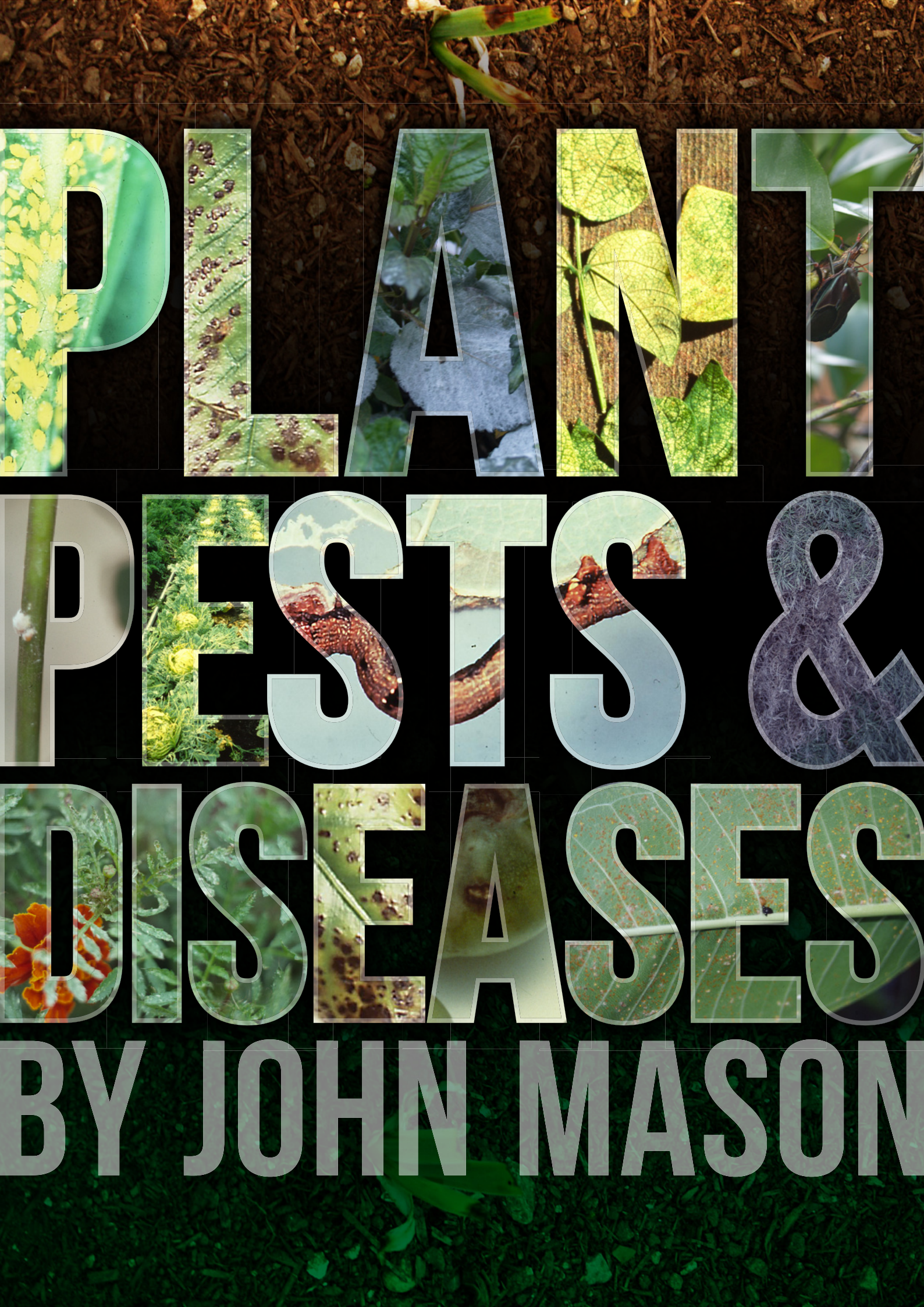
PLANT
PESTS &
DISEASES
BY JOHN MASON

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As such, the publisher and author do not accept any liability for actions taken by the reader based upon their reading of this book.

