Sulfathiazole Control of American Foulbrood

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During the last five years the use of sulfathiazole in the fight against American foulbrood has literally swept this country and is also being used quite generally in many foreign honey producing countries. It has already saved American beekeepers thousands of hives and productive colonies and millions of pounds of honey. When properly used it can in time completely rid beekeeping of the foulbrood menace. This brief report, taking the place of the more complete one written in 1944 by Haseman and Childers, has been prepared to meet the request from beekeepers for an up-to-the-minute report on the proper method of treatment.

How the Sulfa Drugs Affect Bacteria

Such startling results have been obtained from using the various sulfa derivatives to save life and protect the health of man and beast that they have often been called the wonder drugs. More recently penicillin and the other newer antibiotics have given even more marvelous results in controlling some of the more resistant diseases. The sulfa drugs and the antibiotics are not bactericidal in action; that is, they do not kill bacteria outright as does bichloride of mercury, for instance. They simply operate by slowing down the multiplication of the killing germ in its most dangerous stage. As a result, the germ-fighting antibodies or white corpuscles in the body of the patient are able to devour the newly formed germs faster than they are produced. By this means a sick person is able to get well and a well person remains well and free from attack by the killer germ so long as he maintains an effective dosage of the sulfa drug or antibiotic in his system. Such a drug or medicine, therefore, will effect a cure and maintain a protection from a dangerous disease just as well, in fact often better, than a strong bactericidal chemical which may at times also damage patients' living tissue. All responsible medical men, therefore, recognize the sulfonomids as actual curatives for the various diseases against which they prove effective.

In case of the honey bee and Bacillus larvae, which cause American foulbrood, the same holds true. This germ kills as an intestinal parasite of the bee grubs. To germinate and actually kill the grub,
the spores of the disease must enter the digestive tract of the grub with its food during the first few days of its life. To prove completely effective as a control for this disease, therefore, the sulfathiazole need protect each developing grub for only 3 or 4 days. That is why an infected colony will so quickly begin to clean out its combs and to rear normal, healthy brood again after it begins to receive the sulfathiazole mixed with syrup or in pollen substitute or pollen supplement. Similar to a mother pigeon the nurse bees eat the sulfatreated materials, digest them and then feed them back as a glandular secretion to each little bee-grub. In this way each grub gets some of the sulfathiazole with each meal and is thus protected against the killing action of the foulbrood germs.

The Sulfathiazole Treatment and How to Use It

Perfecting the sulfathiazole treatment for controlling American foulbrood was the culmination of a study of this disease begun in 1916 at the Missouri Agricultural Experiment Station. The advice and assistance of medical men, medical bacteriologists and sulfa drug specialists were obtained before the more recent stage of the investigation was begun in 1942. From the very beginning of these experiments it was evident to us that sulfathiazole was the most effective of the sulfa derivatives which specialists advised us to try out. Later studies showed that sulfaguanidine, sulfapyridine, sulfadiazine and the two antibiotics, penicillin and streptomycin, are all capable of inhibiting the growth of Bacillus larvae but we found sulfathiazole to be most effective.

Fig. 1.—One of the original heavily infected foulbrood combs given to one of the sulfa-treated colonies for cleaning up, July 10, 1944.
Fig. 2.—The same comb shown in Fig. 1 two months later, Sept. 8, 1941, after the sulfa-treated colony had cleaned it up.

