VAROA MITE REPRODUCTIONS GUIDELINE

Courtesy of Jeff Harris & Robert Danka USDA Honey Bee Breeding, Genetics and Physiology Lab
1157 Ben Hur Road, Baton Rouge, LA 70820

ABSTRACT

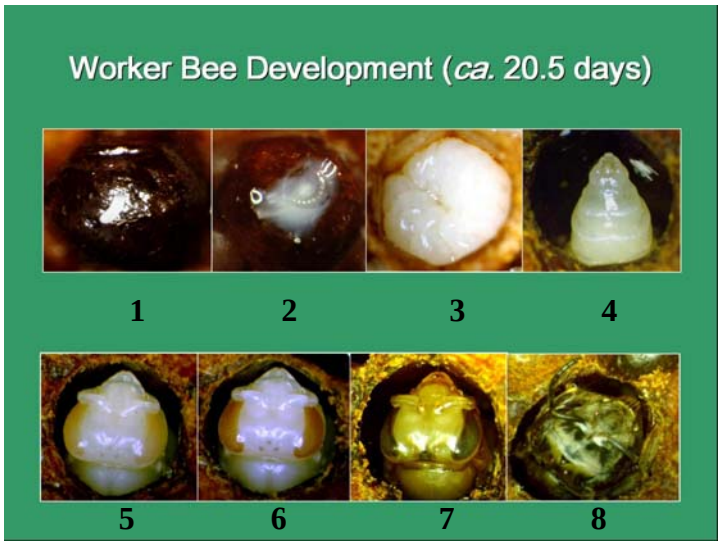
The foundress mite is reproductive if she produces 1 adult daughter and 1 adult son before the bee emerges. A mite is infertile if she produces no offspring. Adult male tan color, body is longer than wide; lower left of Picture #14. Adult female tan or light brown, body is wider than long; lower right of Picture #14. At 18 days old(black eyes), a bee pupae should have one adult daughter varroa mite if things are on schedule. You can tell the daughter is an adult if you can find her shed skin, which is triangular and mostly transparent (but with one white point, more or less).

GLOSSARY OF TERMS

Layman Description

Larval Instar	like caterpillars, bee larvae molt into successive larval stages as they grow. Bee larvae experience five of these larva-to-larva molts, and each new larval stage is called an instar. There are visual changes in shape and size of larvae as they grow that help characterize each instar.
Pupa – Pupation	stage of bee development after the last larval instar; pupae look more like adult bees and less like a grub; happens after cells are capped.
Protonymph	First stage of mite. Pearly – white small.
Deutonymph	Second stage before becoming adult. Deutonymphs that are feeding are mobile and vary in size; those that are preparing to molt into adults become immobile and have a size similar to the adult mite (male or female)
Male Adult	Smaller than female (body is slightly longer than it is wide; see last page)
Female Adult	Body of immobile female deutonymphs and adult females is wider than it is long (see last page)
Foundress Mite	The old female (or mother mite) which entered cell to reproduce.
Entrapped Mites	Mite trapped by cocoon that was spun by the last instar larva as it prepared to pupate, see Picture #19.

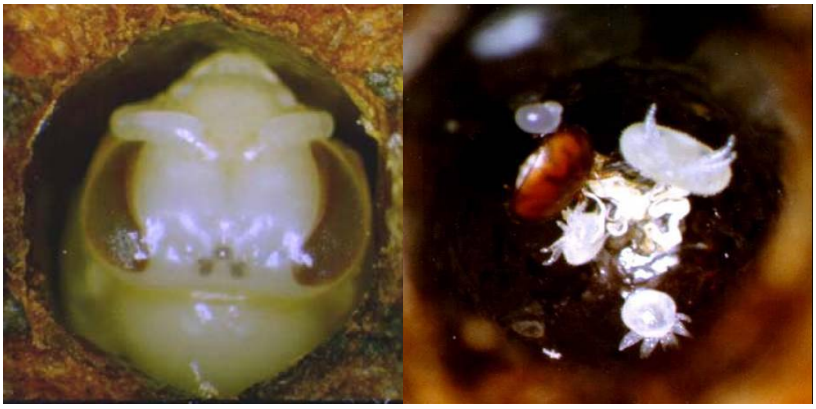
The life cycle of the honey bee worker begins when the queen lays an egg into a worker cell. The egg (Picture #1) hatches after 72 hours, and each of the first four larval instars occurs at a 24-hour interval (e.g. Picture #2). The fifth larval instar (Picture #3) is capped while it is still feeding, and the cell cap is put on by the adult bees at 8-8.5 days after the egg has been laid. Pupation does not occur until about 3 days postcapping. The last larval instar feeds during the first day postcapping, but it becomes immobile (a stage we call the prepupae, Picture #4) as it prepares to pupate. Varroa mites invade cells with last instar larvae (Picture #3) before the cell is capped.



