

Do queens of social Vespidae use cuticular hydrocarbons (CHCs) to signal their fertility and regulate reproductive division of labour?

	<i>Dolichovespula saxonica</i>	<i>Vespula vulgaris</i>
Effective queen mating frequency (# of colonies)	1.4 (35)	1.9 (17)
Worker-worker relatedness (# of colonies)	0.61 (35)	0.51 (17)
Average colony size in terms of workers (# of colonies)	113 (25)	2042 (46)
Queen policing present?	yes	no
Worker policing present?	perhaps	yes
Effectiveness of policing ^a	0.88	0.99-1
Observed % RW in queenright colonies (# of colonies)	6.5% (22)	1.0% (6)
Expected ESS % RW in queenright colonies ^b	7.9%	0.0%
Observed % RW in queenless colonies (# of colonies)	10.0% (19)	29.7% (10)
Expected ESS % RW in queenless colonies ^b	16.9%	23.4%

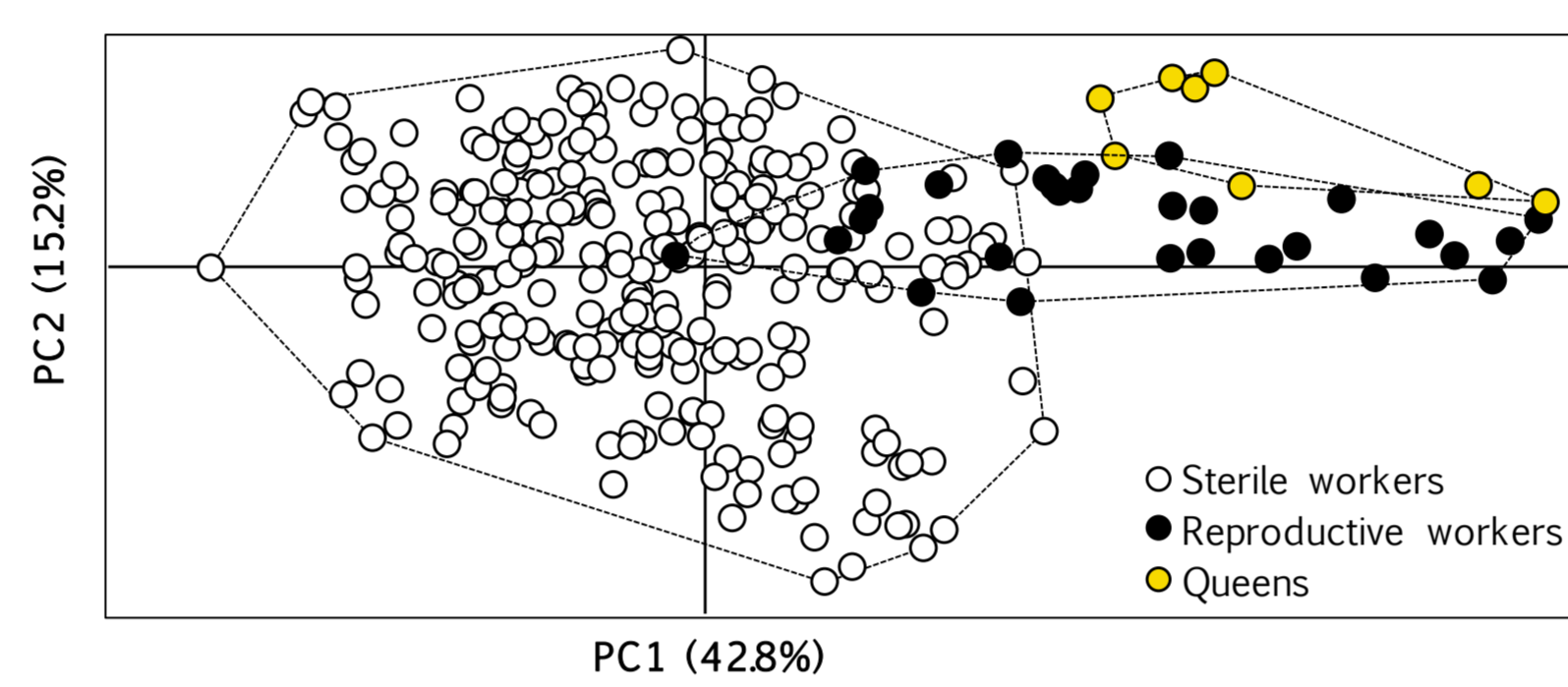
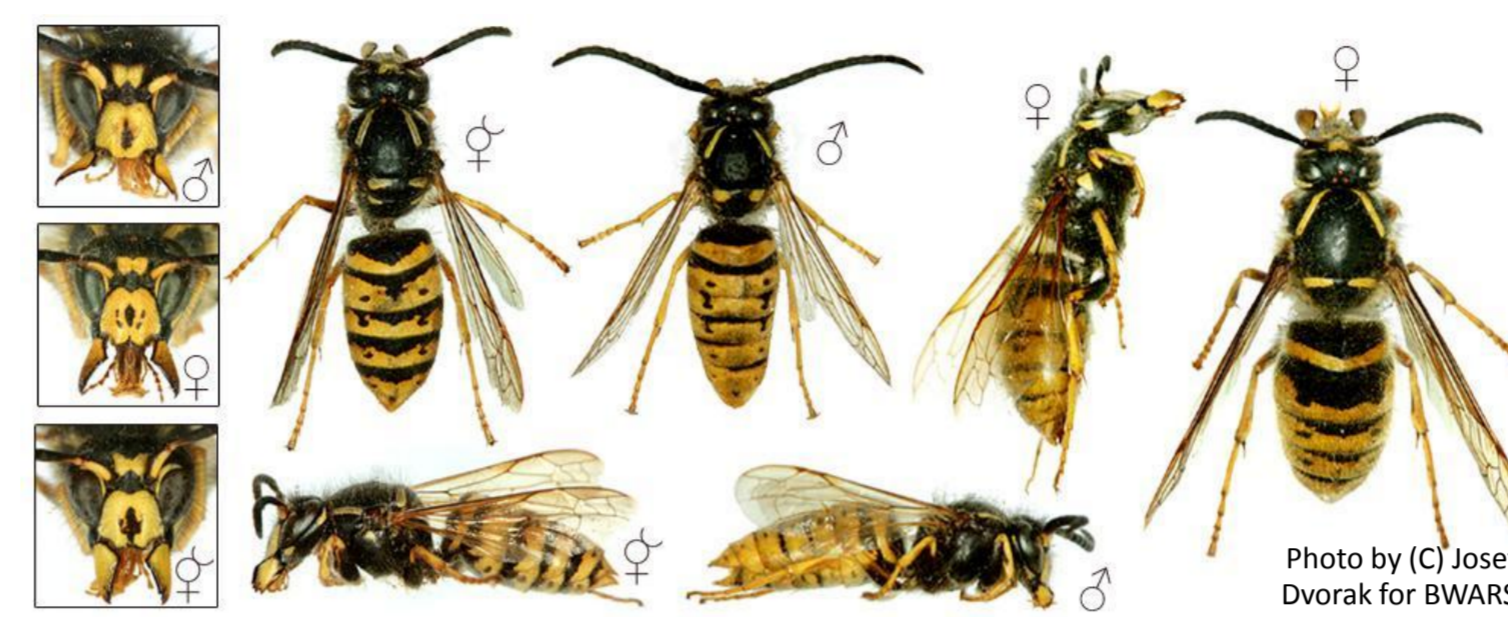
% RW = Percentage of reproductive workers, ESS = Evolutionary Stable Strategy

^a Defined as $(1-S_w)$, where S_w is the probability that worker-laid eggs survive to adulthood relative to queen-laid eggs.

