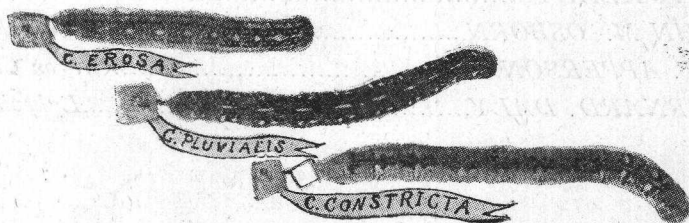


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Oregon Agricultural Experiment Station

Bulletin No. 33. December, 1894.



ENTOMOLOGY.

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Tent Caterpillars.

F. L. WASHBURN.

Three forms of tent caterpillars have been abundant in the Willamette Valley during the past season, *Clisiocampa erosa*, *Clisiocampa plurialis*, and *Clisiocampa constricta*. The first named feeds upon almost everything but the pear, viz upon apple, quince, cherry, prune, rose and privet. The second has not been nearly as numerous as *C. erosa*, about one of *pluvialis* to every one hundred of *erosa* representing their proportionate abundance. *C. constricta* devastated whole groves of oak, particularly *Quercus Garryana*, and though they occasionally migrated to the prune tree, thereby causing considerable alarm among orchardists, they have nowhere injured fruit trees. Experiments with this oak tree form in the entomological laboratory, demonstrate the fact that they will not eat the leaves of apple, plum, or prune.

These three forms are figured on the front page of this bulletin with the appropriate label attached to each.

DESCRIPTION, LIFE HISTORY, ETC.

The life history of the group known as "Tent Caterpillars" has been described in a previous bulletin. These larvæ transform into brownish or cream colored moths, about one inch long, the females of which lay their eggs in a band around twigs on their several food plants. These eggs, in case of the first two forms, are covered with a slate colored gelatinous cement, which hardens as soon as deposited, and constitutes the first food of the newly hatched larva. The egg bands of *C. constricta*, however, are whitish.

The moths are on the wing during July and August and deposit a new batch of eggs. These eggs however, do not hatch until the following season, as has been determined by observations here, and therefore we need only look for one brood, though irregularity in time of hatching of the eggs cause the visitation to extend throughout the summer.

I append a popular description of each form, which will doubtless, be intelligible to all.

C. erosa. Whitish, irregularly oval spots on middle of back on all but the first few segments. On either side of these spots, and somewhat separated from them is a broad blue band bordered on either side by a brick red line. Below that, on either side, and reaching to the legs is a bluish space, characterized by one blackish dot on each segment marking the position of spiracles or "breathing holes". Below, the caterpillar is dark blue with oval black spots in median line on all but first few segments. Over the whole caterpillar are numerous fine yellowish or cream colored hairs.

C. pluvalis. The oval whitish dots of *C. erosa* replaced by linear blue spots on all but first few and last three segments, each bordered by black, and outside of that a mass of yellow broken into by black spaces, each black space being marked by two blue dots. Below this on either side is a broken line of yellow, running from one end to the other, and between this and the feet a space with mottled yellow and black coloring. Below, black and irregular blotches of white on each segment. The caterpillar is covered with long deep yellow hairs coarser and more frequent than the hairs in *C. erosa*. On account of these yellow hairs and the preponderance of yellow in the body, this caterpillar is easily distinguished from the foregoing.

C. constricta: A broad, broken, yellow and black line down middle of back, the line broken by constrictions, forming two irregular quadrangular spaces on each segment. Below this on either side of the caterpillar, a wide blue area containing numerous black spots which are bounded by yellow. Below, on ventral side, a nearly uniform black with indications of light spots in many of the segments. The caterpillars are sparingly covered with yellow and black hairs. This species presents a decidedly blue appearance.

NATURAL ENEMIES.

But few of our birds are tempted by these hairy larvae, but I have observed in a badly infested orchard a flock of Brewer's blackbirds, very common with us, greedily tearing open the cocoons and feeding on the soft pupae within. All three species are attacked by a *Tachina* parasite which lays eggs on, or in the vicinity of, the head, and its larva, when hatched from the eggs

bores into and feeds upon the caterpillar's tissues thus eventually killing its host, that is, the caterpillar never transforms to a moth.

Some fungus disease induced by warm wet weather appears disastrous to them, to *C. constricta* at least, for the writer has found them in June, dying and decaying by the hundreds along fences in the neighborhood of oak trees. Chalcid parasites, too, deposit their tiny eggs in these pests and emerge in numbers from the cocoons.

