

# ORCHID CONSERVATION NEWS

The Newsletter of the Orchid Specialist Group of the IUCN Species Survival Commission

Issue 2

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## Mysteries and Discoveries

**Colour pattern mimicry facilitates floral deception in silver slipper orchid,  
*Paphiopedilum micranthum***

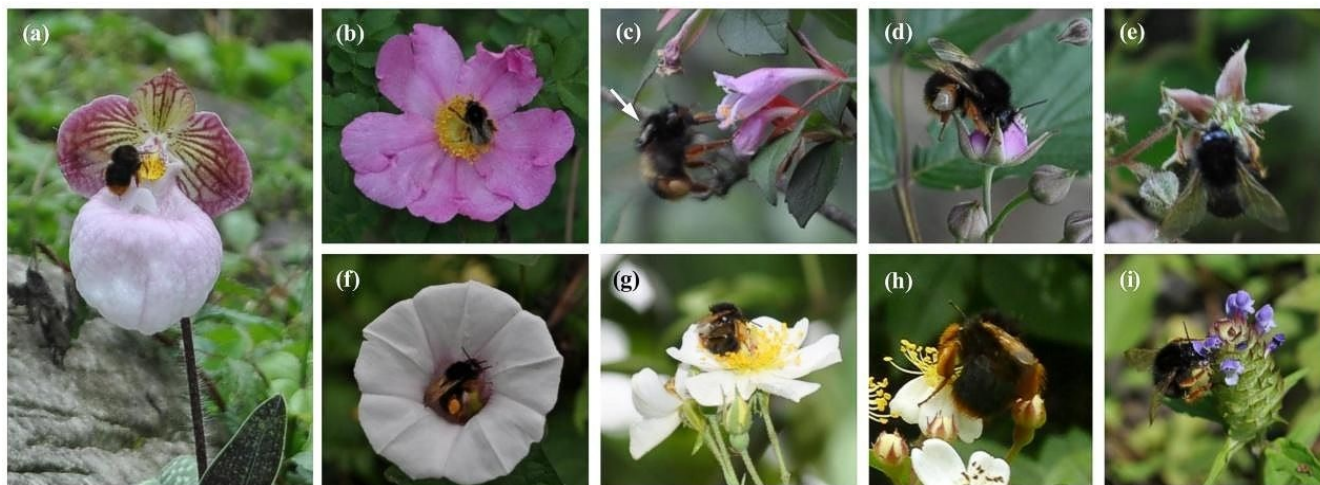


Figure 1. Pollinator bumblebee, *Pyrobombus flavescens*, visiting *P. micranthum* (a) and sympatric flowers.

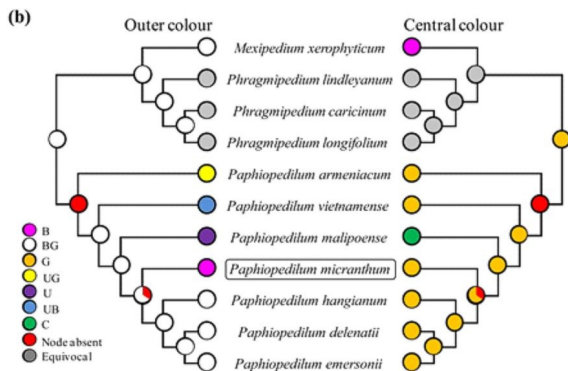
Mimicry, where one species evolves to resemble another unrelated species, is a renowned textbook example of natural selection and adaptation. Mimicry is often based on imitation of special visual patterns such as the gorgeous colour patterns on butterfly wings and snake skin. Flower mimics, which are widespread among plants, often dupe animal pollinators with no reward by imitating the colour of nectar- or pollen-providing flowers that share the same habitat. Moreover, both the mimics and the food flowers often display complex colour patterns, including contrast between outer and central flower parts, that could be discriminated by pollinators. However, whether the colour pattern is the key to flower mimicry is still a mystery.

