In summarizing the essential times for spray application to apples in the Lower Fraser Valley, we deduce the following:—

Insect.	Spray.	With what.
Bud-moth	In April	Arsenate of lead.
Lesser apple-worm	In April and in July	Arsenate of lead.
Leaf-roller	In April	Arsenate of lead.
Fall web-worm	In July	Arsenate of lead.
Tent-caterpillar	In June	Arsenate of lead.
Woolly aphis	In April and June	Kerosene emulsion.
Cigar-case bearer	In April or June	Arsenate of lead.
Pear-slug	In June	Arsenate of lead.
Click-beetles	In April	Arsenate of lead.
Rosy aphis	In April	Lime-sulphur and Black Leaf 40.
European grain-aphis	In April	Lime-sulphur and Black Leaf 40.
The apple-aphis	In April	Lime-sulphur and Black Leaf 40.
Oyster-shell scale	In June	Lime-sulphur.
Pear-leaf blister-mite	In April or September	Lime-sulphur.

From the above it will be seen that the two essential mixtures are lime-sulphur and arsenate of lead. Black Leaf 40 is also of use against aphides. These three ingredients can be mixed together satisfactorily without injury to the relative effectiveness of any one. It will be seen also that the first spraying on apple-trees is required during April or at the time when the buds are breaking and previous to the formation of blossom. The second spraying should take place in June or after the blossoms have fallen. The third or midsummer sprays will only be required during exceptional cases and relative to special insects. The same applies to the fall sprays and winter spraying. The first two sprayings are necessary, one year with another, in every orchard in the Lower Fraser. The later sprayings are optional to the grower, and need only be applied in special cases of severe infestation and as specially directed remedies against special outbreaks. It should be borne strictly in mind, however, that these spray recommendations can be considered only from the standpoint of the insects. The various fungous diseases are probably more serious to the apple-grower than any existing insect attack, and these diseases have to be fought by special methods and at special times. From information at our disposal, we are informed that three sprayings a year are necessary in the majority of orchards in the valley. The first two coincide with the first two insect sprays—viz., in April and in June—and the third takes place in the fall, in September or October, depending on climatic conditions of the year and as to whether the tree is in fruit or otherwise. The lime-sulphur may be used in the spring sprayings against the fungi as against the insects. Bordeaux or lime-sulphur may be applied in the fall, according to the preference of the grower.

The following insects are believed to be present in the valley, but further records are necessary before further reference is made: The raspberry-cane borer; the raspberry-root borer; gooseberry-borer; several blossom-beetles; *Teras minuta;* apple-buccalatrix; *Archips argysopila;* apple-scolytids; apple-sawfly; flat-headed apple-borers; round-headed apple-borers; apple-leaf miner; *Aspidiotus ostræformis; Pulvinaria innumerabilis; Chionaspis furfura;* red spider; clover-mite; *Vanessa antiopa; Plodia interpunctella,* with several others of lesser importance.

BEE-DISEASES IN BRITISH COLUMBIA.

BY F. DUNDAS TODD, APIARY INSPECTOR, LOWER FRASER VALLEY.

Once upon a time, it is said, a learned gentleman was called upon to prepare a paper for a natural history society upon the subject of "Snakes in Ireland." He disposed of the whole matter in one sentence, "There are no snakes in Ireland."

While not posing as a learned gentleman, I have been asked to write for this Society a brief paper on "Bee-diseases in British Columbia," with the solemn warning from the Secretary that I must limit my verbosity to the reasonable duration of fifteen minutes. But in one respect I can emulate the brevity of the learned gentleman who was posted on snakes, and say: "So far as I know, there are no serious bee-diseases in British Columbia." Understand, please, that we are not without worries, for if the chiefs of our Agricultural Department had not luckily inaugurated hive-inspection at a most opportune moment, we in British Columbia would to-day be probably fighting a rearguard action against a most insidious foe. Three times in three years foul-brood, the most deadly of all bee-diseases, has broken out in the Province, but thanks to the all-pervading system of apiary-inspection in force, each outbreak has been discovered and so terminated before it had a chance to spread from the centre of infection. British Columbia, so far as I know, is the only part of the world where systematic inspection of every hive is the rule, and the results of the past three years demonstrate the wisdom of the procedure.

