FUMAGILLIN-TREATED EXTENDER PATTIES INEFFECTIVE FOR NOSEMA CONTROL IN NUCLEI[1,2,3]

by JON L. WILLIAMS

Bee Breeding Investigations, Agr. Res. Serv., USDA
Baton Rouge, Louisiana 70803

NOSEMA disease is by far the most common disease in commercial apiaries throughout the United States and Canada. Adult worker, drone, and queen honey bees (*Apis mellifera* L.) are susceptible to infection by the causative organism, a spore-forming protozoan known as *Nosema apis* Zander. Infected honey bees display no reliable external signs of disease (Bailey 1963, 1969) though the effects include (1) a reduction in the lifespan and foraging ability of worker bees, (2) a reduction of the lifespan and egg production of queens leading to supersedure, (3) increased winter losses, and (4) decreased honey production (Cantwell and Shimanuki 1969). The severity of Nosema disease varies markedly by geographic region and from year to year (Oertel 1964; Jaycox 1960; and Doull and Eckert 1962). For example, Furgala and Hyser (1969) found that over 86% of 302 over-wintered apiaries in Minnesota contained colonies that were infected with *Nosema apis,* but Foote (1971) determined that only slightly over 9% of 860 package-producing apiaries (representing 73,000 colonies) and approximately 27% of 67 nucleus yards (representing over 10,000 nuclei) were infected in California.

The discovery that fumagillin was effective against *N. apis* (Katznelson and Jamieson 1952) was followed by a continuing search for methods of utilizing this antibiotic to control Nosema disease in North America (Farrar, 1954). One especially significant development was Furgala's report (1962) that fumagillin as Fumidil B® had long residual activity (8 months or more) when it was mixed in sugar syrup that is manipulated and stored in honey bee colonies. Subsequently Moeller (1968) found that spring feeding of pollen supplement containing fumagillin as Fumidil B effectively controlled Nosema in overwintered colonies at Madison, Wisconsin. Also, Furgala and Gochnauer (1969) compared three methods of feeding Fumidil B to overwintering and package colonies, and concluded that when powdered sugar or soft candy were used as the carrier for Fumidil B and fed in October to overwintering colonies or in spring to package colonies as they were being installed, the disease was not controlled because the antibiotic was available to the bees for such a short time. However, their results reemphasized that sugar syrup is well suited as a carrier for Fumidil B for both autumn and spring preventive treatments. Package and overwintered colonies generally are able to store the treated syrup and then consume it in the spring before the major nectar flows. In addition, when the antibiotic is contained in a relatively large volume of carrier (syrup) it is usually not eaten quickly, unlike candy or powdered sugar is. Nevertheless, treatment with Fumidil B in sugar syrup for starting package colonies is limited in some areas of the northern United States and Canada because of freezing temperatures.

The fact that many commercial operators prefer not to feed pollen supplement which can be medicated, as previously mentioned, further limits the methods that are readily adaptable by the northern beekeeper who may wish to feed Fumidil B. The antibiotic extender patty method developed by Wilson et al. (1970) for prevention of American foulbrood was evaluated for Nosema control by the author at the Idlewild Experiment Station of Louisiana State University, approximately 40 miles north of Baton Rouge, where ample space was available for isolation and separation of the experimental colonies though it is in a poor honey producing area.

Materials and Methods

Fifty 11-frame (6¼ x 8⅛ in.) 2-story nuclei were established on April 13 with 1 to 1½ pounds of bees naturally infected with *N. apis* and sister Italian queens. The 5 groups of 10 nuclei each were placed about 400 feet apart and the individual nuclei were spaced at intervals of approximately 50 feet along the margins of wooded areas to control drifting.

The recommended dose of Fumidil B (5 grams per U.S. gallon of sugar syrup) was chosen as a basis for comparison of the effects of medicated syrup and extender patties because the minimum amount of the antibiotic required to control Nosema disease in nuclei was not known. Each of 10 nuclei received 1 of the 5 treatments as follows: Group 1—1 gallon of nonmedicated 60% sugar syrup plus a nonmedicated extender patty (granulated sugar and Crisco®, 2:1); Group 2—1 gallon of 60% sugar syrup containing 5 grams of Fumidil B plus a nonmedicated patty; Groups 3, 4, and 5—one extender patty containing 5, 10, or 15 grams of Fumidil B, respectively, plus 1 gallon of nonmedicated sugar syrup. The 50 nuclei each received an extender patty weighing slightly less than ½ pound and a feeder can containing 1½ quarts of 60% sugar syrup according to this treatment plan on the day of installation. Feedings of sugar syrup were repeated as the cans were emptied, and by May 21 each colony had been supplied with a total of 1 gallon of medicated or plain sugar syrup. All subsequent feedings of syrup were made with untreated sugar syrup.

The antibiotic extender patties were weighed 3 times during the test period so that the average rates of consumption of Fumidil B by Groups 3-5 could be calculated from the decrease in the weights of the patties (Fig. 1). Also, the average rate at which the nuclei in Group 2 consumed Fumidil B in sugar syrup was estimated on the basis of the volume of syrup remaining in the feeder cans at each feeding; however, these values are somewhat approximate because small amounts of bee-manipulated sugar syrup were stored in some nuclei despite the scarcity of nectar that prevented most of the bee populations from storing honey until the latter part of June.

The adult bees taken for determinations of Nosema were captured during the morning with entrance traps. Average levels of Nosema spores were calculated after counting the number of spores in a homogenized 30-bee mass sample with a hemacytometer by the method of Cantwell (1970).