ARTIFICIAL REMEDIES AND METHODS OF PREVENTION.

This subject has been thoroughly discussed in previous bulletins.

Spraying with the arsenites, for the codling moth poisons the leaves and hence kills the leaf-eating caterpillar. Their nests or "tents" with contents, when small and within reach, can be crushed by the hand, and when larger or out of reach can be burned by the application of a torch. It is a noticeable fact that these forms are not so prone to manufacture elaborate nests as the eastern form, *C. americana*. They are frequently found massed on the side of a limb or trunk, thus offering an opportunity to easily kill a large number by the use of a flat stick, piece of shingle or the like.

On the principle, however, that an "ounce of prevention is worth a pound of cure" the most efficacious way of disposing of them is to destroy the egg masses found on twigs in Autumn and Winter, by burning. This may be accomplished by cutting off the twigs upon which the eggs are found and consigning them to the fire; or better, in order to avoid the excessive pruning of small trees which this will entail, break the egg masses, slip them off the twigs and then destroy them. It requires a careful search, or better, several careful searchings to find all the egg masses, but it is by far the most advisable method of procedure.

The above methods apply to the two forms which infest fruit trees. It would be hardly feasible to practice it against the oak tree form. It is probable, from the large number of diseased individuals of this latter species observed and empty cocoons found that their numbers next year will be very markedly lessened, but from the number of egg masses of *C. erosa* and *C. pluvalis* which can now be seen, it would appear that we may expect them again the coming season.

The Grain Plant Louse.--*Siphonophora avenae*, Fab.

F. L. WASHBURN.

Almost all of the wheat growing districts in Oregon have been more or less affected this year with the Grain Aphis or Grain Plant Louse, causing the farmer no little anxiety. Many had never before seen anything like it, and were loth to believe that to the grain had come a pest which they were practically powerless to successfully combat. It attacked wheat, oats and rye, and the writer found it on a form of mesquit grass within two miles of the sea-coast, far from any grain field.

Grain badly infested, invariably shrivelled, and millers inform me that its effect is easily seen in the fact that much of the marketed wheat is of an inferior quality.

It is probable that this pest was in the state in limited numbers last year, but unnoticed, and the marvellous rapidity with which new individuals are produced will account for the seemingly miraculous invasion. Prof. Fitch, State Entomologist of New York, has proved, by actual experiment, that the females of the grain aphis begin to produce living young when three days old, at the rate of four a day; hence, in three weeks time, eliminating all unfavorable conditions, the descendents from one mother amount to nearly or quite two millions.

The insect is greenish in color, attacking the stalks, and later the heads of wheat, rye, and oats. It has a large beak with which it extracts the sap. This absorption of the sap is what injures the berry. As wheat ripens it migrates to the more succulent oats and when these ripen it goes to the various grasses. It spreads over a wide extent of territory quicker than any insect known.

On the back of the last page of this bulletin is a photograph of some wheat heads badly infested with this pest.

ITS HISTORY.

Although its existence was observed seventeen years before, the grain aphis first appeared in great numbers in 1861, spreading over New England, all of New York except the western portion, northeastern Pennsylvania and portions of Canada. Every grain field was invaded and many of them thronged. In many cases the wheat crop was reduced one-half, and the oat crop hardly paid for harvesting. The following year it spread over the re-

maining portion of Canada and into Michigan, and then disappeared. In 1883 it appeared in ten counties in California doing considerable damage to wheat, one man reporting that the yield of his spring wheat was diminished one-half by the ravages of the pest. April 29th and 30th and May 2nd and 3rd large flights of the winged variety were noticed in Sacramento, but disappeared after the rains of May 4th. In nearly every instance where the pest has appeared it has been met by a host of parasitical and pre-daceous insects

