WORKSHOP ON ORCHID CARE AND CONSERVATION

18TH AUGUST 2019

CONFERENCE HALL TFDPC BHAVAN

10:00 AM ONWARDS

WORKSHOP ON ORCHID CARE AND CONSERVATION

LISTEN

- Orchids in Tripura
- How to take care of your orchids
- Need for Orchid Conservation
- Rules and regulations involved

KNOW

- Visit to an Orchid farm
- Familiarize with Wild and Hybrid Orchids

Interact with Plant Enthusiasts from all fields

• Professionals • Home growers • Researchers • Forest Officers • Beginners

Venue: Conference Hall, TFDPC Bhavan

(Behind Old Raj Bhawan), Kunjaban, Agartala -799006, Tripura

ENTRY FREE !!

Date: 18th August 2019, Sunday

Time: 10:00 am onwards

Further information:

- **Tripura Biodiversity Board**
  Email: sputbb@gmail.com M: +91 8259891830
- **Arjun Adit**, Ph.D. Scholar, Department of Botany, University of Delhi
  E-mail: aadit@botany.du.ac.in M: +91 9958346637

Supported by:

Government of Tripura TRIPURA FOREST DEPARTMENT

The Rufford Foundation

Deception and Reward in establishment of Specialized Interactions in Orchidaceae

ARJUN ADIT[1], MONIKA KOUL[2] & RAJESH TANDON[1]

[1]Department of Botany, University of Delhi, Delhi-110007, India

[2]Botany Department, Hans Raj College, University of Delhi, Delhi-110007, India

Introduction

The urge to unravel the eco-evolutionary forces, which facilitate orchids to establish complex pollination mutualism has inspired two schools of thoughts – (i) One supports a strong phenotypic/phenological matching driven by synchronized flowering among the sympatrics, and (ii) the other supports the unilateral evolution without any change in the pollinator clades. The latter can be attributed to orchids having appeared when most of the key pollinator groups had already evolved and established mutualism with other species of angiosperms.

These two thoughts can be empirically validated by looking into orchids with specialized pollination mechanisms, which achieve reproductive success either by 'deception' or by offering 'rewards'. Such interactions are known among Cypripedioideae, Orchidoideae and Epidendroideae, while the basal clades of Apostasiodeae and Vanilloideae show generalised pollination.

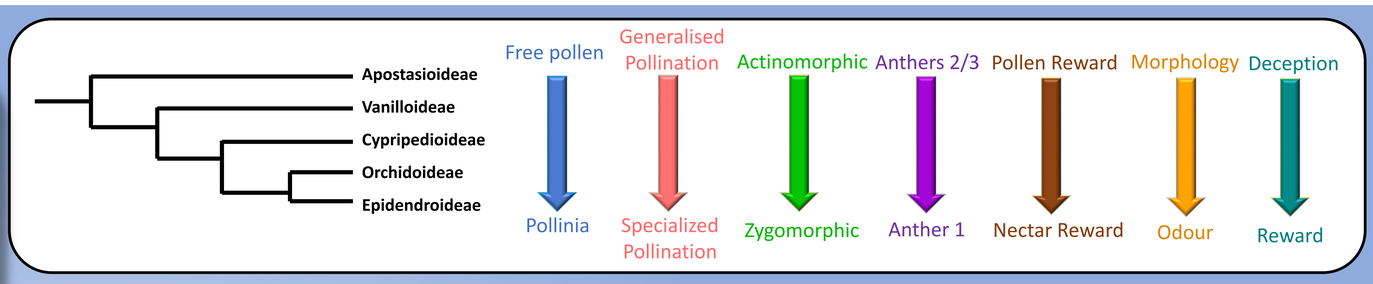

Fig. 1: 'Eco-Evo-Devo, A tryst with destiny'- Comparative trends in the Orchidaceae family.

Rationale

Ecological network analysis provides ways to analyze within system interactions and identify properties that are otherwise not evident from direct observations. In view of the large data available from field studies on interactions and properties of interacting partners, there is an urgent need for meta-analysis to reach suitable conclusions.

While orchids with specialized pollination mechanism depend on a single pollinator, the other way round is not true. Thus, vanishing of these partners can lead to catastrophic loss of orchid clades. As the reproductive success in majority of orchids is pollinator-dependent, any conservation effort is likely to involve an ecosystem approach.

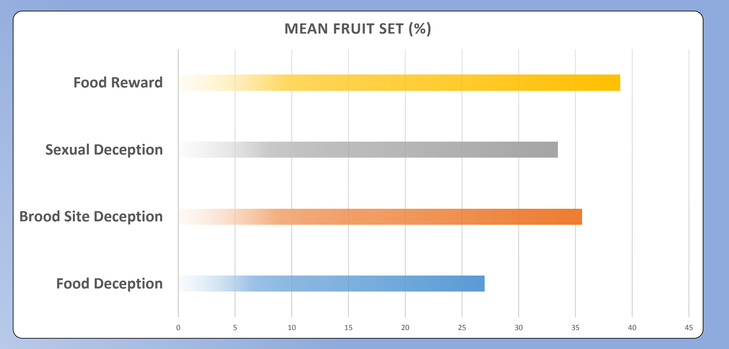

Fig. 5: Pollination Mechanism vs. Mean Fruit Set from metadata analysis

Methodology

- Pollination data of **200 orchid species** from the three advanced sub-families was gathered.
- A dendrogram was constructed in '**FigTree**' from phylogenies after ***Freudenstein et al., (2004)*** and ***Givnish et al., (2015)***. Pollination strategies marked next to each taxa on the tree are supported by the literature reviewed during the construction of metadata.
- The metadata was analyzed in '**MS Excel**', and networks along with heat maps were generated using '**Bipartite**' package of '**R**'.