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John is a well respected member of many professional associations, and author of over thirty five books and of over two thousand magazine articles. Even today, John continues to write books for various publishers including Simon and Shuster, and Landlinks Press (CSIRO Publishing).

INTRODUCTION USING THIS BOOK

If you have a plant problem in the garden; this book will help you find it, understand it and show you how to deal with it. The first step in finding out what is wrong is always to carefully inspect the problem. Chapter 1 will show you how to do this.

After inspecting a problem, you don't always need to know exactly what it is in order to treat it! Often knowing which major problem group it belongs to is sufficient. For example, you may determine that the problem is caused by caterpillars chewing the leaves of a plant, rather than trying to identify the individual species of caterpillar.

Often it takes the expertise of a scientist to say exactly what insect or fungal disease is causing a problem. As long as you know that it is an insect, that may be enough.

The second step is to look at chapter 3 and refer to the plant variety with which you are having problems. This will tell you what the most likely problems are for that plant genus. By considering these possibilities along with what you saw in your inspection, you should be able to narrow down the likely problems to just a few.

The third step involves checking the most likely problems with the descriptions of pests, diseases, weeds and other problems found throughout the book. If the problem matches, you will then find a recommendation for treatment following the description of that problem.

The final step is to follow the recommended treatment in accordance with the information provided in chapter 2.

CHAPTER 1 IDENTIFYING PROBLEMS

It always seems that the more work you do in a garden, the more pest and disease problems seem to appear. For this reason, the keen home gardener and the professional landscaper need to be aware about what pests and diseases they may come in contact with, and how to control them.

This book will help in the identification of these problems. Without correct identification, it would be very difficult to suggest a suitable method of control. For example, a hole in a leaf may indicate damage by a pathogen such as a fungus, bacterium, or virus, or it could be caused by an insect. If you thought the problem was caused by an insect and sprayed it with an insecticide, but it was actually caused by a virus, then the spray is totally wasted.

This book will help the home gardener to identify and control a range of the most common pests and diseases of plants.

We live in an age of heightened environmental awareness where there is an emphasis on caring for our environment through sustainable land management, farming, and horticultural practices which includes reducing the use of chemicals. It is therefore important that plant problems are correctly identified so that an appropriate treatment can be chosen. This will help to prevent useless spraying of possibly harmful chemicals or, perhaps more importantly, the spraying of beneficial insects.

What's wrong with my plant?

UNDERSTANDING WHAT CAN GO WRONG WITH YOUR PLANTS

Plants can suffer from a range of problems. The types of problems they encounter can include:

- **Pests:**
  Included here are animals of various sizes and forms (from microscopic worms to birds, dogs, cows & humans). Insects are the most significant group which can cause damage to plants.

- **Diseases:**
  These are problems caused by living organisms other than animals. Fungi, bacteria and viruses are the most common. Not all fungi and bacteria cause problems for plants. In fact, many are extremely important in maintaining the healthy growth of most types of plants.

- **Environmental disorders:**
  Problems can caused by environmental factors including things like; poor soil conditions, pollutants, adverse weather conditions such as frosts, strong winds, extremes of temperature, and hail.

Heavy frost and snow caused this leaf burn on a Choisya ternata

- **Nutritional problems:**
  Too few nutrients can lead to deficiencies, and too many nutrients can cause toxicity in plants. Plants can also suffer from deficiencies when nutrients present in the growing media are not in a form that can be easily used by the plant.

- **Weeds:**
  These are plants growing where you don't want them. It is the location of a plant which makes it a weed, NOT the species of the plant. A plant can be weed in one position and a desired plant in another. A weed can be a host plant for pests & diseases or it may compete with your desired plants for nutrients, water, light and space making it difficult, or even impossible, for your desired plants to maintain healthy growth.

MORE THAN ONE PROBLEM

Often your plants can suffer from more than one problem at the same time. Frequently these different problems are interrelated, with one problem causing the others to develop.