Results and Discussion

The average level of spores shown in Table 1 for bees from Group 1 (untreated nuclei) is probably representative of the level in larger package and spring-divided colonies located in the southern portions of those states that border the Gulf Coast (except Florida).

FOOTNOTES

[1] In cooperation with Louisiana State University Agricultural Experiment Station.

[2] This paper reports the results of research only and does not constitute a recommendation of antibiotic patties.

[3] Mention of a proprietary product does not constitute an endorsement of the product by the USDA.

Table 1. Development of Nosema disease in honey bee nuclei fed Fumidil B in sugar syrup or in extender patties.

Group	Treatment	Average Spore Counts (millions/bee)				
		Before Test[1]	During Test[2]			
		April 10	May 6	May 27	June 12	July 2
1	Untreated control (No Fumidil B)	0.98	10.24	9.74	5.87	1.65
2	Sugar syrup + 5 grams Fumidil B	1.04	0.14	0.14	0.40	0.33
3	Patty + 5 grams Fumidil B	1.36	3.57	2.10	1.39	0.26
4	Patty + 10 grams Fumidil B	0.39	3.72	1.35	0.55	0.33
5	Patty + 15 grams Fumidil B	0.50	3.31	1.95	0.43	0.36

[1] Each average represents 4 samples of 100 bees taken from different frames of the source colonies as packages were shaken.
[2] Average of 10 samples of 30 bees each from 10 nuclei per group.

These bees had a moderately low infection when they were shaken but developed a substantial infection after hiving. The average spore counts for Groups 1 and 2 (Table 1) indicate that medicated syrup not only prevented a rapid development of a high level of Nosema infection between the time of installation and the first sampling date but reduced the infections and held them to a very low level throughout the test. Extender patties containing 5, 10, or 15 grams of Fumidil B (Groups 3, 4, and 5, respectively) were much less effective, apparently because of the slow initial rate of consumption of patty material by the small populations of bees (Fig. 1). For example, during the first 24 days after the patties were placed in the hives, the nuclei consumed small quantities of patty material, whether the patty was medicated or plain, an average of only about 20 grams per colony by May 10. However, consumption of patties containing Fumidil B increased markedly after the emergence of the first cycle of brood. By May 27, the average amount of antibiotic consumed per colony had reached 1 gram in Group 2 and about 3 grams in Groups 3 and 4. Nevertheless, this late consumption and presumed absorption of large amounts of Fumidil B from patties did not reduce the spore counts significantly although any reduction during June and July was somewhat difficult to assess because the level in the control nuclei had begun to decrease rather sharply.

In a preliminary test at Baton Rouge, the rate at which extender patties were consumed appeared to be dependent on population size, at least during the early part of spring. Six strong, overwintered, 11-frame nuclei consumed nonmedicated 225-gram patties in as little as 19 days from the latter part of February to mid-March, but a 10-frame Langstroth colony ate only 12% of a similar 225-gram patty during the same 19-day period. The populations of the nuclei used in the present test varied much less, which is probably the reason for the more uniform rates of consumption by the 5 groups of nuclei. However, consumption of patties containing 15 grams of Fumidil B per patty was appreciably slower than consumption of patties containing 5 or 10 grams, which suggests a possible repellency at the highest dose (Fig. 1).

A material that is somewhat more attractive than the sugar-Crisco mixture and consumed somewhat faster during the first few weeks after installation may provide control of Nosema disease in package and overwintered colonies operated for honey production. Additional tests are planned with Fumidil B-treated powdered sugar, fondant candy, and other formulations of extender patties for Nosema control in wintered colonies. ●

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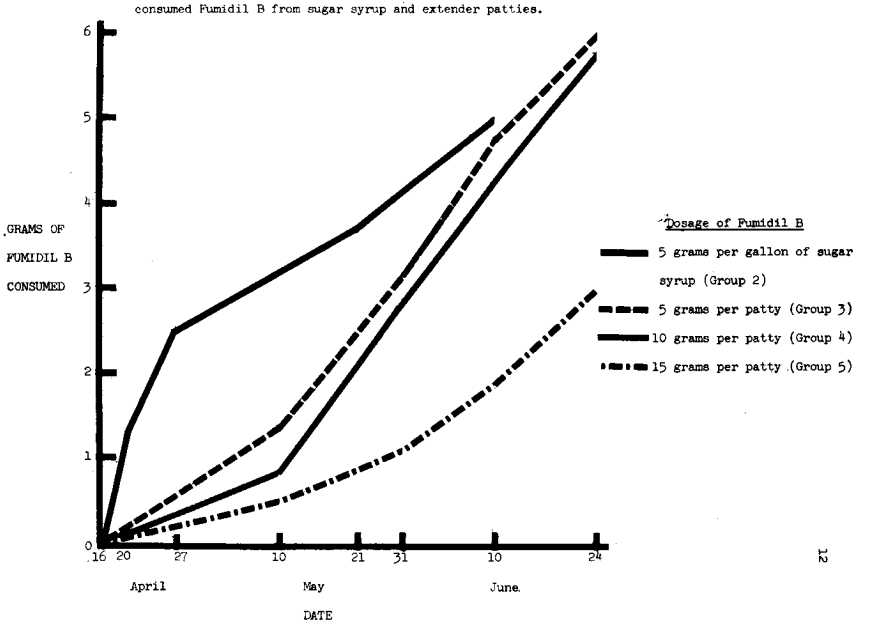
Figure 1. Average rate at which honey bee nucleus colonies consumed Fumidil B from sugar syrup and extender patties.



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