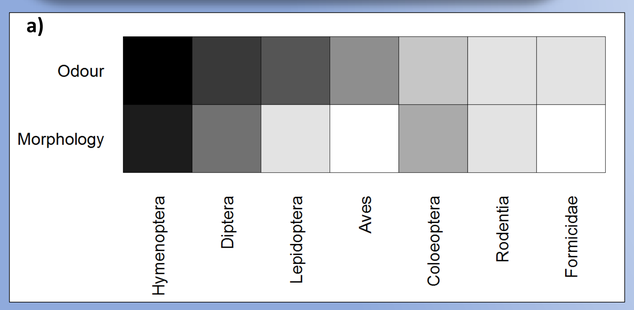

Fig. 3: Bipartite Heat Maps-
(a) Co-relation between Pollination Cue and Pollinator Guild
(b) Relationship between Pollination cues and Pollination mechanisms

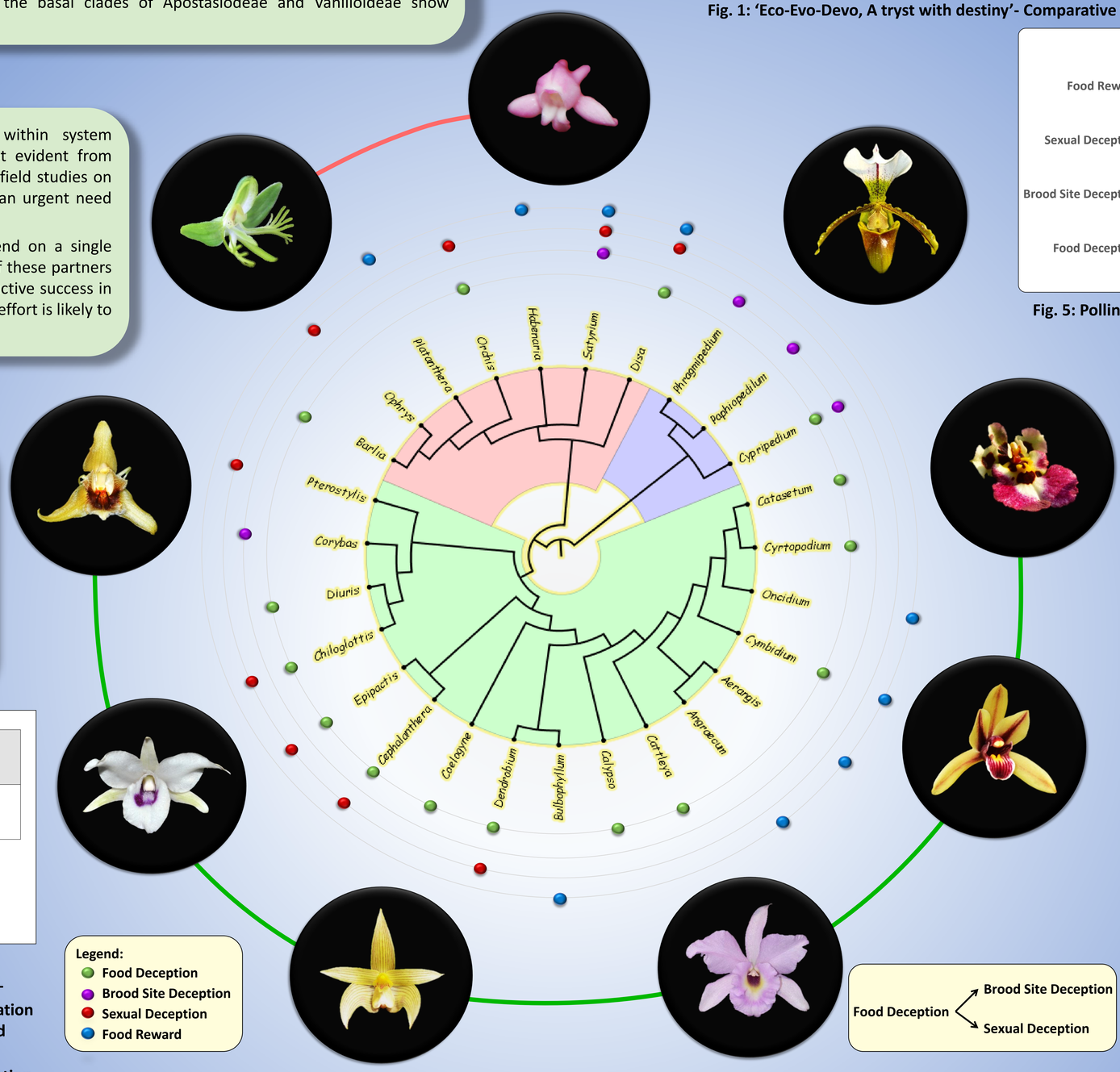

Fig. 2: Display of specialized pollination strategies against respective orchid members and their relation with particular clades (Sub-families).