For example, poor drainage may result in damage to a plant's roots. This in turn can result in reduced vigour, opening the plant up to attack from various pests and diseases. These pests and diseases may be obvious, but the damaged roots may not be. The most important problem is called the "primary problem" and other problems which can occur as the plant weakens, are called "secondary problems."

When you look for the cause of a problem, always remember; you might be looking for several answers (not just one).

FINDING OUT WHAT THE PROBLEM IS

Quick methods for assessing plant problems tend to be less technical and include things like: matching the problem to a photograph or description (in a book or on a chart), checking problems common on that plant, and identifying broad groups rather than specific diseases.

Before we can treat a plant we need to know what is causing the problem/s. It requires a great deal of knowledge and expertise to be able to precisely diagnose plant troubles. Do not expect to develop such ability quickly.

The first and perhaps most important skill to develop is how to inspect a plant in order to discover the telltale symptoms which will provide an indication of what is wrong.

These azalea leaves have been severely attacked by microscopic mites (red spider).

CONDUCTING AN INSPECTION

As already stated, a sick plant may be sick due to have one or several causes being present at the same time. There are thousands of possible causes which can contribute to a plant's problems.

More often than not, there are several factors involved. Minor diseases or environmental problems may weaken the plant, making it susceptible to some more major (obvious) disorder.

When you inspect a plant for problems, systematically consider all of the things which might possibly be going wrong.

STEP ONE

Systematically examine the plant, paying attention to any abnormalities.

Look closely at the leaves

- Is there any discoloration?
- Are there abnormal markings, swellings, distorted shapes, etc?
- Are there dead patches, or holes, or sections that appear chewed?

Examine the fruit and flowers

- Are the flowers and fruit developing well?
- Is there any fruit drop?
- Is fruit undersized? This often indicates weakness of the plant, a lack of water, or over-bearing (too much fruit on the plant creates competition for nutrients and water).

Look at the stems/branches

- Are the growth tips lush and fast growing? A healthy plant will have lush, growing tips during the main growth seasons. If other parts are damaged but the tips are lush, this can indicate that the plant is recovering from a previous problem.
- Are there any abnormalities on the stems, such as swellings or weeping gums/resins (known as gummosis on most plants, or resinosis in the case of conifers)?

Look carefully at the roots

- Are roots coming out of the surface of the ground? This may indicate soil is frequently infertile or dry deep down (roots are coming up for water and nutrients); or that soil has been eroded away.
- Is the plant loose in the ground? This can indicate that roots are weak or damaged.
- Are root tips healthy and strong, or black and rotting?

Identify which parts of the plant are most damaged

The parts which are most exposed to the problem will generally be the most affected.

- Frost damage occurs more on parts most exposed to frost.
- Sun burn occurs more on parts exposed more to the sun.
- Fruit rots may occur on branches close to the ground where disease spores can splash up from the soil.

- Small animals tend to eat lush growth in preference to older tough foliage, whilst grazing animals will eat lower growth on shrubs and trees that is within their reach.

STEP TWO

Examine the plant's surroundings. Identify and note anything which may relate to your plant's abnormalities.

Soil

- Is it wet or dry?
- Is it well-drained?
- Are there signs of salinity problems (perhaps a white sheen or the crystallised salts left after surface water has evaporated)?
- Are signs of erosion evident?
- Is the soil hard and compacted?

Surrounding plants

- Are they healthy?
- Do they have similar symptoms?
- Are they competing with the plants for light, root space, water or nutrients?

Environmental factors

Consider the plants exposure to wind, frost, sun, etc.

- Has anything been changed since the problem arose (e.g. a building or large tree which provided protection may have been removed)?
- Is the plant at the bottom of a hill or slope? Could something have washed down from further up the hill (e.g. weedicide, disease from another plant, weed seeds). Does cool air collect there (e.g. a frost hollow)?
- Is the area subject to possible pollution sources (e.g. car fumes, overspray from pesticide use, by-products of industrial processes)?
- What is local water quality like? Underground water sources from wells or bores may contain high levels of salts (levels vary from one time to another). Dam or stream water may be contaminated with farm or industrial wastes.

