Tropilaelaps clareae, a Serious Pest of *Apis mellifera* in the Tropics, But Not Dangerous for Apiculture in Temperate Zones

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TWO PAPERS have recently appeared in the *American Bee Journal* concerning the parasitic brood mite *Tropilaelaps clareae*. That of Burgett and Akratanakul (1985) reviewed the current knowledge of the mite and the paper by Rajesh et al. (1984) recommended a fumigation program with formic acid to control mite populations within infested colonies. The major question concerning *T. clareae* is its potential for escape from tropical Asia and whether it could become established on *A. mellifera* in temperate climates around the world.

Evidence suggests that *T. clareae* might be capable of surviving in temperate beekeeping regions of the world (Burgett et al. 1983; Burgett and Krantz 1984; Burgett and Akratanakul 1985). The potential for serious damage to world beekeeping could be far greater than that caused by the honey bee tracheal mite, *Acarapis woodi*, or the brood mite *Varroa jacobsoni* .

As an FAO (Food and Agricultural Organization of the United Nations) apicultural consultant, I investigated *T. clareae* for ten months in 1983-84 in Afghanistan and for two months in Vietnam in 1985. As a result of these observations, I am able to answer the above question regarding the potential for escape from its Asian homeland of this serious honey bee pest. The answer is based on investigating first the biology of the mite and secondly, on testing methods of mite control.

The life cycle of *T. clareae* parasitism of *A. mellifera* is believed to be similar to that of *Varroa*. *T. clareae* mites feed on the larvae and pupae and reproduce inside the sealed brood cells. Together with emerging bees, the mites emerge. The mites then frequently attach themselves to adult bees, both workers and drones, and presumably feed on the hemolymph of the bees (Bharadwaj 1968; De Jong et al. 1982; Nyein and Zmarlicki 1982; Burgett and Krantz 1984; Zmarlicki 1984; and Burgett and Akratanakul 1985).

Akratankul (1984) found that adult *T. clareae* can survive without food for only two days, as has been similarly reported for *Varroa* (Smirnov 1978). *Varroa* adults are known to be able to survive on adult bees alone in the absence of brood; in the summer for two to three months and in the winter for five to eight months (Langhe et al. 1976; Shabanov et al. 1978). The life span of adult *T. clareae* on adult bees, in the absence of brood, has not been reported.

These observations suggest that T. clareae *cannot survive on adult bees for more than two days.*

Methods similar to control of *Varroa* have been attempted to combat infestations of *T. clareae*. Six weekly treatments with the commercial fumigant *Folbex* were ineffective in controling *T. clareae*, whereas sulphur dusting of combs every month reduced the mite populations (Atwal and Goyal 1971). Continuous fumigation with formic acid for two weeks is also reported as being effective against *T. clareae* (Rajesh et al. 1984). Other recommendations include depriving bee colonies of brood by either removing all brood or by the caging of the queen for at least a full 21 day brood cycle and fumigating the colonies to kill any adult mites remaining on adult bees (Nyein and Zmarlicki 1982; Akratanakul 1984; and Zmarlicki 1984).

The destructive nature of *T. clareae* is much greater than that of *Varroa*. It is claimed that 90% of the *A. mellifera* colonies in Afghanistan have been lost due to *T. clareae* parasitism. Out of 3,000 colonies maintained by the Ministry of Agriculture only 150 survived (Woyke 1984a). The destructive nature is visible from the following observations (Woyke 1984b, 1984c). Quite strong two-story colonies in July possessed an average of eight *Dadant* combs of brood and the honey storage combs were full. The level of *T. clareae* infestation in the brood was 20%. By October both brood as well as the worker population had almost disappeared. In May 1984, colonies moved to Kabul from the tropical region of

