Trees evolved camouflage defense against long extinct predator: First evidence of camouflage defense in plants

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Lance wood (Pseudopanax crassifolius) in native bush in the Owen River valley, South Island, New Zealand. Image: Wikimedia Commons

(PhysOrg.com) -- Many animal species such as snakes, insects and fish have evolved camouflage defences to deter attack from their predators. However research published in *New Phytologist* has discovered that trees in New Zealand have evolved a similar defence to protect themselves from extinct giant birds, providing the first evidence of this strategy in plant life.

"Plants are attacked by a bewildering array of herbivores and in response they have evolved a variety of defences to deter predators such as thorns and noxious chemicals," said lead researcher Dr Kevin Burns from Victoria University of Wellington, New Zealand. "In contrast animals often use colours to hide from predators or advertise defences, but until now there has been little evidence of colour based defences in plants."

Dr Burns' team studied the leaves of the Araliaceae tree (*P. crassifolius*) a heteroblastic species which is native to New Zealand. This species goes through several strange colour transitions during the process from germination to maturity and the reason for these changes is now thought to be a defence strategy from an extinct predator, the moa.

Before the arrival of humans New Zealand had no native land mammals, but was home to moa, giant flightless birds, closely related to the modern ostrich and the top herbivore predator in the food chain. However moa were hunted to extinction 750 years ago.

The Araliaceae tree has several defences which the team suggest are linked to the historic presence of moa. Seedlings produce small narrow leaves, which appear mottled to the human eye. Saplings meanwhile produce larger, more elongated leaves with thorn-like dentitions.

The mottled colours of seedling leaves are similar to the appearance of leaf litter, which would have made them difficult for a moa to distinguish. The unusual colouring may also reduce the probability of leaf outlines and help camouflage leaves against the sunlight-draped forest floor.

Moa also lacked teeth and swallowed leaves by placing them in their bills and snapping their head forward. The long rigid leaves produced by *P. crassifolius* would have been difficult for a moa to swallow. The maximum browsing height of the largest known moa was approximately

300cm and once *P. crassifolius* grow above this height they produce leaves that are ordinary in size, shape and colour, lacking any defence.

To prove that these defences were linked to the presence of moa the team compared Araliaceae leaves to samples from a similar species of tree, P chathamicus, from the Chatham Islands, which are 800 kilometres east of New Zealand. Unlike New Zealand the islands lacked large browsers such as Moa and so the plant life did not evolve a defence against them.

"The Chatham island species displays less morphological changes between adults and juveniles," said Burns. "If these colouring changes developed in response to the presence of moa in New Zealand they are reduced when they have evolved in the absence of moa."

More information: Fadzly.N, Cameron.J, Schaefer.M, Burns.KC, Ontogenetic colour changes in an insular tree species: signalling to extinct browsing birds, *New Phytologist*, 2009: DOI 10.1111/j.1469-8137.2009.02926x

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