

Notes and comments

FURTHER INVESTIGATIONS ON NATURAL MATING OF INSTRUMENTALLY INSEMINATED *APIS* *MELLIFERA* QUEENS

J WOYKE; Z JASIŃSKI; C FLISZKIEWICZ

Agricultural University — SGGW, Bee Division,
166 Nowoursynowska, 02–766 Warsaw, Poland

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Woyke (1963) showed that some instrumentally inseminated queens mate naturally before they start egg-laying. Woyke and Jasiński (1992) worked on a method to prevent natural mating of instrumentally inseminated queens without using queen excluders. Mutant, cordovan (*cd*) body coloured queens in groups of 12–16 were used. However, *cd* may affect worker bee interactions (Frumhoff, 1991). The 1992 work may be flawed because of the use of *cd* and because of the use of small sample sizes. Therefore, this study uses wild type (black and yellow) queens and drones, and larger groups.

Eighty-eight black queens were reared. They were introduced into hives which held them behind queen excluders. The virgins were inseminated with semen from yellow Italian drones. Virgins were divided into four groups:

- Group 1; 23 queens inseminated with 8 mm³ of semen.
- Group 2; 22 queens first treated with CO₂ and after 2 days inseminated with 8 mm³ of semen.
- Group 3; 22 queens first inseminated with 4 mm³ of semen and after 2 days inseminated again with 4 mm³ of semen.
- Group 4; 21 queens first treated with CO₂ and after 2 days inseminated with 8 mm³ of semen, and after 2 additional days, again treated with CO₂.

The CO₂ treatment lasted 3 min. The first treatment was applied to all virgins when they were 6 days old. The mating hives were put into an apiary having only black drones. Queen excluders were removed from

the hive entrances after the last treatment. If the queens mated naturally with black drones, they would produce black workers as well as yellow ones. Sealed combs with emerging workers from the hives were put into an incubator. The numbers of black and yellow workers from each hive were determined. On average 845 workers were examined from each queen.

Of queens inseminated with 8 mm³ of semen, 60.9% also mated naturally. Only 9.1% of those treated with CO₂ before insemination mated naturally. Thus, an additional CO₂ treatment significantly decreased the percentage of instrumentally inseminated queens which also mated naturally. Insemination with 4 mm³ of semen on two separate days eliminated natural mating. Queens inseminated once with 8 mm³ of semen and treated additionally with CO₂ twice (group 4) also did not mate naturally.

A binomial 95% confidence interval for non-mating of 21 or 22 queens from the two non-mating groups is from 0.0 to about 16.0%. Thus, although we did not observe extra matings with these treatments, we cannot use experiments with our sample sizes to infer that they never occur.

The average ratio of black worker progeny was 18.4 ± s.d. 10.6% ($n = 14$) for queens which mated naturally in group 1, and 50.4 ± s.d. 15.6% ($n = 2$) in group 2. The 14 queens each inseminated with 8 mm³ of semen, which also mated naturally, produced from 4% to 50% black workers. Figure 1 suggests that the relationship between proportion of progeny from open matings and the numbers of queens in various classes of proportions is asymmetric. The average of 18% of progeny resulting from natural mating, as well as the distribution of the percentages, suggests that the majority of instrumentally inseminated queens which mated naturally did so from one to two drones.

However, one queen may have mated with about eight drones.

The proportion of progeny from natural mating from all queens in a group naturally mated or not was 11.2% for queens inseminated with 8 mm³ of semen and 4.6% for those treated with CO₂ before insemination with 8 mm³ of semen.

These results are similar to those of Woyke and Jasiński (1992) and overcome the concerns about their experiments. Thus, insemination on two separate days with the same total amount of semen or two additional treatments with CO₂ prevents, in at least most cases, additional natural mating by instrumentally inseminated queens.

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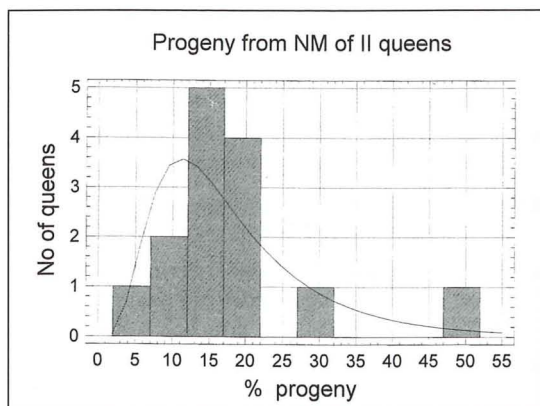


FIG. 1. Percentage of progeny from natural mating (NM) of 14 queens instrumentally inseminated (II) with 8 mm³ of semen. The midpoint of the range is 27%. The curve represents lognormal distribution.