Copy

UNITED STATES
DEPARTMENT OF AGRICULTURE

DEPARTMENT CIRCULAR 287

Washington, D. C. November, 1923

THE OCCURRENCE OF DISEASES OF ADULT BEES, II.

E. F. PHILLIPS,

Apiculturist, Bureau of Entomology

CONTENTS.

INTRODUCTION.

IN VIEW of the wide interest of American beekeepers in the Isle of Wight disease and in the effort to prevent its introduction into the United States, it seems well to summarize the reports that have come to the attention of the Bureau of Entomology regarding its distribution throughout the world. In this paper the situation in Europe is chiefly discussed, partly because the disease is found there, but especially because importations of queenbees are desired from few, if any, countries other than those of continental Europe. There seems to have been no effort elsewhere to make such a compilation, yet this information must be needed by beekeepers of many countries. Under the law enacted by Congress in August, 1922, prohibiting importation of adult bees into the United States, the Secretary of Agriculture is authorized to lift the prohibition from countries in which it is determined that no disease dangerous to adult bees exists, and in the formulation of the regulations under this law information on the distribution of the Isle of Wight disease throughout the world is vitally important. It is also desirable to record the data obtained from the additional search for this disease made within the United States in 1922, since the first publication on this subject. Obviously no claim of originality is made for this

paper, since no cases of this disease are known to occur within the United States and the writer has not had opportunity to study it abroad. All quotations from writers in foreign languages are translations for which the present writer is responsible.

The writer would respectfully request the cooperation of beekeepers in the United States and in foreign countries in furnishing information regarding the Isle of Wight disease in any part of the world, based on the finding of the mite which causes it. American beekeepers are again urged to send for examination samples of all adult bees which show any abnormality. Beekeepers of other countries may *during the season of 1924* send such material to the Bee Culture Laboratory, Bureau of Entomology, Washington, D. C., U. S. A., from any country where provisions are not made for such investigations. For the benefit of foreign beekeepers not familiar with the work of the bureau, it may be stated that it is not the policy of the Bureau of Entomology to publish the names of those sending beekeeping materials for examination. There is no charge for these examinations. Correspondence is preferred in English, French, or German.

NATURE OF THE ISLE OF WIGHT DISEASE.

In a previous publication of the bureau (*46*),[1] in which the Isle of Wight disease was discussed, the nature of the disease was not described, since it was not anticipated at that time that the interest in this subject would be so great. It seems desirable now to summarize the observations on this disease and to correct certain errors that have appeared in American beekeeping literature concerning it, without any attempt to add any new facts concerning the disease. No adequate discussion of this subject has been available to American beekeepers generally, and many inquiries have come to the Bureau of Entomology concerning it.

NAME OF THE DISEASE.

The Isle of Wight disease, as it is commonly called, is also sometimes known in Great Britain as acarine disease, from the order name (Acarina) of the mite which causes it. The latter name was given to the disease by Rennie (*54*) and is preferred by him. In German these two names are translated as "Insel-Wight-Krankheit" and "Milbenkrankheit," while in French, in addition to the translations of the common names, acariose is sometimes used. The disease was first recognized in 1904 in the Isle of Wight, hence the usual common name, and in succeeding years was reported to have spread with great rapidity throughout Great Britain. It is probable, however, that it existed in England previous to its discovery on the Isle of Wight (*29*), and the Isle of Wight can not be considered as its place of origin. The name of "Isle of Wight disease" is used in this paper because it is better known to American beekeepers than "acarine disease." It is preferable, in the opinion of the writer, since it is not descriptive. Descriptive names for brood diseases have proved confusing and it was solely to avoid this confusion that the author proposed the present generally accepted names for the two serious brood diseases in 1906.

[1] Reference is made by number (italic) to "Literature cited," p. 27.

GENERIC NAME OF THE MITE.

Dr. John Rennie, of the University of Aberdeen, Scotland, with his associates, P. Bruce White and Miss Elsie J. Harvey, found in 1920 that this scourge is caused by a microscopically small parasitic mite,[2] which was named *Tarsonemus woodi* (*50*). In this paper it will be noted that in referring to reports from various authors the generic names Acarapis and Tarsonemus are both used for this mite. The name *Tarsonemus woodi* was given this mite by Rennie, and Tarsonemus is still accepted by him as the correct generic name (*17*). Hirst (*31*, *32*) believes that because of certain important structural modifications, probably attributable to its parasitic habit, a new genus, Acarapis, should be erected for it. It is coming to be rather generally accepted that Hirst is correct, and his standing as a specialist in this field entitles his opinion to great weight. The fact that the generic name Acarapis is composed of two appropriate words, "acarus" (a mite) and "apis" (the honeybee), makes it a fitting name for this parasitic species, but in taxonomic nomenclature fitness of the name argues neither for nor against its acceptance (*25*). The name *Acarapis woodi* is preferred by Dr. H. E. Ewing (*25*), of this bureau, specialist in mites, and by the writer (*48*).

An important paper on this subject by Vitzthum (*70*), the well-known mite specialist of Germany, has recently appeared, in which it is shown that the mite causing the Isle of Wight disease certainly does not belong to the genus Tarsonemus, as claimed by Rennie, who discovered it, but that it properly belongs to the new genus, Acarapis, erected by Hirst. Vitzthum states that while Acarapis is related to the genus Tarsonemus, in that both genera belong to the Heterostigmata, it is more nearly related to certain other genera containing mites parasitic on other insects. He points out that, in spite of the fact that Acarapis contains the only known species of mites which are internal parasites, the body form has not been materially modified by the parasitic habit. This taxonomic analysis by Vitzthum seems to settle conclusively the disputed question as to the correct generic name for this species.

ORIGIN OF THE PARASITIC HABIT.

Since the recognition of the Isle of Wight disease there has been much speculation among beekeepers as to how the parasite arose and when and by what means it assumed its parasitic habit. There is, of course, not the slightest reason to believe that this mite first invaded the thoraxes of bees on the Isle of Wight in 1904, or that its parasitic habit is a new one. From its specialized structure, one must conclude that the parasite has existed as such for untold centuries (*cf.* *50*). It is an interesting speculation whether this mite took on

[2] Mites do not belong to the class of insects (Hexapoda), but are members of the class of Arachnida, to which also belong spiders and scorpions. A prominent difference between the two classes is the presence of four pairs of legs in the adult arachnids, instead of three pairs as in insects. Mites (Acarina) are small animals some species of which are found in great abundance. They generally have a saclike, unsegmented body, usually fused with the cephalothorax, and the mouth parts form a beak. The abdomen and cephalothorax are, however, distinct and the abdomen is segmented in the Tarsonemidae, to which *Acarapis woodi* belongs. The larva on hatching from the egg usually has only three pairs of legs, but after molting has four pairs as in most adult mites. Most species are free-living, as predacious forms or scavengers, but some species are parasitic and cause certain plant diseases. Some animal diseases are properly attributed to this group. Certain species are found in human ailments, such as itch. *Acarapis woodi* seems to be the only described tarsonemid mite which is pathogenic on animals.

its present parasitic habit as an invader of colonial honeybees, or whether, as Bouvier (*14*) suggests, it was first a parasite of solitary bees. It has not so far been found in solitary bees. The only practical bearing which this question might have is that if it were actually found that the mite exists in solitary bees at this time, the control of the Isle of Wight disease might be much more difficult (*50*). Rennie reports (*50*) that he and his associates have examined a considerable number of other insect species but have found the tracheæ always clear of mites. The parasite may also have been a plant feeder, as some have suggested, but there seems to be no evidence of it (*50*), except that other tarsonemid mites have this habit. Migratory nymph stages of related species of tarsonemid mites have been found in tracheæ of other insects, but it has usually been assumed that this is a mere accidental and fatal situation for these mites, and that they have entered the spiracles after attaching themselves to the insects, as migratory nymphs of many mite species do. A modification of some such behavior may account for the acquisition of a parasitic and pathogenic habit for *Acarapis woodi*. The course of evolution of this mite is a question which appears to have little practical significance.

METHOD OF ATTACK.

Acarapis woodi apparently enters the body of the honeybee only through the first thoracic spiracles on either side of the thorax, these being larger openings than any other spiracles along the side of the body. Queens, workers, and drones seem equally susceptible to attack, and the mites may enter either one or both sides of the thorax. The structure of the parts of the bee concerned in this invasion has been studied by Snodgrass (*56*), so that it is useless to go into detail here. All developmental stages of the mite have now been found by Rennie (*50*) and Ewing (*24*), indicating that it is able to pass its entire life in this situation. No migratory nymph stage has been described for this species, such as is described for some related species. This species has not so far been found except within the thoracic tracheæ or as migrants from them, or on the outside of the bee, as described by Morgenthaler (*41*, *44*). It appears, therefore, that it is a highly specialized animal, both in structure and in habit, adapted to a parasitic life, and that the disease is strictly a contagious one. The word "infestation" should be used for this disease, not "infection."

The means by which these imprisoned mites feed is not wholly clear, but it is assumed, without doubt correctly, that they draw their nourishment from the blood of their host. They spot the tracheal trunks with feces and thus color the normally white walls brown or black in a characteristic fashion, so that their presence is easily detected on dissection with slight magnification. Efforts to make artificially controlled inoculations of these mites have not been especially successful (*30*), and there is some uncertainty as to the manner in which they pass from one bee to another and succeed in entering the thorax, but there can be little doubt that they do this merely by crawling out of one bee and attaching themselves to another, later to enter the spiracles. The adult and nymph stages of both sexes are capable of locomotion, but, according to Rennie (*52*), only the adult fertilized female mite migrates effectively.

Rennie (*52*) has repeatedly seen the female mites on the outside of infested bees, where they have apparently migrated after mating. The mites live but a short time away from their hosts or after the death of the bees, usually not more than 24 hours.

CAUSE OF SYMPTOMS.

The manner in which these parasites injure their hosts and cause the Isle of Wight disease is also not entirely clear (*59*, *34*). Inability to fly, so common in advanced cases of the Isle of Wight disease, may be produced by artificial stopping of the spiracles of the thorax (*59*), so that "crawlers," so frequently found in badly infested colonies, may result from mere mechanical shutting off of the air which passes into the tracheal trunks. Mites are often so numerous as to make the passage of air virtually impossible. The muscles of flight are located immediately adjacent to the tracheæ which are invaded, and an infinite number of small tracheal branches permeate this musculature (*56*), so that it may be assumed that the stoppage of these trunks would affect the aeration of the flight muscles, and possibly also that of the head, before any other portion of the bee's body would be affected by this mechanical stoppage. This would seem adequate explanation of the lack of power to fly so frequently seen in advanced stages of the Isle of Wight disease, but since the same symptom is seen in bees affected with other diseases of adult bees, this makes the mechanical explanation less certain. The so-called bee paralysis and Nosema disease, both found in the United States, are not caused by this mite and the tracheæ of bees suffering from either of these diseases are clean. In addition to the puncturing of the tracheal walls to suck the blood of the host and the stopping of air circulation, there is believed to be (*59*) some change in adjacent tissues. It is also assumed that these parasites may produce some material which has a toxic effect on the host, but this does not appear certain. The way in which the symptoms of this disease are produced seems to be a question of theoretical interest only, since, regardless of its method, this mite obviously causes the Isle of Wight disease, and therefore the control of the disease must rest on the elimination of the mites.

SYMPTOMS.

The symptom most commonly observed in a colony suffering from a severe attack of the Isle of Wight disease is that many bees crawl inactively on the ground in front of the hive, unable to fly. They are frequently seen falling from the alighting board to the ground or in cool weather gathered in little clusters on the ground in front of the hive. Such bees usually fail to return to the hive and die of hunger or exposure, probably usually of hunger, since active bees in summer live without food for only a few hours. The wings are sometimes carried in a position abnormal for walking bees, with the front and hind wings neither hooked together nor lying flat on the dorsal surface, often described as "dislocated." The badly infested bees in the spring are usually heavily laden with feces, probably because of their inability to fly during winter. Doubtless because of this accumulation of feces, attention was first given the alimentary tract as the probable location of the cause of the disease (*29*, *46*).

