

The genetic architecture of populations where females, males and hermaphrodites stably coexist

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The co-existence of females, males and hermaphrodites, also known as trioecy, is rare in both plants and animals and not predicted by theory. However, puzzling cases of trioecious populations do exist in nature and are still poorly understood. Here, we presented data on sex ratios and geographical distribution of 109 *Mercurialis annua* populations in southern Spain, among which 36 populations are trioecious. We further showed crossing experiments between males, females and hermaphrodites of the trioecious populations. We fitted the sex ratios of the crosses and showed that maleness is determined by a Y chromosome while femaleness may arise from one to two recessive loci. We used simulation to address the population equilibrium and compared the results with the field sex ratios to show a possible cytotype variation. We discuss the stability and evolution of these trioecious populations based on their distribution and the history of *Mercurialis annua*.