STEP THREE

Decide which group you think the main problem comes from - Pests, Diseases, Nutrition, Environment or Weed.

- Decide whether it is likely that there is more than one major problem.
- Identify which of the five main groups the problem is most likely to come from.
- Eliminate the groups you consider unlikely.
- Identify which groups you consider possible, and those groups you are sure of.

STEP FOUR

Look through the section of this publication covering the group of problems you decided it fits.

- If it's a disease, go to the section on diseases.
- If it's an insect, go to the section on insect pests, etc.

ALTERNATIVE APPROACH

Turn to the lists of plants and problems common to those particular plants - and find the most likely problem on the list.

Does that problem or problems give symptoms similar to those you have observed?

STILL UNSURE?

For anything you are uncertain of, devise a treatment which could be used for what you think is the most likely problem, and apply that treatment. You will be able to determine whether it was the problem or whether it was something else by watching how the plant responds.

The following table below provides a systematic approach to inspecting plants which you suspect, or know, are unhealthy.

You should look at each of the 'items' one at a time, following the guide given by the 'method of inspection' column.

ITEM	METHOD OF INSPECTION	WHAT TO LOOK FOR
Leaves	View old and young leaves both above and underneath.	Leaf scorch Discolouration Disfigurement Holes Leaf drop Insects (dead or alive) Unusual deposits
Stems	View top to bottom, push foliage out of the way. Use binoculars for taller plants.	Stem rot Cankers and galls Fungal growths Spots or other markings Suckering Side shoots Thin or thickened stems Flaking bark

ITEM	METHOD OF INSPECTION	WHAT TO LOOK FOR
Growth Habit	Stand back and view. Look at where the strong growth is and direction of buds.	Is it balanced? Is it appropriate? (Bushy for shrub, strong terminal growth for tree, etc) Distortions Witches brooms
Soil	Feel the soil surface, push finger 2-4cm below surface. For potted plants; remove plant from pots	Moisture/dryness Wet or dry spots Hardness/compaction Root density Burrows Surface salt Waste products/debris/ pollutants
Roots	View surface of soil. For potted plants; view holes at bottom of pot. Remove plant from container.	Root tip burn Rotting Distribution of roots; is it even? Discolouration of growing tips Weak growth

TELLTALE SYMPTOMS

1) Wilting

- Insufficient water in the soil.
- Too hot - leaves drying out faster than the water can be taken up by the plant.

Something stopping the water going up the stem (e.g. borer, disease in lower part of plant). **Take a closer look!**

2) Yellow leaves

If older leaves:

- lack of nitrogen (feed with a nitrogen fertiliser).
- Lack of nitrogen caused by wet soil - it prevents nitrogen being taken into the plant (improve drainage or cut watering).
- Chemical damage - overspray from weed killers is the most common cause of this type of damage.

- Soil very dry - often the edges (or margins) of the leaves will show signs of curling up or browning off.

If younger leaves:

- Iron deficiency.
- Other nutrient deficiency.
- Chemical damage.

Die back on a Conifer can be caused by a large variety of problems, from borers, to waterlogging or fungal infection on roots.

3) Distribution of damage

Look to see if the damage is distributed evenly over the plant. Examine whether it is:

- On one side only.
- On the top only.
- On the most exposed parts. Is there a pattern?

4) Recency of damage

Try to determine if the damage has only just happened, or did it occur some time ago?

- The appearance of the growing tips tells you the current condition.
- Young shoots indicate a healthy plant overcoming past problems.
- Excessive side shoots lower down indicates disruption of hormone flow in the plant, or some other problem in the upper parts of the plant.

Iron deficiency causes severe yellowing between leaves mostly on tip growth.

THE MAIN TYPES OF PROBLEMS

PESTS

Plant pests can include a wide range of things including:

- Insects - which feed on plant parts, or which transmit other problems such as fungal and viral diseases from plant to plant.
- Animals - which cause physical damage by digging around plants, knocking plants, eating plants (e.g. goats, birds, rabbits), or burning plant tissue by urinating on them (e.g. dogs, humans).
- Man - causing physical harm to plants by compacting soil through overuse, knocking and damaging plant tissue, transmitting diseases into the vicinity of healthy plants, deliberate vandalism, and through other forms of mismanagement.
- Small animals - snails, slugs, nematodes, yabbies, wood lice, mites and other small animals feeding on plants, transmitting diseases, etc.

