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In common with almost all forms of life, fruit trees are subject to attacks of disease of various kinds, the effect of which is to weaken the vitality of the tree or plant, and to prevent to a greater or less degree its various activities, especially the bearing of healthy and abundant fruit.

The diseases which fruit growers have to contend with are practically all parasitic in character, that is, they are produced by the attacks of other animals or plants which feed and live upon the juices or tissues of the plants.

A parasite may be defined as an animal or plant which continuously derives its nutriment from another individual without immediately destroying it, since such destruction would also involve the death of the parasite. The animal or plant upon which a parasite feeds is called its host. The extra demand made upon a host plant by its parasite almost always results in a weakening of the former, producing finally in many cases death or decay.

The parasites which attack fruit trees belong mainly to two classes, the well-known forms of animal life called collectively insects, and a low order of plant life termed fungi.

The insects form a very large class in the great division of animals called invertebrata or boneless animals, distinguished by having no internal skeleton. The higher types of insects possess considerable powers of intelligence, or, more strictly “instinct,” but most of the parasitic forms are very lacking in this respect.

The red spiders (mites) and certain minute “worms” as well as slugs and snails all attack plants, and belong to lower forms of animal life than insects.

The fungi are a low class of non-flowering plants which contain no green colouring matter (chlorophyll) and are consequently unable, like the green plants, to live upon mineral matters alone, but are obliged to have their food ready prepared for them.

Many fungi are able to live upon decaying animal or vegetable matter, and these (termed saprophytes) are usually harmless to plants. Some fungi
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which are plant parasites are able also to live upon dead organic matter at certain stages of their existence.

As in the case of human beings, a lowered vitality produced by unhealthy surroundings is a common predisposing cause of attack. Thus many fungus diseases are only able to attack plants when these are in an unhealthy condition, and “blight” attacks of *aphis* are notably greater when the general health of the plants is poor.

In addition to the effect of the health of the plant on the prevalence of disease, there is the important influence of weather conditions. Thus many fungi are only able to maintain a vigorous growth on plants during favourable weather (usually damp heavy atmospheric conditions). This is probably usually due to the effect of such conditions on the plant cells, these becoming charged with excess of sap or nutritious liquid, but such weather conditions may be actually necessary for the activities of the fungus itself, as in the case of the fungus producing “potato blight.”

As regards the effect of the weather on insect attack, it is a fact very often observed by growers that *aphis* (“fly”) attack frequently follows upon a spell of easterly winds. In common parlance, the east wind “brings the fly.” This is specially noticeable in the case of hops.

The effect of frost, especially in early spring when the sap is rising in the plant, is often very similar in its effects to actual disease, and the damage noticeable as the result of fungus attack is often attributed to frost, and occasionally vice versa (see page 485).

Although plants are often attacked independently by fungi and by insects, these may work in combination. Thus the wounds in the leaves, etc. of the plants produced by the incisions of insects open the way to the entrance of the fungus. A notable instance of this occurs in the case of apple canker following upon attacks of woolly *aphis* (see page 501). The wounds made by the insect are often so minute as to be invisible to the naked eye. They are quite large enough however to afford a means of entrance to the fungus.

As every grower knows, the loss occasioned by insect and fungus attacks is frequently very heavy, and may involve an entire absence of fruit. More frequently the fruit produced is stunted in size, deformed in shape, and rendered unsightly by spots, cracks, or surface markings. Another very common injury is revealed on cutting open the fruit, when the interior is found eaten away by a grub, leaving
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more or less dark brown "frass" (the excrement of the grub) in its place. In such cases the grub often remains in the apple or other fruit after the latter has been marketed, though a "wormy" apple can always be told by the hole made by the insect in entering or leaving the fruit. Another common source of loss due to disease is the premature falling of the fruit before it is ripe. In the widespread "brown rot" disease the fruit continues to hang on the trees in a hard "mummified" condition.

Owing mainly to the orchards in this country being scattered over considerable areas, and to the diverse varieties of fruit planted, English growers are not subjected to attacks of such virulence as in the case of some other countries, notably America, where attacks on fruit assume often the nature of epidemics, rapidly spreading over large areas. Huge sums of money have been, and are being spent annually by the State in combating various pests which have obtained a firm hold, as, for example, the caterpillar of the gipsy moth.

Although at a first glance it may appear that many insects and fungi are very similar in their methods of attack, closer study has shown that many important differences exist of which an accurate knowledge is essential if a successful method of treatment is to be employed. In particular it is necessary to know at what period in the life-history of the pest it is most open to attack and to take advantage of the information thus gained.

