far as we could tell from field observations and rearing hundreds of them in the insectary, less than 1 per cent. of these eggs hatched before being moulted off by the caterpillars. Another tachinid which deposits eggs on the leaves of the food-plants is only active on hot, sunny days, and deposited most of its eggs too late to be of value in the case of **M. pluvialis.** It was, however, useful in the control of the **erosa** outbreak in the Uplands; these caterpillars being ten days to two weeks later, and the parasitism there ran as high as 20 per cent. Two species of Hymenoptera were present in small numbers—**Campoplex (Ameloctonus) validus** and a species of **Rogas.** Both of these attack the very small caterpillars and are often useful parasites. Some other parasites were found attacking the pupæ, but these were also in negligible numbers. Overcrowding and diseases were very active and important factors, and were successful in reducing the outbreak in all parts of the city, with the exception of the Uplands, which was fairly free from disease.

To sum up, we see that, although the natural enemies of the tent-caterpillars have been successful in reducing the outbreak in Victoria, it is far from being under complete control, and it can increase so rapidly that it will be necessary to assist nature in every way during the coming summer in order to render these pests innocuous. In Vancouver much greater efforts will be necessary. Last year recommendations were made to the Councils of both cities with a view to assisting them in reducing the depredations of the insects, but the results fell far short of being satisfactory owing to a lack of any co-ordinated campaign.

OBSERVATIONS ON THE USE OF POISON BAITS FOR THE CONTROL OF CUTWORMS IN 1918.

BY M. H. RUHMAN.

For some years a mixture of Paris green or white arsenic and bran has been advocated for use against cutworms. The usual recommendation was the application of the poisoned-bran bait round the base of young orchard trees, or its distribution along the rows of plants, or its being placed in small piles under shingles among the plants to be protected. In lectures on control and in most publications emphasis is placed on the fact that the Paris green or white arsenic is liable to cause injury to the plants or trees if the bait is placed in contact with them. Evidence to this effect came to the writer's notice in the spring of 1918 when called upon to investigate the cause of the complete destruction of two separate plantings of 2,000 tomato-plants and approximately 2 acres of beans. On examination it was immediately evident that the plants had been burned by some poison applied to prevent cutworm injury. On inquiry it was found that a bait had been prepared consisting of 2 lb. of white arsenic to 50 lb. of bran mixed with sufficient water to make a crumbly mass. The white arsenic was used

owing to difficulty in obtaining sufficient Paris green. The grower was not aware of the necessity of avoiding contact between the bait and the plants, and had been in the habit of applying the bait to the rows of plants without troubling to avoid contact. No ill effect had resulted in previous years, but Paris green had always been used in place of white arsenic. Greater care, therefore, is necessary in using white arsenic than Paris green, but care should be exercised on all occasions with growing plants with either arsenical. On another occasion a representative of a commercial firm called for advice as to the planting of 80 acres which had been prepared to receive tomato-plants and which had been baited for cutworms. Thirty plants set the previous evening had been cut down overnight and it was feared that heavy losses would result if the field were planted. A visit was paid to this field, and on examination of the plants destroyed an average of seven cutworms to each plant was found. The preparation and handling of this acreage was entirely in the hands of Chinamen, who insisted that the injury was not due to cutworms, as they had carefully baited the land to destroy them by placing about a tablespoonful of poisoned-bran bait on the spot each plant was to occupy. This bait on examination was found to have been improperly mixed, at least 50 per cent. of the bran being free of poison. The method used to apply the bran was not only unsatisfactory, but must have taken considerable time. It was advisable, therefore, to rebait the entire field, the formula given being in the proportions of: Bran, 50 lb.; Paris green, 1 lb.; molasses, 2 quarts; lemons, 6 fruits; and water, 5 gallons.

This bait is prepared by thoroughly mixing the bran and Paris green in their dry state. One gallon of the water is heated, in which the molasses is dissolved, which is then added to the remaining 4 gallons of water. The juice of the lemons, and their pulp and peel after being finely chopped, are then added. The liquid is then gradually mixed with the bran and Paris green and thoroughly worked until all the bran is equally moistened. This bait was, on the occasion mentioned above, and should at all times be prepared just before use and broadcasted over the ground immediately after the ground has been prepared for planting, but before planting or seeding has taken place. It should be applied over the entire acreage as thinly as possible in the cool of the evening. This quantity of bait will cover about 7 acres if thinly broadcasted.

No further visits were paid to this field, but on inquiry at the end of July it was reported that not a single plant had been lost through cutworms.

On another occasion a small lot of about 1 acre, which had been prepared for planting, but was abandoned owing to the enormous quantity of cutworms present, was taken over by two boys for a war-garden. The writer personally baited this lot with the mixture before described, and obtained 100 per cent. results overnight. The boys were put to work to hunt for live cutworms the following morning, and, although over 3,000 dead cutworms were gathered, they failed to find a live one. This lot was then planted to beans, with no loss for the remainder of the summer through cutworms.

The mixture used is a modification of the Kansas grasshopper bait, and was first used by the writer in the spring of 1917 on a small city garden-patch with perfect results.

In many districts cutworms are always present in sufficiently large numbers to warrant the application of a poisoned bait every spring to protect the crops. The broadcast method has the advantage that no green food is present to detract the cutworms from the bait, which is consequently greedily eaten. The desired results are thereby obtained.

Owing to war conditions the cost of material in the spring of 1918 was high, being: Bran, 50 lb., $1.05; molasses, 5 lb. (approximately 2 quarts), 50 cents; lemons, 6 fruits, 25 cents; Paris green, 1 lb., $1; making a total of $2.80 for material sufficient for about 7 acres. With the labour of preparation and application the total cost should not exceed 55 cents per acre. Under normal trade conditions the lower cost of material would reduce this to approximately 40 cents per acre.

Every endeavour should be made to treat land before planting, as the quantity of bait required per acre to treat planted land greatly exceeds the broadcasting method, and the time required to apply the bait, so as to avoid direct contact with the growing plants, can bear no comparison. Furthermore, the effectiveness of the bait is considerably reduced, as when succulent young plants are present the cutworms are liable to give them preference to the bait.

The most important point in the preparation of the bait is the thorough mixing of the bran and Paris green. These ingredients must be mixed in their dry state in the endeavour that each flake of bran shall bear a particle of the poison. The water must not be added in bulk, but worked in gradually and thoroughly. If this is not done the addition of the water will free a considerable percentage of the poison from the bran-flakes, thereby making the bait less effective, it being remembered that only a small quantity of the bait will be consumed by one cutworm.

GENERAL RECORDS OF WORK CARRIED ON IN THE UNITED STATES AND CANADA IN 1918.

BY R. C. TREHERNE.

In Control of Cabbage-worm lead arsenate and calcium arsenate gave best results (1 lb. powder, 2 lb. paste to 40 gallons, with 1 lb. laundry-soap). Zinc arsenate, tobacco-dust, lime, of no use at all. Dusting is becoming the recognized way of controlling cabbage-infesting insects.

(*a.*) Arsenate of lead powder or Paris green mixed with 20 times its bulk of hydrated lime or gypsum.

(*b.*) Sulphur, 50 parts; tobacco-dust, 40 parts; lead arsenate, 10 parts; used in cheese-cloth bag by shaking, or by regular dusting-machine, costing approximately $30.