The concentration or dosage of sulfathiazole finally worked out is close to that which the medical men originally suggested we use. It includes a regular one-half gram tablet or a scant half level teaspoonful of the powdered sulfathiazole to each gallon of sugar syrup or diluted honey fed to the bees as such or used in preparing pollen

Fig. 3.—The same comb shown in Fig. 1 five years later, Sept. 1, 1949, well filled with 100 per cent healthy brood. The uncapped cells were being filled with pollen as the comb was at the edge of the brood nest. In the beginning this comb was a fit subject for the fire pit but for the sake of research it was rescued and in the last 5 years has been in use continuously. In that time the comb has served as the cradle for 30 pounds of bees worth $30 which in turn gathered around 100 pounds of surplus honey worth $30. And as pollenizers the bees rendered service worth many times more. All this was done at a cost of not to exceed the paltry sum of 5 cents for sulfathiazole. Does it pay to feed sulfathiazole and save our bees or shall we continue to burn them together with the hives, combs, brood and honey?
supplement or pollen substitute cake for feeding to the bees. This concentration of the drug in sugar syrup or diluted honey has proven adequate and we have not found that greater concentrations of the drug either hasten or improve the clean-up of American foulbrood. We therefore advise beekeepers to use this dosage in all their foulbrood clean-up work. In our studies we have used the more stable regular sulfathiazole mostly rather than the more soluble sodium sulfathiazole. However, many beekeepers prefer the latter and it has given satisfactory control.

Preparation.—To prepare a gallon of treated sugar syrup, first crush a one-half gram tablet of sulfathiazole to a powder, then dissolve it in a cup of hot water and pour it into a gallon of prepared sugar syrup, or if you wish, a gallon of half and half honey and hot water. For feeding to bees in the spring or summer the beekeeper need use only enough sugar to sweeten the water or perhaps two cups of sugar to the gallon. However, in late fall feeding use up to two parts sugar by weight to one of hot water in preparing the syrup. The treated syrup may then be fed to the bees in the manner most convenient for the beekeeper. In treating a small apiary, however, the writer prefers to spray or sprinkle it directly into the cells of the brood combs. Then it is promptly and continuously used by the nurse bees in preparing grub food with enough sulfathiazole to protect the grubs from the killing action of the foulbrood germs.

If the sulfa drug is to be fed in pollen substitute or pollen supplement cake, first prepare a gallon of thick sugar syrup or thick syrup and honey containing a one-half gram sulfathiazole tablet prepared as described above. Then thoroughly mix either as pollen substitute three parts of soybean flour with one part powdered brewers yeast or two parts pollen with one part brewers yeast as pollen supplement. When well mixed moisten with enough of the sulfa-treated syrup to make a paste that will not run down between the top bars of the brood frames when flat cakes of it are given to the bees directly over the brood nest. This is the best place to feed the treated pollen substitute or supplement cakes. But if one is feeding it early before bees are taken out of winter packing, or late in the fall, after they are prepared for winter, a thin cake on oiled paper resting on a strip of tin may be pushed well back at the hive entrance and the tin withdrawn. Some beekeepers prefer to feed the sulfathiazole in pollen substitute or pollen supplement; and there are some advantages in feeding it that way. However, when sulfathiazole is used to cure a diseased colony the nurse bees will utilize the drug more promptly in preparing food for the grubs if given in sugar syrup sprinkled or sprayed directly into the cells of the brood combs.
A good many beekeepers now feed both sugar and pollen substitute or pollen supplement to the bees in dry form. Some of the commercially prepared dry pollen substitutes and supplements include sulfathiazole. Those who prepare and feed their own dry pollen substitute or supplement or dry sugar should add and thoroughly mix in powdered sulfathiazole at the rate of perhaps up to a level tablespoonful to each gallon of the dry mixture. Three parts soy flour and one part powdered brewers yeast make a satisfactory dry pollen substitute. And one part brewers yeast in two parts pollen is a good supplement to feed early in the spring or late in the fall under a shed or other dry shelter.

To Use Sulfathiazole Effectively as a Preventive

Our experiments, and the wide experience of thousands of practical beekeepers during the last five years, prove conclusively that properly used sulfathiazole is a perfect preventive for American foulbrood. Many beekeepers report that since beginning to use the treatment they have not lost a single colony from American foulbrood. And some go so far as to claim they have not even found a single grub killed by the disease in their apiary for the last four or five years. The official apiary inspectors' principal objection to the sulfa treatment has been that it prevents all evidence of infection from showing up in apiaries by preventing the vegetative stage of the foulbrood germ from developing so as to kill any of the brood.