It should be recognized, however, that if for any reason bees are unable to fly during the period of the year when brood is being reared, feces rapidly accumulate, so that there is no necessary significance in their accumulation. The presence of "crawlers" seems to be the only fairly constant symptom observed in the severe cases; in fact, there are no positive symptoms and there may be no external sign of any sort, so that the only way to be sure of the presence of the disease at present is through the finding of mites by microscopic examination. The crawling bees are often found some distance from the hive. Rennie (*51*, *52*, *53*) emphasizes the fact that crawling is an advanced symptom and that the disease may exist in a colony or apiary for months before this symptom is seen.

The crawling of bees in front of the hive has also been recorded in almost all cases of the so-called bee paralysis observed by American beekeepers and for virtually all of the known affections of adult bees. Whether this indication of abnormality is any more prevalent for the Isle of Wight disease than for most cases of paralysis can not be stated with certainty, but to one familiar with severe cases of bee paralysis but not with the Isle of Wight disease it would seem doubtful. Rennie (*54*) reports the similarity of symptoms in the various diseases of adult bees in England. The shaking of the abdomen, sometimes so prominent a symptom in bee paralysis, and the hurried climbing of grass blades in an effort to take wing are not commonly given as symptoms of the Isle of Wight disease, although they have been recorded (*54*).

CONFUSION DUE TO CHARACTER OF SYMPTOMS.

Since almost the same symptoms have been described for all known diseases of adult bees, as well as for cases of arsenical poisoning, it must be concluded that information on the identification or distribution of any of these diseases based only on diagnosis by symptoms is utterly valueless. Some American beekeepers were formerly led from descriptions of symptoms to believe that the Isle of Wight disease is present in the United States, and more recently certain European beekeepers have arrived at the same conclusion. On this unfounded assumption they reason (*19*) that the methods of treatment for adult bee diseases used in some cases in the United States should be helpful in the treatment of the Isle of Wight disease. If then, as appears to have been the case, there is only a slight manifestation of the disease for a day or two after the treatment, they feel justified in rushing into print with this method as a recommended treatment for Isle of Wight disease. Rennie has repeatedly warned beekeepers against such reasoning, but apparently without avail. The treatments that have been described for bee paralysis in the United States were used without knowledge of its cause, and such treatments have been of doubtful benefit at best, so that it can not be recommended that European beekeepers look to this country for methods of controlling the Isle of Wight disease.

REMEDIES.

It is natural that in an epidemic such as has occurred in Great Britain a great variety of remedies should be tried and recommended. Extravagant claims have been made for certain apparently worthless

proprietary compounds and drugs, and unfortunately some of these have received the indorsement of certain prominent beekeepers, although Rennie has given repeated warnings against reliance on such unfounded claims. None of the claims made for chemical treatments can as yet be accepted as valid, and apparently no specific treatment has yet been found. Doctor Rennie has devised a trap for the catching of crawling bees as they leave the hive, but to what extent it is beneficial can not be determined from a reading of the literature. From the nature of the cause of the disease a hopeful line of attack has been suggested through some gas which will penetrate the tracheæ and kill the mites but leave the bees unharmed. Whether a bee is worth saving which has mites, dead or alive, in its tracheal trunks is questionable. The most promising method of attack seems to be the elimination of the infested bees and the rearing of a large force of young bees to take their places, thus reducing the infestation, as has been urged by both Rennie (*52*) and Morgenthaler (*44*). Rennie (*53*) emphasizes the necessity for swarm control measures, since swarms are especially prone to show crawlers soon after issuing. He says (p. 74):

> I lay special emphasis on rational and intelligent management, because I am convinced that much of the loss which has occurred in the past has given to the disease a gravity which is not inherent in it, and has been due to lack of exact knowledge on the part of competent beekeepers in the one case and to unsatisfactory beekeeping in addition in the other.

Such a method of control is far more promising for the development of beekeeping in the infested regions than one based merely on the destruction of the mites. It is identical in theory with the measures for the control of European foulbrood used in the United States.

Rennie (*67*), in his presidential address before the Apis Club, April 7, 1923, discusses the treatment of affected colonies but does not give any definite directions. He seems to entertain the hope of the eradication of the disease from Great Britain.

EFFECT OF CLIMATE.

The effect of climate on the propagation of the mite *Acarapis woodi* has not been studied, and there are no data from which one dares draw conclusions. Since both severe and chronic cases of the disease exist, it may be concluded that some environmental factor may have an influence on the severity of the disease, but it is not indicated that these factors are those of climate. Severe cases of the disease have now been described in Great Britain, France, and Switzerland, and it is certain that almost any climate encountered in any of these countries may be duplicated somewhere within the borders of the United States. To assume that the disease would not do damage here if it were introduced, because of climatic differences, is extremely dangerous, since absolutely nothing has been learned of the influence of climate on the disease.

DAMAGE.

The damage resulting from the Isle of Wight disease is a subject which it is extremely difficult to discuss at this distance. Reports have varied greatly, all the way from complete destruction of single

apiaries and of all bees over considerable areas to relatively minor losses. In certain cases (*44*) to be discussed later (p. 18), the results are chiefly a reduction of the honey crop through the death of an abnormal number of field workers. It is quite natural that early reports from Great Britain should emphasize the severe cases, especially during the period when the cause of the disease was not yet known. There are evidently chronic cases of the Isle of Wight disease in England and Switzerland, as is clear from a reading of the literature. There is also reason to suspect that such cases are common in France, because of several statements that the disease is less destructive there than in England, these writers evidently having in mind only the reports of severe attacks in England. There can be no question, after reading the reports from Great Britain for a number of years, that the total losses to beekeeping have been heavy and that in many cases beekeepers have lost all their bees from this disease. Some competent beekeepers claim that the damage in England is not now so great as formerly, but such claims are always to be expected as soon as a disease begins to come under control through more knowledge, and there is no definite reason to believe that the Isle of Wight disease is becoming less capable of doing damage.

An interesting paper has appeared by Anderson (*61*), of the North of Scotland College of Agriculture, in which he discusses especially the apparently decreased virulence of the Isle of Wight disease in Great Britain in recent years, as well as the various methods which have been employed for its control. The reason for the assumed decrease in the damage from the disease is not clear, but it is stated that on entering new districts the disease is as serious as ever.

ERRORS FROM DOUBTFUL DIAGNOSIS.

A curious difficulty which one encounters in attempting to estimate the damage done in Great Britain by the Isle of Wight disease and the efficacy of suggested remedies arises from diagnoses by incompetent persons, who, even before the determination of the cause of the disease, published diagnoses from dead bees submitted for examination. Some British beekeepers have relied on these diagnoses and have then used them as a basis for experiments on treatments, and it is thus impossible to determine the value of much of this work. Many American beekeepers have discounted the reports of heavy losses in Great Britain from the Isle of Wight disease chiefly because of their lack of confidence in the diagnoses and, in fact, many were for this reason led into a sense of false security regarding the disease. Even since the discovery of the cause of the disease, such ill-advised practices seem to continue, in spite of the repeated warnings of Rennie.

THE UNITED STATES.

Immediately following the publication of the first paper (*46*) on this subject a conference called by the chairman of a committee appointed by the apiculture section of the Association of Economic Entomologists was held at the bee culture laboratory on March 9, 1922, to consider the desirability of taking steps to prevent the intro-

duction of the Isle of Wight disease into the United States. At this conference it was decided unanimously that immediate action was desirable. It was recognized, of course, that the failure to find the Isle of Wight disease in the United States during the season of 1921 was not conclusive evidence that the disease is absent from this country, but the far more important fact was to be considered that never in the history of American beekeeping has there been any damage from a disease of adult honeybees comparable to that reported from Great Britain. It seemed justifiable to assume that the Isle of Wight disease is not found in the United States, and therefore desirable that, if possible, this scourge be kept out of the country.

Immediately following the conference, and as a result of its recommendations, the Secretary of Agriculture recommended to the Postmaster General that the postal regulations be so amended as to prohibit the receipt through the mails of queenbees and their accompanying worker bees from all foreign countries except the Dominion of Canada. It was thought that with this as a temporary precautionary measure it would be possible to prevent the introduction of the disease until such time as more complete protective measures were available. The revised postal regulation was announced under date of March 21, 1922. The action of the Dominion of Canada, also taken at the advice of the committee of the apiculture section, will be discussed later. This action made it possible to admit queenbees from Canada by an exception to the postal regulation with safety.

At the conference on March 9 the drafting of a bill for presentation to Congress was also discussed, and as a result a bill was introduced into both Houses of Congress early in April to regulate foreign commerce in the importation of adult honeybees into the United States. This bill was amended at the hearing before the House of Representatives Committee on Agriculture, passed both Houses as amended, and was approved by the President August 31, 1922. The history of this bill in Congress has been recorded by Fracker, Rea, and Gooderham (*27*).

Following the passage of the law, two conferences were held regarding the regulations provided for by the law for the exemption of certain countries which were determined by the Secretary of Agriculture to be free of all diseases dangerous to adult honeybees. The first was called by the American Honey Producers' League at St. Louis, Mo., February 8, 1923, and the other by the Bureau of Entomology at Washington on March 12. The rules and regulations (see appendix) are based on the facts regarding the distribution of the Isle of Wight disease presented in this circular.

In several instances, before the cause of the Isle of Wight disease was discovered, statements appeared in bee journals of the United States to the effect that the disease is present in this country, but as these records are without value they are not specifically mentioned. The symptoms described by beekeepers of Great Britain for the Isle of Wight disease were so nearly identical with some of those observed for diseases of adult bees in the United States as to make such belief plausible. As has been explained earlier (p. 6), this can not be accepted as evidence that the disease is actually present.

The failure to find any cases of the Isle of Wight disease in 1921, together with the much stronger evidence based on the lack of any

serious disease of adult bees in the United States, justified the Department of Agriculture in indorsing the bill before Congress and in taking every possible means to prevent the introduction of the disease into the country. The results of the examinations of adult bees in 1921 have been published (*46*).

The work of the season of 1922 in the search for the mite causing the Isle of Wight disease was done chiefly by L. M. Bertholf, under the supervision of A. P. Sturtevant. Beekeepers were again invited to send to the laboratory any adult bees which showed any abnormality whatever, and as a result 183 specimens were received for examination. During the season the beekeeping literature of this country and the correspondence of the bureau failed to record any instances of any disease or abnormality of adult bees of any moment, and this probably is the reason for the relatively small number of bees submitted for examination. As was the case during the season of 1921, the specimens were from widely distributed locations in the United States, which adds greatly to their value as evidence of the absence of the disease. The following table, prepared by Dr. Sturtevant, shows the results of the examinations made in 1922:

TABLE 1.—*Results of examinations of adult bees, 1922.*

State or country.	Counties.	Towns.	Negative.	Nosema apis.	Arsenic.	Total.
Alabama	3	3	2	1		3
Arizona	2	2	1	1		2
California	10	12	13	6		19
Colorado	4	4	4		1	5
Florida	2	2	2			2
Georgia	2	2	1	1		2
Idaho	1	1	1			1
Illinois	6	7	6	1		7
Indiana	5	5	5			5
Iowa	6	6	4	3		7
Kentucky	2	2	1	1		2
Louisiana	2	2	2			2
Maryland	1	1	1			1
Michigan	5	5	4		1	5
Minnesota	4	4	4			4
Mississippi	2	2	1	1		2
Missouri	2	2	3			3
Nebraska	3	3	2	1		3
Nevada	1	1		1		1
New Hampshire	1	1	1			1
New Jersey	8	10	3	1	[1] 8 3?	15
New York	7	9	7	1	1	9
North Carolina	1	1	3			3
Ohio	7	7	10	4		14
Oklahoma	1	1	1			1
Oregon	2	2		2		2
Pennsylvania	11	13	10	2	[2] 1	13
South Carolina	1	1	1			1
South Dakota	1	1		1		1
Tennessee	3	3	3	1		4
Texas	2	2	2			2
Utah	2	2	1	2		3
Virginia	5	5	8			8
Washington	2	2	1		1?	2
West Virginia	4	4	4			4
Wisconsin	7	8	7	7		14
Canada	3	4	2	1	1	4
Foreign:						
Italy			2			2
Carniola				4		4
	131	142	123	43	[3] 17	183

[1] 2 of these arsenic and Nosema.
[2] Also Nosema.
[3] 10 arsenic; 3 arsenic and Nosema; 4 doubtful arsenic.