To investigate this question, Dr. Yibo Luo's lab at the Institute of Botany, Chinese Academy of Sciences, used the silver slipper orchid, *Paphiopedilum micranthum* (Fig. 1a), as a model to test the effects of floral colour patterns of mimic orchids on pollinator bumblebee choices and pollination success using behavioural tests in a community context. Using the bee vision model (Fig. 2), and evolutionary analysis (Fig. 3), they compared the colour patterns of *P. micranthum* with those of its relatives and the food flowers that it mimics. The results reveal that orchid

pollination success might be enhanced by colour patterns that mimic those of food flowers in the local community. Such mimicry enhances attraction of the orchid to bumblebee pollinators. Evolutionary analysis indicates that the colour pattern of orchid mimics might have been shaped by multiple evolutionary histories, with evolutionary innovation of the outer floral colour and pre-adaptation of the ancestral centre floral colour.

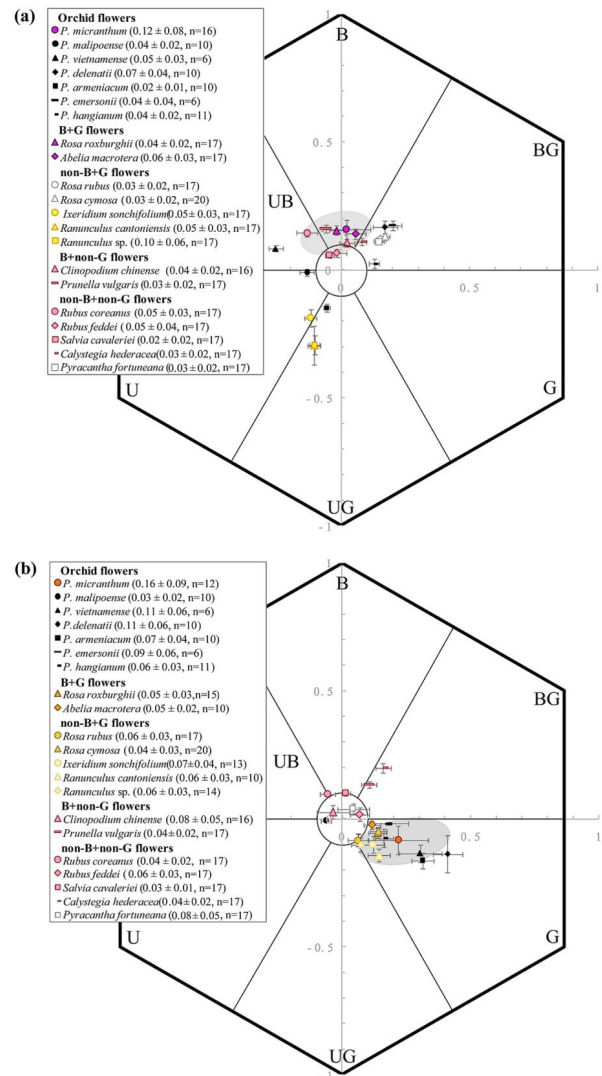
The study is novel in its inclusion of colour pattern in the investigation of floral mimicry in the context of the community and provides the first detailed evidence for the functional importance of colour pattern mimicry for a deceptive flower. This finding advances our understanding of the evolutionary processes governing floral deception via the functional significance of colour pattern traits that influence signalling efficacy. This highlights the importance of complex signals in facilitating species interactions.

Figure 3: Evolutionary analysis



The paper entitled ‘The functional significance of complex floral colour pattern in a food-deceptive orchid’ has been recently published in *Functional Ecology* (doi:10.1111/1365-2435.12571). Xiao-kai Ma from Yibo Luo’s lab first authored the paper. This work is funded by the National Natural Science Foundation of China. Submitted by Dr. Yibo Luo.