Thus it is found that during a considerable part of the life of most insects and fungi these are either very resistant to any destructive agents we can employ, or that they are completely inaccessible, being securely hidden away, or in some manner protected from attack.

An important point to bear in mind in regard to the question of devising remedies for insect and fungus attacks, is that the tissues of the plant itself consist of living cells like those of the parasite which it is desired to destroy. It follows that the choice of remedies which, while being harmless to the plant, are effective in killing the parasite is very restricted, and also that in any of the remedies employed there will always be a certain risk of some degree of injury to the plant. A further point to note is the importance of using exact and uniform strengths in the application of remedies, since if certain concentrations are exceeded, damage to the plant is bound to result, the
appropriate strength being obviously a carefully ascertained mean between what will prove harmless both to the plant and the parasite, and such a strength as will injure them both.

The remedies employed in practice are various, and depend upon the character and situation of the pest in question. A very effective means of control is by “spraying” or “dressing” with solutions or suspensions of various substances. The material is thus brought in contact with the whole exposed surface of the pest which would be difficult of accomplishment in any other manner. An alternative method is the blowing on to the plant of the material in the form of a fine dry dust or powder. Pests which live in the soil are dealt with by digging-in various poisons, or by injecting poisonous volatile liquids near the parts attacked. Where circumstances permit of its employment—as in the case of small indoor plants—fumigation with poisonous gases is very effective.

In the case of insects it is necessary to distinguish between those which eat the tissues of the plant, and those which suck the juices only, having no means of “eating” as ordinarily understood. The first class of insects can be killed by means of poisons placed on the surface of the plant, but this method is of no use at all to the insects which suck the sap of the plant. The only means of reaching this class of offender is by absorption of poisonous solutions through the soft body of the insect, or by acting on the breathing pores which may be made to absorb the poison, or may become choked up, thus causing suffocation.

Spraying has long been employed as a standard practice in fruit growing abroad, especially in America, where it is regarded as essential to the production of clean healthy fruit, and good crops. It is only in comparatively recent times however that the importance of spraying has been recognised in this country, and in many ways we are still very backward in this direction.

A fact which greatly helps the American fruit grower is the interest in the industry taken by the State. A government department is responsible not only for giving free advice on all subjects connected with fruit culture, but undertakes free analyses of materials, soils, manures, etc., and has State Research stations established in every district for carrying on experimental work in the interests of the growers. Analyses of advertised remedies are given, together with hints as to their relative efficiency, so that profiteering at the growers’ expense is effectively prevented, while legitimate manufacturers whose products merit recommendation are encouraged.
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It cannot be too often emphasised that unless spraying is intelligently carried out at the right times with suitable materials, accurately compounded and with efficient appliances, it is often worse than useless.

It will therefore amply repay every grower of fruit, be he small or large, to make a careful study of the pests by which his fruit is attacked and to take full advantage of the information which has been gained by careful and patient research through many years. Much has yet to be learnt, and new and interesting facts are constantly coming to light, but it is now possible by careful treatment to ‘control’ or limit the activities (and therefore the damage) of most of the pests to which fruit trees are subject, and to ensure a clean and healthy crop of fruit. The actual yield of fruit is obviously dependent on other factors besides attacks of parasites, such as variety of tree, fertilisation of the blooms, frost, unsuitable weather conditions and other somewhat obscure influences.

A matter which requires serious attention is the question of making the spraying of fruit and other crops compulsory by the introduction of the necessary legislation. This has been already done in the United States with most beneficial results for the industry. Until such procedure is adopted in this country it will be possible for growers to take all possible pains in the culture of their fruit in keeping it free from disease and yet fail entirely to eradicate serious pests because a neighbour allows his plantations to become breeding grounds for the pests and thus form a centre of infection in the whole surrounding district. At the present time this is the chief deterrent to the proper control of disease and it is extremely discouraging to intelligent, up-to-date growers who, after having done their utmost in this direction, find their labours nullified by the carelessness or indifference of unprogressive neighbours. What is needed is united action to compel the government to give the necessary consideration to the question and to give facilities for introducing into parliament the necessary legislation.1

1 Signs are not wanting that this important matter will soon receive full consideration. Compulsion has been adopted in the case of Silver Leaf disease (see page 577), certain measures to prevent its spread being now enforced.
SECTION II

HOW FRUIT TREES LIVE