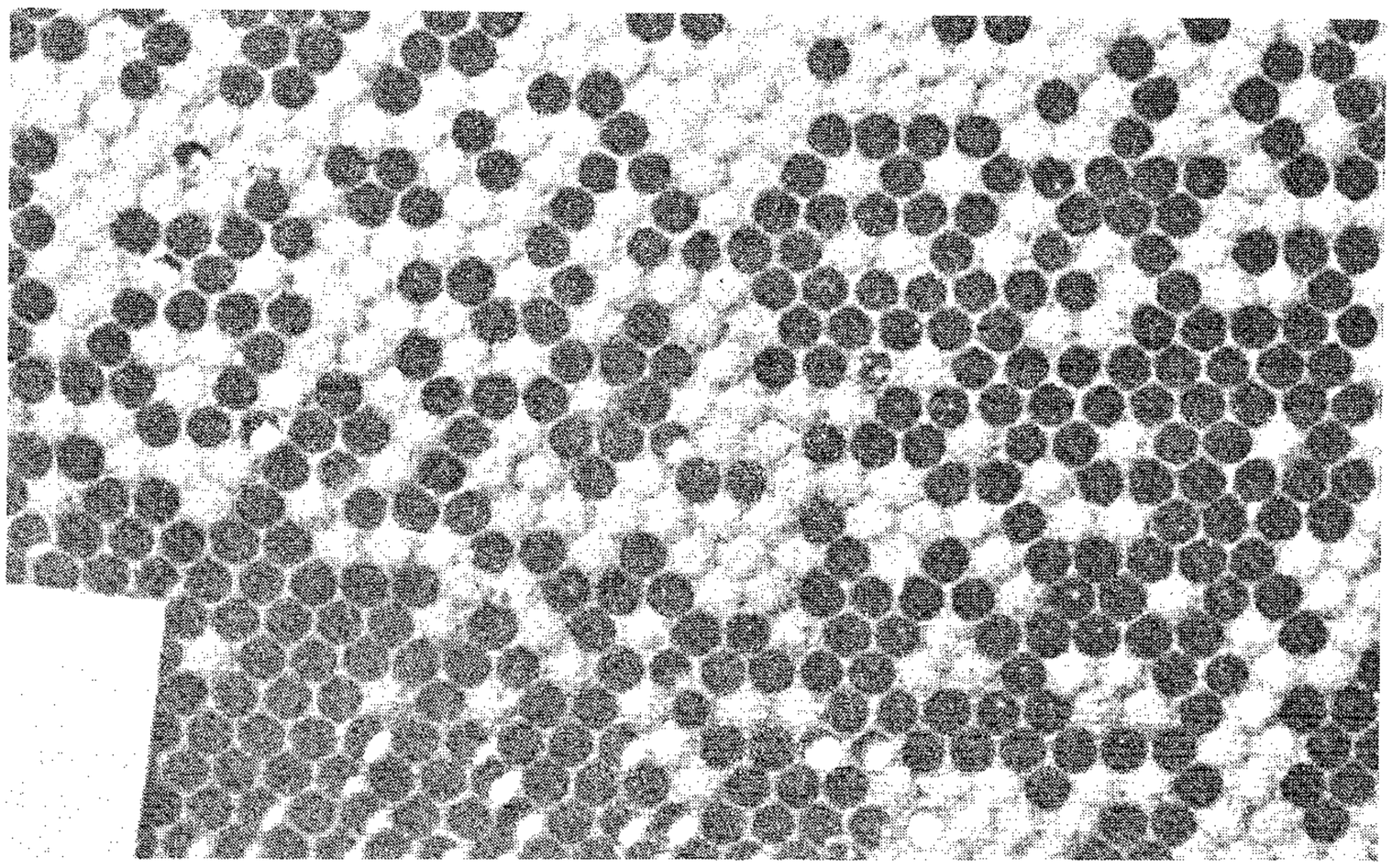

Fig. 1 Infected brood of bees left untreated in the autumn of 1983 to overwinter in Kabul.

Ningrahar district had only three combs of brood and they occupied no more than six combs and the colonies were essentially depleted of honey. Some colonies were on the verge of death. At the same time, healthy colonies had eight to ten combs of brood, occupied two-story hives and were collecting 1.5 kilograms (3.3 pounds) of honey per day. In some colonies up to 86% of the brood cells were infested with *T. clareae* and up to 14 mites were found in single brood cells.

While some apiaries in the Kabul area were heavily infested, others were completely free of *T. clareae,* despite beekeeper assurances that numerous *T. clareae* mites had been present in previous years. It was believed that *T. clareae* appears in many apiaries in the autumn from unknown sources.