Mites hide in the larval food, but begin taking blood meals as soon as they are liberated by the feeding bee larva. They often lay the first egg when the bee is in the prepupal stage (Picture #4). Each foundress lays an egg every 30 hours after that until 4-5 offspring are produced in worker cells. The first egg is usually the son, and all subsequent eggs become daughters.

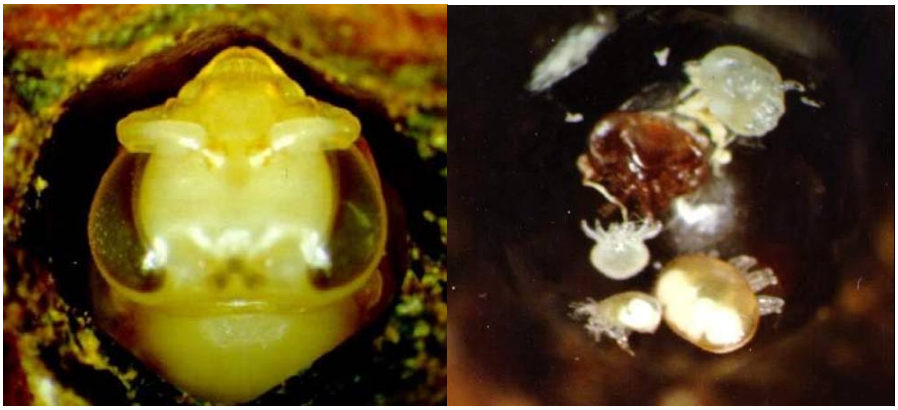
Each mite offspring goes through 4 discrete stages of development. Eggs hatch into protonymphs; protonymphs molt into deutonymphs; and deutonymphs molt into adult mites. Only the skins from the deutonymph-to-adult molts are visible.

So, to be successful at reproduction, the varroa mite must produce mated daughters before the worker bee emerges from her brood cell. In our experience, 4-5 offspring are usually produced by the time the bee host reaches the purple-eyed pupal stage (Picture #11). However, it can be difficult to identify the sex of the offspring at this stage. In this mite family (Picture #12), there is an egg, a large female deutonymph, a female protonymph, and a male deutonymph (the latter two stages are hard to discern).



11 **12**

We have found it easier to decide reproductive status for mites when the bee host is older (Picture #13). In this situation, the male mite is usually an adult and often the oldest daughter is also an adult (both at bottom of cell in Picture #14). ***The foundress mite is reproductive if she produces 1 adult daughter and 1 adult son before the bee emerges.*** A mite is ***infertile if she produces no offspring***.