The bees recorded as coming from Italy consisted of two lots of worker bees which had accompanied queenbees, one lot having been shipped in 1921. The specimens from Carniola were all lots of workers from mailing cages, the shipments being made early in 1922. During 1922 specimens were received from 36 States, Canada, Italy, and Carniola, and during 1921 and 1922 specimens have been received from 44 States and from 4 foreign countries. No cases of Isle of Wight disease have been seen in this work except the cases from Scotland discussed in the earlier publication (*46*).

THE DOMINION OF CANADA.

Following the discussion of the apparent freedom of the United States and the Dominion of Canada from the Isle of Wight disease and the danger of its introduction at the meeting of the apiculture section of the Association of Economic Entomologists in Toronto in December, 1921, and the conference of March 9 called by the committee of the apiculture section, the committee recommended to the Dominion Government that immediate steps be taken to prevent the introduction of the disease into Canada. It was further recommended by this committee that the action of the Dominion and United States Governments be such as in no way to interfere with a free interchange of bees between the two countries. The Dominion apiarist was a member of the committee of the apiculture section. The action of the Dominion Government consisted of an order of the Deputy Minister of Agriculture, dated April 22, 1922, prohibiting the importation into Canada of bees, used and second-hand hives, and raw hive goods and products, except honey and wax, from the continent of Europe. A later statement from the deputy minister includes Great Britain in this prohibition.

At no time has any noteworthy disease or abnormality of adult honeybees been reported at any place in Canada, and it is believed that there is no disease within the boundaries of that country which has not been found within the limits of the United States. Bees sent to the Bureau of Entomology from various points in Canada have shown *Nosema apis*, which is not considered a disease dangerous to adult honeybees under the act of Congress. Bees examined by the Dominion apiarist have failed to show the presence of *Acarapis woodi*. The former Dominion apiarist, F. W. L. Sladen, was familiar with the Isle of Wight disease in England, and several years before his death recommended a joint action of the Dominion of Canada and the United States to prevent the introduction of this disease, which he knew from experience to be dangerous.

GREAT BRITAIN.

It is unnecessary to attempt to give the distribution of the Isle of Wight disease in Great Britain, as it may be assumed to be distributed throughout that country. Since the announcement of the cause of the disease, a large number of writers in England have discussed this disease and its treatment, but so far no definitely specific treatment for it has been announced. Doctor Rennie has continued his observations on this disease and has issued several interesting articles (*51*, *52*, *53*) on his findings. He has also published some records of the distribution of the disease.

Further study of the disease in Great Britain is bringing to light many interesting facts. The disease varies considerably in seriousness from season to season and in various locations, and a study of the conditions under which it does little or no damage would seem to be the most promising field for investigation in devising further control measures, just as has been done in the United States for the variable brood disease, European foulbrood. The extensive shipping of "driven bees," or bees without combs, to replace colonies dead of various causes has doubtless served to spread the Isle of Wight disease, as well as Nosema disease, which is also evidently prevalent there. Since the rapid breeding up of colonies in the spring seems to be very important in eliminating the disease, it is strange that more emphasis has not been placed by British beekeepers on methods of better wintering, which are vital for success at this season in the United States.

The most popular means of combating the disease in Great Britain seems to be the importation of bees from Holland and queens from Italy, and the advocates of the two races of bees have claimed for them greater power to resist the Isle of Wight disease than is possessed by bees native to Great Britain. On the contrary, other beekeepers are vehement in their denunciation of these importations and of the wide distribution of foreign races of bees, so that at a distance it is impossible to judge the merits of the effort. It seems obvious from the discussions on this subject that the only superiority which can be claimed for the two introduced races lies in their ability to breed up faster than the native bees. If this is true they may have some advantages in combating the malady. No general plan for the control or eradication of the disease under Government supervision has been announced.

FRANCE.

Just as Department Circular 218 was going to press (March, 1922) the first record reached the Bureau of Entomology of the finding of *Acarapis woodi*, the mite causing the Isle of Wight disease, on the continent of Europe. A brief footnote was added to page 7 of the circular to announce this finding. This record appeared in the January, 1922, issue of one of the French bee journals (*49*). The determination of the mite was made by a competent observer, L. Berland, assistant in the Museum d'Histoire Naturelle, Paris, under the supervision of Prof. E. L. Bouvier. The mites found in these diseased bees were identified as *Tarsonemus woodi* after comparisons with Rennie's descriptions and illustrations. The exact location of this outbreak of the disease was not recorded,[3] except that it was in the

[3] From a recent article by Ph. J. Baldensperger ["Quelle est la patrie du Tarsonemus?" La gazette apicole, v. 24, no. 220, p. 57–59], it would appear that this first outbreak was in the town of Champseur, Hautes-Alpes. He states that he took a trip of investigation through this territory with an entomologist, M. Poutiers, of Mentone, and that on this trip they were not able to find any of the mites causing the disease, although they had been definitely identified from the apiaries in which the disease was first discovered. The apparent disappearance of the mites is not explained. Other beekeepers of the region are reported to have lost their bees, but the cause of this loss could not be determined from lack of material. A recent private communication (Apr. 21, 1923) from M. R. Poutiers, Mentone, confirms the absence of mites from the bees examined on this trip. He reports a heavy loss of adult bees at Mentone last December, in the tracheæ of which he found *Acarapis woodi*, but he is not yet entirely certain that the mite causing acarine disease in France is identical with that described in England and Scotland. He states that the disease is made more severe by dampness, but that it appears not to be so severe as in Great Britain. Investigations at Mentone are still in progress.

French Alps. This finding was confirmed in the report of the proceedings of the December 21, 1921, meeting of the Société Centrale d'Apiculture de France (*55*). Berland (*12*) later discussed methods for identifying the mite.

In March, Professor Mamelle (*2*), of l'Ecole Nationale d'Agriculture de Grignon, asked French beekeepers to send him specimens of bees for examination whenever they find any evidence of disease, and it would appear that he took up the study of the Isle of Wight disease at about that time. At the meeting of the Société Centrale of April 18, 1922, he reported (*36*) that the Isle of Wight disease had made its appearance in several Departments of France, especially in Maine-et-Loire, Côte-d'Or, and Saône-et-Loire. Whether these records include the first published record was not stated, but from their location it would appear quite improbable. Two of these Departments are not many miles from the Cantons of Switzerland in which the disease was found at about the same time. It was announced (*3*) that a committee of four men holding the rank of professor in various French institutions had undertaken to study the diseases of bees, and in the same month Professor Mamelle, a member of this committee, addressed the Société Centrale (*26*) on this subject.

In June Giraud and Sevalle (*28*) gave a summary of the work of Doctor Rennie and recorded some recent instances of diseases of adult bees in France, without, however, stating definitely whether the mite was found in the diseased bees. Without this information the record lacks significance in the present discussion.

A later record of the distribution of the Isle of Wight disease in France is to be found in a notice (*37*) in the advertising section of L'Apiculteur for July, 1922, which was an announcement regarding the work of Professor Mamelle, presumably written by him or at any rate published at his request. He thanks beekeepers who have sent him several hundred specimens of adult bees and brood for examination and explains his delay in transmitting his diagnoses, after which the following statement appears: "Regarding the acarine disease (Isle of Wight disease) it can be affirmed that the disease is found somewhat throughout France, but does not seem to present the great injuriousness as in England."

In an article written in October, 1922, Bouvier (*14*), another member of the committee which is investigating bee disease in France, gives some additional records of the finding of the disease in France and adds that it is almost certain that there was an outbreak of the disease in Ardennes in 1919. He states that the disease is "found nearly throughout France," and definitely records the disease as present in four Departments not previously recorded—Basses-Pyrénées (adjacent to Spain), Lot, Ain, and Hautes-Alpes (adjacent to Italy). This makes definite records for seven Departments of that country. The definite records are all from central and southern France. Nothing has come to the Bureau of Entomology from French sources to justify a belief that the cases of Isle of Wight disease in France are directly traceable to recent importations from England, nor has any announcement of any regulatory means for the control of the disease in France reached the bureau, and seemingly no quarantines have been established as has been claimed (*5*). Bouvier is inclined to believe that *Tarsonemus woodi* may also be a

parasite of certain solitary insects, but does not record any cases of the finding of the mite in such insects.

Other articles on this disease have recently appeared in various French bee journals, but many of them have statements regarding the disease that are not based on examinations for mites and therefore are of little if any value in the present discussion. Since several American beekeepers claim to have used flowers of sulphur successfully in combating the disease of adult bees commonly known in the United States as paralysis, certain French beekeepers are advising the use of this material in combating the Isle of Wight disease, apparently on the mistaken idea that paralysis and the Isle of Wight disease are identical. Statements to this effect serve only to confuse the situation and are wholly valueless without experiments to support them. Rennie has repeatedly warned British beekeepers against the drawing of false conclusions of this type. In a recent paper Morgenthaler (*66*) has specifically warned beekeepers not to place confidence in the use of flowers of sulphur in the treatment of the Isle of Wight disease and has shown wherein they may make serious mistakes in judging the effects of treatments tried without proper scientific checks.

An effort is being made to get more detailed information regarding the distribution of the Isle of Wight disease in France, as this will help in determining how widespread the disease is on the Continent and will permit one to form some idea of the possible duration of the outbreak and the probability that the mite is also found in adjacent countries of Europe.[4]

Several of the statements that have been made regarding the disease in France assume that it is less virulent there than in England. To what extent such statements may be accepted is uncertain, and, if such a difference exists, it may be due to the condition described by Morgenthaler (*44*) and discussed on a later page of this circular (p. 18). Possibly some of this opinion is due to an overestimation of the losses in Great Britain which naturally arose from the reading of some of the articles from that country which appeared before the cause of the disease was known. Those reporting the supposed difference between France and England do not record whether they have seen cases of the disease in Great Britain.[5]

THE DUCHEMIN MITE.

In the article by Giraud (*28*) reference is made to the finding by Émile Duchemin in France in 1866 of a mite on the exterior of dead bees and also on the sunflower, *Helianthus annuus*. This mite was mentioned by Rennie (*50, p. 776*) in the first announcement of the discovery of *Acarapis woodi*. Since this finding and the references

[4] In a recent private communication (Apr. 3, 1923), M. Lucien Berland, of the Museum Nationale d'Histoire Naturelle, Paris, who made the first determinations of the mite from the French Alps (p. 12), writes that the disease exists throughout the territory of France, not continuously, but widely distributed. He states: "It appears to me probable that the disease exists throughout Europe." He calls attention to the fact that the disease is not easily spread, for all the colonies in an apiary are not attacked. He has not found the condition which Morgenthaler (*41, 44*) describes of the mite indistinguishable from *Tarsonemus woodi* on the outside of bees. He does not believe that the spread of the disease in France is of recent occurrence.