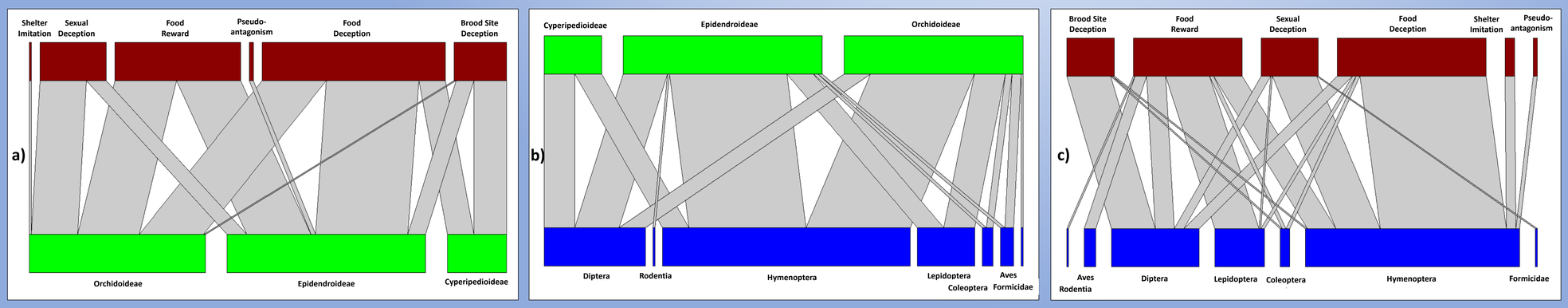

Fig. 4: Bipartite Networks- (a) Between Pollination Mechanisms and Orchid Clades; (b) Between Orchid Clades and Pollinator Guilds; (c) Between Pollination Mechanisms and Pollinator Guilds

Results

- Pollination syndromes in Cypripedioideae consist of only Food and Brood Site deception.
- **While Food deception is more prevalent in Epidendroideae, Sexual deception is common in Orchidoideae.**
- Reward pollination in specialized interactions is only seen in the most advanced sister clades i.e., Orchidoideae and Epidendroideae.
- **Aves, Mammals and Lepidopterans only associate with reward syndrome.**
- Hymenopterans are major victims of Food and Sexual deception, while Dipterans are largely involved in Brood site deception and Lepidopterans in Food Reward.
- **Odour and Morphology are almost equally important as a cue for attraction in case of Hymenopterans.**
- Guilds like Aves and Formicidae depend solely on Odour for attraction.
- **Odour is a more important component of attraction as compared to morphology for Sexual, and Brood site deception as opposed to Food deception.**
- From the data, it is evident that almost all orchids providing food reward employ odour for attraction.
- **Non-major deceptive pollination mechanisms like Pseudoantagonism and Shelter imitation are completely dependent on floral morphology for attraction of pollinators.**

Conclusions

- Odour plays a more important role in attracting pollinators towards deceptive orchid clades as compared to the floral morphology.
- **Deceptive pollination is a basal mechanism while reward pollination evolved later in the family.**
- Hymenopterans and Dipterans are generalist pollinator guilds, forming associations with all Orchid clades and all pollination mechanisms.
- **While Hymenopterans, Dipterans and Coleopterans have close affinity to deception, Lepidopterans and Aves primarily pollinate orchids providing rewards.** ***This suggests that later evolved pollinator genera are intelligent enough to associate with only reward syndromes, indicating co-evolution.***

Key References

- **Freudenstein JV et al. 2004**. An expanded plastid DNA phylogeny of Orchidaceae and analysis of jackknife branch support strategy. *American Journal of Botany*, 91: 149-157.
- **Givnish TJ et al. 2015.** Orchid phylogenomics and multiple drivers of their extraordinary diversification. In *Proceedings of Royal Society of London B*, 282: 20151553.
- **Jersáková J et al. 2006.** Mechanisms and evolution of deceptive pollination in orchids. *Biological Reviews*, 81: 219-235.
- **Johnson SD. 1994.** Pollination and the evolution of floral traits: selected studies in the Cape flora. *Ph.D. Thesis*, Department of Botany, University of Cape Town.
- **Tandon R and Bhardhwaj I. 2012.** Reproductive Strategies in Orchidaceae. *Journal of Orchid Society of India*, 26: 35-48.
- **Vereecken NJ and Schiestl FP. 2009.** On the roles of colour and scent in a specialized floral mimicry system. *Annals of Botany*, 104: 1077-1084.

Correspondence: aadit@botany.du.ac.in

Acknowledgements

The work was supported by **Rufford Small Grant for Nature Conservation**. Arjun Adit is thankful to the **Council for Scientific and Industrial Research** for the Junior Research Fellowship.