South African Avocado Growers' Association Yearbook 1987. 10:75-79
Proceedings of the First World Avocado Congress

Avocado insects of South Africa

EA DE VILLIERS and MA VAN DEN BERG
Citrus and Subtropical Fruit Research Institute,
Private Bag X11208, Nelspruit 1200, RSA

SYNOPSIS
In South Africa, the avocado is relatively free of serious pests. This can be attributed to the balance that exists between potential pests and their natural enemies and also to grower awareness of this natural biological control. Minor insect pests are discussed which have the potential of becoming economic pests if their natural enemies are destroyed. Chemical control of avocado pests is not a standard practice. Insecticides used on avocado thus far are limited to those used in bait sprays for the control of fruit fly.

INTRODUCTION

In South Africa avocado orchards are relatively free of serious insect pests. This can be attributed to the presence of natural enemies capable of controlling these insects and because the avocado producers realise the value of biological control. The use of insecticides has thus far been limited to those used in bait sprays against fruit fly on a few farms only and, so far, there have been no pest repercussions as a result of this (De Villiers, in press). A warning against the use of insecticides on avocados was given by Schwartz (1978).

So far 18 potential insect pests have been found in South Africa on avocados, namely: 2 Thysanoptera; 4 Lepidoptera; 1 Hemiptera; 2 Coccidae; 6 Diaspididae; 2 Pseudococcidae; and 1 Diptera (De Villiers, in press). The more troublesome pests are those which cause markings on the surface of the fruit pericarp, such as the fruit fly, the false codling moth (Schwartz, 1978) and the coconut bug (Viljoen, 1986). A detailed study of the markings of the two former insect pests was made by Du Toit, De Villiers & Tuffin (1979).

The aim of this article is to stress awareness of the insects which have thus far been found in South African avocado orchards, as well as their natural enemies.

DESCRIPTION OF INSECTS

Natal fruit fly, *Pterandrus* rosa (Karsch) (Dipt: Tephritidae)

The Natal fruit fly lays its eggs under the pericarp of the fruit. The lesion which develops resembles a star-shaped break or crack in the fruit skin, which is associated with a white powder around the lesion (Du Toit *et al,* 1979). Under normal orchard practices no larvae develop in avocado fruit. There are, however, isolated instances where larvae

can be dissected from over-ripe fruit which lie rotting on the ground underneath avocado trees. This is therefore not considered a problem with regard to our export markets.

Schwartz (1978) warned against the use of insecticides on avocados and advised farmers to treat the natural bush surrounding avocado orchards with a bait. He stressed the necessity to destroy the natural host plants of the Natal fruit fly, such as wild-growing guavas and bug-tree, *Solanum mauritianum* Scop, in the vicinity of orchards. Robertson (in press) recommends that fruit fly populations be monitored with pheromone traps, and if control is necessary that knap-sack sprayers be used within the orchard to apply the bait. He further recommends that only every third or fourth tree in every third or fourth row be baited weekly.

Natural enemies of the Natal fruit fly include a larval parasitoid, *Opius concolor* Szepligeti, a pupal parasitoid *Trichopria capensis* Kieffer (Annecke & Moran, 1982) and certain predatory ants (Searle, 1964).

Soft scales (Hem: Coccidae)

Two soft-scale species have been reported on avocado, namely the soft brown scale, *Coccus hesperidum* L, and the heart-shaped scale, *Protopulvinaria pyriformis* (Ckll). Both species feed on avocado leaves and produce excessive quantities of honeydew on which sooty mould grows that stains the fruit and leaves. The heart-shaped scale is more often troublesome on Hass than on other cultivars.

The soft brown scale is attacked by 26 hymenopterous parasitoids (Annecke & Moran, 1982). Of these the most important are *Metaphycus stanleyi* Compere, *Microterys flavus* (Howard), *Coccophagus pulvinariae* Compere and *C. semicircularis* (Foerster). According to Searle (1964) a number of coccinellids such as *Chilocorus angolensis* Crotch, *C. simoni* Sci, *Exochomus flavipes* Thunb, *Hyperaspis felixi* Nulsant, *H. hottentota* Muls, *Rhyzobius lophanthae* (Blaisdell) and *Platynaspis capicola* Crotch are predators of the soft brown scale.