[5] A recent letter (Apr. 22, 1923) from a prominent British beekeeper states that early in that month he imported some bees from near Marseilles and that the bees of one colony began to crawl in a few days after they were received. Examination of the tracheæ showed them to be crowded with young parasites, but the tracheal trunks were not yet stained. "I am of the opinion that English bees would not crawl at this stage. The possibility of a very severe outbreak in this region [Marseilles] is great."

made to it in recent discussions have been the cause of some confusion in the minds of beekeepers in America and elsewhere, it is well to record exactly what Duchemin found and to show that this had nothing whatever to do with the Isle of Wight disease. No claim is made by Giraud or Sevalle (*28*) that *Acarapis woodi* and the Duchemin mite are the same species.

In 1866 M. Duchemin published a brief article (*21*) in which he described his finding several years before of a mite in the apiary of a poor peasant to which Duchemin attributed the rapid death of 30 colonies of bees. On near-by flowers of the sunflower, *Helianthus annuus*, to which the bees had access, he also found a mite which he considered to be identical. He concludes from observations then made and from work which he did on this subject in 1864, several years later, that the mites inhabit the sunflower and that in this way these plants are destructive to honeybees as sources of this enemy. This finding was discussed in several succeeding numbers of the same journal by the editor, Hamet, André (*7*), and again by Duchemin (*22*), who replies to cricitisms of André. The notes by Duchemin also appear in another journal (*20*). From the recent discussion it appears that this purported discovery was then discussed in other periodicals (*15*).

After the announcement of the discovery of *Acarapis woodi* as the cause of the Isle of Wight disease, several writers referred to this early finding by Duchemin. The well-known German investigator Von Buttel-Reepen (*15*) refers to his own finding of a mite on bees of *Apis indica* and raises the question whether *Tarsonemus woodi* may not be the same mite which Duchemin found in France. This article was translated in part into English and reply was made to it by the writer (*47*). Von Buttel-Reepen wrote his article before the description of *Acarapis woodi* had been published. In the reports of M. Duchemin's discovery in certain German periodicals mention had been made of an illustration which Duchemin had prepared, but unfortunately this illustration was not available to Von Buttel-Reepen when he prepared his paper. The illustration was not given in the account of this mite which Duchemin published in the Comptes rendus hebdomadaires des séances de l'Académie des sciences [Paris] (*20*), and Rennie (*50*) refers to the absence of an illustration. It appeared in L'Apiculteur, a French bee journal, for February, 1866 (perhaps also elsewhere), and the illustration was copied in the American Bee Journal for May, 1922. Ewing (*25*) later stated that the Duchemin mite, as determined from this illustration, was doubtless a nymph of a species of Trichotarsus, so there is not the slightest reason for thinking that the Duchemin record has anything to do with the Isle of Wight disease. These mites may have been injurious to the bees, as Duchemin claims, but this finding has no bearing on the present outbreak of Isle of Wight disease in France or elsewhere.

A similar record of the finding of a mite on bees is mentioned by Manger (*39*) (see also Elsaas-Lothring. Bienenzüchter, 1884 (*1*)), and Dennler (*18*), where it is recorded that Trapp, of Strassburg, found mites in considerable numbers on the head of a bee. An illustration of a ventral view of this mite by Schmidt (much better than the illustration drawn by Duchemin of his mite) is copied by Manger, which shows that there is no reason to believe it is any way

related to the Isle of Wight disease or identical with *Acarapis woodi*. This mite is identified with a considerable degree of certainty by Vitzthum (*58*) as a migratory nymph of *Trichotarsus osmiae*. Several species of mites have been found on honeybees and in and about beehives (*11*, *16*, *43*, *50*), and it is important that such mites shall not be confused, through careless identifications, with the one species known to be pathogenic to honeybees.

SWITZERLAND.

Since the announcement of the discovery of the cause of the Isle of Wight disease in 1920, the investigators of the Schweizerische Bakteriologischen Anstalt at Liebefeld, near Bern, and the apiary inspectors have been watching for *Acarapis woodi* in that country. The investigation of bee diseases for Switzerland is carried on in that laboratory, under the direction of Prof. Robert Burri, whose work on the brood diseases of bees is well and favorably known.

During the year 1921 examinations were made of adult bees that were suspected of disease or which showed any abnormality, but no specimens of *Acarapis woodi* were found (*40*). It is now known, however, that the mite was present in Switzerland before that time (*44*). On February 1, 1922, Dr. Otto Morgenthaler (*41*) of the station found dead mites, later identified by Rennie and himself as *Tarsonemus woodi*, on the outside of bees that had died during the winter, no evidence of disease having been noted previously. He then found that mites of this species, or at any rate indistinguishable by microscopic examination, were present on similar dead bees obtained by him from five towns in Switzerland ("wherever I looked for it"). This finding of the mite on the outside of dead bees which had not shown any definite signs of disease led to speculation as to the possibility that *Acarapis woodi* is in Switzerland a harmless symbiote of the honeybee; that it lives with the bees without either species being injured by the mutual adaptations. In an English review (*13*) of the above-mentioned paper this view is suggested, following a less definite suggestion of the same nature by Morgenthaler himself. In reply to this review Morgenthaler (*42*) states, however, that this does not correctly reproduce his view and that he considered the mites found on the outside of dead bees as dead animals (parasites) which had left their hosts on the death of the hosts.

In the same numbers of the two Swiss bee journals in which the report of the unsuccessful search in 1921 appeared, there was published a note by Morgenthaler (*40*) reporting that two specimens of diseased bees had been examined in cases in which definite symptoms of disease had been noted. This indicates that the Isle of Wight disease as it is found in Great Britain is actually found in Switzerland, and precludes the belief that *Acarapis woodi* is in Switzerland always a harmless symbiote. The development of the work in Switzerland on this mite and on the conditions in the colonies which it produces have added materially to our knowledge of the subject, and while there is still much to learn it is becoming more and more evident that this mite is to be considered a serious pest of the apiary in Switzerland and elsewhere, wherever it is found.

In a later article (*43*) Morgenthaler summarizes the information on *Tarsonemus woodi*, gives various reports of the finding of mites

of other species in and about beehives, and repeats the records of the finding of *Tarsonemus woodi* in Switzerland just mentioned. At the time of the writing of this article he had been unable to find living mites in the thoracic tracheæ of bees from those colonies in which they were found dead on bees which had died during the previous winter, but he specifically states that he does not question the statement that it is the cause of the Isle of Wight disease.

The most recent discussion of the situation, which covers the ground as it is so far understood in Switzerland, is contained in an interesting lecture (*44*) which Morgenthaler delivered before the Wanderversammlung des Vereins deutschschweizerischer Bienenfreunde on August 20, 1922, in Brugg. This lecture deals briefly with most of the diseases of adult bees, but the portion which is of special interest is that part dealing with his results with the mite. It may be mentioned that he finds that the protozoan parasite *Nosema apis* is in Switzerland, as in America, usually a relatively harmless parasite, but that under certain circumstances it produces a serious disease. Morgenthaler is inclined to believe, so far as can be judged from his lecture, that *Nosema apis* and *Tarsonemus woodi* are usually about of equal destructiveness to the colonies, but it is not quite clear as yet what the circumstances are which increase their damaging characteristics.

He reports that the mite has now been found throughout Switzerland. This is a small country, enabling him in one season to make a rather complete survey, but he records finding the mite throughout the country. The virulent cases were found in the Cantons of Geneva and Vaud (adjacent to France), while the worst case was in the middle of the Canton of Valais (adjacent to Italy). He reports five such virulent cases, and in a private communication he reports a sixth case. Regarding the more general distribution of the mite in the milder or chronic cases, he states (*44*):

> And indeed these mite-infested apiaries were found scattered through the whole country, among others also on our northern, southern, eastern, and western boundaries, so that it may be surmised that the mite is also scattered in neighboring lands and will be found as soon as it is sought. Switzerland may therefore not be considered as an especially dangerous center of infection of the acarine disease.

Regarding the worst case of infection, in middle Valais, he states:

> The acarine disease in its virulent form has been found in Switzerland in five apiaries * * * but worst in a little village in middle Valais, where all three apiaries of the place were attacked. Here the occurrence of the disease may be traced back with certainty to the year 1915, and the chief sufferer—incidentally it may be noted, an excellent beekeeper, bee inspector, and teacher of beekeeping in an agricultural school—has in this time lost 26 of his 35 colonies. Importation of bees from England has nowhere occurred.

The record for Switzerland can not be interpreted as consisting of cases directly attributable to importations,[6] and one must con-

[6] In a recent article Fr. Leuenberger (Jahresbericht über die Faulbrutversicherung des V[ereins] D[eutsch] S[chweizerischer] B[ienenfreunde] pro 1922, *in* Schweizerische Bienen-Zeitung, n. f., v. 46 (1923), no. 3, p. 115–120), who has charge of the bee disease control work in Switzerland, states the Isle of Wight disease occurs in increasing amounts in French Switzerland and that apparently it has been brought in through importation of bees from western France. No case of the disease is reported by him from German Switzerland. He expresses the hope that the disease may be localized by energetic measures before it causes greater damage, but does not report the nature of the measures adopted. Morgenthaler (*44*) reports finding the mite on the northern boundary of Switzerland (German Switzerland).

clude that the infestation is at least of several years' duration. The same thing is, of course, true of the records from France, so that we dare not assume (*5*) that the disease in continental Europe is traceable to recent introduction from Great Britain.

Since Morgenthaler has found mites on bees which were not recognized by their owners or by inspectors as diseased, this has given rise to the idea that the mite is often not a serious pest or that it is quite harmless in most cases. For some reason this interpretation has been put on his work, but not on that of Rennie, who has described the same things. This does not seem to agree with the present ideas of Morgenthaler in the slightest degree. It is quite true that he has found mites where he himself has not been able to detect the ordinary symptoms of the Isle of Wight disease, but so has Rennie. In a private communication (January 15, 1923) he states that he sent dead bees from the Liebefeld Station apiary on which he found mites to Rennie and that Rennie found that from 3 to 5 per cent of the bees showed mites in various developmental stages in their tracheæ.

> I have been unable to confirm this finding through my own investigation, although I have dissected many such bees. I find the tracheæ always clean. I am, however, now about to test this question with new and better material.

Regarding the assumed harmlessness of these mites, Morgenthaler has the following to say (*44*):

> The harmlessness of the parasite has been erroneously asserted from these findings. I may here allude to only two points which must be regarded in the examination of this phenomenon. First, the bee colony possesses a series of contrivances for defense against the parasite, so that it does not succumb without a struggle to the first attack. The most powerful of these means of defense is found in the constant renewing of the inmates of the colony through the death of the old infested bees and the emergence of young healthy ones. It is therefore made very difficult for the parasite to obtain a foothold, notwithstanding that it can probably be found for a long time in the colony. Only when it invades the colony in overwhelming numbers because of special circumstances does it get the upper hand.
>
> Secondly, however, it is very likely that the apparently healthy colonies containing parasites after all are not entirely normal. By rigorous investigations it would indeed be shown that many remain in colony strength below what one would expect of them. Exact weighings and measurements * * * would show clearly that for many apiaries which outwardly do not give an impression of disease, the loss of flight bees is too great. The question would here also have to be examined whether the lack of swarming is not also due to infection, concerning which many beekeepers have complained these last years.

Throughout this lecture, Morgenthaler deals both with *Nosema apis* and *Acarapis woodi* as parasites which under certain circumstances, not understood, become harmful, so that these remarks are not to be interpreted as applying solely to the mite. The experience with *Nosema apis* in the United States would appear to support his contentions for that parasite.

It would therefore appear from the findings in Switzerland that whereas *Acarapis woodi* may produce a chronic and damaging disease, it can also at times become dangerous to as great a degree as has been described for England. It is also clear that the outbreaks of the virulent form of the disease can not be attributed, as some (*5*) have attempted to claim, to recent importations from England, for Morgenthaler specifically states regarding these severe outbreaks that "importation of bees from England has nowhere occurred."

