement with the APG system and reflected their similarities. Aristolochiaceae and Nymphaeaceae have shown very distant relationship while expressing dissimilarities with the above families. Although Aristolochiaceae also belongs to order Piperales, similarities with *P. nigrum*, *P. betle* and *P. longum* were not reflected in the present analysis. Therefore, foliar appendages and leaf flavonoid pigments play a very significant role in inferring the phylogeny of these taxa.

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