Populations of *Varroa jacobsoni* in a Florida Apiary[1]

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On February 9 and 10, 1988, we surveyed the mite populations in a large apiary that was said to be highly infested with Varroa. The apiary, located about 40 miles southeast of Orlando, had never been treated with miticides. Our immediate goals were (1) to find a suitable technique for measuring the degree of mite infestation in a colony, and (2) to get a rough measure of the natural variability that exists in Varroa infestation rates among colonies in an apiary. Both are important in reaching our long-range goal of breeding for resistance to Varroa.

Measuring Varroa Infestation

THE METHOD of measuring resistance to *Varroa* is very important, for one cannot breed for characteristics that cannot be measured, and more accurate measures of a heritable characteristic make selective breeding easier. Measuring the populations of mites is one possible way to measure progress in breeding for resistance to mites. Since mites occur on adult bees and in capped brood, it is logical to sample brood or adults. Other options are certainly available, such as measuring mite reproduction rates in brood cells, but we decided to begin with the simplest technique, sampling adults.

We collected about ½ pint of worker bees (about 650) from the brood area of a colony into a pint jar. Ether (in a pressurized can from an auto parts store) was sprayed into the jar for 1 second or less. The lid was replaced, and the bees were rolled in the jar to see if mites collected on the inner surface made sticky from the bees' regurgitated honey. (This use of ether to detect mites apparently originated in Turkey, but is now widely used in the USA. Ether is very explosive, so never use is in a casual way.) The sample was then barely covered with 95% alcohol to keep the shipping weight minimal. Upon arrival in Baton Rouge, the jars were filled with 70% alcohol (ethanol).

Separating Mites from Bees

We separated mites from bees by using a tray and screen (Fig. 1). A sample was poured into the screen so that the bees remained in the basket, but the mites could fall to the bottom of the tray. The bees were shaken in the basket to free mites that were entangled with the bees (mites sank in alcohol but tended to float in water). The basket was then removed, and the mites in the tray were counted. After removing the mites from the tray (Fig. 1), the process was repeated until no mites were found.

Over 95% of the mites were recovered in the first separation; 82% of the samples had no mites recovered in the third separation. To check accuracy, 500 bees were microscopically examined for mites (20 bees from 25 samples). No mites were found. By finding no mites per 500 bees, we can be 99% confident that the separation technique left fewer than 1 mite per hundred bees (Table of binomial confidence limits in Steele and Torrie, 1980, *Principles and Procedures of Statistics*).

The Mite Populations

Fig. 2 shows the number of mites found per 100 adult worker bees in the 95 colonies. The colony average was 25.4 mites per 100; the median was 19 per 100. The lowest infestation rate was 7 mites per 100 workers; the highest was 136 per 100. According to Posern (*ABJ* 128:427), European beekeepers would tolerate mite infestations that were lower than 20 mites per 100 adult bees in April, but higher infestation rates required their attention. February in south Florida is comparable to April in central Europe, so about half of the colonies in this apiary would be above that minimum threshold.

The test apiary consisted of 8 small clusters of colonies. Each cluster was

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on a raised platform that held 9-16 colonies within a 3 meter radius. The clusters were spaced along a line that extended 550 meters from the first to last cluster. Populations of *Varroa* were not significantly different in any of the clusters (Table 1).

Smaller colonies tended to have more mites per bee than larger colonies. There was a significant statistical correlation between colony population (number of frames covered by bees) and mites per bee (P = 0.0004). We simply note the correlation; we do not know if there is a cause and effect relationship here.

Apiaries in the Surrounding Area

The ether roll test was used to detect *Varroa* in surrounding apiaries. With this field test, we easily detected mites in all 95 colonies of the test apiary where the lowest infestation rate was 7%. We estimate that the ether roll test would detect *Varroa* in more than half of the colonies that had a 1% infestation rate.

Two apiaries located within 2 miles of the study site were infested with *Varroa*. However, no mites were detected in five apiaries located 5-20 miles away (10% of the colonies sampled).