Detailed inquiries showed that colonies which were wintered in warmer areas such as near Jalalahad, were infected by *T. clareae,* while those wintered in colder areas such as Kabul, were apparently mite-free. The conclusion was drawn that *T. clareae* cannot survive in colonies that undergo a long broodless period, which deprives the mites of their primary hosts in a colony, larvae and pupae. Adult bees apparently are not a sufficient alternate host for the mites for longer lengths of time.

To verify this hypothesis, bee colonies infested with *T. clareae* were left untreated in the autumn of 1983 to overwinter in Kabul (see Fig. 1). Interruption of brood rearing occurred during two months. In the spring of 1984 no *T. clareae* were found in those colonies (see Fig. 2). This evidence provides strong support for the hypothesis that the mites require brood for long-term survival. It would also explain why the mites were not found in all apiaries overwintered in Kabul despite the observations that mites had been present in previous years.

So the question arose concerning survival of *T. clareae* on different developmental stages of *A. mellifera.* From a series of mites placed on pupae in test tubes, some survived more than two weeks. When mites were put into test tubes together with worker bees, they very quickly attached themselves to the bees, but after about eight hours they apparently "lost interest" in the bees and dismounted to search for an alternate host, presumably brood. Most of these mites died within 48 hours. Some survived as long as 60 hours. These observations suggest that *T. clareae* cannot survive on adult bees for more than two days. Probably the mites are unable to ingest hemolymph from adult bees. Surely the mites are not feeding on the adults in a way which would enable them to survive for longer periods. These observations were the basis for developing methods