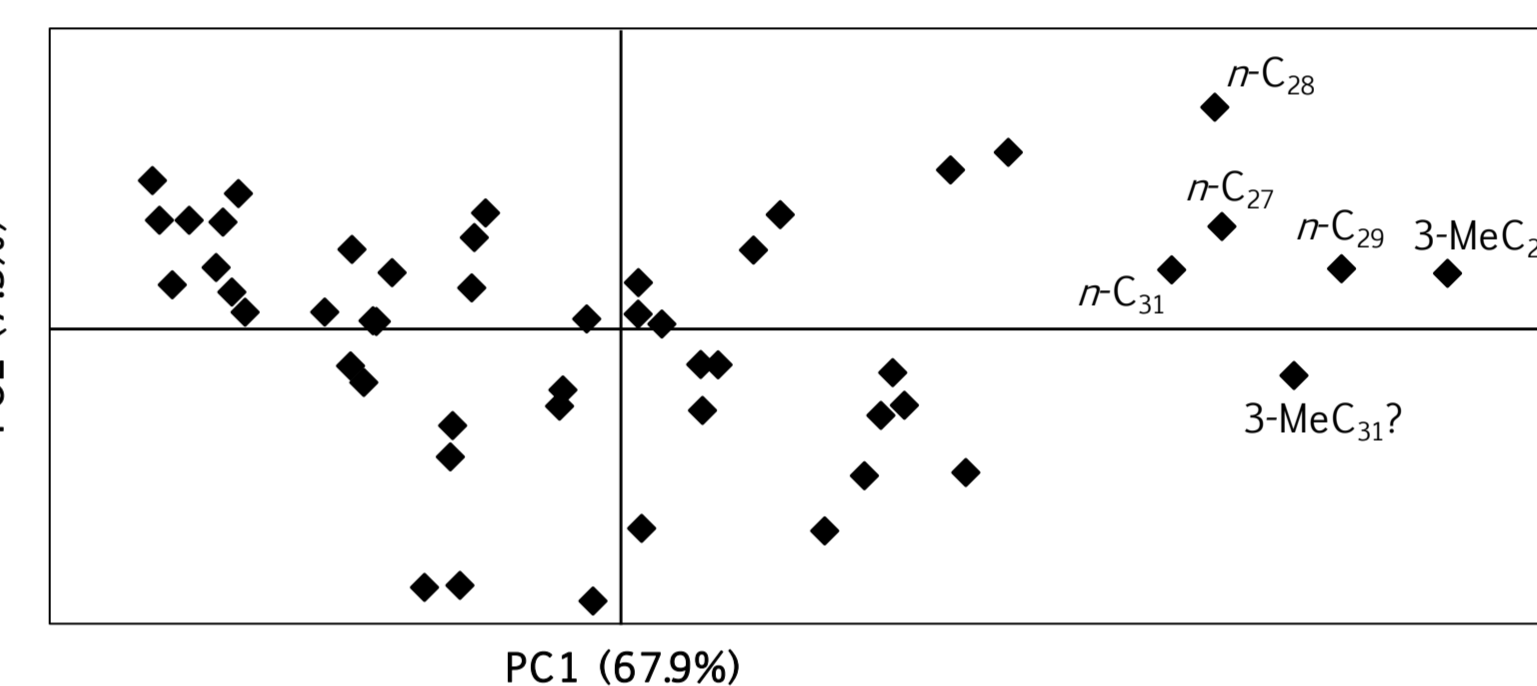
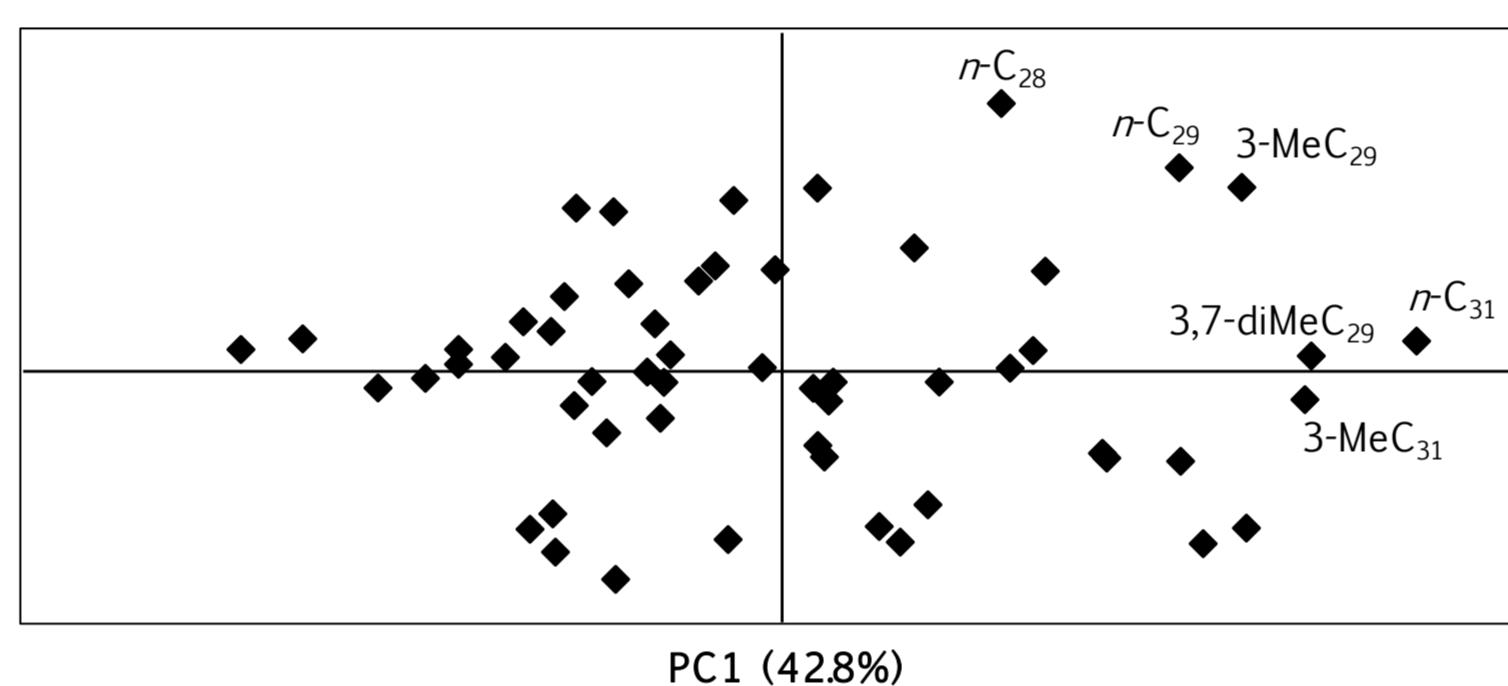
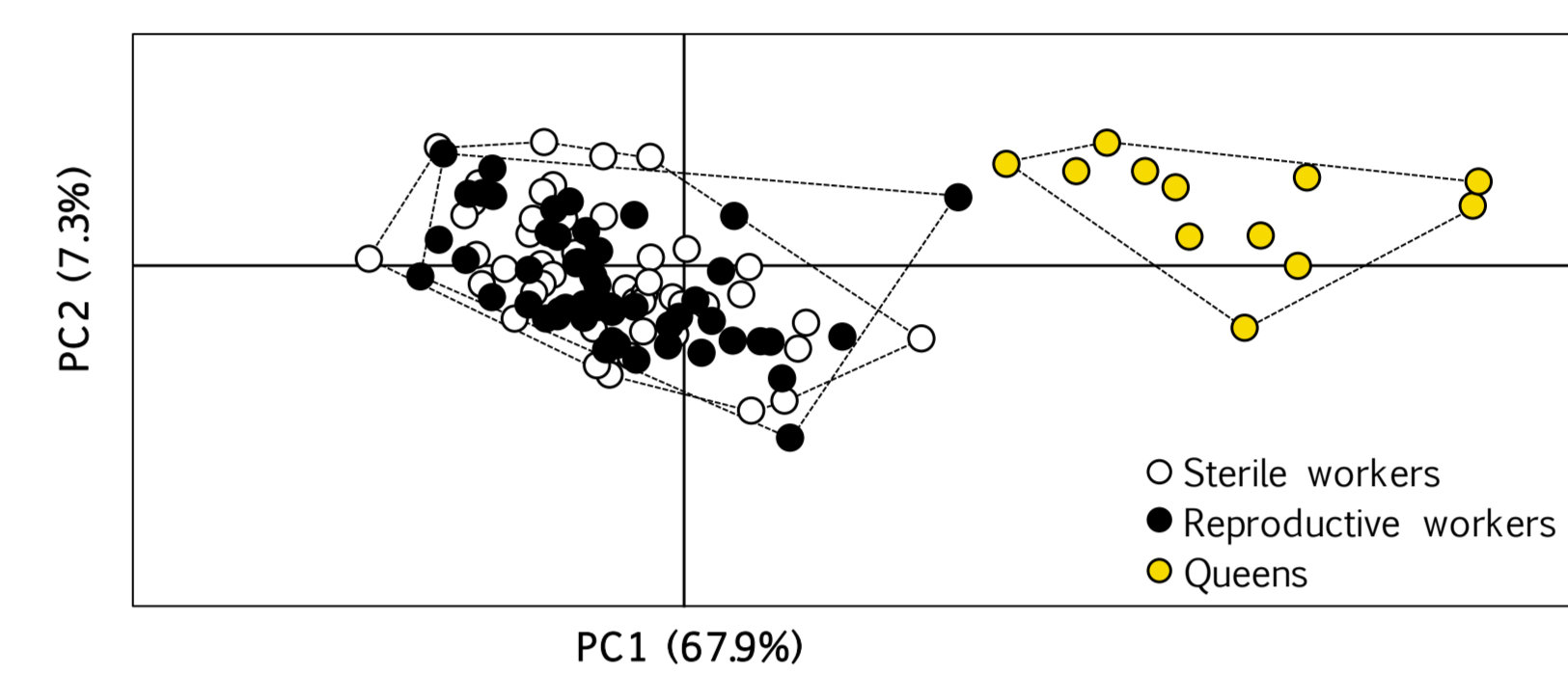
^b Predicted evolutionarily stable percentage of reproductive workers in queenright and queenless colonies, as described in Wenseleers et al. 2004.

