AGRICULTURAL RESEARCH ON THE PACIFIC COAST.

DURING the past summer Professor W. A. Henry, director of the Wisconsin Agricultural Experiment Station, was sent by the secretary of agriculture to the Pacific coast to report upon certain matters connected with agricultural research in that part of the country, and incidentally to look into the work of the agents of the department, and to ascertain the popular feeling regarding the character and importance of their work. The report has just been submitted to Secretary Rusk, and much of it will be of general interest, more especially as Professor Henry is a man of established reputation as an original investigator in practical agriculture.

In his report, Professor Henry states that several days were spent in visiting fruit-farms at various points in the vicinity of Los Angeles, and noting the destructive effects of the white scale and red scale, and the efforts in progress to check their ravages. At Orange, in Orange County, the destruction of citrus-trees by the red scale has been great, and only a few more years would suffice to leave that section without any such trees if remedies to check the destruction had not been put in operation the present season. The Santa Anna vine-disease has destroyed most of the grape-vines, and every orange-orchard shows in a greater or less degree the attacks from the red scale. Every stage, from thriftiness to death itself, was noted. In some orchards only the yellow-spotted character of the leaves showed the presence of the scale just beginning its fatal work; in others the ends of the branches were leafless and dead, the interior portions of the top yet carrying leaves, though little or no fruit. Still other orchards had but the stumps of the orange-trees left, all of the limbs to the size of one's arm having been killed by the scale, and removed with the saw. From these stumps green shoots showed signs of life, and, if care was given, promised to renew the value of the orchard. The careless treatment of the land showed as plainly as the trees themselves the discouragement of the people.

Usually an orange-orchard in southern California receives the best of care, and the carefully tilled soil lying loose, without a weed in sight, and as level as a floor, delights the lover of thrift and good tillage. In many orchards weeds cover the ground, and form thickets five or six feet high, so dense that a man can hardly get through them. The dead and dying orange-trees among these weeds stand like monuments marking the deadly march of the insidious, insignificant, but wonderfully fatal scale. Professor Henry visited an orchard in which Mr. Coquillett was conducting spraying experiments with resin-soap solutions, and he also visited many other groves in all stages of thrift and decay, from those bearing heavy crops to those with nothing but the stumps standing. It was very apparent that those who had fought this scale the most vigorously, even though very imperfectly heretofore, are coming out the best in the end, and that those who early gave up and neglected their orchards will suffer far the most heavily. One orchard near the California Central Railroad station, at Orange, of 850 seedling trees, showed the ends of the branches already dead; and there were scales enough on the leaves to so reduce the vitality of the trees the present season that by next spring most of the trees would have to be cut back to mere stumps. A few weeks before the visit the owner plucked up courage, and sprayed the trees with the resin-soap compound in a very thorough and systematic manner, the whole operation costing, for the 850 trees, $200. Professor Henry spent an hour in observing the effects of the wash, and estimated that more than 95 per cent of the scale had been destroyed, while not one leaf in ten thousand had been injured in the least by the wash. Mr. Hamilton stated that resin was now being brought to Orange by the car-load for the purpose of making the resin soap. For the first time people are really taking heart, and are going at their orchards in dead earnest to make them profitable once more. The plough had been set to work to reduce the weeds and bring back the old-time thrift in many cases, though some orchards were yet as desolate as ever. Before speaking further in regard to remedies for the red scale, the destruction of the cottony-cushion scale should be noted.

In studying this insect, Professor Henry first visited the place of Mr. William Niles, in Los Angeles, where the "lady-bug" (*Vedalia cardinalis*) was being propagated by the county insect commission for dissemination among the orange-groves infested with the cottony-cushion or white scale. He found five orange-trees standing about eighteen feet high, enclosed by walls of cheap muslin supported by a light framework of wood. The orange-trees inside this canvas covering had originally been covered with the white scale, but the *Vedalia* which had been placed on these trees were rapidly consuming the last of the pests. Entering one of these canvas houses, he found the *Vedalia*, both larvæ and adults, busy consuming the scale. Here and there on the canvas were the beetles endeavoring to escape to other trees. These insectaries were in charge of Mr. Kircheval, one of the county insect commissioners, who kept a record of the distribution of the beetle. It was indeed a most interesting sight to see the people come, singly and in groups, with pill-boxes, spool-cotton boxes, or some sort of receptacle in which to place the *Vedalias*. On application, they were allowed within the insectaries, and each was permitted to help himself to the beetles, which were placed in the boxes and carried away, to be placed on trees and vines infested by the white scale at their homes. Mr. Kircheval kept a record of the parties and the number of beetles carried off. The number coming for the *Vedalia* was surprisingly large, — scores in a day, — and each secured at least a few of the helpful beetles. That the supply should hold out under such a drain was a great surprise, and speaks better than words the rapidity with which the *Vedalia* multiplies when there are scale insects enough to nurture the young.

