

CHAPTER 9

LOCAL PESTS AND DISEASES OF *PLECTRANTHUS ESCULENTUS*

9.1 Introduction

In order to meet the increasing demand for food it is necessary to increase the available food supply. In Africa it has been estimated that almost half of the crop losses are due to diseases, insect pests and weeds, so crop production on the continent could almost be doubled merely by using correct crop protection measures. Although plants which are indigenous to an area tend to be relatively free of problem pests and diseases, this no longer remains true when the plants are brought into cultivation, and large scale production in monoculture commences. At this stage insect pests and disease may become a problem (Cunningham, de Jager & Hansen, 1992). It is very important that potential insect pests and diseases are identified during the development phase of a potential new crop, in order to develop possible control measures. *Plectranthus* has its share of pests of diseases, although the majority of these are rarely serious (Tindall, 1983; van Jaarsveld, 1987).

No information on pests which attack *Plectranthus esculentus* could be found, but ornamental species of this genus are attacked by a wide variety of insect pests. These plants are susceptible to attack by nematodes, with the root knot nematode (*Meloidogyne incognita*) being the major problem (Goodey, Franklin & Hooper, 1965; van Jaarsveld, 1987). Other species such as *M. javanica* and *M. arenaria* have also been identified as attacking this plant (Goodey *et al.*, 1965). A number of insect pests such as stem-borer, stinkbugs, scale insects, aphids, whitefly and grasshoppers have been reported to cause problems in the ornamental varieties of this genus (van Jaarsveld, 1987). Some wild animals have been reported to present problems in plantings of *Plectranthus esculentus*, as it has been reported from Malawi that they gnaw up the root-stock (Burkill, 1995). Plants in both glasshouse and field plantings were monitored for the occurrence of pests during the course of this study. This was done in order to identify problem pests so that control measures could be set in place before introducing the plants to

communities.

No insect pests were noted on plants in the field at Roodeplaat. Some leaf damage due to larval feeding was noted, but this was very minor being limited to one or two leaves on isolated plants, and no larvae were ever seen. A number of problem insects were, however, noted in glasshouse plantings.

No information on the diseases of this species could be found, but it could be expected that diseases which attack other species in this genus could be problematic. Rust and blight have been noted on ornamental varieties planted in pots, and *Pythium* occasionally attacks seedlings which have been sown too thickly and kept too damp (van Jaarsveld, 1987). During the course of this study all plantings were monitored for the occurrence of any diseases. Diseases were identified by plant pathologists using standard isolation procedures.

9.2 Pests

9.2.1 Whitefly

Whitefly is a particular pest in glasshouse plantings of this species, and infestations were noted both in glasshouses at Roodeplaat, as well as heavy infestations in the Conservatorium at the Kirstenbosch Botanical garden. These small (<3 mm long), white insects resemble small moths with four wings. They are usually found on the abaxial leaf surfaces where they suck the plant sap. Upon being disturbed they arise in swarms. Final identification of the precise species found on *Plectranthus esculentus* has yet to be undertaken. These insects do not usually cause direct damage to the plants when they occur in small numbers. Even though the damage to the plants is minor, they can spread diseases, and are known vectors of a number of virus diseases. However, problems do occur when large numbers are present. Under these conditions the leaves become chlorotic, dry out and can drop off, and can result in almost total defoliation of the plant.

There are a number of insecticides which are registered for the control of whitefly in South Africa (Krause, Nel & van Zyl, 1996). A natural parasitoid of this insect, a small wasp of the

genus *Encarsia* is found in South Africa. This insect, which is found at Roodeplaat, parasitises the juvenile forms of the white fly.

9.2.2 Two-spotted spider mite

The two-spotted spider mite (*Tetranychus urticae*) is a common pest of both indoor and cultivated plants. On *Plectranthus esculentus* this pest has only been noted on plants being grown in glasshouses. This mite can be found in both a green and a red form, with the latter commonly known as the red spider mite (Meyer, 1998 - personal communication¹). Even the largest of these mites, the adult females, are less than 1 mm long. They have an oval body with eight legs, and are characterised by the two red eyespots near the head. The females usually have a large dark blotch on each side of the body and numerous bristles covering the legs and body (Anon., 1997).