The degree of worker policing depends on the species-average colony kin structure. Workers thus police according to their own fitness interests, not the queen’s.

Dolichovespula saxonica

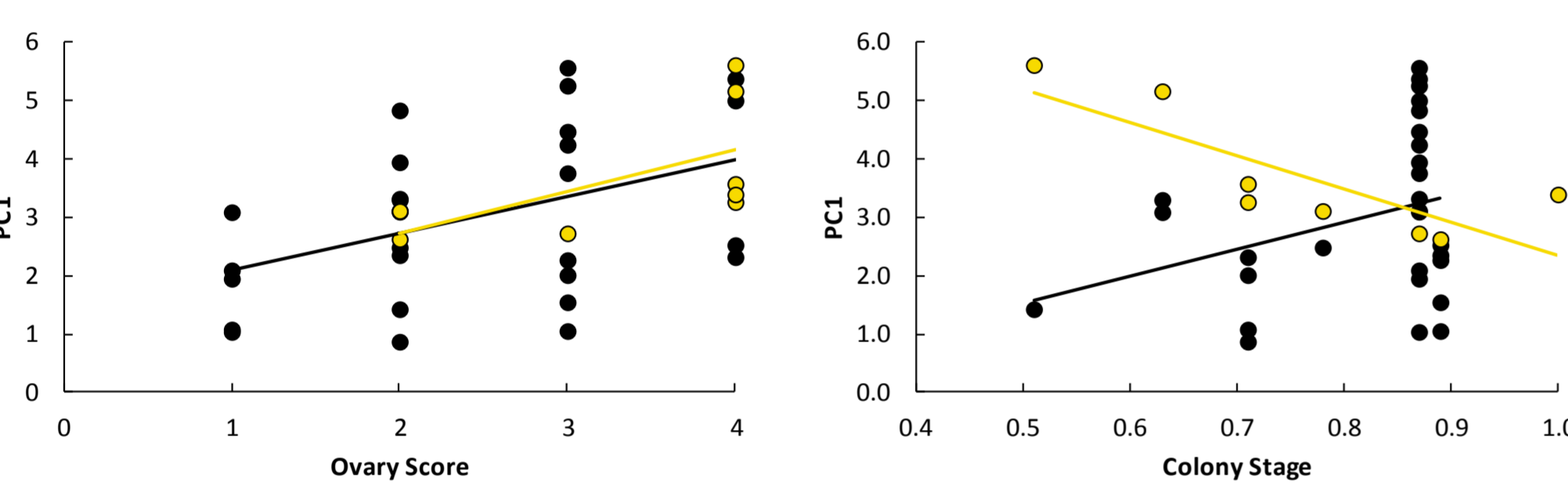


Vespula vulgaris

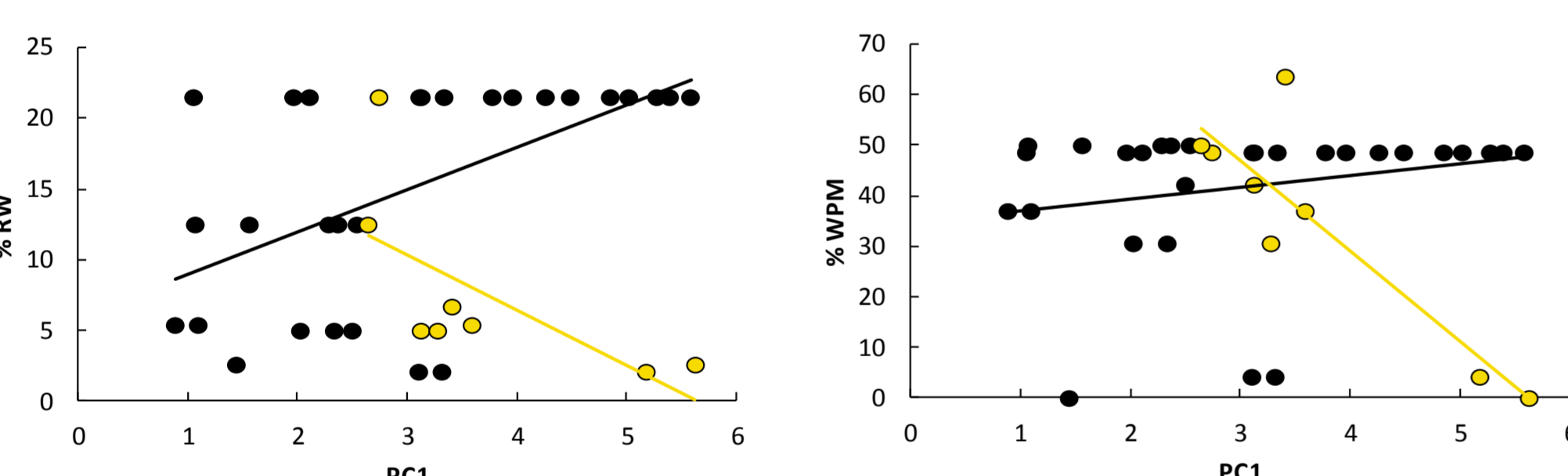


Queen CHC profiles are separated from those of sterile workers in two species of Vespine wasps, and are typically characterised by linear and 3-methyl alkanes.