In the serum treatment for hog cholera official veterinarians have long recognized the same action or effect in concealing all evidence of active cholera virus by preventing it from killing the animals even though with each treatment a fresh supply of the virus is given each pig. Veterinarians now hail that treatment as a perfect cure for hog cholera and the savior of the pork industry. Beekeepers, who are using the sulfa treatment properly, likewise recognize in it a complete preventive control for foulbrood. Many beekeeping officials are beginning to do the same.

To use the treatment as a preventive for foulbrood, every colony in the apiary should receive some sulfathiazole as a regular part of apiary management, preferably each spring and each fall during active brood rearing. The most satisfactory method of supplying each colony with enough of the sulfathiazole to fortify it fully against American foulbrood is to feed it to each colony either in sugar syrup or diluted honey or in pollen substitute or pollen supplement as described above. Some beekeepers will prefer to feed it in pollen substitute or pollen supplement. Others, including the writer, prefer to feed it in sugar syrup. Clearly there are some advantages with either method. A colony will take the sulfathiazole and use it in preparing
food for the young grubs when fed in sugar syrup sprinkled directly into the brood combs even when a honey flow is on. Commercial beekeepers in treating hundreds of colonies, and even some small beekeepers, may prefer to feed in the open. Without opening the hives a regular garden sprayer with a small angled nozzle can be used to spray the treated syrup in at the entrance and up into the cells of the brood combs.

Under average conditions where American foulbrood is not too prevalent in a region we have found that one or two gallons of sulfatreated sugar syrup or comparable amount of treated pollen substitute or pollen supplement fed to a colony in the spring and the same amount given to them again as they are prepared for the winter will fortify them one-hundred per cent against American foulbrood. When used as a preventive by feeding it in the spring before the supers are put on and again in the late fall after supers have been removed there is no possible chance for any of the sulfa drug to be stored in the surplus honey as some still seem to fear.

Sulfathiazole is clearly giving effective control of American foulbrood by inhibiting or slowing down the germ, Bacillus larvae, in the digestive tract of the bee grubs. And so it seems logical that for best results the drug should be given the bees in their food. Some workers, however, have reported very good results by making it available to the bees in their watering troughs or sprayed over the combs. We have not had satisfactory results when used in this way, and the writer does not recommend this method. Also we have failed to secure proper results by dissolving the sulfathiazole in alcohol and spraying this into the cells of the brood combs. It must be used so that the nurse bees will take it and include some of it in every mouthful of food eaten by each young grub.

**Using Sulfathiazole Properly to Cure Infected Colonies**

The writer agrees with those who advocate the use of the sulfa treatment as a future preventive in preference to a cure. On the other hand he is convinced from his past eight years' intensive study of the treatment that unlike the hog cholera serum treatment the sulfathiazole treatment for American foulbrood is fully effective when used either to prevent a colony from developing foulbrood, or to cure a colony already infected.

In developing the sulfa treatment we repeatedly took colonies in the last stages of foulbrood destruction. Their combs were messed up with foul decaying grubs and the typical dried up foulbrood scales. Only a mere handful of bees and a queen were left. But by using 3 to 6 gallons of sugar syrup containing 3 to 6 half-gram tablets of sulfathiazole, these colonies were restored within 60 to 70 days to
full strong healthy honey-gathering colonies. The treatment properly used will do just that. However it takes time, care and work and the writer concludes that a colony of bees is more valuable when working in the field gathering nectar than when cleaning house where the combs are badly messed up. He therefore now suggests that when a beekeeper finds a colony with brood combs badly messed up with foulbrood he remove, cut out and melt down all such combs and give the colony drawn combs from the super or frames with full sheets of foundation and then proceed with the sulfa treatment. Give them time and the treated syrup and they will clean such messed up combs. But by helping them with housecleaning one can return the colony to normal health and honey gathering so much more quickly that he cannot afford to leave all the comb and hive cleaning to the bees.

