In a Different Light – Australian Native Flower Photographs in Ultraviolet Light

David Oldfield

David has been a 'camera nut' ever since he was bitten by the photo bug at school in the UK in the 1950s. He studied chemistry at Birmingham University then moved to a new job in Australia in 1967 and has been here ever since. His wife Sue is the one in the family with green fingers which provided the impetus to explore close-up photography of Australian native flowers.

Many flowers have dark patterns visible under Ultraviolet (UV) light, but not visible to the naked eye. On the basis of much overseas work on honeybee vision, the eyes of pollinating insects are known to be sensitive to UV and it is widely believed that the UV patterns assist insects, such as bees or wasps, to find the nectar or pollen on the flower.

There is a wonderful website www.ultravioletphotography.com which explains how to take UV flower photographs which answered all my questions when I started in this field in 2013. I was welcomed into the UV fraternity with open arms and I discovered, to my great surprise, that nobody else in the world seemed to be taking digital photographs of Australian native flowers in UV light! You will now find many of my images of Australian natives on that site.

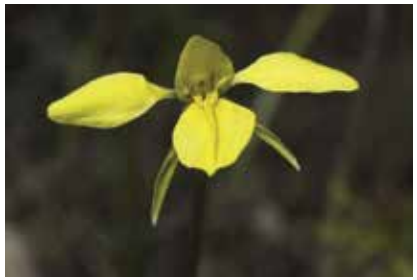
The first time you see the comparison of the visible and UV shots, in this case for *Hibbertia exutiaces* taken in the Grampians in Victoria, it hits you in the eye.

Hibbertia exutiaces Visible light

Hibbertia exutiaces UV

This is typical of UV images where the stamens and styles are black and petals may be pale yellow in UV.

Diuris chryseopsis Golden Moths Orchid, shows a distinct UV pattern.



Diuris chryseopsis Visible light

Diuris chryseopsis UV

These UV images are typical of what UV forum members in Europe and USA have reported for their flora with so called dark "bullseye" patterns on yellow petals in many of their UV images.

So, what do we with find with our yellow wattles?

Acacia longifolia Visible light

Acacia longifolia UV

The stamens, which are yellow in visible light become very dark grey or black in the UV image. This corresponds to the black stamens in *Hibbertia exutiaces* above. There are four relatively inconspicuous petals and sepals in each flower which are dark grey in UV.

As a chemist, I knew that the first thing on moving into a new area of research was to do a literature survey. Now I'm retired I no longer have access to most of the 'good stuff' behind paywalls but I did find that in 1924 James Matthew Petrie at the University of Sydney had worked on the yellow pigment of *Acacia longifolia*. He showed that the water-soluble yellow pigment was a derivative of kaempferol, a widely distributed flavonol, found in foods as varied as apples and broccoli. It is effectively

a natural sun-screen which absorbs UV strongly. So the stamens are yellow in visible light and black in UV because of the yellow pigment.

It seems to me, as someone who is not a botanist, that UV-absorbing pigments may be acting to prevent UV-induced damage to the genetic material in the flowers. Pollinating insects which are able to see in UV would then be able to orient themselves to visit those areas.

A similar situation exists with Eucalyptus blossom. Regardless of the colour of the blossom which we see with our eyes in visible light, it turns out black in UV. The visible colour is probably due to different pigments from those in wattles but they absorb UV and so appear black in the UV image.

Eucalyptus torquata Visible light

Eucalyptus torquata UV

Greenhood orchids make attractive subjects. Here the transparent green flower becomes dark blue while the labellum of this Large Bearded Greenhood from Central Victoria, became dark grey in UV. It is believed that greenhoods are pollinated by fungus-gnats.

Pterostylis plumosa Visible light

Pterostylis plumosa UV

The Blunt Everlasting proved to be a spectacular flower in UV, with a change from white to blue bracts.

Argentipallium obtusifolium Visible

Argentipallium obtusifolium UV

Dwarf Wedge Pea was also interesting, with a typical ‘bulls-eye” pattern on the petals in UV.

Gompholobium ecostatum Visible

Gompholobium ecostatum UV

A Common Billy Button was found in the Grampians with a grasshopper. As with wattles, the visible yellow was replaced with dark grey or black in UV.

Craspedia variablis Visible

Craspedia variablis UV

Grevillea alpina was another colourful flower from the Grampians.

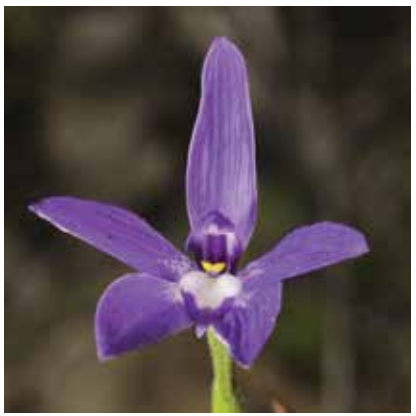
Grevillea alpina Visible

Grevillea alpina UV

All the visible colours were replaced by grey or black, which is interesting as pollinating insects, such as honeybees, have three receptors in their eyes sensitive to UV, blue and green. Very little has been reported on the visual sensitivity of Australian insects so it is impossible to know how evolution of Australian native plant colours was influenced by Australian insect vision.

On the other hand, birds are attracted to red flowers and are important pollinators of Australian native plants.

Waxlip orchids were prominent as usual, with a change from purple in visible light to dark blue in UV.



Glossodia major Visible

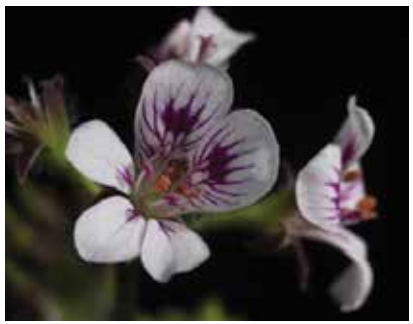
Glossodia major UV

A few Common Buttercups were also found, the petals remained yellow in UV with the carpels and stamens becoming black and the suggestion of a “bulls-eye” pattern at the base of the petals.

Ranunculus lappaceus Visible

Ranunculus lappaceus UV

Austral Storksbill...



Pelargonium australe Visible

Pelargonium australe UV

and Magenta Storksbill show interesting changes in colour.

Pelargonium rodneyanum Visible

Pelargonium rodneyanum UV

This is just a taste of the wonderful world of UV photography.