Dolichovespula saxonica



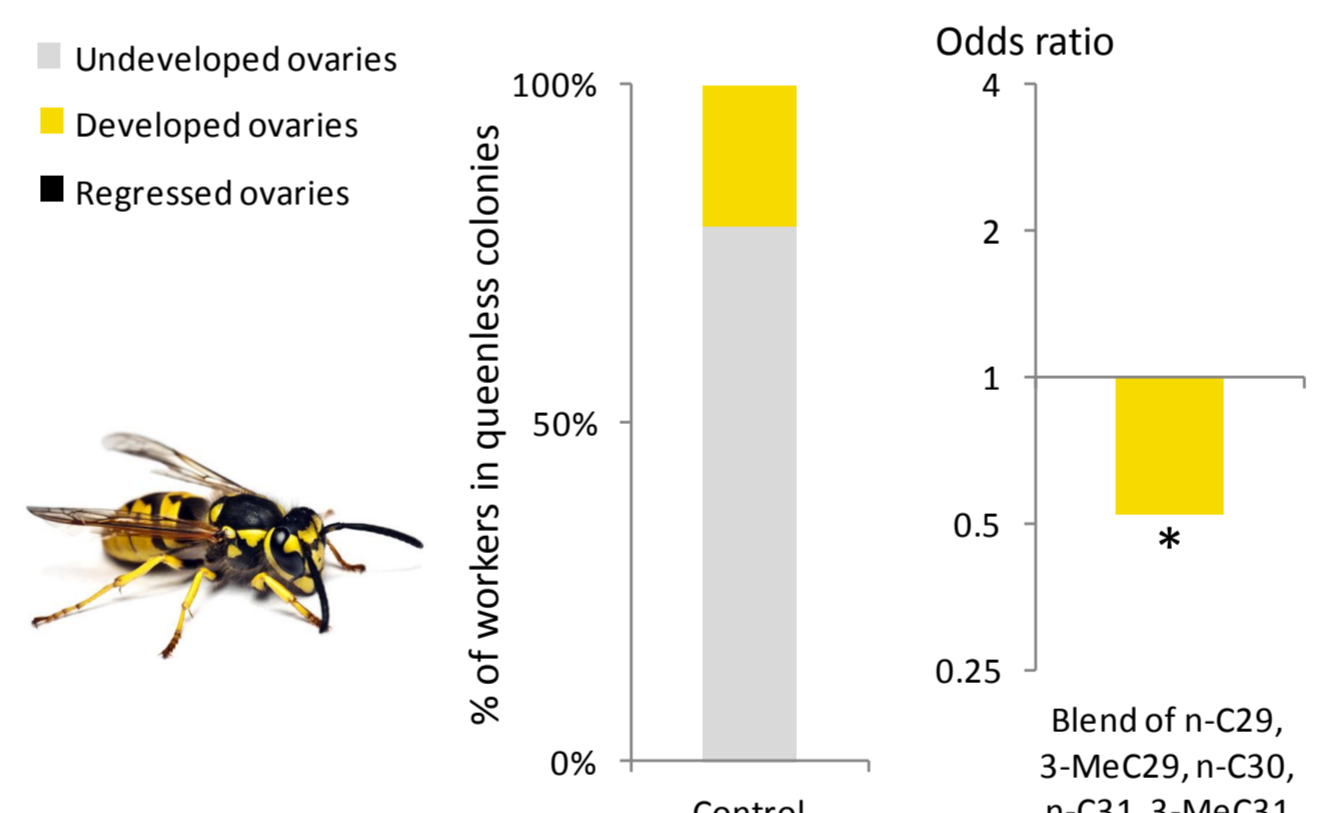
Variable	Estimate	t	p
(Intercept)	0.50	0.88	0.384
Ovary Score	0.89	5.81	<0.001 ***