On the other hand, the writer does not agree with those who insist that whenever a colony is found showing the least evidence of American foulbrood it should be gassed, and the combs, brood and honey consigned to the fire pit. In the large commercial apiaries the beekeeper should regularly use the treatment as a preventive and if used properly he should not find American foulbrood showing up. However, under such conditions should he occasionally find a colony with a few typical cells of American foulbrood he may prefer to burn it. If he does, he should continue to use the treatment as a preventive with all colonies and even step up its use for he must remember that even by burning the affected colony, the original source of infection remains and his other colonies will continue to be exposed.

On the other hand, if the beekeeper, on finding one or more colonies with a few American foulbrood scales or decaying grubs, does not choose to burn them he should move such colonies to a distant hospital yard and give them the complete sulfa-treatment. He should also step up the preventive treatment of all colonies in the main apiary. To make the treatment fully effective in cleaning up visibly affected colonies or entire apiaries the beekeeper should use the sulfa treatment more systematically than when merely using it as a preventive treatment. He must continue the treatment much longer, covering at least three full 21-day worker-brood cycles. Also, when used to clean up an affected colony the treatment must be applied at once be it spring, during the summer honey flow or in the fall. To hasten cleanup, preferably remove supers and surplus honey. When the clean-up treatment is fully and properly carried out and the spring and fall preventive treatments thereafter are given regularly there will be no recurrence of the disease as thousands of beekeepers have fully demonstrated. When a treated colony or an apiary shows a recurrence of foulbrood it was either not given a complete treatment or the follow-
up preventive treatments were not given and reinfection occurred.

We still have some of our original colonies and most of the original American foulbrood combs, together with a few secured from one of the neighboring states, with which we began the sulfa experiments in 1942. Remember that the sulfa drug does not necessarily destroy the resistant spore stage but it certainly will prevent the destructive vegetative stage of Bacillus larvae from injuring the brood if the treatment is properly used and made a regular part of apiary management just as the cholera treatment is a “must” in safe pork production. Continue to use the sulfa treatment regularly therefore, even though colonies remain free of the disease for years without retreatment. It is cheap insurance and will contribute much to the future peace of mind of the beekeeper.

Summary

In conclusion keep in mind:

(1) That each beekeeper, be he a commercial honey producer or one of the health and pleasure seeking amateurs, is a co-partner with each of his busy bee colonies and he should do his part by putting into use every practical, safe, proven practice or treatment that will further the well-being of the bees.

(2) That in protecting his own bees and his neighbors’ bees from the major bee disease menace, American foulbrood, he should keep each colony strong, headed preferably with a recognized strain of resistant queen; utilize the sulfathiazole treatment regularly on each colony as a preventive and the full treatment as a curative if the disease ever appears in the apiary.

(3) That in using the sulfa treatment in order to restore a diseased colony to full health, strength and normal honey gathering, he should do his full share of the hive and comb clean-up work, and cooperate with his neighbors and state apiarist.

(4) That prevention is always preferable to a cure and that while burning may eliminate all infection in the hives burned, the sulfa treatment used as a preventive is our only known assurance that lurking American foulbrood spores in the neighborhood or in other hives in the apiary will not later cause other colonies to come down with the disease and in turn be ready for the fire pit.

(5) That the simple, inexpensive fool-proof and easy to apply sulfathiazole treatment as outlined herein for use both as a preventive and as a cure for American foulbrood when fully understood and properly used by all beekeepers, will rid the beekeeping industry of all future loss from this disease as completely as the pork producing industry is protected from the hog cholera menace.

(6) That from here on it is up to the beekeeper. He has in the sulfathiazole treatment the solution to the American foulbrood problem if he will only use it and use it properly.