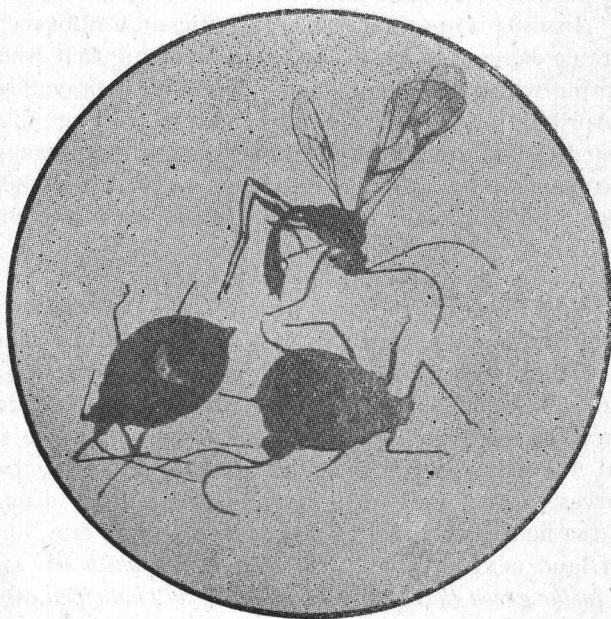
ARTIFICIAL REMEDIES.

From the nature of the circumstances, the farmer can himself do little or nothing against this pest. It may do no harm to suggest the following measures the value and practiability of which are questionable. 1. Burning the stubble immediately after harvest together with all straw, weeds, litter, waste, etc. on or about the field. 2. Cultivating the land after the crop has been harvested, removing all grass and weeds from around the edge of the field, and growing no grass or grain crop on that piece of land next year. 3. *Wheat and oats which are so badly infested in the green that they very evidently will not ripen can be cut for hay with advantage, Such hay is perfectly acceptable to stock.*

NATURAL ENEMIES.

Under the head of natural enemies occur the "Lady Beetle," or "Lady Bugs" as they are called, Syrphus Flies, "Aphis Lions" and the numerous minute flies which are parasitic on plant lice.

Fortunately, almost simultaneously with an outbreak of this pest appear myriads of these their foes, and as the beneficial forms multiply very rapidly, they greatly reduce the numbers of the lice. It is to these we must look for help, in this crisis and they are about all we can rely upon to lessen the evil. Whenever the aphid turns a dark color, either brown or black, it means that it is doomed. For this is caused by the aphid parasite which deposits its egg on or within the aphid. The egg hatches and the larva feeds on the tissues of the louse causing the death of the latter while the larva turns into a parasitic fly within the aphid. The accompanying illustration represents one of these parasites, about one-eighth of an inch long, which has issued from the body of the louse beside it. From the body of the other aphid protrudes the head of a second fly on the point of emerging.



Parasites [*Aphidius*] emerging from dead Grain Aphids. much enlarged.
From a photograph.

As far as personal examination has led me, the species of Lady Beetle attacking this pest is *Hippodamia convergens*. If one goes into an infested field and is on the alert to observe, he will see many of the above; besides various kinds of Syrphus Flies darting from one wheat head to another, depositing their eggs among the lice. Their worm-like larvae, greenish or brownish, can be counted by the score, snugly ensconced among the aphids and rapidly picking them up and sucking their juices.

I quote from a report by Prof. A. L. Cook, formerly of Michigan, dated July 10th 1889, in order to more fully demonstrate the great value of these insects to the agriculturist. Prof. Cook says: "Ten days ago, June 30th, the heads of wheat were crowded with hungry aphids or plant lice. These myriad lice, often five or six around a single kernel of wheat, and two hundred on a single head, were sucking the sap and very vitality from the forming kernels. They were rapidly blighting the grain, and unless some friendly hand were raised against them

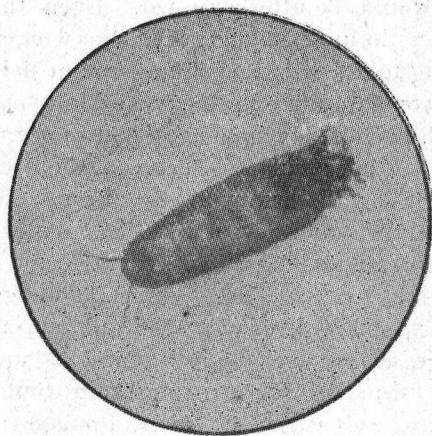
the wheat crop would be utterly ruined. Even then, when the lice were countless in number, and when the winged forms were rapidly spreading to the oat fields, the hand of deliverance was discerned in the comparatively few but wonderfully prolific enemies of the lice which had already sounded a halt in the march of destruction. A week later and the enemies of the lice were in the ascendancy, and to-day the lice are nearly exterminated, the wheat crop rescued and the oat crop saved. Close observation easily demonstrates these truths. Even the careless eye can see the savage insects dining on the lice, or the fatal egg laid which dooms the larva which receives it." It would appear that excessively wet or excessively dry and hot weather is unfavorable for the grain aphid; for in the first case much rain would chill or kill newly born lice, as well as give the plant abundant nourishment thereby enabling it to withstand attack the better, while excessively warm and dry weather would likewise be fatal to young lice. A medium warm and damp atmosphere is most conducive to the growth and multiplication of all plant lice.