Erinose mite on lychee will cause a distortion and discoloration on the plant leaves

DISEASES

plant pathology is the section of botanical science which deals with diseases and troubles in plants. Disease in a plant consists of a series of harmful physiological processes caused through irritation of the plant by a primary agent. Plant pathology is generally distinguished from insect and other pest problems. Plant pests actually eat the plant, or break the plant by standing on it (as does the human pest). Plant diseases are different. They are far more subtle, disturbing the microscopic physiological processes which go on within the plant.

When a plant is diseased, it may be affected by one, two, or more different problems. Clearly identifying what is wrong with a plant can be difficult,

because the problem is in fact a combination of problems. A possible scenario is given in the example below:

- The plant is weakened by poor nutrition in the soil.
- Excessively wet conditions create an environment that encourages the growth of an infectious fungus.
- The plant which is weakened by poor nutrition is infected by the fungal disease which develops in wet conditions.
- The roots begin to rot through fungal attack.
- Because the roots are damaged, the plant does not take in water and nutrients as well as it would do normally.
- The leaves of the plant are infected by a second disease because the plant has been weakened.

Codling moth are often found on apples, pears and crab apples

This citrus has split because of excessively wet weather as it nears ripening.

Common terms

The following terms can be used to help identify what disease is infecting your plant:

Rot: Decomposition or decay of dead tissue.

Spot: Well-defined grey or brown, dead tissue surrounded by purplish margins (or margins of some other dark colour).

Shot hole: Dead tissue in a spot cracks and falls, leaving a hole in the leaf.

Blotch: Where fungal growth appears on the surface of a dead spot.

Blight: Quick death of complete parts of a plant. The disease pathogen develops very quickly e.g. leaves die and fall.

Wilting: Drooping of leaves and/or stems.

Scorch: Similar to blight but leaf veins are not affected. Leaf tissue dies between the veins, or along the margins.

Scald: Whitening of surface (or near surface) cell layer on fruit or leaves.

Blast: Unopened buds or flowers die suddenly.

Dieback: Death of growing tips, moving down through the plant (i.e. the terminal buds die, then the stems below them die, then parts below that die). Dieback can occur to just part of the plant, or in severe cases can continue moving through the plant right to the roots.

Damping off: Sudden wilting and falling over of young plants due to tissue being attacked by a fungal disease near the soil line.

Mummification: Diseased fruit dries up, becoming wrinkled and hardened as it shrinks.

Canker: Death of a restricted area of woody tissue - usually a callus of healthy growth forms around the edge of the canker.

Bleeding: A substance is exuded from a diseased part of the wood. The exudation is not resinous or gummy.

Gummosis: Bleeding where the exudation is resinous or gummy (known as resinosis on conifers).

Firing: Leaves suddenly dry, collapse and die.

Rosetting: Spaces between leaves on stem do not develop; buds and leaves become squashed together all within a short section of stem.

Mosaic: Mottling of yellow and green on leaf surfaces.

Dwarfing: Plants do not grow to full size.

Fasciation: Round plant parts such as stems become distorted and turn broad and flattened.

SHORTCUTS TO PROBLEM IDENTIFICATION

WHAT INSECT IS IT?

If you think or know it's an insect but aren't sure what insect it is, you can classify it by the way the insect feeds. The following list may help you to quickly identify insects causing damage to a plant. They are grouped according to the type of plant damage they cause. The list is not exhaustive, but it should cover most common insects you will encounter regardless of the country you inhabit.

1) Insects (and Other Pests) Which Chew Plant Parts Above Ground

Ants, Armyworms, Bugs, Beetles, Caterpillars, Crickets, Cutworms, Earwigs, Flea beetles, Grasshoppers, Leaf miners, Leaf rollers, Leaf skeletonizers, Sawflies, Slugs, Snails, Springtails, Weevils.