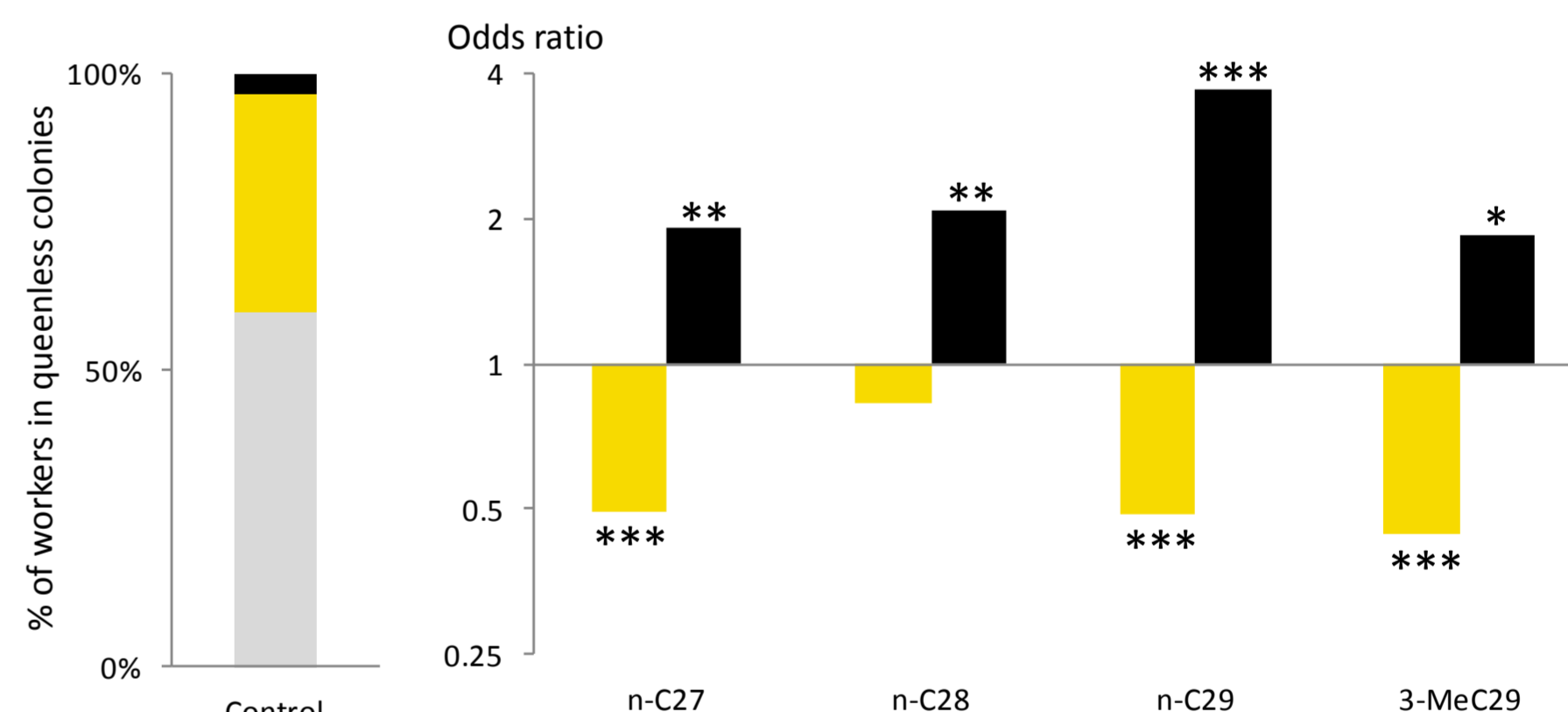
Variable	Estimate	t	p
(Intercept) Q	21.96	2.63	0.013 *
PC1	-3.88	-1.78	0.084
Caste RW	-16.06	-1.82	0.078
PC1 * Caste RW	6.89	2.95	0.006 **