According to Robertson & De Villiers (1986) the following parasitoids were bred from the heart-shaped scale: *Metaphycus galbus* Annecke, *M. helvolus* (Compere), *M. stanleyi* and *Tetrastichus* sp and the hyperparasitoids, *Cheiloneurus cyanonotus* Waterston and *Marietta javensis* (Howard); the predators recorded are *Chilocorus angolensis* and *Hyperaspis* sp.

Armoured scales (Hem: Diaspididae)

Of the six species of armoured scales that have been recorded on avocado, the palm scale, *Hemiberlesia lataniae* (Signoret), and the Spanish red scale, *Chrysomphalus dictyospermi* (Morgan) are the most important.

The palm scale is dirty white and occurs on fruit, leaves and branches. Natural enemies of the palm scale include the parasitoid *Aphytis lingnanensis* Compere (Peck, 1963) and the coccinellid *Rhyzobius lophanthae* Blaisdell (McKenzie, 1935).

The Spanish red scale is brown to copper-coloured and also attacks fruit, leaves and branches. Parasitoids recorded from this scale are *Aphytis chrysomphali* (Mercet), *Aspidiotiphagus citrinus* Craw (Quayle, 1941) and *Aspidiotiphagus lounsburyi* (Berlese & Paoli) (Peck, 1963).

Other armoured scales that occasionally occur on avocado are *Aonidiella aurantii* (Mask), *Chrysomphalus ficus* (L), *C. rossi* Mask and *Aspidiotus destructor* Sign (Munro & Fouche, 1936).

Coconut bug, *Pseudotheraptus wayi* Brown (Hem: Coreidae)
The nymphs and adults of the coconut bug feed on young and mature avocado fruit. A lesion which is slightly darker than the rest of the fruit skin can be distinguished from about the second day after feeding takes place. With age this becomes indented and dark-brown to black, much like a hail mark. Internally the lesion forms a typical hard clot that is easily removed together with the skin when the latter is pulled off (Viljoen, 1986).
Damage by the coconut bug has mainly occurred on avocados planted next to macadamia and especially if the latter had been sprayed for the control of other stink bugs. In a similar situation in Israel, outbreaks of insect pests occurred on avocados adjacent to cotton fields, which had been sprayed with pesticides (Wysoki, Izhar, Swirski, Gurevitz & Greenberg, 1977; Wysoki & Izhar, 1980; Wysoki, Swirski & lzhar, 1981).

No information is available on the natural enemies of the coconut bug in South Africa.

Thrips (Thys: Thripidae)
Two species of thrips attack avocado, ie the greenhouse thrips, *Heliothrips haemorrhoidalis* (Bouché), and the redbanded thrips, *Selenothrips rubrocinctus* (Giard). As a result of their feeding on leaves and fruit (De Villiers, 1980) chlorophyll is extracted and a pale to brown area develops. Distinctive blackish spots of their excreta are present on the damaged areas. Thrips damage is seldom found on fruit. No information is available on the natural enemies of these thrips in South Africa.

Mealybugs (Hem: Pseudococcidae)
The long-tailed mealybug, *Pseudococcus longispinus* (TT) and the striped mealybug, *Ferrisia virgata* (Cockerell), can be found on fruit and fruit stalks. Sap is extracted and honeydew is excreted, which leads to the growth of sooty mould. As a result of good biological control, these mealybugs are seldom present on avocados and, if they are, the natural balance has been disrupted. Prinsloo (1983) lists the following parasitoids for mealybugs. For the long-tailed mealybug: *Gyranusiodea litura* Prinsloo, *Leptomastix* sp and *Tetracnemoidea* sp. For the striped mealybug: *Aenasius advena* Compere, *Anagyrus subproximus* (Silvestri), *Anagyrus* sp, *Blepyrus insularis* (Cameron), *Gyranusoidea citrina* (Compere), *Leptomastidea abnormis* (Girault), *Leptomastix bifasciata* Compere, *L. longipennis* Mercet and *Pseudaphycus ferrisianae* Bennett and the hyperparasitoid *Prochiloneurus aegyptiacus* (Mercet).

Looper (Lep: Geometridae)

An unidentified looper species occasionally feeds on the skin of young fruit. On mature fruit the lesion is slightly sunken and shows brown scabs. This can easily be confused with a wind mark. One of the natural enemies which help to control this insect is a wasp parasitoid.

It is possible that this looper is the same species found on citrus, *viz Ascotis selenaria reciprocaria* (Walker) and similar to the species found in Israel, *viz Boarmia (Ascotis) selenaria* Schiffermüler (Wysoki & Izhar, 1980).