Figure 2: Bee vision model



## Conservation of Orchids at CSIR-NBRI Botanic Garden

J.S. Khuraijam and R.K. Roy

Botanic Garden, CSIR-National Botanical Research  
Institute

Rana Pratap Marg, Lucknow-226 001, India

Email: [jskhuraijam@yahoo.com](mailto:jskhuraijam@yahoo.com) [roynbri@rediffmail.com](mailto:roynbri@rediffmail.com)

CSIR-NBRI Botanic Garden is one of the oldest and historical Botanic Gardens in India. The Garden is known for its immense contributions towards conservation and sustainable utilization of important plant resources of economic, ornamental, horticultural, biological, ecological, educational and recreational values. The Botanic Garden is actually the historical 'Sikander Bagh' laid out around 1800AD as a royal garden by the 'nawab' (King) of Lucknow. It is located in the heart of Lucknow, the capital city of Uttar Pradesh state. Spread over an area of 65 acres, full of greenery and a vast collection of plant diversity, the garden serves as a lung of the city. This Botanic Garden serves as a National Facility with four main functions viz. conservation, education, scientific research and display of plant diversity in plant houses and arboreta. It is designed to conserve the indigenous and exotic flora and fulfils the basic function of making available for study, research and use, in one place, a wide diversity of trees, shrubs, climbers and other plant species. The Botanic Garden is a living repository of over 5000 taxa/cultivars of various groups of native and exotic plants. The garden has an excellent collection of ornamental crops, trees, houseplants, medicinal plants, cycads, palms, ferns, bryophytes, bonsai, water lilies, cacti and succulents. There are several thematic gardens and plant houses where plants are displayed for educational and aesthetic purpose. Considering the rich plant diversity in the Botanic Garden, the Institute has been designated as Living National Repository by the National Biodiversity Authority, Chennai. Besides, this Botanic Garden has also been recognized as a Lead Botanic Garden by the Ministry of Environment, Forests & Climate Change, Government of India for enhancing the *ex situ* conservation activities of rare, endangered and threatened (RET) taxa.

## Orchids

Orchidaceae is one of the largest families of angiosperms with about 27,000 species (Govaerts *et al.*, 2016; The Plant List, 2010). Orchids are known for their curious shapes, long lasting and colourful flowers. They are considered as high value flowering plants as cut flowers well as potted plants. Around 1350 species of orchids are reported from India (Jalal & Jayanthi, 2012; Yonzon, 2012). They are restricted mainly to the tropical forests of Himalayas, Eastern Ghats and Western Ghats. Over-collection from forests and illegal trade have threatened several species of orchids especially in the Eastern Himalayan region. As a result the group needs urgent conservation measures. Besides *in situ* conservation, *ex situ* conservation at Botanic Gardens will play an important role in long term conservation and their mass multiplication.

## Ex situ conservation of Orchids

At present, around 80 species of orchids are conserved in the Botanic Garden. Some notable rare species are - *Paphiopedilum spicerianum* (Fig. 1), *Paphiopedilum insigne*, and *Eulophia nicobarica*.



Fig.1. Beautiful flower of *Paphiopedilum spicerianum* at CSIR-NBRI Botanic Garden.  
Photo: JS Khuraijam

In the last two years, several field trips were conducted to collect orchids for *ex situ* conservation in the Botanic Garden (Fig. 2).



Fig. 2. Collection of orchids from Eastern Himalayan region.  
Photo: K.D. Singh

The orchids were collected from natural habitats of six states viz., Assam, Bihar, Jharkhand, Meghalaya, Manipur and Odisha. Some



of the species collected are - *Acampe praemorsa*, *Arundina graminifolia*, *Bulbophyllum crassipes*, *Coelogyne cristata*, *Cymbidium bicolor*, *Dendrobium aphyllum*, *Dendrobium herbaceum*, *Dendrobium kentrophyllum*, *Dendrobium moschatum*, *Dendrobium polyanthum*, *Gastrochilus inconspicuus*, *Oberonia* sp., *Pelatantheria insectifera*, *Rhynchostylis retusa*, *Vanda coerulea*, *Vanda tessellata* etc. (Fig. 3). *Dendrobium aphyllum* and *Vanda tessellata* are threatened in wild and included in the IUCN Redlist. *Vanda coerulea*, the Blue Vanda, is protected under Wildlife Protection Act of Government of India. A new species, *Luisia indica* was recently discovered from Himalayan foothills of north-western Bihar during plant collection tours (Khuraijam & Roy, 2015).