Spider mites are most likely to be encountered under warm dry conditions when their colonies can be found on the abaxial surface of the leaves where the mites suck out the plant sap (Ebeling, 1975). The first symptoms of two-spotted spider mite infestation are white or yellowish speckled areas that appear on the upper surface of the leaves as a result of the loss of chlorophyll. This soon spreads until the entire leaf takes on a more uniform bronzed or yellow discolouration. The leaves desiccate and drop, leading to defoliation, stunting, and even death of the plant. In severe cases of infestation a silky webbing joining leaves can be seen. These symptoms are similar to those noted by Ebeling (1975).

Working with plants infested with this pest is known to lead to occupational asthma, hay fever and urticaria (Delgado *et al.*, 1994). A variety of control measures exist for this troublesome pest, including physical, biological and chemical control. Physical control measures include spraying the underside of the leaves with cold water, as well as keeping the area free of other

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host plants. A number of predatory insects such as lacewings and lady bugs, as well as predatory mites prey on red spider mites. Chemical control consists of the use of systemic insecticides, but due to their rapid life cycle they build up resistance to insecticides fairly quickly, and a number of spray treatments utilising different insecticides may be required to get rid of them. In South Africa a large number of insecticides are registered for use on this pest (Krause *et al.*, 1996).

9.2.3 Fungus Gnats

The term fungus gnats refers to a number of species in the insect order Diptera, family Sciaridae (Lindquist, 1994). This pest has only been noted on plants cultivated in pots filled with a commercial potting mixture in a glasshouse. The adult insects are small (less than 3 mm long) sooty-grey long-legged slender flies that do not cause any damage to the plants (Krause *et al.*, 1996). They can be seen flying close to the soil surface, or hiding below the leaves. The larvae are very small white and threadlike, with a shiny, black head capsule, and can grow up to about 6 mm long. They feed on decaying organic matter in the soil, and can cause problems under certain conditions by feeding on the root hairs of healthy plants (Lindquist, 1994). As the potting mixture is very rich in organic matter, this is probably the reason that these pests have only been noted on plants in this substrate.

The root hairs are responsible for the majority of water and mineral absorption by the plant (Salisbury & Ross, 1978). Infestation results in the plant suffering from nutritional deficiency, which can be seen in the form of a gradual chlorosis of the leaves which cannot be alleviated by the addition of fertiliser. Under high temperature conditions this can be followed by wilting of the plants, despite the growing medium being moist. Prolonged infestations can cause stunted plants, and even ultimately result in death of the plants if the pest is not controlled. These larvae may also aid in the introduction and spread of diseases such as *Pythium* and *Verticillium* (Lindquist, 1994).

The larvae can be controlled by drenching the soil with an insecticide containing *Bacillus thuringiensis* var. *israelensis*, at a rate of 1.2 ml.L⁻¹. However, this is not a registered pesticide

on plants in South Africa, and as such cannot be recommended for use. A soil drench using a 2% diazinon water emulsion has also been found to be very effective in controlling the larvae (Anon., 1998). The adult insects can be controlled by contact insecticides. At this stage only insecticides with the active ingredient dichlorvos, diflubenzuron or mercaptotion are registered for use on this pest in South Africa, and then only in mushrooms (Krause *et al.*, 1996).