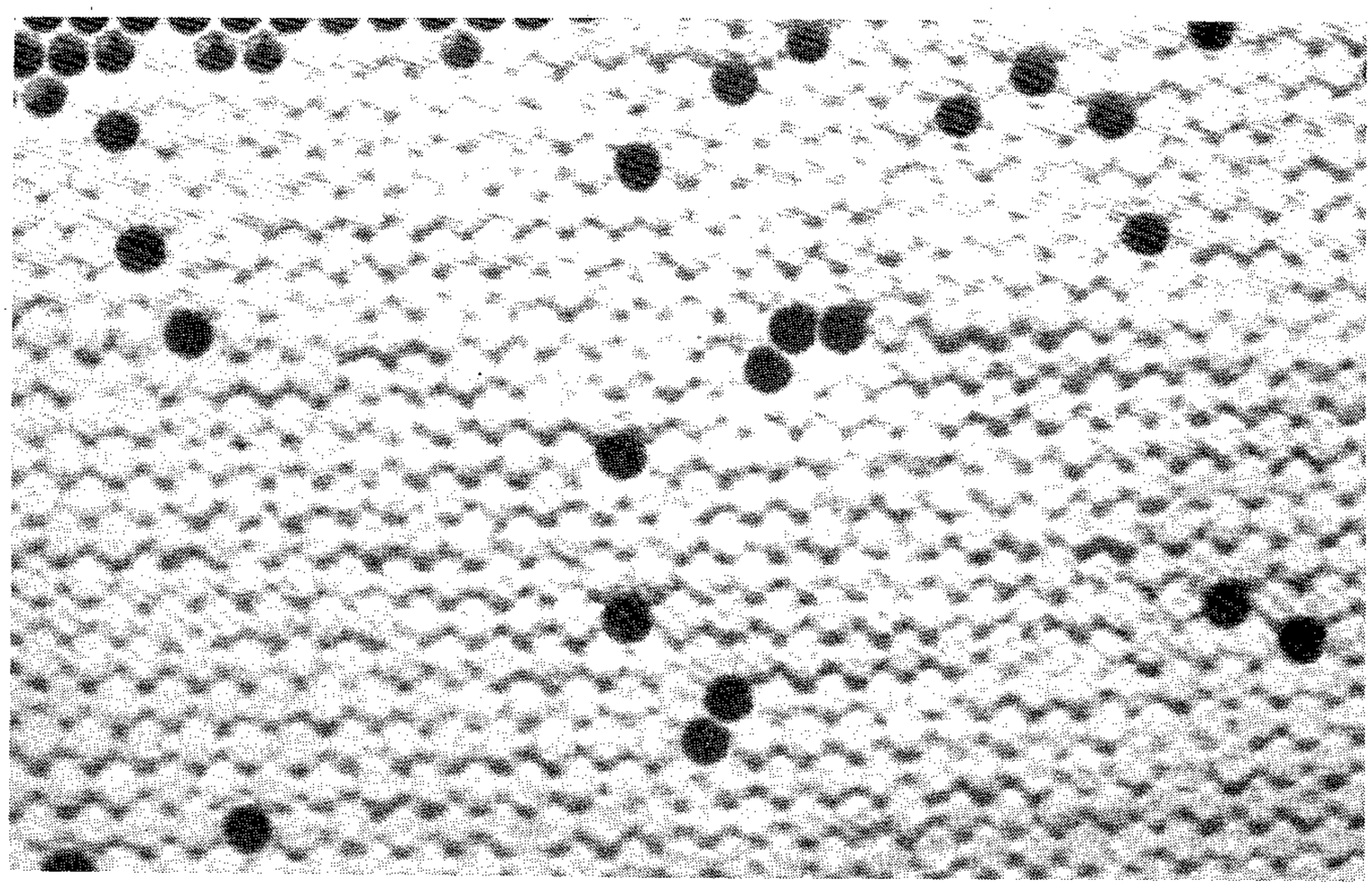

Fig. 2 In the spring of 1984, no T. Clareae **were found in the same colonies. This demonstrates that the mite cannot successfully overwinter due to the break in the brood cycle that normally occurs.**

to combat the mites without the use of any chemicals, simply by depriving the colonies of all brood (Woyke 1985).

The effect of broodless colonies on the mites was detected by determining the infestation percentage of worker bees before, during and after the treatments, as well as by the number of mites falling daily onto the bottom boards of test colonies. When queens were caged for more than 21 days infestation percentages of worker bees as well as the number of mites falling onto the bottom boards increased up to ten times after eight days when no more unsealed brood were present in the colonies. Within three days following the emergence of the last adults, the number of dying mites decreased considerably, and within a few days, no more mites were found on adult bees. When queens were caged for nine days and then the brood cappings were removed and the brood shaken out, the number of dying mites decreased considerably within three to four days and a few days later, no more mites were found on the workers. When all brood was removed from test colonies, the number of dying mites decreased considerably within one to three days and no more mites were found on the workers a few days later. *T. clareae* is unable to feed on the hemolymph of adult bees and in the absence of bee brood the mites die within a few days. Therefore, *T. clareae* can be effectively controlled without the use of chemicals just by depriving the colonies of all brood.

In Afghanistan only *T. clareae* was present and no *V. jacobsoni* was encountered. However, in Vietnam, as well as in many other southeast Asian countries, both *Varroa* and *T. clareae* are present. Depriving *A. mellifera* colonies of brood alone is not an adequate control measure for *Varroa.* Therefore, fumigation with acaricides in broodless colonies has been recommended (Nyein and Zmarlicki 1982; Akratanakul 1984). But in many developing countries of southeast Asia the commonly recommended miticides are not available. Therefore, I recommend for countries with high infestations of both mite species, a biological control measure which has been reported as successful for *Varroa* in Europe (Ruttner and Koeniger 1980). In summary, the procedure involves confining the queen to an empty comb that is placed in queen excluder isolator. This comb is exchanged every week with an empty comb and the first brood comb is left in the colony. All the mites emerging with the workers from the brood combs outside of the isolator, do not find, after eight days, any open brood except in the comb in the isolator. The mites then migrate to the open brood on the comb in the isolator. The next week the comb in the isolator is exchanged again and the previous one already has sealed brood, so it is removed from the hive. This procedure of comb exchange is repeated four times. The last comb removed should contain open brood one week later after the last bee emerged from the combs outside the isolator. In tropical countries there is always a period in which bees reared will not participate in nectar collection and this is the time to apply biological control methods.

The case in Afghanistan shows that *T. clareae* can invade *A. mellifera* in an area where *A. dorsata,* the giant honey bee and natural host for *T. clareae,* is not present. Furthermore, *T. clareae* can cause severe damage to apiculture under conditions where *V. jacobsoni* is not present.

All of the above demonstrates that *T. clareae* can escape from southeast

Asia and can cause severe damage to beekeeping in all tropical and subtropical regions where brood rearing is not interrupted by a prolonged nonforaging period. However, *T. clareae* will not become a severe pest of *A. mellifera* in temperate zones in which winter interruptions of brood rearing occurs.

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