Fig. 3. Orchids under conservation at CSIR-Botanic Garden:  
A. *Dendrobium kentrophyllum*, B. *Vanda tessellata*, C. *Acampe praemorsa*, D. *Gastrochilus inconspicuus*, E. *Cymbidium bicolor*, F. *Pelatantheria insectifera*, F. *Pholidota articulata*  
Photo. JS Khuraijam



All the species are under *ex situ* conservation in a special temperature regulated plant house with a misting system. Maximum temperature of 25°C and 70-80% humidity is maintained in the plant house. Species collected from the Himalayan region are very sensitive to slight change in temperature. An acclimatization study under outdoor conditions is underway for species collected from Jharkhand, Bihar and Odisha state. The orchid conservation effort at CSIR-NBRI Botanic Garden has been initiated with a humble collection but aimed to increase the germplasm collection to 150 species this year through extensive field surveys. The germplasm collection of orchids thus collected and displayed will serve as an *ex situ* conservation centre in India besides supplementing education and research.

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Krawczyk, E. *et al.* (2016) Evidence for mixed sexual and asexual reproduction in the rare European mycoheterotrophic orchid *Epipogium aphyllum*, Orchidaceae (ghost orchid). *Ann. Bot.* 118 (1): 159–172 doi:10.1093/aob/mcw084

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## Food for Thought

Ma, Xiaokai, Shi, J., Bänziger, H., Sun, Y., Guo, Y., Liu, Z., Johnson, S.D. and Yibo Luo (2016). The functional significance of complex floral colour pattern in a food-deceptive orchid. *Functional Ecology* 30: 721–732. doi: 10.1111/1365-2435.12571

**Seven papers** and an editorial have been published in *Annals of Botany* - resulting from the 5th International Orchid Conservation Congress: <http://aob.oxfordjournals.org/content/118/1?etoc>

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Vogt-Schilb, H. *et al.* (2016) Responses of orchids to habitat change in Corsica over 27 years. *Ann. Bot.* 118 (1): 115–123 doi:10.1093/aob/mcw070

Pedersen, H. Æ. *et al.* (2016) Strengthening the taxonomic backbone of Thai orchid conservation: genetic fingerprinting and morphometry applied to a species complex in *Geodorum*. *Ann. Bot.* 118 (1): 125–133 doi:10.1093/aob/mcw071

Hetherington-Rauth, M.C. and S.R. Ramírez (2016) Evolution and diversity of floral scent chemistry in the euglossine bee-pollinated orchid genus *Gongora*. *Ann. Bot.* 118 (1): 135–148 doi:10.1093/aob/mcw072

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## Meetings

**International Orchid Conservation Congress IOCC6** was held in Hong Kong, May 16-20, 2016. Orchid conservationists from 31 countries were represented. A day was spent visiting Kadoorie Farm and Botanic Garden where many conservation initiatives were viewed in progress. (<http://www.kfbg.org/eng/>)

More news of this successful congress will follow in the next newsletter.

## Call for conservation news

Members are asked to provide news of their recent conservation activities for publication in the OSG Conservation News.

Please submit material in Microsoft Word, and illustrations, if any, as separate jpeg files (not embedded), including a caption and photographic credit.

## Changes to contact information?

To maintain effective communication, we need to know of any changes in contact information. Please inform the OSG Chair, Dr. Mike Fay ([M.Fay@kew.org](mailto:M.Fay@kew.org))