Conclusion

As a way to evaluate colonies for mite infestation, sampling adult bees has many advantages. It is simple, it requires just one trip to the colony, the

Table 1. Distribution of mites within the large apiary. The colonies were arranged along a road to make 8 small clusters. Each cluster was on a raised platform that held the colonies within a 3 meter radius. None of the clusters had significantly more or fewer mites than the others (ANOVA, F = 1.28 P = 0.27).

Cluster No.	Distance to next cluster	Number of colonies	Mites per 100 bees mean	Mites per 100 bees range
1	24 meters	12	23.6	11-63
2	18 meters	14	22.8	10-57
3	34 meters	13	24.7	11-102
4	214 meters	9	26.5	14-40
5	90 meters	10	17.8	7-35
6	104 meters	16	35.2	10-136
7	66 meters	11	16.5	8-39
8	- - - -	10	32.9	15-115

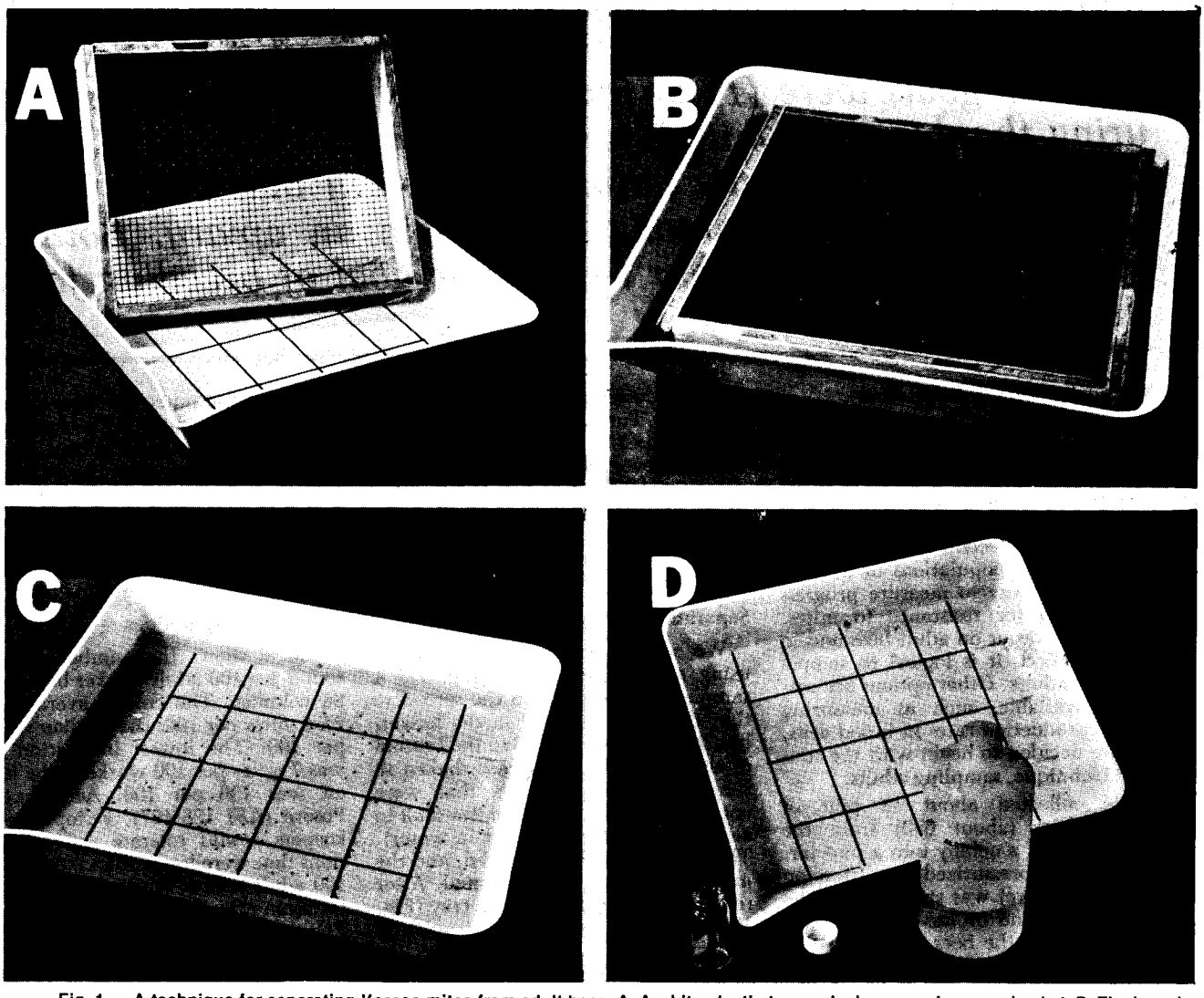

Fig. 1 — A technique for separating *Varroa* mites from adult bees. A. A white plastic tray and a large-mesh screen basket. B. The bees in the basket are stirred, plunged in and out, and shaken in alcohol (70% ethanol) to cause the mites to fall into the tray. C. Lines drawn on the bottom of the tray simplify the counting of mites. Mites sink in alcohol, so the alcohol is poured off and saved. Mites are either discarded or saved (as shown in D) and the alcohol is reused to collect mites in a second washing. (Technique developed by Robert Daniel, Biological Technician, ARS, Baton Rouge).