Because of the thoroughness of the search in Switzerland and the wide distribution of the mite, the supposition of Morgenthaler that the mite will doubtless be found in adjacent countries when it is sought must have greater weight than the statements which have appeared from these adjacent countries that the mite is absent, since in all the adjacent countries except France no effort has been reported of surveys of the kind demanded for definite statements on this point.

The Government apiary inspection service of Switzerland has taken steps to prevent the spread of the Isle of Wight disease (*35*), and the methods employed are discussed later (p. 26).

GERMANY.

The situation regarding the Isle of Wight disease in Germany is yet very indefinitely known. In a publication issued in 1922, Hirst (*32*) states that apparently *Acarapis woodi* has been found only in English bees, but he adds a footnote in which he states (p. 97): "According to Vitzthum, Doctor Ellinger, of Weimar, has reported that the disease has made its appearance in Germany also (Bayerische Bienenzeitung, April 1922)." Count Vitzthum is a well-known specialist in mites and Doctor Ellinger is the author of several papers on bee diseases. There also appeared a statement from Alfonsus, of Vienna (*6*), in which he states (p. 2): "The occurrence of *Tarsonemus woodi* has now also been established in Germany * * * (Archiv für Bienenkunde, vol. III, 6, 1921)." The number of the Archiv für Bienenkunde to which Alfonsus refers contains two articles (*33*, *39*) on the Isle of Wight disease, but in neither case is there any statement which can be interpreted as supporting the statement quoted.

The Bayerische Bienenzeitung to which Hirst refers is not regularly received in the Bureau of Entomology, but the editor, Hofmann, of Munich, kindly sent the copies of his journal which contained articles on this subject. In the article by Vitzthum (*57*) to which Hirst refers there is only the following statement on this subject: "Doctor Ellinger of Weimar communicates that the disease has also appeared in Germany." No additional information is given and it is not stated whether this statement is based on an examination of diseased bees for the mites or merely on the general symptoms observed in diseased adult bees, which are known to be quite unreliable. Since this statement appeared only a few months (November to April) after Rennie's announcement of the discovery of the cause of the disease, it appears somewhat doubtful whether any search for the mite had been made, especially since these intervening months were during the winter. In order to clear up this point, a letter was written to Doctor Ellinger, who replied under date of January 10, 1923: "Your question on the occurrence of the *Tarsonemus woodi* in Germany I answer as follows: It is not yet certainly found in Germany." Doctor Ellinger also kindly sent some advance proof sheets of an article of his (*23*) on the diseases of bees which is soon to appear in a new edition of Unsere Bienen (Ludwig, editor), in which he makes no reference to the finding of the Isle of Wight disease in Germany. It would, therefore, appear that his statement to Count Vitzthum was based solely on external symptoms, although this is not stated.

In the meantime a number of other articles (*15*, *33*, *38*, *39*) have appeared in German journals regarding the Isle of Wight disease and its newly discovered cause, and in none of those which have come to the attention of the writer is there any statement regarding the occurrence of the disease in Germany. Dr. Bartholomäus Manger of Ingolstadt in a private communication writes (December 30, 1922) that he reads all the German bee journals and has seen no such statement. Because of the geographical position of Germany in the center of various important beekeeping regions of Europe, it seemed quite desirable to determine whether the disease is actually present in that country. Probably no American beekeeper would wish to import queenbees from Germany, almost certainly not of the race of bees native to that country. Germany has long been the home of scientific research in beekeeping and there are a large number of competent investigators in beekeeping in that country. It was felt that if the disease has actually been found in Germany this fact would indicate a wider distribution than has been assumed for the mite in most of the publications on the subject. With this thought in mind, the writer addressed a considerable number of the prominent beekeeping investigators of Germany, asking whether they had any knowledge of the actual finding of the mite within the boundaries of Germany.

The replies to these inquiries were uniformly to the effect that the mite has so far not been recorded in any German beekeeping periodical and none of the men who replied had any knowledge of such findings. It appears from these letters that no search has been made specifically for this mite, but one of the men who wrote, a prominent investigator, states that he expects to undertake such a search during the summer of 1923.

Except for the surmise of Morgenthaler, based on his finding of the mite on the northern boundary of Switzerland, adjacent to southern Germany, it may therefore be stated that there is so far no evidence of the occurrence of the Isle of Wight disease in Germany. This negative statement will be of little value in comparison with such scientific investigations as will doubtless be made in the near future.

ITALY.

American beekeepers are perhaps more concerned with the situation as to diseases of adult bees in Italy than in any other country of continental Europe, since more importations of queenbees have been made and will be desired from that country than from any other. Several articles (*8*, *9*, *10*, *45*) have appeared in the Italian bee journal on the Isle of Wight disease and on its newly discovered cause, but they are usually a summary of the work of Rennie or announcements of the finding of the disease elsewhere in England. The effort of the United States Government to prevent the introduction of the disease into this country has also been mentioned on several occasions, not always favorably (*4*).

The only definite statement which has come to the attention of the writer is a brief one by Prof. Vincenzo Asprea, of Calabria. In discussing the United States postal regulation approved March 21, 1922, prohibiting the mailing of queenbees into the United States, he says (*8*) :

It is strange that while the English Government imports a large quantity of Italian queens to combat the disease, and with good success, the Americans wish to keep it out by not importing. To tell the truth, the fear is justified by the fact that the disease has been observed in the French Alps and in near-by Italian apiaries, but since then it has not been seen further.

The reference to the French Alps doubtless refers to the actual finding of the mite in diseased bees from the French Alps, previously mentioned (*49*). It will be recalled that this first report from France did not give the exact location of the apiary from which the diseased bees were received, and in that notice no mention was made of bees in neighboring apiaries, either in France or Italy, being diseased. The disease is recorded by Bouvier (*14*) as occurring in Hautes-Alpes, France.

Since the publication of this brief mention of the disease in Italy, several other articles (*9*, *10*, *45*) and notices have appeared, some of them by Asprea, which would lead one to surmise that the authors believe that the Isle of Wight disease does not occur in Italy, since they usually urge that the Italian Government shall take steps to prevent the introduction of the disease into that country. The Federazione Apistica Italiana has stated in a private communication (Dec. 20, 1922) that they believe that it will be possible to furnish full assurance of the absence of the Isle of Wight disease from Italy. It may therefore be concluded that there is little reliable evidence of the presence of the Isle of Wight disease in Italy, based on examinations of diseased bees. The chief reason for suspecting that the disease may be present is the fact that it has definitely been found in neighboring apiaries in France and Switzerland.

From private sources the author has learned that the Italian Ministry of Agriculture has been requested by the Federazione Apistica Italiana to take steps to prohibit all importation of foreign bees into Italy, in order to prevent the introduction of the Isle of Wight disease into that country, and that in all probability a search will be made in the near future to determine whether the mite is actually found in that country. The Italian beekeepers are evidently and properly anxious to prevent the introduction of the disease and to keep up the standing of their stock throughout the world. The results of their efforts will be watched with keen interest in the United States. Prof. Amyandro Ghigi of the University of Bologna, reports in a private communication (April 18, 1923) that he has examined bees from apiaries in that Province and has failed to find any *Tarsonemus woodi*.

DENMARK.

In a private communication (April 30, 1923), Dr. L. Bahr reports that *Tarsonemus woodi* has not been found in Denmark through the occurrence of the disease which it causes. No extensive inquiry has been made on this subject in that country, but further investigations will be made in the near future. Doctor Bahr further reports that no record of the mite in Sweden or Norway has come to his attention.

CZECHOSLOVAKIA.

In a letter dated May 23, 1923, from Rev. Ivan F. Kitzberger, Veleslavin, Czechoslovakia, editor of one of the leading bee journals of that country, it is stated positively that the mite causing the

Isle of Wight disease has been found in that country. Identifications of the mite were made by Blattný, an assistant in the Zoological Institute at Prague, who is a specialist on mites. He has also found several other species of mites in and about the hives, but these are not associated with any disease and some of them have previously been found in hives. No statement was made regarding the occurrence of the Isle of Wight disease or whether the mite is found without manifestation of the disease, as has occurred in parts of Switzerland.

That the Isle of Wight disease may be present to an alarming degree in Czechoslovakia is indicated by an article by Altmann (*60*), in which it is stated that during the spring of 1923 reports have been received by him of the heavy death of adult bees and of entire colonies, of such a character that the loss can not be attributed to poor wintering. Altmann is in charge of the bee investigations for the Deutsch. bienenwirtschaft. Landes-Zentral Verein für Böhmen, and asks that diseased bees be sent in for examination to determine whether *Nosema apis* or *Acarapis woodi* is the cause of the heavy losses. An even more severe loss of adult bees and of colonies has been reported from the territory of Teschen (Bohemia) by Kessler (*62*), but no indication of the cause of this loss is given.

SOUTH AFRICA.

In a letter dated June 18, 1923, from Dr. Otto Morgenthaler, Liebefeld bei Bern, Switzerland, whose investigations of the Isle of Wight disease have added so materially to our knowledge of this subject, it is stated that the Isle of Wight disease has become established in South Africa and that attacked colonies have been destroyed by officials in Natal. Details of this outbreak are lacking.

OTHER EUROPEAN COUNTRIES.

So far as has come to the attention of the Bureau of Entomology, no search has been made for the Isle of Wight disease or for the mite which causes it in any country of Europe other than those already mentioned, nor has any definite statement been seen regarding its presence, based on investigations. It has been reported to the bureau by certain American beekeepers that they have assurance that the disease does not exist in certain countries, but so far it has been impossible to get any accurate first-hand information on these subjects, and in some cases the reported evidence has been found to consist merely of letters from some queen breeder who is eager to sell his queens in this country, but who has no means of examining bees for the presence of mites or any knowledge of its presence in his country.

The finding of mites so generally in France and Switzerland, as soon as steps were taken to search for them, shows conclusively that the mite is not one which has until recently been confined to Great Britain. There is, therefore, a high degree of probability, amounting almost to a certainty, that the mite is present in countries other than those in which it has been sought. The facts which Morgenthaler (*44*) brings out regarding the wide prevalence of weak colonies, lack of swarming, and other evidence of abnormality in

the bees of Switzerland due to the infestation indicates that the mite may be present for a considerable time without the beekeeper being aware of the fact, and, even from an experienced beekeeper, one may not accept the statement that there are no cases of the disease in his country, merely on the basis of lack of visible symptoms among his own bees. Various diseases or abnormalities of adult bees, known variously as paralysis, May disease, and under other names, have been recorded repeatedly from the various countries of Europe, and since these names mean little or nothing, the causes of these conditions being purely a matter of speculation, one is entirely unable to estimate the probability that some of these conditions are actually the Isle of Wight disease. It certainly can not be considered safe to accept statements of interested persons who desire to make sales of queenbees in the United States when there is no way of checking their statements.

CARNIOLA.

The Province of Carniola, in the Kingdom of the Serbs, Croats, and Slovenes, is the home of the Carniolan bee, which has for a number of years had some ardent advocates in the United States. They are excellent bees, but have not gained the popularity in this country which Italian bees enjoy. There are only a few queen breeders in the United States who have found demand enough for these bees to make their propagation profitable, and as a result many beekeepers who prefer bees of this race have been in the habit of obtaining their queens directly from Carniola. Perhaps because of this fact, there has been more demand that this Province be excluded from the operation of the law against importations and that queens from Carniola be admitted freely than has come from those who desire queens from Italy. The statement has been made by those interested in these importations that there is no Isle of Wight disease in that Province. An effort has been made by the writer through correspondence to learn if there has been any investigation to determine whether any Isle of Wight disease or any disease of adult bees exists in Carniola, but so far without success. The president of the provincial beekeepers' association, M. Humek, wrote under date of August 18, 1922, that he is not aware of any kind of infectious bee disease in his country. He states in his letter that certain bees had been sent away for examination and that one of the best-known queen breeders of that country would send to this Government a report which would show that the Isle of Wight disease is unknown in Carniola. So far the report has not been received, and from other correspondence it would appear that there has been some unavoidable delay in the examinations, the nature of which is not clear. The Royal Department of Commerce and Industry of the Kingdom has also stated that there is no case of any disease of bees in the Kingdom. An effort is being made to obtain the data on which this statement is based.