9.2.4 Nematodes

The only serious pests which have been noted on *Plectranthus* in the field at Roodeplaat are nematodes, and these have been identified as belonging to the genus *Meloidogyne*, the root-knot nematodes. The symptoms of infestation by this pest are characteristic galls at the point of infection. When several infections take place along a single root the galls give the root a rough, clubbed appearance. The infected roots remain smaller than those of uninfected plants, and various stages of necroses occur. Rotting of infected roots was noted, particularly in the later part of the season. Tubers that were attacked by this pest exhibited small swellings on the surface. These symptoms are the same as those described by Agrios (1978). Severe infestation by nematodes manifests as stunted plants with pale green or yellow leaves that tend to wilt in warm weather, and the characteristic root-knots can be seen when the plants are dug up. These plants do not normally die, but linger throughout the season.

It is important that nematode damage be limited, as some fungi such as *Fusarium*, *Pythium* and *Rhizoctonia* have been shown to grow and reproduce much faster on nematode galls than in other areas of the root (Agrios, 1978). This was noted during both the 1996 and 1997 seasons with *Fusarium* (see section 9.3.1) infestation in *Plectranthus* plots.

9.2.4 Other pests

The only other pests which have been noted at Roodeplaat are porcupines (*Hystrix spp. [cristata or africana australis]*), which gnaw up the tubers after planting, or once the tubers are fully developed at the end of the growing season.

9.3 Diseases

9.3.1 *Fusarium* wilt

This disease was noted during March/April of 1996 for the first time after high rainfall during the months of February and the beginning of March (465mm), was followed by a period of high temperatures. It occurred again during March of 1997 when similar conditions were encountered. According to Agrios (1978) this disease generally only becomes a problem under conditions of high temperature.

The first symptoms appear as a yellowing of the margins of the older leaves. The yellowing spreads toward the midrib and then to the younger leaves. This is followed by wilting of leaves and young stems, marginal necrosis of the remaining leaves, defoliation and finally death of the plant. The tubers of the infected plants eventually turn black and start to rot. Samples of the infected plants were taken, and the causative agent was positively identified as *Fusarium oxysporum*. No other pathogenic organisms were identified in the tissue of infected plants. The symptoms of the disease are similar to those caused by this organism on tomato. It is characterised by the rapid wilting of stems during the heat of the day, and can easily be confused with other wilts, with the exception that there is no root rot associated with this disease (Burton, 1998)

According to Agrios (1978), *Fusarium* can penetrate the root tips directly, or enter the roots through wounds, or at the point of formation of the lateral roots.

Cultural practices such as deep ploughing, crop rotation, and fallow periods or flooding of land are useful in reducing the populations of this pathogen in the soil, but do not eliminate it completely (Agrios, 1978). In South Africa a number of fungicides containing the active ingredients Mancozeb or Thiabendazole are registered for the treatment of seed potatoes against this disease prior to planting (Krause *et al.*, 1996). These products should also be tested on *Plectranthus esculentus* in order to determine if they have any positive effect. However, these products only kill spores on the tubers, and do not give any protection against soil borne infection.

9.3.2 Charcoal rot

This disease was noted during March/April of 1997 on a fairly heavy (30% clay) soil. The causative organism was identified as the fungus *Macrophomina phaseolina*, after it was isolated from the stems of infected plants. This fungus is very widespread and infection is stimulated by warm, moist conditions. Under these conditions this disease can be exceptionally severe and destructive.

The first signs of infection are chlorosis and wilting of the leaves, often more pronounced on one side of the plant, followed by premature defoliation. This disease is characterised by stems that turn brown, even appearing black, and then begin to die back. The internal tissue of infected stems also appears dark brown. The disease can normally be distinguished from other wilts by the presence of small black micro sclerotia embedded in the crown epidermis and internal vascular bundles, together with the general absence of root rot in the initial stages of disease development (Burton, 1998).

Charcoal rot is spread by infected planting material, and can generally be controlled by the use of disease free material, resistant cultivars and a number of cultural practices (Lubbe, 1997 - personal communication²).

9.4 Conclusions

The most serious pest noted on this crop was root knot nematode, and few other pests cause economic damage. Two fungal diseases (*Fusarium oxysporum* and *Macrophomina phaseolina*) have occurred, and all possible control measures should be investigated to limit crop damage by these diseases.

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