

INSECT PESTS OF BRASSICA FORAGE CROPS

by L. Morrison,
Canterbury Agricultural College, Lincoln

The crops under consideration are turnips, swedes, rape, kale and chou moellier and the major insect pests are Aphids, Diamond-back Moth and White Butterfly. A number of minor pests, especially Brown Beetle, Springtails, Weevils and the *Nysius* Bug, may cause damage to the crops in their seedling stage.

SEEDLING DAMAGE

The Brown Beetle (*Costelytra zealandica*) is the parent of the grass grub and its main flight takes place during the period second week November to the third week December. Seedling brassicas during this flight period are very attractive to the beetles which settle to feed during the early part of the evening especially when the weather is mild and reasonably calm. Thousands of beetles settling on a crop can practically eat it out in a single night. If sowing dates can be arranged so that the crops are not in the two-leaf susceptible stage during this flight-period trouble may be avoided.

Damage to seedlings by hordes of microscopic, wingless, jumping Springtails, by small earth-coloured snouted weevils and it is claimed also by the small, flat, brown bug *Nysius* is more sporadic and much less widespread when it does occur. Springtails and weevils nibble at the young plants and damage or completely destroy them, chiefly before the rough leaf appears, whereas the *Nysius* bug is claimed to be responsible for piercing the stem to suck the sap just at ground level so that the plant wilts and may show a callus formation which may cause the stem to become brittle and break over readily in the wind. Springtails and

Nysius bugs are universally present in both cultivated and uncultivated land in the spring time. Weevils are more likely to be found damaging seedling forage crops when such crops follow very old grass pastures where weevils have been breeding undisturbed. Springtails, weevils and bugs can best be controlled, if the cost of the treatment warrants it, by the application of Lindane at the rate of $\frac{1}{2}$ lb per acre.

MAJOR PESTS OF GROWING CROPS—Aphids

Several species occur on brassicas, but the Cabbage aphid (*Brevicoryne brassicae*) is the most important, while the Green Peach aphid (*Myzus persicae*) which is primarily a pest of potatoes and peach trees is of lesser consequence on forage crops. Aphids are most destructive when the crop is suffering a check from lack of moisture and they thrive best in hot dry weather. Aphids are small insects about 1/20th inch long and usually greyish-green or yellowish-green in colour. They are wingless during the early summer but as the season advances at first occasional and later numerous winged individuals appear so that the spread of the infestation is greatly speeded up as more and more individuals are born which develop wings. Aphids are extremely fragile insects and quite incapable of sustained or directed flights but they are readily carried by wind. During periods of strong winds they tend to remain fixed on the vegetation, whereas in light or moderate winds they are more likely to take to the wing and hence are liable to be carried about. Since all the individuals in the early part of the season and the majority even in

the late part of the season are females each capable of producing say a dozen offspring which mature in two or three weeks, the rate of increase is extremely rapid. From a few females or eggs which have overwintered on cruciferous plants in fields or gardens or on cruciferous weeds, a population of millions will have arisen by mid-summer and will only disappear when parasitic control has gradually built up and when the cold, wet weather in autumn and early winter produces the usual mortality.

Aphids feed by inserting into the plant tissues their long, slender, hair-like mouth-parts and imbibing the sap from the leaves and stems. Besides the loss of sap which is by far the most damaging activity resulting in poor, shrivelled, wilted crops, the plants are clogged up with a powdery wax secretion and a sweet honey-dew excretion resulting from the imbibing of copious quantities of sap. In addition, because of their peculiar mode of feeding—driving their mouth-parts into the tissue to reach the cell sap, then injecting a drop of saliva to help aid digestion and then finally imbibing the partially digested sap for nourishment—aphids are the most efficient transmitters of virus diseases in the plant kingdom. Turnip mosaic and cauliflower mosaic are dependent for their spread on the aphid population in the crop.

Diamond-back Moth (*Plutella maculipennis*)