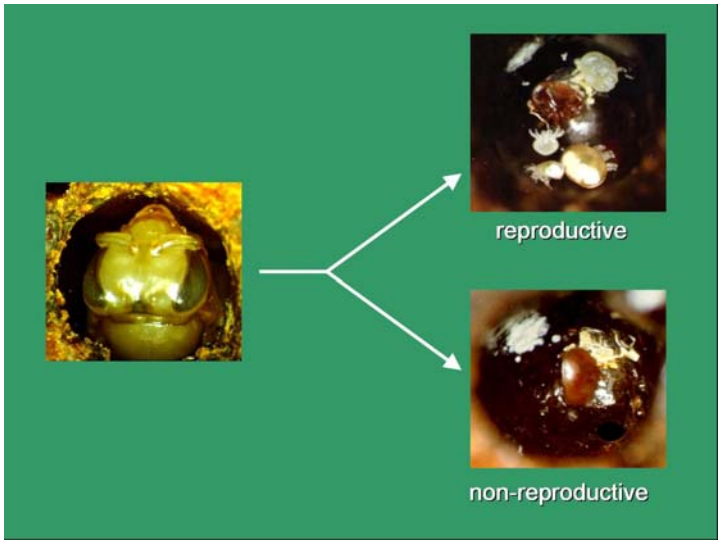


13 **14**

Some mites will only produce a male, and some produce daughters but not in time for any of them to reach adulthood before the host bee emerges from the cell. These latter two types are said to be fertile mites that did not successfully reproduce. We have found that in our SMR/VSH bees, the percentage of infertile mites increase to a very high level (e.g. 100%).

To estimate the degree of VSH/SMR in a colony, we install the queen and wait 6-8 weeks and measure the degree of mite reproduction. To do this, we obtain combs that have tan pupae and sample 50 capped cells per side for two of these combs. We decide the reproductive status for each foundress mite (see below), and we ignore cells that have more than 1 foundress because it

can be difficult to decide the reproductive status for each mother in multiply infested cells. We try to find a total of 30 mite families from singly infested cells and sometimes it takes many more cells than 200 to find them (thousands). We report the percentage of infertile mites as our indicator that mite reproduction has been changed. Just some guidelines: non-resistant colonies can have 0-40% infertile mites (average 15%); hybrid VSH/SMR colonies can have 50-100% infertile mites (average 60%), and pure VSH/SMR colonies can have 75-100% infertile mites (average > 90%).



15

16

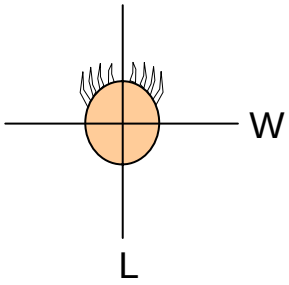
Here are a few other things that we often see with VSH/SMR bees or infertile mites. Many infertile mites are unmated (no stored sperm). Many defecate on the host. Many die when the last instar larva spins a cocoon over them. We call this entrapped by the cocoon. We believe that this condition results when unfit mites are too weak to wake up after the last instar larva has eaten the food. If they do not wake up, or if they are too weak to move fast, the larva spins her cocoon over the top of the mite.