Professor Henry also visited other points, Lamanda Park, Santa Anita, Sierra Madre Villa, Pasadena, etc. At the time of his visit to Sierra Madre Villa, Aug. 23, the white scale had already disappeared before the *Vedalia*. At Santa Anita, the ranch of Mr. E. J. Baldwin, he examined a 350-acre orange-orchard, in which the white scale had started a most destructive course. Mr. Baldwin began an equally vigorous defence, going personally into the orchard and superintending the work of fighting the white scale. There was every sign, however, that the scale was going to be the victor. Some of the trees were almost ruined by the severity of the application made. Happily, before the pest had gone far in its work, the *Vedalia* was heard from, and Mr. Baldwin secured a number, which were placed in the hands of one man specially detailed to look after its welfare. This individual spent six weeks in colonizing the *Vedalia* in various parts of the orchard. After that time, a careful examination showed the superintendent that the work of colonizing was so complete that further effort in that line was unprofitable. It was predicted at the time of the visit that a few weeks more would leave the orchard entirely free from the white scale. At Chapman's he found the citrus-orchard, formerly so famous, entering the death stages from the white scale, which was now fortunately being so effectually checked. At Pasadena, on the grounds of Professor Ezra Carr, he found that some of the shrubbery had been seriously injured by the white scale, but, thanks to the *Vedalia*, not a single pest was alive at the time of his visit.

A word in relation to the grand work of the department in the introduction of this one predaceous insect. Professor Henry thinks it is without doubt the best stroke ever made by the Agricultural Department at Washington. Doubtless other efforts have been productive of greater good, but they were of such character that the people could not clearly see and appreciate the benefits, so that the department did not receive the credit it deserved. Here is the finest illustration possible of the value of the department to give people aid in time of distress; and the distress was very great indeed. Of all scale pests, the white scale seems the most difficult to cope with; and, had no remedy been found, it would probably have destroyed the citrus industry of the State, for its spreading to every grove would probably be only a matter of time.

At Sierra Madre Villa, in the orchard of W. D. Cogswell, a chalcid fly was found to be parasitic on what is there called the red scale. In company with the county insect commissioners and Mr. Coquillett, Professor Henry visited this orchard. It was quite evident that the so-called red scale of this orchard has been greatly checked, and may yet be entirely destroyed, by the chalcid. At E. J. Baldwin's the commission also found the same scale being destroyed by the same parasite. In this case each parasite destroys

but a single insect, and the commissioners were very solicitous and also sceptical as to its ability to rapidly destroy the red scale. Furthermore, they questioned whether the chalcid would destroy the true red scale, as they did not believe that the scale on the orchards mentioned was identical with that about Orange. The *Vedalia* has brought the people a simple, rapid, and effective remedy for the white scale, and the commission was very solicitous lest the people should give up the use of washes for the red scale, and wait for the spread of the chalcid parasite. If the parasite should multiply but slowly, which seems probable, the red scale would be enabled to spread and do great harm before overtaken. It is of the highest importance, at this time, that a constant fight against this scale should be made; and there should be no halting, even if imperfect means of holding the pest in check are only at hand.

Professor Henry carefully examined the experiments conducted by Mr. Coquillett with resin washes, and considers that he has used excellent judgment in the manner in which he has conducted them, and thinks he plans his spraying experiments carefully and with good judgment, and carries them through with thoroughness to the end.

It seems of the highest importance that experiments with washes be prosecuted, and that the great advance of the last year be followed up vigorously. With the resin washes for the red scale, and the *Vedalia* for the white scale, the citrus industry will again move forward, and people have the confidence in it of former days.

CAUSATION OF HOG-CHOLERA.

INVESTIGATIONS of the epizootic diseases of swine, occurring in the neighborhood of Baltimore, have been made by Professor William H. Welch, M.D., with the co-operation of A. W. Clement, V.S., and F. L. Russell, V.S., in the Pathological Laboratory of the Johns Hopkins University during the past two years. They examined about fifty hogs, from six herds, affected with hog-cholera, as well as several isolated cases. Only a summary of the most important results will be given here, a fuller report being in preparation for the volume of studies from the Pathological Laboratory, to be issued by the Johns Hopkins Hospital.

The most common and characteristic lesions, as given in the *Johns Hopkins Bulletin* for December, consisted in superficial and deep necroses, either circumscribed or diffuse, of the inflamed mucous and other coats of the large intestine, associated often with superficial branny diphtheritic exudation. Similar necroses were occasionally found in the stomach and small intestine, in the mouth, palate, and epiglottis, and less frequently in the gall-bladder, bile-ducts, and preputial sac. Some form of pneumonia was usually, although not constantly, present. In a few cases pneumonia was present without intestinal lesions; more frequently intestinal lesions were observed with little or no pneumonia. Strongyles in the bronchi were rarely missed. Bronchitis was the rule. Pleurisy was common; pericarditis and peritonitis were present in the minority of cases. Redness of the skin was common, but inconstant. The subcutaneous, mediastinal, and abdominal lymph-glands were usually swollen and reddened, chiefly in the periphery. The spleen was often normal, but in many cases was moderately and sometimes extremely swollen. The kidneys were either normal or the seat of hemorrhages and of parenchymatous degeneration or nephritis. The liver was often normal, but sometimes it presented necrotic areas. Ecchymoses were often observed in the gastric and intestinal mucosa and beneath the epi- and endo- cardium. In some cases all of the organs of the body were studded with small hemorrhages.