Queen CHC profile (PC1) corresponds well with ovary development, colony stage, % reproductive workers, and % worker-produced males.

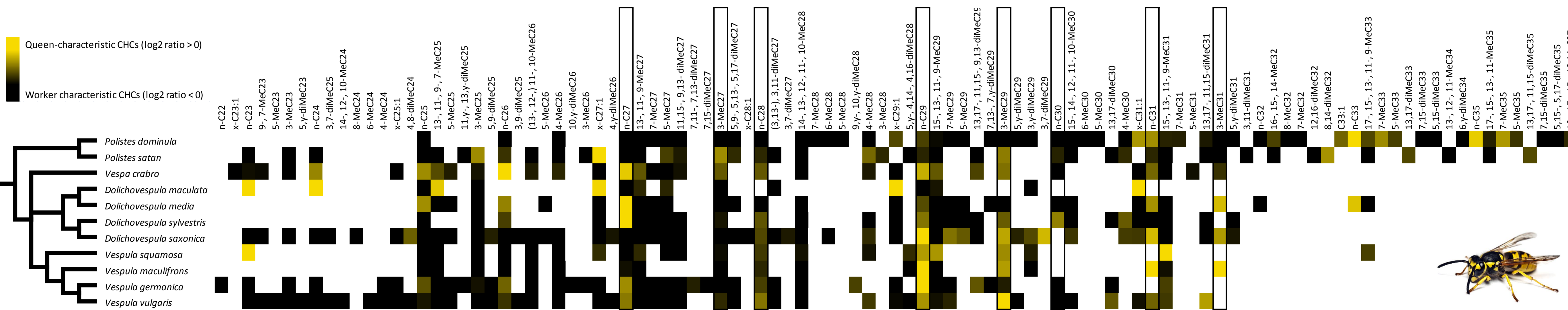
Dolichovespula saxonica



Vespula vulgaris



Treatment with synthetic queen-characteristic CHCs reduces worker ovary development, so these compounds indeed function as queen pheromones.



Queen-characteristic CHCs are by and large conserved between social Vespidae species, consistent with slow rates of evolution and thus arguing against queen-worker arms races over reproduction.

These data are consistent with the hypothesis that queens of social Vespidae reliably signal their fertility and workers respond according to their own fitness interests. The data argue against queen control over reproduction and queen-worker arms races.