THE UNIVERSITY OF HONG KONG
SCHOOL OF BIOLOGICAL SCIENCES

Postgraduate Student Public Seminar

"KEY FUNCTIONAL FLORAL TRAITS IN ANNONACEAE: THE EVOLUTION OF GYNOECIAL DIVERSITY AND THE ROLES OF FLORAL NECTAR"

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Abstract

Flowers of the early divergent angiosperm family Annonaceae possess morphologically very diverse carpels and associated stigmatic exudates. These are crucial sites for flower-pollinator and ovule-pollen interactions, and understanding gynoecial structure and chemistry is key for appreciating function. This study compares the gynoecia of a broad range of Annonaceae taxa from all four subfamilies (Anaxagoreoideae, Ambavioideae, Annonoideae and Malmeoideae).

Extragynoecial compita (EGC) are evolutionary innovations that enhance fertilisation success of apocarpous species. Different types of EGC are observed in the Annonaceae species studied, including suprastylar EGC, which is the most phylogenetically widespread strategy occurring across all four subfamilies; in contrast, infrastylar EGC is only reported from *Artabotrys* (subfamily Annonoideae, tribe Xylopieae), *Annona* (subfamily Annonoideae, tribe Annoneae) and *Miliusa* (subfamily Malmeoideae, tribe Miliuseae). The occurrence of suprastylar EGC is often associated with copious stigmatic exudate, whereas that of infrastylar EGC is correlated with incompletely fused ventral carpel grooves and/or basal placentation.

Complete syncarpy has only been demonstrated in the sister genera *Isolona* and *Monodora* (subfamily Annonoideae, tribe Monodoreae). Another strategy to compensate for the limitations of apocarpy is revealed in *Cyathocalyx* (subfamily Ambavioideae), with the evolutionary reduction in carpel number and increased number of ovules per carpel: this strategy structurally resembles syncarpy. *Cananga* and *Drepananthus* flowers are moreover shown to possess a confluent zone that consists of trichomes interconnecting all stigmas and is filled with stigmatic exudate, enabling intercarpellary pollen-tube growth among the adaxial grooves of the stigmas.

Temporal changes of floral chemistry and molecular regulation in the stigmatic exudate of early divergent angiosperms are revealed here in a combined transcriptomic-proteomic study of *Uvaria grandiflora* (subfamily Annonoideae, tribe Uvariaeae). The flowers are protogynous with a prolonged pistillate phase that overlaps with the staminate phase, and with a fully open corolla that promotes beetle and bee pollination. Sugar profiles change significantly in the transition between the peak pistillate (PP) and early staminate (ES) phases, possibly increasing exudate osmolarity. The alteration of sugar composition is corroborated by the transcriptomic regulation, which also displays a considerable fully up-regulation of defence-related pathways in the ES phase compared to the PP phase, showing the responses of plant reproductive organs to environmental threats including evaporation and pathogenic microbes.

Differences in the chemistry, molecular regulation and function of nectar produced by the stigmas and inner petals of *Monoon laui* (subfamily Malmeoideae, tribe Miliuseae) are associated with a fungus-mediated plant-pollinator mutualism. Fungi developing on dehydrated inner petals provide a food source for insect larvae that are conspecific with adult pollinators. Comparisons of fungal communities further indicate that floral visitors act as vectors that disperse fungi between flowers. The stigmatic exudate is sugar-rich, whilst the petal exudate has a higher amino acid content. Transcriptomic and proteomic regulation displays a consistent trend with the nectar chemistry, with stigmas showing stronger immune responses than petals. The petal nectar of *M. laui* functions as a brood site for the pollinator larvae, thereby maintaining the functional population size of pollinators and boosting pollination success.

--- ALL ARE WELCOME ---