The first discovered case of foul-brood was introduced from Ontario by a settler. The second case as the result of the bringing-in of a colony of bees from England by a rancher, who had a warm spot in his heart for the kind of bees he had handled in the Home-land. The third case was found in an apiary that had been imported from Oregon. The most noticeable feature of the last case lies in the fact that the germs apparently lay dormant for three years at least, for the disease did not develop until the hives had been in their new location for that period of time.

There is a report of a possible fourth case. One bee-keeper reported to me that several of his colonies had been affected and that he had traced the infection to an empty honey-can that had been thrown outside by a neighbour. The honey came from Ontario, a Province where foul-brood is so widespread that sixteen Inspectors are unable to make headway against its ravages. The bee-keeper at once destroyed all infected combs and apparently eliminated the disease, but with the delayed development that happened in the Oregon case before us, you may be sure this particular apiary will be closely watched in 1914.

Outside of foul-brood, there are many minor bee-diseases which have been loosely classified as "pickle-brood." In 1912 there were hundreds of cases of pickle-brood in the district of the Lower Fraser Valley, so many that I had considerable anxiety; so about half a dozen samples were submitted to the Bacteriological Department at Washington, D.C., where special investigations on the causes of the bee-diseases have been conducted for many years. It is comforting to know that in every instance they reported that the ailment was not of a serious nature.

The trouble reappeared in 1913, but in a very mild form, and in greatly diminished number of cases. By the end of 1912 I had come to the opinion that the very variable weather of the spring and summer was the cause of the trouble.

During the "building-up" season, when nectar is coming in, the unsealed honey is naturally first fed to the larvæ. Should this become exhausted, then the sealed stores are brought into requisition. Given a week of warm weather in spring with a free flow of nectar, the colony will expand the brood-nest and induce the queen to lay freely. Then let a few days' rain occur, with a consequent stoppage of nectar, the natural result is that the unsealed honey is all used up and the bees must uncap the old stores.

This takes time, but the work of the hive has been organized on the basis of easily reached food-supply. As a consequence, many larvæ are sealed up for the pupation period with insufficient food-supply, and consequently die of starvation. This particular form of pickle-brood is really starved brood, and therefore not infectious. Until I came to grasp the real facts of the situation there was naturally an anxious time for me.

By deciding to quarantine all imported bees at the point of entry, the Province has practically eliminated the possibility of introducing foul-brood along with settlers' effects, but unfortunately we are unable to completely attain immunity.

We are very seriously threatened all along the International Boundary-line, for in many parts of the State of Washington, to the south, foul-brood is rampant, especially in the Seattle and Tacoma districts. Every dead cedar-tree is a possible home for a swarm, and so we must look forward to the time, and that not very far distant, when the trouble will reach British Columbia by the dead cedar route. I have seen at least a hundred bee trees in my territory, so I am led to expect that there are more wild bee colonies than those under control in the valley of the Lower Fraser. Since man has but little influence over bees in trees, a long wearisome fight will have to be waged while the increasing population is clearing the land.

The danger from infested honey is ever imminent, for every jar of imported honey is a possible menace. I am in hopes that in a few years this particular form will be materially lessened, as the Bee Inspectors, in giving instruction in apiculture, have materially brought about an increase in the honey-production. It is now evident that there is in existence at the present time in British Columbia sufficient hives of bees to produce as much honey as we import, provided all of them are as intelligently managed as are the most efficient. There has been a widespread opinion among bee-keepers that our Province was not a good honey country, but the Inspectors have been able to devise methods for each locality, so that the more enterprising men have got enough of a honey-crop to encourage them to put more time into the study of apiculture, feeling that the monetary returns will more than justify the effort.

After all has been said and done, the most efficient corps of Foul-brood Inspectors will ultimately consist of efficient and successful bee-keepers. To produce these is the chief aim of the Bee Inspectors of the Province of British Columbia at the present time.

The President: You have heard this very interesting paper by Mr. Todd. It is to be regretted that he was unable to be present with us to-day to say these things in person. However, if there are any present who would like to say a few words on the subject, I am sure we would be glad to hear them.

Mr. Treherne: It is unfortunate Mr. Todd, in his paper, has not been more definite in his reports of the foul-brood cases. I presume he refers to the Lower Fraser Valley alone.

Mr. Robinson: I am sorry Mr. Todd is not present also, as I would like to ask some questions.

