"Pseudocathaya"
Metamorphosis in a living fossil?

CHRIS CALLAGHAN of the Australian Bicentennial Arboretum reports the finding of an intriguing new conifer in the Pinaceae related to the living fossil *Cathaya argyrophylla* from China and, pending valid publication, provisionally named "*Pseudocathaya cyanescens*" here.

Returning to the mist-shrouded mountain during spring, I was astounded to find what under normal circumstances I'd consider a tree of *Cathaya argyrophylla* (Cathay silver fir or yin shan), a conifer I know first-hand and more fully since writing the synopsis of the genus (Callaghan 2007). That is, while it resembled this living fossil, one of the notable differences was that from its branches and trunk hung the most extraordinary blue cones, unlike any I had ever seen (for photos of typical cones of *Cathaya argyrophylla* see Van Hoey Smith 2010).

My camera went into overdrive as I recorded numerous pictures, some I've selected for these pages, depicting the growth of these remarkable cones, the early stages of which were located only after some diligent searching.

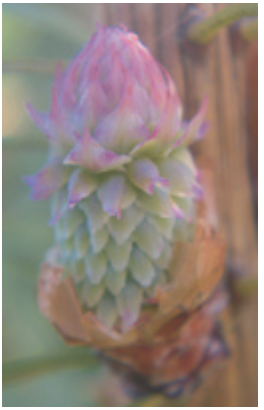
Absorbed in examining a further two of these trees located nearby and a fourth some distance away which fortunately was found with delayed 'flowering', I and my Chinese companions failed to notice the onset of a dense mist which now enveloped the mountain. Soon torrential rain was lashing the mountain, making further examination impossible for this visit and forcing a hasty retreat by all as the trees rapidly receded into the rain-streaked mist.

On returning home with my precious photos, I began the process of trying to determine what these trees may represent. Obviously from their gross morphology they are closely related to *Cathaya*, yet the structure of the cones, the manifestation of a unique genetic code, precludes them being placed in this genus.

Numerous questions now arose, among the more interesting being:

1. Have similar cones been found in the fossil record?
2. Do the cones represent dormant ancestral genes switched-on due to mutation(s)?
3. Are these trees the result of intergeneric hybidization, a rare occurrence in conifers, with the well-known Leyland cypress now found to be an interspecific hybrid? (Eckenwalder 2009). If so, perhaps of monotypic *Cathaya* crossing with a *Pseudotsuga* species, the obvious candidate being the Chinese Douglas fir, *Pseudotsuga sinensis* (huang shan), or a variety of it (?), although the locality is not known for either of these taxa. This being the case, how to explain among other things the blue colouration of the dimorphic cones which with their reversed seed scales are apparently unique in conifers. A number of features not shared with either of these






Siamese-twin pollen cones (strobili) joined at the head.

Top left Female 'flower' of *Pseudocathaya cyanescens* (ined.) emerging from a bud protected by ciliate-haired guard-leaves.

Top middle Female 'flower' opened for pollination, from which a caterpillar has eaten away some pink bracts to reveal receptive pearl-like ovules (embryonic seeds) visible on the backs of immature ovuliferous scales, the feature which the term gymnosperm (naked seed) describes.

Top right A now pollinated cone with reversed bracts (reminiscent but not identical to those of *Pseudotsuga* or *Keteleeria* at this stage), capped by forward pointing *Cathaya*-like bracts. This immature seed cone has grown from a lateral bud on the upper portion of a second year shoot, the location of male pollen cones in *Cathaya*, whereas the female cones of *Cathaya* grow laterally on the lower portion of current year's shoots, thereby bringing both sexes into close proximity.

Above left This recently fertilised cone on a nearby tree is at the apex of a newly extended shoot, the pointed bracts ultimately to be covered by the expanding scales in the same forward and reversed alignments as the bracts.

Above right An hermaphrodite cone. This is a male pollen cone terminating a new 5 cm. shoot (a location in which neither male nor female cones occur in *Cathaya*), topped by a waterlily-like 'flower' of long- pointed *Cathaya*-like female bracts. Unlike the angiosperms where they are the norm, bisexual flowers in conifers are a rare occurrence, the only recorded instance of which I'm aware being the occasional hermaphrodite flowers of *Fitzroya cupressoides* (Dallimore and Jackson, 1966).




Above Typical and atypical seed cones of the Chinese "*Pseudocathaya*", a rare endemic (?) conifer with a small population known only from a single remote mountain locality, the exact location withheld to protect the trees from the danger of human exploitation.

Cones higher in the canopy were seen to be slightly resinous, while being non-resinous in *Cathaya* whose cones are stalkless or only short-stalked. Attention is drawn to the thick, relatively long stalks with scale-like leaves, of the *Pseudocathaya cyanescens* (ined.) cones.

putative parents may be inherited from a common ancestor of these genera.
4. Are the reversed 'scales' on some maturing cones equivalent to the similarly reversed bracts of at least some *Keteleeria* and *Pseudotsuga* species before they are partially or fully hidden by the maturing scales? (Wu & Raven, 2001). Are these bracts now functioning as seed scales?
5. Are these trees chimaeras with genetically different cell tissues within each tree that have resulted sometime in the past by mutation(s) during hybridization?
6. Are these trees the real "giant pandas of the plant kingdom"(?), a description coined by Chinese botanists in the 1950s for the newly found trees of *Cathaya argyrophylla*, which were found to be living relicts of a conifer genus with a lineage stretching back to the Cretaceous period of the Mesozoic era. (Wang X-Q. et al 2000)

These and many other intriguing questions will need to be resolved in coming years pending determination of this new taxon, which I am provisionally naming here "*Pseudocathaya cyanescens*", the generic name meaning "false Cathay silver fir" and the specific epithet "becoming blue", referring to the unique cones.

In the meantime, my Chinese colleagues have requested that the location of these rare conifers remain fully confidential to ensure their safety and long-term survival into the future, and we have agreed to say nothing further regarding these puzzling trees. A formal description, validating the name, will be published when the trees have been more thoroughly researched.

References and further reading

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