When the revised postal regulations were adopted prohibiting the mailing of queenbees through foreign mails in March, 1922, four persons who had imported queenbees from Carniola sent to the Bureau of Entomology the original cages in which imported Carniolan queenbees had been received, including the accompanying worker bees. These worker bees were not found to contain *Acarapis woodi*, but they were heavily infected with *Nosema apis*. This

parasite is found widely distributed in the United States, and under the regulations provided for the enforcement of the importation law the disease which it causes is not considered as one dangerous to adult honeybees, but the fact remains that probably never in the work of the Bureau of Entomology on this disease have bees been examined which contained a larger number of these intestinal parasites. If such a heavy infection were found in bees in this country, one would expect there would be marked symptoms of abnormality. It therefore appears strange that the beekeepers of Carniola have never noted any abnormality of adult bees. If Carniolan bees have the ability to harbor this parasite without showing any symptoms or are better able to resist it than are other bees, this has not previously been proved. The presence of *Nosema apis* in Carniola will not serve to confuse the situation with regard to importations from that Province if the much-needed examinations of adult bees are made by competent investigators.

AUSTRIA.

No information has been received by the Bureau of Entomology concerning the details of any search which may have been made in Austria to determine the presence of the Isle of Wight disease. A letter has been received by the author from Alois Alfonsus, of the Austrian Department of Agriculture, Vienna, written from within the United States, in which he states that the scientific institute of that department has so far been unable to find *Tarsonemus woodi* in that country. He does not state how extensive a search has been made or from what parts of the country bees have been examined. No published report of this work has been reported to the bureau. Austria is immediately adjacent to Switzerland, and Morgenthaler (*44*) reports finding *Tarsonemus woodi* on the contiguous border.

While it is most essential that a serious effort be made to determine especially whether Italy and Carniola are free from the dangerous diseases of adult bees, it is also of the highest importance to American beekeepers that efforts be made to determine these facts for all of Europe, just as soon as conditions are favorable for the prosecution of such investigations. The shortness of the distances between important beekeeping regions in Europe and the considerable traffic in bees which has long been customary throughout Europe make it necessary that detailed studies be made on this point for each country, and it will doubtless be several years before the facts are adequately known.

Although beekeepers of all countries are at present interested in the Isle of Wight disease, the investigation of its presence in many countries is difficult or impossible because of disturbed economic conditions.

Investigations on beekeeping subjects were not systematically conducted in most European countries before the war, and since then some of the work which had been organized has been discontinued. Several countries have so far made no provision for such work. Under these circumstances it will probably be several years before the distribution of the Isle of Wight disease on the continent of Europe is fully known. It will be recalled that the discovery of the cause of this disease was the result of work by members of a university staff,

aided by private funds, and not a Government project. The interest in this subject promises to be the incentive for support for much-needed investigations, either from public or from private sources.

EMBARGOES TO PREVENT INTRODUCTION OF BEE DISEASES.

Several countries other than the United States have taken steps to prevent the introduction of the Isle of Wight disease and other diseases of bees. The embargo placed by the Dominion of Canada is well known to American beekeepers. Other British Dominions have taken similar precautions, notably the Union of South Africa, Jamaica, and Australia. There seems now to be an insistent demand from beekeepers of Italy for a strict prohibition of importations of bees into Italy. Because of the vast interest created by the work of Doctor Rennie and his associates, it is to be expected that other countries will follow the same course, and in all probability the free international shipment of bees will soon be a thing of the past.

Under regulation 5 (*b*) of the regulations formulated for the enforcement of the act of Congress of August 31, 1922 (see appendix), it is provided that importations of adult bees from any country other than the Dominion of Canada shall be conditioned on the determination of the Secretary of Agriculture, as a result of adequate scientific investigation, that no diseases dangerous to adult honeybees exist in the country in question, and that adequate precautions have been taken by such country to prevent the importation of adult honeybees from countries where such dangerous diseases exist. The purpose of this regulation is solely to safeguard American beekeeping interests, but it indicates clearly what steps are necessary for the protection of the beekeeping interest of any country against these dangerous diseases. This policy on the part of the United States Government will make it less probable that beekeepers of other countries wishing to ship queenbees into the United States will attempt to conceal the true situation; rather, they will urge that provisions for thorough investigations be made, if their trade with this country justifies the expense and labor of such investigations.

As a result of the freedom which American beekeepers formerly enjoyed regarding the importation of bees, they now have three brood diseases, Nosema disease, the so-called paralysis, and perhaps other diseases of adult bees, all of which, so far as they are contagious or infectious, were assuredly brought to this country from abroad, since the honeybee is not native to America. The price which beekeepers of the United States are now paying for these accidental importations of diseases amounts to at least a million dollars annually, a high price to pay for the privilege of buying bees wherever one wishes, without knowledge as to the safety of the transaction. Under the law now in force, such importations may be safeguarded, so far as investigation has discovered the causes of diseases which are not yet present in this country. That there is still at least one disease of adult bees which is not present in the United States seems probable, because of the inability to find it during the past two seasons. Why the Isle of Wight disease is not widespread in the United States is a matter of mystery, but one of purely theoretical interest. If, as is believed and hoped, the United States is free from this disease, then the door has been closed in time, and it should be

the privilege of every American beekeeper warmly to support the enforcement of this law, and this is in fact the attitude of the vast majority at this time.

In the correspondence with the Bureau of Entomology regarding the regulations for importations, the necessity for further importations of queenbees is emphasized by those who wish to make such importations, and is minimized or denied by those who do not wish to make importations. This is a natural condition and occasions no surprise. It seems evident that there is no popular demand or great necessity for large importations at present, and, in fact, it is not proved that any actual damage would result to American beekeeping from a total prohibition of importations for a time. With the safeguards which have been provided under the law, it will be possible to make such importations as may be urgently needed for experimental and scientific purposes. As further investigations are made in the various foreign countries, it may be found safe to allow bees to enter from them without restrictions and for any purpose. Until accurate information is available from the various countries, it is the part of wisdom to limit the importations to those for experimental and scientific purposes and to keep a careful watch for information from all the countries from which any importations may be desired.

In addition to the countries named above as having prohibited or restricted the importation of adult bees, special attention should be drawn to the recent action of Switzerland. As has been pointed out, the Isle of Wight disease occurs in that country and in all Morgenthaler (*66*) now reports 19 cases of the disease in French Switzerland. Under these circumstances the prohibition of importations might seem unnecessary, yet the recent action of the Swiss Government puts such a prohibition into effect and outlines steps for the eradication of the disease already present. The situation with regard to the disease in that country is outlined in three recent articles by Leuenberger (*63*, *64*, *65*).

On April 18, 1923, the Swiss Bundesrat issued a proclamation (*68*) under which the Isle of Wight disease is included under the animal diseases covered by the Federal law of June 13, 1917, concerning the combating of animal diseases, and the ordinance for its execution dated August 30, 1920. Provision is also made for partial compensation by the Federal Government for colonies destroyed in the enforcement of this law and the several ordinances. Under date of April 25, 1923, the details for the control of the Isle of Wight disease are set forth by the veterinary office of the Swiss Government (*69*), in which the work of control is assigned to the foulbrood inspectors of the several cantons and the methods of compensation for colonies destroyed are outlined. The importation of bees and combs is forbidden from March 15, 1923, and as no exceptions to this prohibition have appeared, the prohibition seems to be absolute. It is the evident intention of the Swiss Government to eradicate the Isle of Wight disease which has already appeared in that country and to prevent any further introduction of the disease by this rigid prohibition.

LITERATURE CITED.

(1) ANONYMOUS.
1884. [Article on the mite discovered by Trapp.] *In* Elsass-Lothring. Bienenzüchter. Reference from Manger (*39*); original not consulted.

(2) ———
1922. Maladies des abeilles. *In* L'Apiculteur, v. 66, no. 3, p. 104.

(3) ———
1922. Maladie de l'Île de Wight. *In* L'Apiculteur, v. 66, no. 5, p. 172. *See also* no. 6, p. 192.

(4) ———
1922. Il bando anche alle api italiane? *In* L'Apicoltura italiana, v. 18, num. 9, p. 216. (Extract from weekly bulletin of the Italian Chamber of Commerce, New York, "La Revista commerciale," April 22, 1922.)

(5) [ABUSHÂDY, A. Z.]
1922. Wisdom or panic? *Editorial in* The Bee World, v. 3, no. 11, p. 261–262.

(6) ALFONSUS, ALOIS.
1922. An enemy of the mites in the bee-hive. *In* The Bee World, v. 4, no. 1, p. 2–3, 1 fig. (Authorized translation by Herbert Schering.)

(7) ANDRÉ.
1866. Sur l'acare de l'abeille. *In* L'Apiculteur, v. 10, p. 174–176. (Copied from *Cosmos*, with note by Hamet.)

(8) ASPREA, V[INCENZO].
1922. [Spigolature apistiche.] *In* L'Apicoltura italiana, v. 18, num. 5, p. 117.

(9) ———
1922. [Spigolature apistiche.] *In* L'Apicoltura italiana, v. 18, num. 8, p. 188.

(10) ———
1922. [Spigolature apistiche.] *In* L'Apicoltura italiana–L'Apicoltore, v. 18, num. 9, p. 201.

(11) BANKS, NATHAN.
1915. The Acarina or mites. U. S. Dept. Agric., Office of the Secretary, Report 108, 153 p., 294 figs.

(12) BERLAND, LUCIEN.
1922. Méthode pour déceler l'existence de l'acarien agent de la maladie de l'Île de Wight. *In* L'Apiculteur, v. 66, no. 5, p. 172–173.

(13) B[ETTS], A. D.
1922. Acarine disease in Switzerland. *In* The Bee World, v. 3, no. 12, p. 293. Review of article by Morgenthaler (*40*).

(14) BOUVIER, E. L.
1922. Fléaux entomologiques nouveaux pour notre pays. *In* Les Annales, no. 2050, 8 Octobre, p. 387–388.

(15) v. BUTTEL-REEPEN, [H.].
1920. Die neue (?) verheerende Milbenkrankheit der Bienen. *In* Archiv f. Bienenkunde, v. 2, no. 8, p. 328–332. (Partial translation *in* American Bee Journal, v. 62, p. 58.)

(16) COOK, A. J.
1883. A new bee enemy. *In* Amer. Apiculturist, v. 1, p. 134–136, 1 fig.

(17) DADANT, C. P.
1922. Tarsonemus not Acarapis. *Editorial in* American Bee Journal, v. 62, no. 6, p. 253.

(18) DENNLER.
1885. An interesting discovery. *In* British Bee Journal, v. 13, p. 15.

(19) DEVAUCHELLE.
1922. Maladie de l'Île de Wight ou acariose des abeilles. *In* L'Apiculteur, v. 66, no. 9, p. 290–295.

(20) DUCHEMIN, ÉMILE.
1866. Note sur les abeilles et un de leurs parasites. *In* Compt. Rend. Acad. Sci. [Paris], v. 62, p. 48–49. *See also* p. 225 and 683.

(21) ———
1866. Sur un parasite de l'abeille. *In* L'Apiculteur, v. 10, p. 144–146, 1 fig. (Note by Hamet, H., p. 146.)

