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.

Control of Clothes-moth—Sulphur fumigation destroys adults and larvæ, not eggs. Heat at 110° Fahr. for 30 minutes kills all stages. Larvæ and eggs killed by dipping for 10 seconds in water at 140° F. Camphor and naphthaline are the only materials fit to use in closets, etc.

Control of Cockroaches.—Sodium fluoride has given best results. Borax is good, but its action is slow.

Red-spider Control.—Use soft-soap solution, 4 per cent. if buds are closed; soft soap 1 per cent. and nicotine 3 per cent.; soft soap 1 per cent. and quassia 2 per cent. A new spray where red spider is really bad has been devised in California, uniting lime-sulphur, miscible oil, glue, and water.

Sprays—Arsenate of Lead Spreaders.—Sage-brush tea, 1 lb. to 1 gallon; allow to stand for 12 hours, 5-1,000. Casein lime: 3½ grammes quicklime and 1½ grammes casein; grind in mortar; 4-8 oz. to 100 gallons.

Calcium Arsenate is not safe for general recommendation. It is suggested for apples, potatoes, pear, but not for plum, cherry, or peach. Used alone, it burns. One to ten of lime is safe for apple. Excess of lime prevents arsenic going into solution.

Dusting is rapidly replacing liquid sprays for many insect and disease controls. The machinery and dusting mixtures have not as yet reached a stage of perfection. To-day, relative cost is higher. They are using 80 to 85 per cent. sulphur, 10 to 15 per cent. powdered arsenate of lead, with 10 per cent. diluent, at 3 lb. per medium tree. Cherries may be dusted without arsenate within a few days of picking. Dusting is cheaper for large trees, 50 per cent. dearer for medium trees, and much more expensive for small trees. Liquids hold better to leaves. Diluents or carriers are silt, gypsum, talc, limestone. In general, liquid sprays are advocated until dusting equipment is improved.

Lime-sulphur is liable to cause injury with trees in poor vitality, applications in unusual heat, direction of spray with high humidity and high sunshine record.

Nicotine has been shown by several investigators to be an effective ovicide, in some cases by itself destroying 80 per cent. of eggs. With soap, 4 lb. to 100 gallons (B.L. 40, 1-1,200), 100 per cent. mortality has been shown. A new combination with nicotine extract and oleic acid has been brought forward. Olein, from which the acid is made, is the chief constituent of the fatty oils, such as olive-oil, whale-oil, etc.

Soluble Sulphur (a sodium sulphide) is advocated from several quarters, but is not generally recommended. If used, it appears that calcium arsenate is safer than lead arsenate in combination. The formula suggested is: 2½-3½ lb. soluble sulphur; 1¼ lb. calcium arsenate; 15-20 lb. hydrated lime; 100 gallons water. Liver of sulphur (potassium sulphide) cannot be used with arsenicals.

Residues from Spraying.—Experiments have been conducted to show the effect of feeding hay cut from beneath trees sprayed with arsenicals. With cattle, no effects at 3 lb. arsenate to 50; symptoms of poisoning, 6-50; serious, 10-50. The same applies to sheep, but not so with poultry. As to

sprayed apples, 0.5 mg. is left on one apple at 3-50; medicinal dose is 2-5 mg.; dangerous dose, 60-120 mg. Thus no danger unless 120 apples are eaten at one time.

House-ant Control.—One pound sugar dissolved in 1 quart water, to which add 125 grains (approximately ¼ oz.) sodium arsenate. Boil until thoroughly dissolved and add about a tablespoonful of honey. Set out with sponge in shallow dishes.

Rice-weevils.—Do not breed in stored, sun-dried wheat containing moisture up to 8 per cent. In 9 per cent. moisture they lie dormant, and above 9 per cent. are active. Weevils in flour may be controlled by heat, 113° Fahr. at 24 per cent. relative humidity.

Carbon-bisulphide fumigation for pea-weevil is used in Kentucky at 1 lb. per 83 cubic feet; a greater strength than this destroys germination.

Pear-slug.—Parthenogenesis proved; virgin females laid eggs in spring, giving rise to virgin females entirely. Males are rare.

Aphides.—It must be realized that three kinds of aphides may be found associated in a single cluster on an apple-tree. These are known as the green apple-aphis, the European grain-aphis, and the rosy aphis.

The Green Apple-aphis (**A. pomi**).—Eggs are laid in autumn on apple; hibernates as egg. Hatching occurs when nearly all buds show some green, forming, after moults, stem-mothers; wanders around, settles in buds. In ten days reproduces about forty young, giving rise to wingless viviparous females, winged females, and intermediate forms. The number of young produced in earlier generations is higher than later, varying as 55 : 30 : 12, according to season. Winged forms are not produced as a result of lack of food, and not necessary for the propagation of the species. Thus two theories are disposed of. Intermediate forms are variants, but reproduce normally; seventeen generations occur. Sexes are formed by the winged and wingless females; usually commence in August or September. The proportion of males to females is ten to ninety. Plural mating takes place, an average of six eggs per female being laid.

The Rosy Aphis (**A. malifoliæ**).—The most injurious species. A variation is shown in the life-history from the green apple-aphis. The winged forms are again seen. All form wings and migrate to secondary host-plant. Eggs are laid in apple. Hatch at same time as **A. pomi.** Stem-mother in fifteen days starts to reproduce, laying about seventy-one young. Then five to seven generations follow; the first wingless, later winged; approximately 122 young being produced per individual. The winged forms become migrants in late May. Settle on plantains; produces eighteen young, each wingless. No aphides of this species are now in the apple; all are on plantains. Forty-seven young are produced in geometrical ratio in plantain. Winged forms in later generations in plantain are formed, which fly back to apple in September. Males are formed in plantain in late summer and fly to apple at a time when the first migrants have produced young of the oviparous type. Seven eggs per female are laid on apple-twigs in October.

The European Grain-aphis (**A. avenæ**) has a similar life-history to the rosy aphis, but it uses the grain and grasses as alternate hosts instead of plantains. The only important point—this aphis hatches ten days earlier.

Aphis-control.—Buds too far expanded makes spraying difficult. In all recommendations for spraying it is stated that the best results attend a dormant spray as the buds are nicely broken. It costs money to spray; often not desirable; depends on degree of infestation and on early spring temperatures, etc. There is a certain stage in the embryo which is susceptible to outside agencies. A high temperature of 65° Fahr. in February often kills most aphides. The study is a very complicated matter; the critical temperatures are not yet determined. In dry air 4 per cent. eggs hatch; in 22 per cent. moisture, 12 per cent.; in 63 per cent. moisture, 20 per cent.; in 100 per cent. moisture, 36-46 per cent. hatch. Lime-sulphur tends to harden shell and nicotine tends to penetrate. Spray 1-9 lime-sulphur and nicotine 1-500.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1920.