mites can be effectively separated from the bees, it doesn't destroy the mite population in the colony (not an advantage for beekeepers), and the results are in mites per bee rather than mites per colony. As Ellis *et al.* (*ABJ* 128: 262-263) point out, adult sampling may not detect extremely low levels of *Varroa*).

None of the colonies in the major test area was mite free. Therefore, none of these colonies had a natural, high level of resistance to *Varroa*. If one or more colonies had been free of mites, it would not necessarily mean that they possessed genetic resistance, nor does our observed variability in mite populations necessarily indicate that the colonies vary in their level of resistance to *Varroa*. Such differences may have an environmental cause, or they may occur by chance. Measuring mite populations is only the first step. The second step is to make planned matings and test the progeny to learn if some of the observed differences in mite populations can be attributed to the genetics of the bee. •

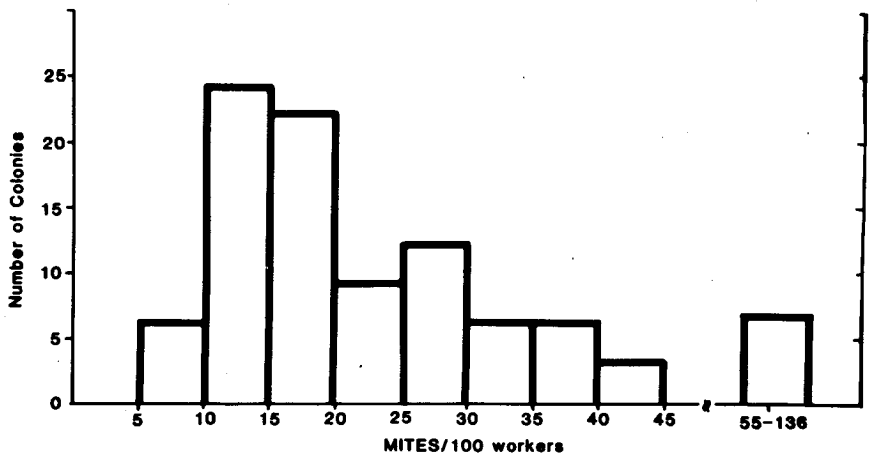

Fig. 2 — Populations of *Varroa* mites in 95 colonies of honey bees in a single apiary in SE Florida on February 10, 1988. Populations were measured by counting the number of *Varroa* mites in a sample of worker bees collected from the brood combs of each colony.