(22) ———
1866. Sur l'acare de l'abeille. *In* L'Apiculteur, v. 10, p. 240–241.
(23) Ellinger.
1923. Die Erkrankungen der Honigbiene. Aus "Unsere Bienen," von Ludwig, 4. Aufl., p. 336–362. (In press; proof sheets furnished by author.)
(24) Ewing, H. E.
1922. Studies on the taxonomy and biology of the tarsonemid mites, together with a note on the transformations of *Acarapis* (*Tarsonemus*) *woodi* Ren. (Acarina). *In* Can. Ent., v. 54, no. 5, p. 104–113, 3 fig.
(25) ———
1922. Concerning mites. *In* American Bee Journal, v. 62, no. 7, p. 317.
(26) Favier, Marcel.
1922. [Comptes rendus de la] Société centrale d'apiculture, Séance du 19. Mai, 1922. *In* L'Apiculteur, v. 66, no. 7, p. 253–254.
(27) Fracker, S. B., Gooderham, C. B., and Rea, George H.
1923. Protecting American bees against the introduction of the Isle of Wight disease. *In* Jour. Econ. Ent., v. 16, no. 2, p. 133–136.
(28) Giraud, E., et Sevalle, E.
1922. Maladie de l'Île de Wight. *In* L'Apiculteur, v. 66, no. 6, p. 185–192.
(29) Graham-Smith, G. B.; Fantham, H. B.; Porter, Annie; Bullamore, G. W.; and Malden, W.
1912. Report on the Isle of Wight bee disease (miscrosporidiosis). Supplement no. 8, Journ. Board Agr. [London], v. 19, no. 2, 143 p., 5 pl.
(30) Harvey, Elsie J.
1921. Isle of Wight disease in hive bees. (3) Experiments on infection with *Tarsonemus woodi*, n. sp. *In* Trans. Roy. Soc. Edin., v. 52, pt. 4, no. 29, p. 765–767.
(31) Hirst, Stanley.
1921. On the mite (*Acarapis woodi*, Rennie) associated with Isle of Wight bee disease. *In* Annals and Mag. Nat. Hist., ser. 9, v. 7, p. 509–519, 7 fig.
(32) ———
1922. Mites injurious to domestic animals (with an appendix on the acarine disease of hive bees). Economic series no. 13, British Museum. 107 p., illus. (Portion on *Acarapis woodi*, p. 94–103, fig. 78–85.)
(33) Hoffmann, H.
1921. Die Insel-Wight-Krankheit der Bienen. *In* Archiv für Bienenkunde, v. 3, no. 6, p. 193–196, 2 fig.
(34) Killick, C. R.
1923. Some aspects of the pathology of acarine disease. *In* The Bee World, v. 4, no. 8, p. 169–171, 7 fig.
(35) Leuenberger, Fr.
1922. Die Milbenkrankheit. *In* Schweizerische Bienen-Zeitung, n. f., v. 45, no. 4, p. 159–160.
(36) [Mammelle.]
1922. [Maladie de l'Île de Wight en France.] *In* L'Apiculteur, v. 66, no. 6, p. 217. (Reported by Favier.)
(37) ———
1922. A propos des maladies des abeilles. *In* L'Apiculteur, v. 66, no. 7; advertising section, following p. 256.
(38) Manger, [Bartholomäus].
1921. Zur Entdeckung des Erregers der Insel-Wight-Krankheit der Honigbiene. *In* Bayerische Bienen-Zeitung, v. 43, no. 1, p. 11 and 13.
(39) ———
1921. Über die Milbenkrankheit der Bienen (Insel-Wight-Krankheit). *In* Archiv für Bienenkunde, v. 3, no. 6, p. 187–192, 2 fig.
(40) Morgenthaler, Otto.
1922. Bienenkrankheiten im Jahre 1921. *In* Schweizerische Bienen-Zeitung, n. f., v. 45, no. 4, p. 149–159.
1922. Maladies des abeilles en 1921. *In* Bulletin de la société romande d'apiculture, v. 19, no. 3, p. 63–68; no. 4, p. 86–87; no. 5, p. 118–121.

(41) ———
1922. Die Milbe *Tarsonemus woodi* auch in der Schweiz? *In* Schweizerische Bienen-Zeitung, n. f., v. 45, no. 3, p. 105–106.
1922. Apparition de l'acare *Tarsonemus woodi* également en Suisse? *In* Bulletin de la société romande d'apiculture, v. 19, no. 4, p. 88–89. (Traducteur, Dr. E. Rotschy.)
1922. Tarsonemus in Switzerland. *In* American Bee Journal, v. 62, no. 5, p. 193–194. (Translated from French translation by C. P. Dadant.)
1922. The mite *Tarsonemus woodi* in Switzerland also? *In* The Bee World, v. 3, no. 10, p. 258. (Translated from German by Annie D. Betts.)
(42) ———
1922. Acarine disease in Switzerland. *In* The Bee World, v. 4, no. 1, p. 22.
(43) ———
1922. Zum Kapitel "Bienen und Milben." *In* Archiv für Bienenkunde, v. 4, no. 2, 1 tafel, p. 45–52.
(44) ———
1923. Einiges über die Krankheiten der erwachsenen Bienen. *In* Schweizerische Bienen-Zeitung, n. f., v. 46, no. 1, p. 26–28, 2 fig.; no. 2, p. 81–85.
1922–23. Quelques observations sur les maladies des abeilles adultes. *In* Bulletin de la société romande d'apiculture, v. 19, no. 12, p. 287–290, v. 20, no. 1, p. 4–10.
(45) Penna, E.
1922. Sulle malattie delle api in rapporto all'applicazione dell'attesa legge sull' apicoltura. *In* L'Apicoltura italiana, v. 18, num. 4, p. 74–81; num. 5, p. 118–123; num. 6–7, p. 147–154; num. 8, p. 177–181, illus.
(46) Phillips, E. F.
1922. The occurrence of diseases of adult bees. U. S. Dept. Agr., Circ. 218, 16 p., 2 figs. (Literature, p. 15–16.)
(47) ———
1922. The mite and the Isle of Wight disease. *In* American Bee Journal, v. 62, no. 5, p. 211–212.
(48) ———
1922. The Isle of Wight disease. *In* Gleanings in Bee Culture, v. 50, no. 4, p. 234.
(49) Ranguis, Abbé.
1922. Maladie des abeilles: un nouveau et grave danger. *In* L'Apiculteur, v. 66, no. 1, p. 20–23.
(50) Rennie, John.
1921. Isle of Wight disease in hive bees—Acarine disease. (4). The organism associated with the disease—*Tarsonemus woodi*, n. sp. *In* Trans. Roy. Soc. Edin., v. 52, pt. 4, no. 29, p. 768–779, 1 pl., 2 figs.
(51) ———
1921. *Tarsonemus woodi* and Isle of Wight disease. *In* Report of Aberdeenshire and Kincardineshire Bee-Keepers' Association for 1920, p. 19–21.
(52) ———
1921–22. Notes on acarine disease. Parts 1–13. *In* The Bee World, v. 2, no. 12, p. 144–145; v. 3, no. 1–12, p. 5–7, 35–36, 66–67, 95–96, 115–117, 145–146, 180–182, 204–206, 219–221, 237–239, 262–263, 285–287; fig. 3–5, 68–74, 106, 113–114, 126–127, 167–168. Also reprinted as North of Scotland College of Agriculture Bee Disease Investigation Memoir 6, with title, Acarine disease explained, 50 p. (no fig.), Aug., 1923 (revised and enlarged).
(53) ———
1922. The presidential address [delivered at the third annual conference of the Apis Club, Reading, England, April 8]. *In* The Bee World, v. 4, no. 3, p. 72–74.
(54) Rennie, John; White, Philip Bruce; and Harvey, Elsie J.
1921. Isle of Wight disease in hive bees. (1) The etiology of the disease. *In* Trans. Roy. Soc. Edin., v. 52, pt. 4, no. 29, p. 737–754, 1 pl.

(55) [Sevalle.]
1922. [Île de Wight maladie en France.] *In* L'Apiculteur, v. 66, no. 2, p. 59. (Reported by Leclerc.)

(56) Snodgrass, R. E.
1923. The breathing organs and the muscles of the honeybee. (Unpublished manuscript, with figures.)

(57) Vitzthum, Hermann.
1921. Ein Wort über die Insel-Wight-Krankheit. *In* Bayerische Bienen-Zeitung, v. 43, no. 4, p. 82–83.

(58) ———
1922. Die Trapp'sche Bienenmilbe. *In* Archiv für Bienenkunde, v. 4, no. 2, p. 61–64.

(59) White, P. Bruce.
1921. Isle of Wight disease in hive bees. (2) The pathology of Isle of Wight disease in hive bees. *In* Trans. Roy. Soc. Edin., v. 52, pt. 4, no. 29, p. 755–764, 1 pl.

ADDITIONAL REFERENCES.

Since the preparation of the manuscript of this circular in the spring of 1923, several important papers on the Isle of Wight disease have appeared and some new records of the occurrence of the disease have been published, so that it seems desirable to make additional record of these findings as this circular goes to press. The additional literature cited is appended. The same arrangement of material is followed here as in the main list.

(60) Altmann, Richard.
1923. Massenhaftes Bienensterben. *In* Der Deutsche Imker, v. 36, no. 6, p. 161.

(61) Anderson, John.
1923. Isle of Wight disease in hive bees. *In* Scot. Jour. Agr., v. 6, no. 2, p. 183–191.

(62) Kessler, Viktor.
1923. Achtet auf die Bienenkrankheiten. *In* Der Deutsche Imker, v. 36, no. 6, p. 167–168.

(63) Leuenberger, Fr.
1923. Die schweizerische Bienenzucht in Gefahr. *In* Schweizerische Bienenzeitung, n. f., v. 46, no. 4, p. 162–163.

(64) ———
1923. Zur Bekämpfung der Milbenkrankheit der Bienen. *In* Schweizerische Bienenzeitung, n. f., v. 46, no. 5, p. 213–214.

(65) ———
1923. Bericht der Konferenz der kantonalen Bieneninspektoren, den 27. und 28. April, auf dem Rosenberg, Zug. *In* Schweizerische Bienenzeitung, n. f., v. 46, no. 6, p. 275–281, no. 7, p. 326–328.

(66) Morgenthaler, O.
1923. À propos du traitement de l'acariose par le soufre. *In* Bulletin de la société romande d'apiculture, v. 50, no. 5, p. 115–117.

(67) Rennie, John.
1923. [Presidential address before the Apis Club Conference, Bristol, England, April 7, 1923.] *In* The Bee World, v. 5, no. 1, p. 11–12.

(68) Schweiz. Bundesrat.
1923. Bundesratsbeschluss betreffend Aufnahme der Milbenkrankheit der Bienen in das Tierseuchengesetz vom 13. Juni 1917 (vom 18. April 1923). *In* Schweizerische Bienenzeitung, n. f., v. 46, no. 5, p. 214–215. *Also in* Bulletin de la société romande d'apiculture, v. 20, no. 5, p. 128–129, with title, Arrêté du conseil fédéral portant admission de l'acariose des abeilles dans la loi fédérale du 13 juin 1917 sur les mesures à prendre pour combattre les épizooties (du 18 avril 1923).

(69) Schweiz. Volkswirthschaftsdepartement. Veterinäramt.
1923. Verfügung des Eidgen. Veterinäramtes über die Vollziehung des Bundesratsbeschlusses betreffend Aufnahme der Milbenkrankheit der Bienen in das Tierseuchengesetz vom 13. Juni 1917 (vom 18. April 1923). *In* Schweizerische Bienenzeitung, n. f., v. 46, no. 5, p. 216–218.

(70) Vitzthum, Hermann.
1923. Der Erreger der "Insel Wight"-Krankheit. *In* Archiv für Bienenkunde, v. 5, no. 1–3, p. 25–32, 6 figs.

APPENDIX.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.
SERVICE AND REGULATORY ANNOUNCEMENTS.

REGULATIONS GOVERNING THE IMPORTATION OF ADULT HONEYBEES INTO THE UNITED STATES.