While these insects may, in one season, so reduce the numbers of the Grain Plant Lice, that its attack the following year is hardly appreciable, it may rally sufficiently to cause some injury the second season. Therefore, although there may be no visitation the coming year, it is quite possible its ravages may be felt, after which, if our little friends the Lady Beetles etc., do good work we may expect immunity for many years.

The Pear Leaf Blister.

F. L. WASHBURN.

This affection of the pear leaf is caused by a minute mite, *Phytoptus pyri*, and is probably more common, and has been here longer, than most orchardists realize; in fact, it is very likely that much of that which has been called "blight" on the pear by casual observers, is really the work of this pest. The mite is very small, hardly visible to the naked eye, and is well represented in the accompanying micro-photograph furnished by Mr. Pernot.

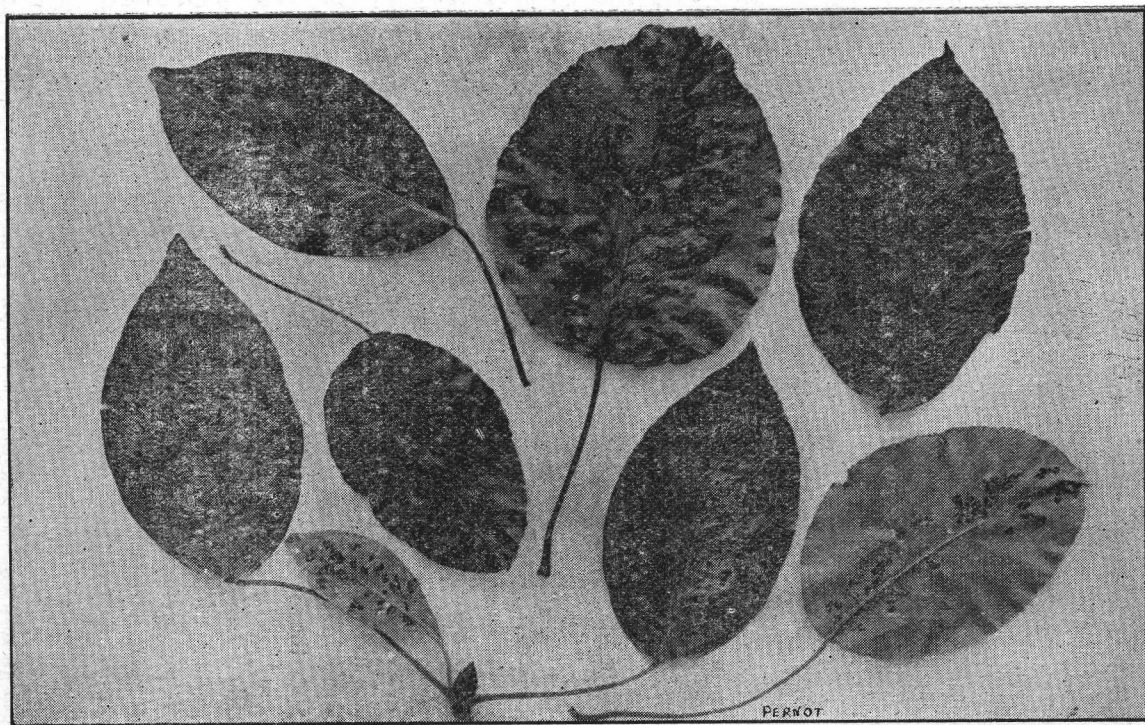


Phytoptus pyri, enlarged about 300 times.

It attacks both sides of the leaf, but individuals are more numerous on the under side where the small "blisters" can be seen with the naked eye. A lense, however, is required to show the opening in the centre of the blister which serves as a doorway for the mite. The location of the injury below is made apparent on the upper surface of the leaf, by an irregular reddish spot, (in the early stages) which changes later to brown and black, while the tissue of the leaf between these two points, in which tissue eggs and young mites are found, becomes corky and dies.

The injury to the tree is more readily seen in the middle and late summer, when, in bad cases, almost its entire foliage looks blighted.

