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Notes and comments

DOES QUEEN PHEROMONE INCREASE SWARM CAPTURE IN HIVES BAITED WITH NASONOV PHEROMONE?[1]

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The efficient baiting of swarms to artificial cavities has become a crucial component of monitoring and control programmes for Africanized honey bees (*Apis mellifera* L.). Many studies (see references in Witherell, 1985; Schmidt & Thoenes, 1992) have clearly demonstrated the benefit of baiting cavities with different combinations of three synthetic Nasonov pheromone components (citral, geraniol, and nerolic/geranic acid). However, the addition of queen pheromone components to bait hives has not had the dramatic effect of Nasonov components. In field tests with paired bait hives in England (Free *et al.*, 1981) and Kenya (Kigatiira *et al.*, 1986), more captures were obtained with the addition of 9-keto-2(*E*)-decenoic acid (9ODA) to Nasonov lures, but due to low overall capture rates they were not significantly higher than captures in bait hives with only Nasonov components. More recently, a five-component queen pheromone blend was tested in combination with citral and geraniol (no nerolic acid), producing more captures than bait hives with only citral and geraniol in one study (Winston *et al.*, 1993), and fewer captures in a second study (Denby & Scott-Dupree, 1992). Interestingly, the higher captures in the first study were statistically significant only when Nasonov baited hives with queen pheromone were placed within 50 m from ones with

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TABLE 1. Number of swarms captured in bait hives with two pheromone treatments in southern Louisiana. Numbers in parentheses indicate available bait hives with each kind of lure at each site.

Pheromone blend	New Orleans	Baton Rouge	Lake Charles	New Iberia	Total
citral/geraniol/ nerolic/geranic acid + queen pheromone	21 (26)	15 (24)	18 (20)	8 (8)	62 (78)
citral/geraniol/ nerolic/geranic acid + blank	23 (26)	17 (24)	15 (20)	7 (8)	62 (78)
Total	**44**	**32**	**33**	**15**	**124**

only citral and geraniol, but were not significant when distances between bait hives were over 1 km.

We report on a field test with high capture rates in which bait hives with the three components of Nasonov pheromone (citral, geraniol, nerolic/geranic acid) were compared against bait hives at least 1 km apart with the three Nasonov components plus the five-component queen pheromone blend. The two pheromone treatments were distributed among 156 wood-pulp bait hives (31 litre, round design, Western Pulp Products, Corvallis, Oregon) placed individually along deep-water docking facilities in four areas of southern Louisiana. Both pheromone treatments had a capped thin-walled 400 µl polyethylene Eppendorf microcentrifuge tube with 30 µl of citral (*E*- and *Z*- isomers) and 30 µl of geraniol, and a second tube with 30 µl of nerolic/geranic acid. In an alternating sequence in each area, half of the bait hives received a third open 2.5 ml polypropylene tube with a cotton wick and synthetic queen pheromone (3 times the average amount found in queens: 525 µg 9ODA, 174 µg 9HDA [69% *R*-(-), 31% S-(+)], 39 µg methyl *p*-hydroxybenzoate, and 6 µg 4-hydroxy-3-methoxy phenylethanol). The other half of the bait hives in the alternating sequence received a blank tube with methanol solvent in the cotton wick.

Pheromones were placed in the bait hives between the end of March and the beginning of April 1992 in all four areas. Swarm captures were followed through the swarming season, until the middle to end of July. In three of the four areas, bait hives were checked every 2 weeks for occupation by swarms; in the other area (Baton Rouge, Louisiana, USA) they were checked on a monthly cycle. Captured swarms were killed with ether and a cleaned bait hive with the same pheromone treatment was returned to the same location.

The results of this test clearly demonstrated that adding queen pheromone to bait hives with the three Nasonov components did not increase their attractiveness relative to bait hives that had the three Nasonov components only (table 1). The total number of captures with each pheromone were exactly the same (62 swarms), and the number of captures in each of the four areas were very similar for the two treatments (χ^2= 0.555, d.f. = 3, *P*= 0.91).

The large sample size, the independence of each bait hive location in attracting swarms without the influence of a neighbouring bait, and the use of the most active components in Nasonov and queen pheromone unequivocally resolve the relative importance of these two sources of pheromone in long-distance swarm attraction. Addition of queen pheromone might be useful for short-range attraction of swarms (Schmidt *et al.*, unpublished observations) by influencing the actual landing of swarms in response to queen pheromone. However, synthetic Nasonov components (citral, geraniol and nerolic/geranic acid) seem to be the most effective attractants for swarms known to date. The presence of these components inside a bait hive increases the chances of discovery by scouts and the eventual occupation of this artificial cavity in 'preference' over other natural and artificial cavities.

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