The Act of August 31, 1922 (Public No. 293—67th Congress), entitled "An Act to regulate foreign commerce in the importation into the United States of the adult honeybee (*Apis mellifica*)," provides as follows:

That, in order to prevent the introduction and spread of diseases dangerous to the adult honeybee, the importation into the United States of the honeybee (Apis mellifica) in its adult stage is hereby prohibited, and all adult honeybees offered for import into the United States shall be destroyed if not immediately exported: *Provided*, That such adult honeybees may be imported into the United States for experimental or scientific purposes by the United States Department of Agriculture: *And provided further*, That such adult honeybees may be imported into the United States from countries in which the Secretary of Agriculture shall determine that no diseases dangerous to adult honeybees exist, under rules and regulations prescribed by the Secretary of the Treasury and the Secretary of Agriculture.

SEC. 2. That any person who shall violate any of the provisions of this act shall be deemed guilty of a misdemeanor and shall, upon conviction thereof, be punished by a fine not exceeding $500 or by imprisonment not exceeding one year, or both such fine and imprisonment, in the discretion of the court.

In accordance with the foregoing Act, notice is hereby given that the following rules and regulations have been prescribed by the Secretary of the Treasury and the Secretary of Agriculture, the same to become effective on and after the fifteenth day of May, 1923.

HENRY C. WALLACE,
Secretary of Agriculture.

MAY 12, 1923.

RULES AND REGULATIONS.

The following rules and regulations are promulgated under the authority conferred by the Act of Congress approved August 31, 1922, providing for the regulation of foreign commerce in the importation into the United States of the adult honeybee (*Apis mellifica*):

REGULATION 1.—*Definition.*—For the purpose of these regulations, it is understood that a disease dangerous to the adult honeybee is one which attacks adult honeybees, as distinguished from one which attacks the brood or developmental stages of the honeybee. Such diseases of adult honeybees are understood to include all diseases which attack adult honeybees, including queenbees, worker bees, and drones or male bees: *Provided*, That the disease caused by the protozoan parasite, *Nosema apis*, sometimes known as Nosema-disease, now widespread in the United States, shall not be considered as a disease dangerous to adult honeybees for the purposes of these regulations.

REGULATION 2.—Since, in the opinion of the Secretary of Agriculture, the importation of queenbees, with necessary accompanying worker bees, is the only kind which is necessary for the improvement of the stock of honeybees within the United States, it is understood that, for the purposes of these regulations, such expressions as the "importation of honeybees" or "importation of adult honeybees" shall mean the importation of queenbees and the necessary accompanying worker bees, except as hereinafter provided.

REGULATION 3.—The importation into the United States of the honeybee (*Apis mellifica*) in its adult stage, except as hereinafter provided, is prohibited, and all adult honeybees offered for entry into the United States, except as hereinafter provided in these regulations, shall be destroyed if not immediately exported.

REGULATION 4.—On representation by any person to the Department of Agriculture that there is adequate necessity for the importation of adult honeybees for experimental and scientific purposes, from any country other than those determined by the Secretary of Agriculture to be free of all diseases dangerous to adult honeybees, the Department of Agriculture will undertake to import such adult honeybees under the first proviso of the Act for the purpose intended, when the Department shall determine that such importations can be made without risk to the beekeeping industry of the country.

(2) All shipments of adult honeybees made for experimental and scientific purposes shall be addressed to the United States Department of Agriculture, Washington, D. C., and shall be subject to such examinations and holding in quarantine as may be necessary to determine the freedom of the shipment from diseases dangerous to adult honeybees. It is understood, as a further precautionary measure, that the Department of Agriculture will destroy all the worker bees accompanying such imported queenbees and will provide fresh worker bees and a fresh mailing cage for each such shipment. Any such importation made for experimental and scientific purposes which is found to be infected with any disease dangerous to adult honeybees may be destroyed or returned to the country of origin, at the option of the Department of Agriculture and no shipment will be distributed until the Department of Agriculture is convinced that the adult honeybees therein contained are free from all dangerous diseases. Any persons receiving adult honeybees distributed by the Department of Agriculture shall agree to the re-examination of the shipment from time to time, at the option of the Department, and shall relinquish the shipment and any increase therein to the Department of Agriculture for destruction or safeguarding, should any diseases dangerous to adult honeybees at any time develop in connection with it.

REGULATION 5.—In accordance with the second proviso of the Act, adult honeybees may be imported into the United States from countries in which the Secretary of Agriculture shall have determined that there exists no disease dangerous to adult honeybees.

(a) The Secretary of Agriculture, having determined that no disease dangerous to adult honeybees exists in the Dominion of Canada and being advised that, under order of the Deputy Minister of Agriculture of the Dominion of Canada, dated April 22, 1922, the importation of bees, used and second-hand hives, and raw hive goods and products, except honey and wax, from the continent of Europe into the Dominion of Canada, is prohibited, does hereby authorize that adult honeybees, unrestricted as to the definition thereof contained in Regulation 2 hereof, may be imported from the Dominion of Canada into the United States or any of its Territories or Districts free from any restriction whatsoever provided in these regulations, until otherwise ordered.

(b) Importations under the second proviso of the Act, from any country other than the Dominion of Canada, shall be conditioned on the determination by the Secretary of Agriculture that, as a result of adequate scientific investigations, no diseases dangerous to adult honeybees exist in the country in question and that adequate precautions have been taken by such country to prevent the importation of adult honeybees from countries where such dangerous diseases exist.

REGULATION 6.—Nothing in these regulations shall interfere with the regulations of any state pertaining to the control of the diseases of bees, either of the adult stage or of the brood, and a removal of the restrictions of this Act as applied to any country shall not be construed as granting permission for importations prohibited by the laws of the state into which shipment is contemplated.

HENRY C. WALLACE,
Secretary of Agriculture.
A. W. MELLON,
Secretary of the Treasury.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY.
SERVICE AND REGULATORY ANNOUNCEMENTS.

SPECIAL RULES

For the Importation of Queenbees for Experimental and Scientific Purposes by the Department of Agriculture in Accordance With Regulation 4 of the Rules and Regulations Prescribed by the Secretary of the Treasury and the Secretary of Agriculture and Made Effective as of May 15, 1923.

Regulation 4 of the rules and regulations prescribed by the Secretary of the Treasury and the Secretary of Agriculture in accordance with the Act of August 31, 1922 (Public No. 293—67th Congress), is as follows:

REGULATION 4. On representation by any person to the Department of Agriculture that there is adequate necessity for the importation of adult honeybees for experimental and scientific purposes, from any country other than those determined by the Secretary of Agriculture to be free of all diseases dangerous to adult honeybees, the Department of Agriculture will undertake to import such adult honeybees under the first proviso of the Act for the purpose intended, when the Department shall determine that such importations can be made without risk to the beekeeping industry of the country.

(2) All shipments of adult honeybees made for experimental and scientific purposes shall be addressed to the United States Department of Agriculture, Washington, D. C., and shall be subject to such examinations and holding in quarantine as may be necessary to determine the freedom of the shipment from diseases dangerous to adult honeybees. It is understood, as a further precautionary measure, that the Department of Agriculture will destroy all the worker bees accompanying such imported queenbees and will provide fresh worker bees and a fresh mailing cage for each such shipment. Any such importation made for experimental and scientific purposes which is found to be infected with any disease dangerous to adult honeybees may be destroyed or returned to the country of origin, at the option of the Department of Agriculture and no shipment will be distributed until the Department of Agriculture is convinced that the adult honeybees therein contained are free from all dangerous diseases. Any persons receiving adult honeybees distributed by the Department of Agriculture shall agree to the re-examination of the shipment from time to time, at the option of the Department, and shall relinquish the shipment and any increase therein to the Department of Agriculture for destruction or safeguarding, should any diseases dangerous to adult honeybees at any time develop in connection with it.

Information is not at present available as to the number of queenbees which are urgently needed for experimental and scientific purposes, but the number of such importations will necessarily be limited by the Department's facilities for examining the imported material and for keeping the imported queenbees in quarantine for such time as may be deemed essential. In order, therefore, to limit the volume of such importations and to insure that the queenbees shall be imported solely for experimental and scientific purposes, as provided by the law, and in order adequately to safeguard the beekeeping interests of the United States, the following special rules are announced to govern such importations:

(1) Importations will be limited to the following classes of institutions and persons:

(a) Public institutions, such as Agricultural Colleges, Agricultural Experiment Stations, and similar institutions, which desire to conduct investigations on the various races of honeybees, may obtain queenbees through importation by the Department of Agriculture for such experiments.

(b) An individual, who can show that he is engaged in some special field of experimental and scientific work in beekeeping or with honeybees, may, on a satisfactory showing of scientific training and experience requisite for such work, obtain queenbees through importation by the Department of Agriculture for that purpose, provided there is reason to believe that the proposed experimental and scientific work will have value as a public service.

(c) Commercial queen-breeders, who urgently need queenbees for breeding experiments, may apply to the Department of Agriculture to have the necessary importations made. Such an application shall contain, or be accompanied by, evidence that the applicant is engaged in the rearing of queenbees on a commercial scale and shall indicate the purpose of, and the necessity for, the importations. If an applicant is not well known to the Department, he may be required to submit a list of persons qualified to substantiate statements made regarding his ability and standing as a breeder of queenbees.

(d) The Department of Agriculture does not consider that the experimental and scientific purpose for which importations may be made under said Regulation 4 includes the importation of queenbees for individual beekeepers merely for the purpose of requeening their own apiaries. In case, however, queens of

certain races cannot be obtained in the United States, and the testing in the United States of such races would be of value to the beekeeping industry, the necessary importations will be made by the Department, provided that those who make request therefor, and to whom the queens are to be distributed for experimental and scientific purposes, will agree to report to the Department twice annually on the merits of such races in comparison with races already known in the United States. Applications for such importations must show that it is impossible to secure such queens from commercial queen-breeders in the United States.

(2) Persons, institutions, and others, in urgent need of imported queenbees for experimental and scientific purposes, may submit a statement of their needs to the Department of Agriculture, giving the name and address of the foreign queen-breeder from whom the queenbees are desired, and, if approved, the Department will transmit an order to the breeder in the foreign country from which such queenbees are desired. No orders for imported queenbees will be placed by the Department of Agriculture with any but experienced and recognized breeders of queenbees in foreign countries and evidence must be presented by the applicant that the foreign queen-breeder is qualified to rear good queenbees and to mail them in a satisfactory condition.

(3) In the event that importations are made and the queenbees die enroute, the Department of Agriculture assumes no responsibility whatsoever, either in the shipment of the queenbees from the foreign country to the Department of Agriculture or in forwarding the queenbees to the person at whose request the importation was made. Every care will be exercised so that the queenbees may be safely mailed under the restrictions laid down in said Regulation 4. All shipments of queenbees will be made in accordance with the regulations of the Post Office Department governing such shipments in domestic mails.

(4) All persons receiving queenbees from foreign countries distributed by the Department of Agriculture shall agree further to cooperate with the Department in such additional examinations of the colonies containing the imported queenbees or their offspring, as shall be deemed necessary to protect the beekeeping interests of the United States from the introduction of diseases dangerous to adult honeybees. In the event that any later examination of the offspring of the imported queenbees is deemed necessary by the Department, the person receiving the imported queenbees shall agree to furnish the bees desired promptly or to permit such examinations by a representative of the Department as may be deemed necessary. Any person receiving such imported queenbees from the Department of Agriculture shall further agree to notify the Department immediately if any abnormal conditions are seen in the adult honeybees in the colony headed by the imported queenbee, or in any other colony in the same apiary, so as to permit immediate examinations of any apparently abnormal adult honeybees.

The foregoing special rules are hereby adopted and shall be in force until further notice.

C. W. Pugsley,
Acting Secretary of Agriculture.

June 19, 1923.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY

▽

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1923