The young mites when hatched spread from leaf to leaf, creating new blisters and thus bringing about the condition referred to above. In the autumn when leaves begin to wither and fall, the mites migrate to the twigs and hibernate beneath scales of bark or bud in the minute crevices on twigs, and in the spring they are fully open. It is hardly necessary to say that this mite saps the vitality of the tree, and interferes with the natural functions of the leaves. The work of this pest is illustrated by the accompanying full page plate, showing views of upper and lower surfaces of leaves.



REMEDIES.

When a tree is observed to be first attacked, pick off and burn the infected leaves. Heavy pruning and burning the cuttings of such trees as are badly affected, during the winter will probably be more efficacious than anything else. One or two sprayings of kerosene emulsion in the autumn when mites are migrating would destroy many. The same spray, used several times, has been recommended for winter use. It is highly spoken of in a Cornell University bulletin, and is to be used in this proportion,—one part emulsion to seven or eight parts of water.

The Clover Mite.

Bryobia pratensis.—Garman.

F. L. WASHBURN.

It is now evident that this pest is more prevalent in Oregon than is generally supposed. No complaints having been received from growers of clover, the Entomologist has referred specimens of eggs and young mites sent him to the species known as the Red Spider with which this mite is almost identical. But, suspecting from its abundance, that it might be *Bryobia*, specimens have been recently sent to specialists at Washington D. C. and our suspicions confirmed. The young Clover Mite resembles so closely the young of the so called Red Spider that only specialists in this branch of entomology can satisfactorily determine the difference.

The two belong to the same family, *Tetranychidæ*, and have been for a long time confused. Like the Red Spider, the Clover Mite feeds on plant tissues, infesting almost all kinds of fruit trees, though red clover is said to be its principal food plant. When attacked the leaves of clover look sickly as if suffering from some fungus. It is also found on some grasses and has been known to occur in houses. It was first reported from this coast (California) as early as 1879. May 28, 1889, Mr. E. Shipley of James Val-

ley P. O., Oregon sent specimens of this mite to Washington D. C. with the statement that it was abundant on boards, stones, fences and fruit trees. It has been found on Apple, Pear, Plum, Prune, Poplar, Elm, Peach, and Almond.

In some localities young mites are found with the eggs during the entire winter season. These eggs are red or reddish, easily seen with the naked eye, and are laid in masses on the bark or beneath the scaly bark of old trees. In the winter they are found by the hundred in protected situations.

When attacking forage crops, it cannot, with our present knowledge, be combatted. When on fruit trees, the Department recommends spraying with kerosene emulsion to which a little sulphur has been added, and when infesting houses the same solution should be used on the lawn and outside walls of the house.

As stated before, no complaint of this pest with regard to clover has been received at our Station. If, at any time, the clover crop should appear to be suffering from the attacks of this mite, the Entomologist would like to be advised of the fact, and to receive specimens of the mite and its work.

Koebele's Resin Wash.

F. L. WASHBURN.

During Mr Koebele's last visit to Oregon he made, in the Entomological laboratory, some resin wash according to the following recipe: Resin 4lbs., Carbonate of Soda (common washing soda) 3lbs., water 1 gallon; boil together until all the resin is dissolved and then add gradually four gallons of warm water, stirring all the time, and continue the boiling until the mixture is the color of molasses. He recommended its use as follows: for Woolly Aphis 1 part of wash to 6 parts of water, for any other Aphis 1 part wash to 10 or 12 parts of water, for Mealy Bug 1 part of wash to 10 or 12 parts of water.

We have had occasion since then to make and use this wash

and feel able to indorse all that Mr Koebblec says in its praises when used against different forms of plant lice.

During his investigations in the hop fields of this state, it was his aim to show the growers the virtues of this wash, claiming it was in many respects better than kerosene emulsion or quassia chips though he by no means denied the efficacy of the last two.

It was his idea that this wash could be used at such a strength that it would kill all the lice and yet not injure the beneficial forms of insects found amongst and feeding on the former. It was a suggestion from him which prompted the Entomologist to begin a series of experiments in this direction. The following is to be regarded as only a preliminary report on this work.

Winged and wingless hop lice were found on plum leaves Oct. 13th. Some of these leaves were immersed in a solution of resin wash and water, one part of the wash to thirty parts of water, for five seconds. After forty-eight hours these leaves were examined and it was found that but comparatively few lice had been killed. One part of the wash to twenty five of water gave the same results. One part wash to fifteen parts of water was then used and all the lice so treated were dead when leaves were examined a few hours later. Naturally one part of wash to ten and twelve parts water respectively was equally efficacious.