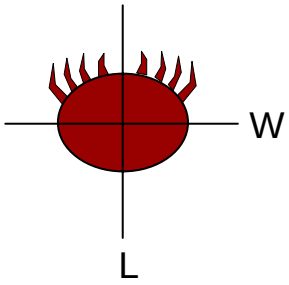
17 **18** **19**

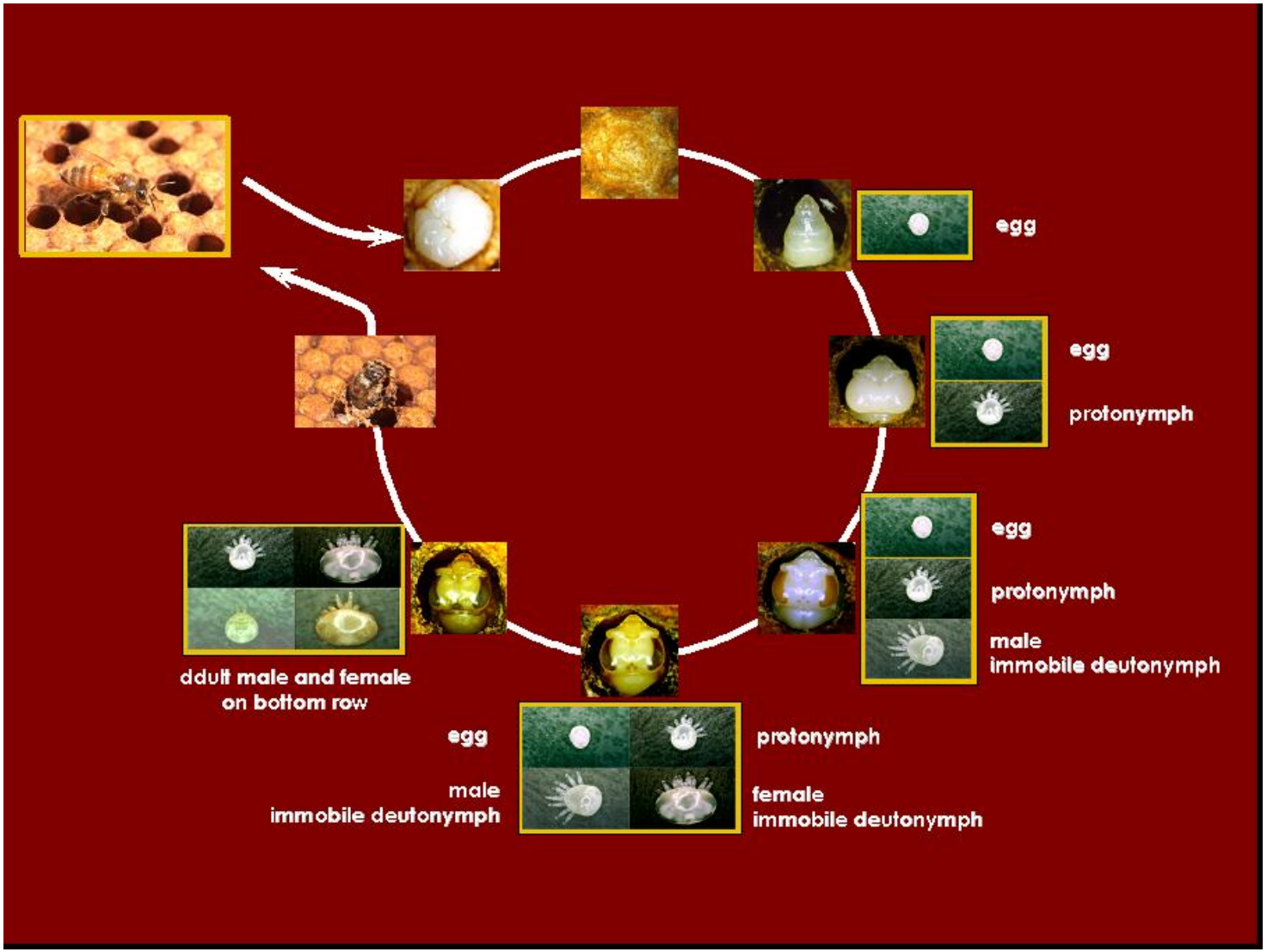
VAROA MITE REPRODUCTIONS GUIDELINE

Courtesy of Jeff Harris & Robert Danka USDA Honey Bee Breeding, Genetics and Physiology Lab
1157 Ben Hur Road, Baton Rouge, LA 70820

Bee Age days	Pupal characteristics	Expected mite offspring	Layman's description of mite offspring; Example
18 Days	Black head, gray wing pads, black eyes	Adult male Adult female 2 deutonymph females	tan color, body is longer than wide; lower left of Picture #14 tan or light brown, body is wider than long; lower right of Picture #14 usually white and immobile, body is wider than long; upper right of Picture #12 and Picture #15
17 Days	Tanned body, white wing pads	Adult male Immobile deutonymph females 2 active deutonymph females	tan color, body is longer than wide; lower left of Picture #14 the body color of deutonymphs is white, some may be immobile as they prepare to molt (upper right of Picture #13 and Picture #15), while younger deutonymphs still crawl and feed; female deutonymphs have bodies that are wider than they are long
16 Days	Purple eyes, tanned joints	Deutonymph male 2 deutonymph females Protonymph female	The mobile deutonymph male is hard to distinguish from female protonymphs. The immobile deutonymph male has a body that is slightly longer than wide, and it may be white or a light tan color (as molting begins) Protonymphs are the earliest stages after the egg hatches, protonymphs of both sexes are small and white
15 Days	Purple eyes, white body	Same as above	
14 Days	Pink eyes	Proto- or deutonymph male Proto- or deutonymph female Egg or protonymph female	


W
L


W
L


egg
egg
protonymph
egg
protonymph
male
immobile deutonymph
ddult male and female
on bottom row
egg
male
immobile deutonymph
protonymph
female
immobile deutonymph