Bee Research Digest

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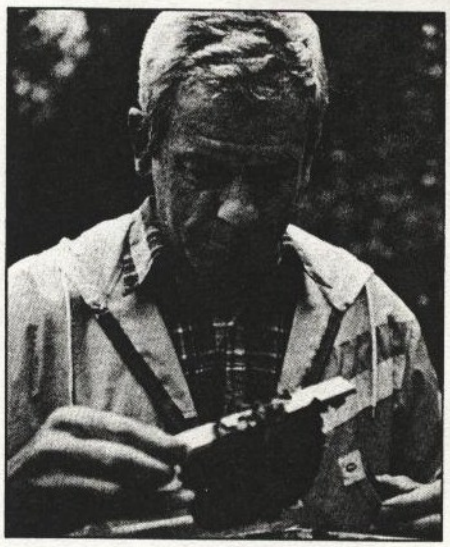

Bee Research Labs

Since 1907, the Bee Research Laboratory in Beltsville, Maryland has been providing diagnostic testing services for honey bees (Adams 1993). Each year beekeepers using this service send in about 2000 samples of bees from their apiaries where they have encountered problems with ailments, infestations or bees have died from unknown causes. The samples are sent to the lab throughout the year, but peak in the months of April, May and June. The chief troubles are caused by bee mites, bacterial or fungal diseases and pesticide loss. The lab is usually able to tell what ailed the honey bees and caused their illness or death. By examining trends of the samples received, Dr. Hachiro Shimanuki, who heads this U.S. Department of Agriculture research lab, working with his colleagues, discovered that the fungus causing chalkbrood in bee larvae is linked to decreased infection of foulbrood diseases. Foulbrood is the most devastating disease for managed honey bees and attacks bee larvae. However, the chalkbrood fungus, *Ascosphaera apis*, produces a chemical substance that inhibits the growth of the foulbrood-causing bacteria. This discovery occurred by careful analysis of the data of samples of honey bees over 30 years.

The data collected at the facility show that 30 years ago in New Jersey, European foulbrood (caused by infection with the bacterium, *Melissococcus pluton*) was widespread in areas where honey bees were being used for pollination of blueberries and cranberries. There was also an increasing incidence of chalkbrood. In the decade from 1980 to 1990, however, samples from New Jersey showed European foulbrood in sharp decline. During this same time the chalkbrood stayed nearly constant. Tests showed that the fungus released a chemical that inhibited the growth of *M. pluton* and also *Bacillus larvae*, the cause of American foulbrood. The protective chemical substance has now been isolated and could provide an effective inexpensive control for both American and European foulbrood.

The identification of bee diseases at the laboratory has lead to the publication of a USDA handbook, *Diagnosis of Honey Bee Diseases*, in 1991. This book helps bee inspectors, researchers and serious beekeepers to diagnose and treat honey bee diseases.

This is just one aspect of the research endeavors of one of the five USDA bee research labs.

Another bee research lab shares the spotlight this month as its 70th anniversary is celebrated this year. This is the Rothamsted Experimental Station in the United Kingdom (Williams et al. 1993). Over the past seven decades this research lab has focused on the areas of honey bee pheromones, honey bee pathology, pollination, and agricultural chemicals and bees.

Pheromone studies have shown that chemicals produced by the queen, workers, and brood regulate the various activities in the colony. Three important pheromones discovered and elucidated here include queen pheromones, Nasanov pheromones, and alarm pheromones. The prominent biologically active component in queen substance was identified in 1960 as 9-oxodec-2-enoic acid. This was the second insect pheromone to ever be isolated and identified. The first was discovered just a year earlier and was the sex pheromone of the silk moth called bombykol. The honey bee queen pheromone component showed most of the characteristics of queen substance including inhibiting ovary development in workers and preventing queen rearing.

In 1883 the Nasanov gland was described (by a Russian of that name) but not until the 1950s was it recognized that the Nasanov pheromone played a key role in orientation of flying bees to the hive entrance. Later, its attractiveness in foraging and swarm clustering was demonstrated at Rothamsted.

That there was an alarm pheromone from the sting gland that marks the attacker as a target for other bees, was not described until the 1960s. Dr. John Free demonstrated that characteristics important in attack provocation included the alarm pheromone along with color, hairiness and jerkiness of the object.

In the area of honey bee pathology, the studies at Rothamsted have paralleled those at the USDA bee labs in search of identification and control of bee diseases. In England, as in the United States, the

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biggest problems are associated with bee mites (ecto- and endo- parasites) and bacterial and fungal diseases, particularly diseases affecting bee brood. Isolation and culture growth of *B. larvae* were perfected at Rothamsted. This provided the opportunity to raise and study the disease-causing organism in the laboratory and effect a control for it. The natural history of the *Nosema apis,* the causal agent of Nosema disease was also carried out at this lab. The latest comprehensive text on the subject is by L. Bailey and B.V. Ball published in 1991 and entitled, *Honey Bee Pathology* (Academic Press, London, UK).

Pollination, primarily of crop plants, is the second general area studied at the lab. Basic biological aspects were studied including foraging preferences, foraging behavior, constancy, and pollen transport. Many of these studies were linked to honey bees, but other work on bumble bees and wild solitary bees was also carried out. The work continues in collaboration with plant breeders, agronomists, chemists and beekeepers. An excellent text coming out of this work was recently published and is *Insect Pollination of Crops* by J.B. Free (which will be reviewed in the Books & Media column in an upcoming issue of *ABJ*).

The last major area of research interest in bees at Rothamsted is in the purview of agricultural use of pesticides and the possible hazards to bees. Laboratory toxicity studies showed which pesticides were likely to be most dangerous to bees. Field evaluations examined the toxicity of pesticide products as they are normally used in the field. The ultimate aim of these studies is to make recommendations on the safer use of pesticides, limiting their effects on bees.

Bee research is being carried out at many institutions in several countries in a combined effort to better understand the biology of the bees and their importance in the success of entomophilous plants.

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