At first glance, you might mistake this caterpillar for the plant stem. It is important to look closely.

2) Insects (and Other Pests) Which Suck Plant Parts Above Ground

Aphids, Harlequin bugs, Lace bugs, Leafhoppers, Mealy bugs, Mites, Psyllids, Scale insects, Squash bugs, Thrips, Tree hoppers, Whiteflies, Capsid bugs.

3) Insects (and Other Pests) Which Feed Below Ground

Root aphids, Root nematodes, Root borers, Rootworms, Root weevils, Woolly aphids, Wireworm, Beetle larvae, Weevil larvae, Leatherjackets, Chafer grubs.

4) Borers (including into Fruit)

Codling moths, Bark beetles, Corn earworms, White pine weevils, Melon worms, Longicorn beetles, European apple sawflies, etc.

Beans damaged by Leaf Mite

DIAGNOSIS OF PLANT DISORDERS

The following table may give you some clues to possible causes of plant disorders.

SYMPTOM	POSSIBLE CAUSES	TREATMENT
Spindly growth	Low light (e.g. shade), excess water, high temperatures, plants too close together	Improve light, cut watering, reduce night temperature in greenhouse by cooling or ventilation, reduce feeding, increase spacing between plants
Growth reduced	Insufficient nutrients and/ or water	Feed more often but in low concentrations. Water more often
Old or lower leaves yellowing	Nitrogen deficiency	Feed plants with a fertiliser high in nitrogen. Highly soluble or liquid fertiliser will give fast results. Follow up with further applications or slow-release nitrogen fertiliser
Young leaves yellowing between the veins	Iron deficiency	Similar treatment as for nitrogen above
Purple leaves	Phosphorous deficiency	Similar treatment to nitrogen above
Root tips burnt or discoloured on container grown plants	Excess fertiliser, salts, or toxic chemicals in soils or potting mixes (sometimes occurs in fresh media)	Leach media thoroughly to wash away excess nutrients or toxins, or re-pot into fresh potting mix with low salt/toxin levels
Woody growth	Plants over-hardened (i.e. exposed to tough conditions) or slow-growing	Increase feeding & prune if problem is excessive
Stems very wet and decaying at the base of plant	Damping off disease caused by dirty conditions, high humidity and/or overcrowding	Thin out plants and apply fungicide

SYMPTOM	POSSIBLE CAUSES	TREATMENT
Algae, moss or liverwort on surface of soil & potting mixes	Excess moisture & nutrients on surface; doesn't harm plant initially but can impair the flow of nutrients in the long-term	Reduce watering, increase ventilation, use better-draining medium. Some chemicals e.g. ferrous sulphate can be used to kill algae and moss
Poor root growth	Medium may have poor aeration or drainage, low temperature, or contain toxic chemicals	Determine which of these is the problem & act accordingly

DIFFICULT TO DIAGNOSE PROBLEMS

If you can't determine a problem easily with the information on the previous pages then you have only two options:

Option One

Try a general-purpose pesticide (one that works on many different problems). You don't really need to know what the problem is, as long as you can cure it.

a) Try some common treatments

If it's a pest or disease, but you don't know which pest:

Either, remove and burn the diseased plant and replace it with a new plant.

Or, spray with a broad spectrum pesticide e.g. sulphur or benomyl for diseases), or a proprietary insecticide for pests.

b) If the plant is generally unhealthy

Attend to feeding, watering, weed control, drainage, mulching, and pruning out any weak, diseased or dead wood. This could rejuvenate the plant and help it to overcome most types of problems as long as they are not too severe.

Option Two

Seek more expertise. If you can't identify the problem by using this book your own knowledge, the following sources may provide more expertise:

a) Literature

You may discover what the problem is by reading or studying more. Visit the library, buy books, magazines etc., contact staff at chemical companies and ask them to send you literature, study a course, conduct internet research, and so forth.

b) Seek expert advice

Advice from experts is sometimes available free of charge through government departments and other places such as:

- Various government departments - e.g. agriculture, parks and gardens, botanic gardens.