Like the aphids, this pest thrives best in hot, dry seasons. It is particularly a pest in the east coast districts of New Zealand—Hawke's Bay, Marlborough, Canterbury and Otago. Southland, with its cooler and moister climate, rarely experiences anything more than a mild infestation. The moth originated from Europe, but has spread throughout the world and is now an enemy of cruciferous plants, both field and garden, in tropical, temperate and even cold regions, especially in Northern Europe. Its distribution is fairly similar to that of the Cabbage aphid. The slender, grey moth rests with its wings folded roof-wise over the body, displaying a row of three lighter-coloured diamond-shaped markings along the back. It is actually a night-flying moth which rests during the daytime among the foliage,

but is readily disturbed and may be noticed rising in great numbers with a quick, darting flight in front of one walking through an infested crop in the daytime. Nevertheless, even when abundant the moths are very inconspicuous and can easily be overlooked. The moth frequents crops of turnips, rape, cabbages, swedes, kale and chou moellier from spring right through summer until late autumn producing as many as six or seven generations in a year and reaching its greatest density in the month of February. Small, inconspicuous, white eggs laid on the plants give rise to greyish-green spindle-shaped caterpillars easily recognised by their habit of wriggling violently when disturbed and dropping off the plant to hang suspended in mid air on a fine silken thread spun from the mouth. They feed on the foliage, stripping off the softer tissues and leaving the thin upper epidermis which breaks away as it withers and leaves large holes. An attacked crop may be readily noticed by the unhealthy, withered, blasted appearance it presents. The amount of damage is determined by the severity of the infestation. Turnip crops are often rendered practically worthless as the severe loss of foliage causes the stunted bulbs to become extremely fibrous and woody. The caterpillars change to moths inside filmy, silken cocoons attached to the food plant.

The weather conditions prevailing during spring and early summer largely determine to what extent crops will be attacked during the later growing season. If the weather is cold and wet in the early part of the season the moth does not seem able to build up sufficient numbers in the early generations to constitute a menace to the crops in February and March when greatest damage can be expected. On the other hand, if the weather is dry and warm in the early part of the season, severe damage is likely to be experienced later on in the season. Cool, wet conditions in late March or April, especially if accompanied by frosts, lead to a sudden and rapid decline in moth numbers with a consequent cessation of damage.

White Butterfly (*Pieris rapae*)

This pest was first recorded in New Zealand in 1930. It is much more restricted in its distribution than the

other two major pests for it is confined to the temperate regions of the Northern Hemisphere and only occurs in New Zealand, Tasmania and the southern parts of Australia in the Southern Hemisphere. It is primarily a pest of the domestic and market garden due to its decided preference for cabbage and cauliflower. It will, however, readily attack turnip, chou moellier and, to some extent, rape. Unlike the Cabbage aphid and the Diamond-back moth, it is not absolutely confined in its food choice to brassica plants for it will attack both nasturtium and mignonette. The large creamy-white insects with dark markings on the wings are familiar to most people and require no description. The adults frequent flowers on roadsides, in fields and gardens or crops of flowering red clover where they are adept at extracting nectar from tubular flowers. They are attracted to brassica crops merely to lay their eggs. This has been explained by the term instinct; perhaps it is a case of "inherited memory" that impels them to return to lay their eggs on the same kind of plant on which they themselves fed when young.

The eggs are sufficiently large to be readily seen. They are yellow, ridged and sculptured, bullet-shaped and attached by their broad end to the leaf. The caterpillar is light-green with three sulphur-yellow stripes running along the body and so densely covered with short hairs as to give it a velvety appearance. It is sluggish and is not readily agitated when disturbed. It damages plants by eating large holes out of the leaves and if undisturbed may completely skeletonise the leaf which is left with nothing showing but the veins and midribs. It tunnels into hearted cabbages leaving behind masses of slimy green castings reducing the market value out of all proportion to the actual amount of material consumed. It is probably more severe on chou moellier than any other farm crop. Fortunately, this plant, even when severely defoliated by a heavy attack in summer, has remarkable powers of recovery when autumn rains stimulate its growth. At the same time, these rains lead to heavy mortality among caterpillars and a gradual decline and ultimate complete disappearance of the infestation.

PREVENTIVE AND CONTROL MEASURES—Use of Resistant Varieties and Mixed Crops

Much work has been done in New Zealand over the years to find varieties of crop plants resistant to aphids which are particularly severe on swedes and rape. No headway has been made in breeding resistance to caterpillars. So far two varieties of swede, namely Calder and New Zealand Sensation, show a considerable degree of resistance and Wilhelmsburger or New Zealand Resistance is fairly resistant compared with highly susceptible varieties like Superlative and Grandmaster. The Crop Research Division of the Department of Scientific and Industrial Research at Lincoln has bred a variety of rape and tested it out over several seasons and this shows considerable promise. This resistant rape variety will most probably be released and on the market in time for the 1960 sowing. In the drier areas where aphid damage tends to be a limiting factor in the successful growing of swede and rape crops, farmers should make as much use as possible of resistant varieties or at least mixtures of resistant with susceptible varieties.