Mr. Day: I notice Mr. Todd was a little indefinite in reporting the occurrence of foul-brood in the Province. Are there any specific cases determined and reported in British Columbia?

Mr. Robinson: For myself, I do not know whether any exist or not. Two supposed cases occurred at Vernon last year. Our official reports on the subject are too vague for correct diagnosis.

Mr. Treherne: To what extent does American foul-brood occur in the State of Washington?

Mr. Robinson: I have no records with me, but I fancy there is quite a good deal of it.

Mr. Day: And it can be carried by bees in flight?

Mr. Robinson: Certainly.

Mr. Treherne: How close is it to the border?

Mr. Robinson: We do not know. I would like to say, in discussion on Mr. Todd's paper, that in my opinion the present quarantine regulations which force bees to be held for ninety days at the border is not only not humane, but not an efficient safeguard to the Province. The bees will die from worry or from starvation, and the danger of an infected colony confined at the border is no guarantee that the disease is held in bounds. For a complete safeguard I would like to see a complete and efficient quarantine against all imported bees and bee products of the hive. Honey is one of the prime causes of infection and distribution of foul-brood, and the

case mentioned in Mr. Todd's paper, in his Oregon case where the disease, if it proved to be, held over for three years, is quite possible. Empty honey-tins of imported honey may also spread the disease.

(A long and interesting discussion on the above lines proceeded for some time, in which all the members joined. In the evening session the discussion again began regarding the possibility of introducing foul-brood, with the result that a resolution was moved and passed relating to the issue. This resolution will be seen on page 74.)

Mr. Taylor: While we are on the subject of bee-diseases, I would like to bring up the question of the possibility of the germs of fire-blight (*Bacillus amylovorus*) "carrying over" in hives during winter. I may say that at a recent meeting at Kelowna a discussion on the above subject was begun and it caused quite a stir. The growers thought that the disease was spread from the hives to the trees in the spring, and if this was so it meant another way of combating the disease which during the last year has been very destructive to our orchards in the Okanagan. I told the meeting in Kelowna that I would bring the matter to the attention of the entomologists in session in January to determine what was known in the matter. Can any one offer any suggestions?

Mr. Lyne: I would like to remark that there is an excuse for the growers in their supposition that there is a possibility of carrying over the disease in wax or honey in bee-hives. It is well known, of course, that the bees are the active agents in the spring for spreading blossom-infection; consequently it may be so as they suggest. I am not prepared to say. The question may prove to me a scientific problem which may be of use.

Mr. Taylor: I may say that I asked Mr. Brittain when he was with us in the Okanagan, and the question was new to him. I placed my bees at his disposal, but he had no time. At any time I should be glad to place my bees at the disposal of any who would care to work out the problem.

Mr. Robinson: I have no data on this point, neither have I heard the question asked before. I can offer no suggestions on the point beyond the fact that, if this disease you mention can be carried over in bee-hives during winter, the same treatment as D. A. Jones some thirty years ago applied to foul-brood colonies may be applicable. In this case germs are carried over and all attempts at disinfection were useless. The starvation cure, however, proved successful. This consisted of shaking the bees into new hives and starving them. When some dropped it was supposed the germs or spores of the disease were killed. The bees were then returned to their quarters.

Mr. Taylor: In view of the disconnected knowledge on this point I believe some kind of investigation would be in place. I will therefore place the following resolution before you. (This resolution will be found on page 73.)

Mr. Day: We will now adjourn for lunch, meeting here at 2 p.m. this afternoon.

THE TENT-CATERPILLAR.

BY TOM WILSON.

The species of tent-caterpillar that we have with us in the Lower Fraser Valley is probably that known as *Malacosoma erosa*, which we are informed is only a variety species from *M. disstria*. Its appearance in the valley is periodical. It is subject to years of ups and downs in the matter of prevalence. The same occurs with a great many insects, and this periodical occurrence of insect-life, in abnormal numbers or otherwise, is, of course, influenced by natural causes, climate, fungus, bacterial diseases, or insect parasites being the main causes.

The study of the real and actual causes under strictly local conditions and relative to this species of tent-caterpillar has not up till now been proceeded with, and I do not propose dealing with these issues in this paper. Suffice it to say that the tent-caterpillar, a familiar insect to all of the farmers in the valley, varies in