The bacteriological examination consisted in the study of cover-glass preparations from the different parts of the body; in the inoculation of animals, either white mice or rabbits, with parts of the lung, spleen, liver, intestine, and sometimes other organs; and in the preparation of Esmarch roll cultures, usually of agar, from the blood, intestinal contents, and all of the principal organs of the body.

Of the bacteria isolated in pure culture and observed in microscopical preparations of the tissues, only two species were sufficiently common or had such distribution as to suggest an etiological relation to the disease. These are the so-called hog-cholera bacillus and the swine-plague bacillus; the former first described in the "Report of the Bureau of Animal Industry for 1885" as the bacterium of swine-plague, and in the report for 1886 as the bacterium of hog-cholera, — a change of nomenclature due to the detection in certain diseased swine in this country of the latter organism, which now received the name of the "bacterium of swine-plague," as it was believed to be identical with the micro-organism previously described by Löffler and by Schütz as the specific cause of Schweine-Seuche in Germany.

The bacilli of hog-cholera are short rods with rounded ends, averaging 1 μ – 2 μ in length and about 0.6 μ in breadth, but forms both longer and shorter than these measurements may occur. They are very actively motile. They grow readily on all of the ordinary culture media, and best at temperatures between 30° and 38° C. They do not liquefy gelatine. The growth on gelatine and on agar has a grayish or whitish color, often with a bluish translucence. Bouillon cultures present a diffuse cloudiness with whitish sediment and without surface membrane. The growth on potato assumes generally a brownish or yellowish tint, but it may be white, and sometimes is indistinct, although microscopically the growth is abundant. The bacilli are killed by exposure for ten minutes to a temperature of 58° C. In cover-glass preparations from the fresh juices and tissues of animals dead of hog-cholera, the bacilli stain readily, and for the most part uniformly, with aniline-oil gentian-violet. If the stained specimen be treated with acetic acid, many of the bacilli appear with clear centre and stained margin, which may be either uniform or slightly thicker at the poles, as described in the reports of the Bureau of Animal Industry. Some may present a typical polar staining, but they are not regarded as good polar staining bacilli, like those of swine-plague. Various irregularities in staining appear in old cultures.

The hog-cholera bacilli are pathogenic for rabbits, mice, guinea-pigs, and pigeons. Only the experiments with rabbits will be described here. These animals, when inoculated subcutaneously with a platinum loop from a pure culture of hog-cholera bacilli, die usually in from six to eight days, but the duration of life may be shorter or longer. There is generally considerable dry purulent infiltration at the seat of inoculation; the subcutaneous lymphatic glands on the same side are enlarged, and often present necrotic foci; the spleen is swollen, as a rule extremely, and of a dark red color and firm consistence; the liver generally presents yellowish-white streaks and dots; the heart-muscle is fatty; and in some cases ecchymoses, necrotic patches, and diphtheritic exudation may be found in the intestinal mucosa. The bacilli, which often occur in clumps, are found most abundantly at the seat of inoculation, in the affected lymph-glands, the spleen, and the liver, and are often so scanty in the blood as to escape detection by microscopical examination. The statements in the reports of the Bureau of Animal Industry of the effects of these bacilli when inoculated in pigeons have been confirmed by Professor Welch.

The swine-plague bacilli are shorter than the hog-cholera bacilli. Measuring on the average 0.8 to 1.4 μ in length, they may be very small, and present the appearance of slightly oval bodies, more like cocci than bacilli; or, on the other hand, they may present themselves as rods of considerable length. In appearance and other properties, they belong to the same group of organisms as the well-known bacteria of chicken-cholera and of rabbit septicæmia. They are devoid of independent motion. They grow on the ordinary culture media, with the exception of potato, but at ordinary temperatures the growth is less rapid and abundant than that of the hog-cholera bacilli. They do not liquefy gelatine. On gelatine and agar the growth is grayish, translucent, not extending far from the point of inoculation. Bouillon cultures are sometimes diffusely cloudy; but more frequently the growth is in the form of a whitish, rather viscid sediment, or in little specks, with clear fluid. When planted on potato, there may be a feeble invisible growth for one or two generations, probably due to the transferrence of a little nutritive medium to the potato with the organisms. We have not been able to cultivate them for several generations upon potato. They are killed at a temperature slightly lower than that destructive to hog-cholera bacilli, and their vitality in cultures is much shorter than that of hog-cholera bacilli. In cover-glass prepara-