Preliminary Findings from Ultraviolet Induced Visible Fluorescence Imaging of Orchids

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Abstract
Plants exposed to sunlight interact with the incident ultraviolet (UV) producing a glow or fluorescence in response, which is usually overwhelmed by visible light. When molecules of a substance absorb photons of UV, some electrons are excited to a higher-energy state. After some energy loss these electrons relax to their original state emitting light with a longer visible light wavelength. The associated color produced is dependent on the substance's composition. Orchid blooms and plants have been imaged using an ultraviolet-induced visible fluorescence (UVIVF) technique, along with equivalent images recorded in ambient visible light, to explore the diverse colors, structures and patterns that are revealed by this fluorescence. UVIVF images were acquired in total darkness to ensure any visible light recorded was induced by the absorption of UV light only. LEDs with a wavelength of 365 nm were used to expose the subject under study. Due to low levels of induced visible light, images were recorded with long exposure times of up to 30 seconds. A growing range of orchid genera have been studied to explore UVIVF images. Whilst some simple color shifts could start to be anticipated in hybrids of *Phalaenopsis* and *Anguloa,* with pastel yellows, mauves, etc., the recorded UVIVF images often exhibited unexpected colors while highlighting details of petal morphology. The ethereal images do follow a pattern with the orchid flower's modified column and anther cap appearing brighter than their surroundings with a definite usually white glow. Pollinator landing sites on the epichile of the labellum were again highlighted in some images, such as with *Epipactis gigantea*. While these UVIVF images are not a representation of what insects see, they give us an indication of the interactions with UV light. UVIVF emissions are usually hidden by the dominant visible-reflected light. However, in studies, bees and other attracted pollinators have been shown to be capable of fine color discrimination in some circumstances. Pollinators who can also see near UV-reflected light receive three sources of light that are combined depending on their observable range of wavelengths and which wavelengths they see best. More study is required, but glowing pollen and columns in UVIVF images agree with what we already know of the high absorption of UV and therefore the dark regions in black and white UV-reflected images of flowers.

CV of Speaker	
	*Dr. Stuart Meeson*
Country	United Kingdom
Organization	Meeson Orchids – private research
Position	Research Physicist
Short Bio	Postdoctoral research physicist working in medical imaging. However, I am also a keen amateur orchidologist. Grow and exhibit orchids. Successes include Best *Pleurothallidinae* at Bournemouth Orchid Society's 60th Anniversary Show, Best Hybrid Orchid at RHS Orchid Shows in 2018 and 2022, Silver medal for exhibit of orchids in the Floral Marquee at RHS Chatsworth Flower Show 2017. Five RHS Orchid Committee awards (CC/RHS 2015, 2017, 2019, 2022 x2). In 2018 I became Guinness World Record Holder for the Most blooms on an orchid plant (sympodial) at 1684, with my *Epipactis gigantea* 'Trefor'. I am a member of the management committee of the Orchid Society of GB. This year I became a BOC judge trainee. As a scientist I have presented work at national and international conferences. I have been awarded two poster prizes. My scientific publications include twenty papers, four official reports and a book chapter on CT radiation dose.