Third gender identified in a close relative of the olive tree

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A hitherto unknown reproductive system in a species closely related to the olive tree, *Phillyrea angustifolia L.*, has been discovered by French researchers. This system explains the high concentration of male individuals co-occurring with hermaphrodites in this species.

The hermaphrodites, whose blossoms bear both male and female organs, are divided into two morphologically indistinguishable groups. The plants of each group are sterile among themselves but fully compatible with those of the other group. Under these conditions, the hermaphrodites can fertilize only half of the pollen recipients, whereas the males can pollinate all the hermaphrodites. The disadvantage weighing upon the males is thus neatly counterbalanced. This discovery proves for the first time the possibility of an evolutionary transition from hermaphroditism to dioecy. A report has been published in *Science*.

Researchers at the Laboratoire de Génétique et Évolution des Populations Végétales (CNRS/France) have discovered in *Phillyrea angustifolia L.*, a species closely related to the olive tree, a hitherto unknown reproductive system characterized by incompatibility between hermaphrodite plants. This new reproductive mode explains the mystery of the high frequencies (up to 50%) of male individuals co-occurring with hermaphrodite individuals in this species. The hermaphrodite individuals, whose blossoms bear both male and female organs, are divided into two morphologically indistinguishable groups. The plants of each group are self-incompatible (they cannot fertilize each other) but fully compatible with plants of the other group.

In such a system, a given hermaphrodite plant can pollinate only half of the other hermaphrodites, while a male can pollinate all the hermaphrodites in the population. These conditions neatly offset the reproductive disadvantage affecting the males, which have no female function (and are also referred to as "female-sterile" for this reason) and can thus transmit their genes only by male gametes, and not by both male and female gametes like the hermaphrodites.

In addition, this self-incompatibility within two morphologically identical groups of hermaphrodites could be a key reproductive mode, the origin of plant species with separate genders that evolve through "intermediary" reproductive systems. In the overall context of the evolution of reproductive systems from hermaphroditism toward dioecy (system in which individuals are exclusively either male or female), mixed systems involving the presence in the same species of both females and hermaphrodites (gynodioecy) or both males and hermaphrodites (androdioecy) are considered intermediaries derived from hermaphroditism. However, all previous empirical examples have shown that androdioecy had evolved from dioecious systems through the females' acquisition of a male function, and not from hermaphroditic systems through the loss of the female function by certain hermaphrodites. This new study shows for the first time that a transition from hermaphroditism to androdioecy is possible.

This discovery of a self-incompatibility system involving only two morphologically indistinguishable groups of hermaphrodite plants comes as a totally unexpected development. One of the researchers' next challenges will be to explain, from a functional point of view, how the number of self-incompatibility groups has been maintained at two.

More information: A Self-Incompatibility System Explains High Male Frequencies in an Androdioecious Plant, P. Saumitou-Laprade, P. Vernet, C. Vassiliadis, Y. Hoareau, G. Magny (de), B. Dommee, J.

Lepart, *Science*, 26 March 2010.

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