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Conserved class of queen pheromones stops social insect worker reproduction

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A major evolutionary transition to eusociality with reproductive division of labor between queens and workers has arisen independently at least 10 times in the ants, bees, and wasps. Pheromones produced by queens are thought to play a key role in regulating this complex social system. However, their evolutionary history remains unknown. Here, we sought to identify sterility-inducing queen pheromones in three extant species of social insects, by testing queen-characteristic compounds in bio-assays, and found that in all cases hydrocarbons could reduce worker ovary activation (*Vespula vulgaris*: n-C_{27}; n-C_{28}; n-C_{29}, 3-MeC_{29}; *Bombus terrestris*: n-C_{25}; *Cataglyphis iberica*: n-C_{27}; n-C_{29}, 3-MeC_{29}). Furthermore, we synthesized existing data on compounds that characterize female fecundity in 64 species of social insects, and found that queen pheromones are strikingly conserved across at least three independent origins of eusociality, with wasps, ants, and some bees all appearing to use nonvolatile, saturated hydrocarbons to advertise fecundity and/or suppress worker reproduction. These results suggest that queen pheromones likely evolved from conserved signals that were already present in solitary ancestors, such as fertility cues used by females during courtship.