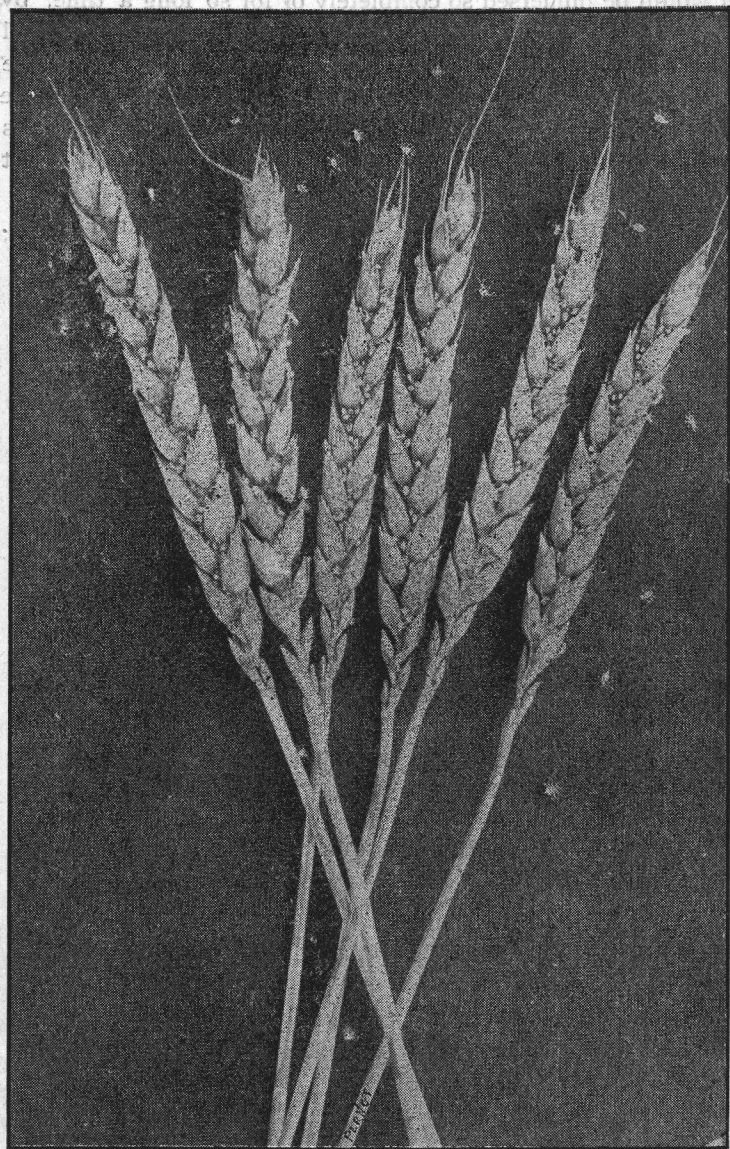
Attention was then directed to the effect of these strengths upon the predaceous insects found with hop lice. One part of the wash to fifteen of water did not effect the larvæ of *Syrphus* flies, and only induced a temporary disability on the part of the larvæ and imagos of the *Coccinellidae* "Lady Beetles". One part of the wash to eight parts of water (10-20 seconds immersion) killed both *Coccinellidae* larvæ and imagos but did not seriously inconvenience the *Syrphus* larvae, which can stand, as found later, a solution of one part of the wash to six of water, without succumbing.

It would appear, then, that one part of the wash to fifteen of water can be used against hop lice without endangering either of the above two predaceous insects in company with them.

Of course, the test in the field would not be as rigid as in the

laboratory; in other words, neither the lice nor the beneficial insect would be immersed so completely or for so long a time, by the spray. Hence one part to twelve could probably be used with safety, and perhaps with greater efficacy as far as the lice are concerned. By reference to the first part of this article it will be seen that this strength, 1 part to 10 or 12 of water, is exactly what Mr Koeblele recommends for all forms of plant lice except Woolly Aphis.

All illustrations in this bulletin have been prepared by Mr. Pernot in charge of our Photographic department



Heads of Wheat infested with Grain Plant Louse; on one head a larva of *Syrphus* fly can be indistinctly seen feeding on the lice.