

tion, and therefore only control measures were put into effect. These consisted of a careful inspection in summer and collecting all larvæ found; thoroughly spraying with lead arsenate all trees infested; another careful inspection in late fall and early winter to gather all cocoons from the twigs.

The insectary records were kept by my assistant, Mr. M. P. Zappe, to whom I am indebted for some of the data included in this paper.

During 1915, two complete generations were reared and a number of males of the third generation emerged late in the fall. Possibly another year we may be able to obtain three complete broods, because on account of an accident some of the first second-brood larvæ died. The broods overlap and are rather irregular. Some of the overwintering pupæ did not produce adults until after the first generation of larvæ had matured. If the needles became dry, as is sometimes the case with cut twigs, the eggs failed to hatch. Unfertilized eggs hatched, and the larvæ developed normally to the pupal stage, in which condition they are now passing the winter.

The average length of the larval stage appears to be about thirty and one-half days.

In Connecticut *Diprion simile* feeds upon the white pine, *Pinus strobus*; the Austrian pine, *P. laricio* var. *austriaca*; the Japanese or Bhotan pine, *P. excelsa*; the Scotch pine, *P. sylvestris*; the mugho pine, *P. montana*; *P. flexilis* and *P. densiflora*. All newly-hatched larvæ died when fed on Austrian pine, but after the first instar they were able to finish their subsequent development upon this food plant. Probably when in need of food this sawfly may attack almost any kind of pine and possibly other conifers.

There is some consolation in learning that *Diprion simile* is highly parasitized, and of the parasites which have been reared up to this time, all are native American species; I am indebted to Mr. S. A. Rohwer of the Bureau of Entomology for their identification. Of 152 overwintering cocoons, 46, or about 31 per cent, were parasitized by the Chalcid fly *Pachyneuron* (*Dibrachys*) *nigrocyaneus* Norton. One specimen each of *Hemiteles utilis* Norton, and a species of *Cerambycobius* were obtained. Tachinid eggs are not uncommon upon the larvæ and *Exorista petiolata* Coquillett was reared from the cocoons.

APIARY INVESTIGATIONS IN MISSOURI

By L. HASEMAN, *Columbia, Mo.*

In the past few years the writer has felt the growing need and demand on the part of farmers and beekeepers for help along beekeeping lines. The state agricultural colleges for years have been teaching

better agricultural methods and the experiment stations have been investigating methods of increasing yields and maintaining soil fertility while the beekeepers have received comparatively little help. At least these have been the conditions in this state. In some cases the profits from bees have helped to send young men and women to the University, where they have found instruction in almost every subject except beekeeping.

Three years ago the first real instruction in beekeeping was given by this department. Along with the development of courses in beekeeping we have begun some investigations and are planning more extensive work for the future.

In Missouri it seems that beekeeping must inevitably resolve itself into farm beekeeping. Our natural, climatic and agricultural conditions all point in the direction of small apiaries if future beekeeping in Missouri is to thrive. We do not have conditions for successfully maintaining apiaries of hundreds of colonies in any one locality. If ten strong colonies of bees will save the honey flow in any locality why try to maintain an apiary of fifty colonies to accomplish the same end and eat up all the profits? Since these conditions prevail with us, we have planned, first of all, to "preach the gospel" of small apiaries, well located, with only strong vigorous colonies of bees. Our first investigations are also planned for like conditions. Along with the preparation of our first report on "Farm Beekeeping," now in press, we have been studying economical methods of securing a few strong colonies as a start and the necessary equipment so as to place beekeeping within the reach of every family. A few strong, well cared for colonies of bees on every Missouri farm is the remote goal toward which we are working.

The simple methods of dividing and forming nuclei and the methods of queen rearing and requeening are being studied with a view of enabling any farmer to build up his apiary. We have demonstrated in a modest way in our department apiary that without the expenditure of much money, any one, who is willing to study and work, can build up a small apiary and secure both profits and pleasure from it. Our colonies are used both for class work and for demonstration purposes at fairs and yet in the past three unfavorable seasons we have built up an apiary of from two to seven excellent stands, and have gotten surplus honey every year, even as much as sixty pounds from one of the stronger stands one season. These smaller and simpler things in beekeeping are receiving our special attention now for we realize that to develop successful farm beekeeping in the state we must first reach the beekeepers with simple, practical farm methods. The larger problems of out-apiaries, wintering in cellars, engine extracting outfits and the like have no place in our present work.

We find, according to Dr. Phillips of the Bureau of Entomology of the U. S. Department of Agriculture, that next to Texas, Missouri is in the lead as regards the number of colonies of bees. In round numbers we have 40,000 farmers and others keeping bees with a total of 203,569 colonies. It is with the problems of these forty thousand beekeepers, who have on an average five colonies each, that we are now vitally concerned in order to help make, if possible, not 25 per cent but 100 per cent of the total number of colonies self-supporting and profitable.

Of all the important subjects confronting us the one which seems most vital and in need of first attention is the whole question of bee pasturage. Our honey flows are usually very short and some seasons dry weather shuts them off suddenly when they may not open again until late in the fall. These are the conditions which make beekeeping such a gamble; especially in case of large apiaries. The following questions are a few which we hope to solve within the next few years: How many colonies of bees can one profitably keep under different surroundings in this state? What are our important honey plants? What agricultural crops can we hope to use for bee pasturage? How can we make use of much of our waste lands for beekeeping? Is it possible to keep a few colonies of bees with profit in spite of unfavorable seasons as regards honey flow? Some of these questions have already been touched upon but further investigation of them is necessary. Some of these investigations will be carried on in coöperation with our more progressive and observing beekeepers while the more technical studies will be undertaken in the department apiary on the college farm at Columbia.

Rocky hillsides, unfit even for blue grass pasture, will be worked over and used for growing different plants of possible value as bee pasture. Thousands of acres of Missouri hills now lie idle, much of which may under proper treatment serve as profitable bee pasture. Along with the investigations of waste lands for bee pasture, tillable plots will be used for growing cultivated and wild plants which show promise of proving of value as bee pasture. Our principal honey crop, white clover, is too susceptible to our hot dry spells in early summer and if possible some other crop should be found to serve as a substitute for white clover under unfavorable seasons. Sweet clover or "bee clover" as some call it, has already shown promise under our conditions and it will be investigated thoroughly.

In coöperation with Missouri beekeepers and the recently incorporated Missouri Apicultural Society, the Entomological Department of the University hopes to be able to help develop and direct a more intelligent and a more profitable system of beekeeping in the state. In the future, in this state we must have more intelligent, intensive and less extensive beekeeping.