Of course, forage fattening crops may be composed of mixtures of brassicas with plants which are completely free from attack by aphids, Diamond-back moth and White-butterfly. If mixtures are composed of rape, kale, chou moellier, soft turnip, H.1 rye grass and Borre lupin, then the non brassica components will be entirely free from attack while the susceptible brassica plants will be more widely separated from each other and likely to suffer less than when growing close together. For winter feed crops instead of the susceptible swede and turnip normal sowings, late sowing of York Globe, as late as mid February, will stand a reasonable chance of avoiding the main aphid and Diamond-back moth attack in February. On the other hand, consideration might be given to replacing the susceptible brassicas with Cape barley or green feed oats or H.1 ryegrass, either alone or with a light sowing of turnips or using lucerne hay.

Biological Control

Attempts have been made to effect control of the three major pests by the introduction of various parasites over the years. These parasites have become

established and are always present in greater or lesser abundance. It is difficult to assess the degree of reduction in population level brought about by biological factors which are constantly changing from year to year. However, in the drier east coast areas the degree of control exercised by parasites and predators is very far from adequate, more particularly in hot dry seasons.

Chemical Control

Various chemicals have been used with success in controlling pests of brassica crops. The home gardener and horticulturist who aim at producing unblemished crops depend largely on the use of D.D.T., Lindane (gamma B.H.C.), Nicotine sulphate and certain organic phosphorus compounds. With the exception of Nicotine sulphate, these have been used on a farming scale and with some reasonable degree of success.

(a) D.D.T.—This will control Diamond-back moth and White butterfly caterpillars, but not aphids. It is used at the rate of $\frac{1}{2}$ lb to 1 lb ppi D.D.T. per acre and treatment will cost, for material, 10/- to 12/- per acre.

(b) Lindane.—This will destroy aphids as well as the caterpillars when used at the rate of $\frac{1}{2}$ lb per acre and the cost of the material will be from 15/- to 25/- per acre.

(c) Metasystox.—This is one of the synthetic organic phosphorus compounds which is taken up by the plant and translocated in the cell sap. It is a systemic insecticide and is toxic to sap-sucking forms only. It is very effective against aphids. In an experiment carried out by the Entomological Division of the Department of Scientific and Industrial Research, Ashburton, it was used at the rate of 20 fluid ounces Metasystox in 7 gallons of water per acre, costing 25/- per acre for material and applied by air.

All chemicals used as insecticides require to be treated with care. Some are reasonably safe, some are quite dangerous. The three mentioned here must not be sprayed on flowering crops because they are toxic to bees, Metasystox exceedingly so. D.D.T. and Lindane are safe insecticides, not very expensive, have a considerable residual life, will be washed off the plants only by heavy rain and may be applied as a dust or a spray. Lindane will kill all three major pests. D.D.T. will kill

caterpillars but not aphids. Metasystox requires to be handled with great care as it can be absorbed through the skin. Complete coverage which is so important with D.D.T. and Lindane is not important with Metasystox because it is taken in by the plant and translocated in the sap. It is applied as a spray only. It gives excellent control of aphids but has a fairly short residual life. It is selective in its action killing sap-sucking forms only without harming parasites and predators.

Chemical Residues.—Treated crops should not be fed to stock until the lapse of several weeks or until rain has washed the residues off the plants. This applies to D.D.T. and Lindane which, although harmless to stock, may accumulate in the meat and milk.

Permits.—No permits should be necessary for the treatment of brassica crops for fattening and winter feed purposes, since they will not be in flower at the time of treatment, except that in the case of aerial application of substances regarded as dangerous to the operator, and Metasystox is included in this category, a permit must be obtained from Civil Aviation.

Time of Application.—The cost of application must be added to the price of the material used. Aerial application for example varies from 7/- per acre for dusting to as high as £2 per acre for spraying. Hence treatment is a fairly costly business and most farmers would hesitate to treat a crop more than once in a season. It is impossible to give any particular time when treatment should be applied. Except under very unusual weather conditions it is rare to treat forage crops before January. It is useless to delay treatment until damage has proceeded to a point beyond recovery. One treatment should give protection for three to six weeks. Since the two worst pests, Aphids and Diamond-back moth, reach their greatest density in February, it is likely that treatment in the period mid-January to mid-February would be most suitable.

Other Types of Insecticides.—D.D.T., Lindane and Metasystox are the insecticides most widely used on forage crops at the present time. It would not be surprising if other chlorinated hydrocarbons replaced D.D.T. and B.H.C., and it is very probable that other and safer systemics will replace Metasystox.