Leaf rollers (Lep: Tortricidae)
Two leaf rollers are found on avocado, the apple leaf roller, *Tortrix capensana* (Walker) and the citrus leaf roller, *Archips occidentalis* (Wism). The larvae of both species spin leaves and/or fruit together and feed on the respective surfaces.

The apple leaf roller is attacked by the egg parasitoids *Trichogrammatoidea lutea* Girault and *Trichogramma pretiosum* Riley and the larval parasitoids *Brachymeria boranensis* Masi, *Pediobius amaurocoelus* (Waterston), *Apanteles spp, Goniozus sp* and *Theronia* sp (Prinsloo, 1984).

According to Prinsloo the parasitoids of the citrus leaf roller are the pupal parasitoids *Brachymeria boranensis* and *B. microlinea* (Walker), and the larval parasitoids, *Apanteles* spp.

False codling moth, *Cryptophlebia* leucotreta (Meyrick) (Lep: Tortricidae)
Eggs of the false codling moth are occasionally laid on the fruit of avocados. The larvae that develop from these may gnaw through the fruit skin but are unable to develop in avocado fruit (Schwartz, 1978). The lesion on the skin produces a white exudate and excreta may also be present.

Associated with the false codling moth on citrus are the parasitoids *Bassus* sp, *Microdorus* sp, *Phanerotoma curvicarinata* Cam (Searle, 1964), *Apanteles leucotretae* Ullyett, *A. typhon* Nixon, *Agathis bishopi* (Nixon), *Apophua leucotretae* (Wilkinson), *Oxycoryphe edax* (Waterston) and the egg parasitoid, *Trichogrammatoidea lutea* Giraultt (Prinsloo, 1984; This may refer to *T. cryptophlebiae* Nagaraja). Two predatory ants *Anoplolepis custodiens* Smith and *Pheidole megacephala* F have been recorded (Searle, 1964).

DISCUSSION

Natural enemies of the above-mentioned pests occur in sufficient numbers in South Africa to limit most of the Insects in such a way as to render them of no economic importance. The exception here is the fruit fly, where the use of an insecticide in a bait is recommended. The poisoned bait can be applied in such a way that the fruit fly is controlled without causing a drastic decrease in the numbers of natural enemies of other insects.

Pests such as the fruit fly and false codling moth damage avocado fruit, but according to the findings of Schwartz (1978), the larvae do not develop to maturity. Their control would therefore only be aimed at the protection of the external appearance of fruit, and thus should not be considered as a threat to our export markets.

The heart-shaped scale, *Protopulvinaria pyriformis* (Ckll) is particularly a nuisance on the Hass cultivar. It has been established that dust from sand roads affects the parasitoids of the scale, leading to a build-up of scale alongside sand roads (Robertson & De Villiers, 1986). Insecticides with minimum effects on beneficial and nontarget organisms are presently being used in the experimental work to correctively control the pest.

The looper and leaf rollers do not at present justify the need for chemical control but, if deemed necessary, *Bacillus thuringiensis* var *kurstaki* may prove effective against these Lepidoptera, as is the case with leaf rollers on citrus (Bot, Sweet & Hollings, 1986).

The indiscreet use of pesticides can result in the outbreak of new pests together with an increase in numbers of existing insects. The preservation of the natural enemies of insects found on the avocado must be considered one of the most important aspects of pest management on this crop.

ACKNOWLEDGEMENTS
The authors thank Mr CM Robertson and Miss C Fletcher for help in preparing the manuscript.

REFERENCES

1 Annecke, DP & Moran, VC, 1982. *Insects and mites of cultivated plants in South Africa,* Durban: Butterworth & Co (SA) (Pty) Ltd, 383 pp.

2 Bot, J, Seugnet Sweet & Nora Hollings, 1986. *A guide to the use of Pesticides and Fungicides in the Republic of South Africa.* Department of Agriculture and Water *Supply,* Pretoria: Government Printer, 304 pp.

3 De Villiers, EA, 1980. Thrips in avocados. *Farming in South Africa,* Avocados H3, 2 pp.

4 De Villiers, EA (In press). Avocado insects in South Africa. *S Afr Avocado Growers' Assoc Yrb,* 1987.

5 Du Toit, WJ, De Villiers, EA & Tuffin, A, 1979. The identification of typical surface lesions on avocado fruit. *S Afr Avocado Growers' Assoc Yrb,* 1979, 3, 52-53.

6 McKenzie, HL, 1935. Biology and control of avocado insects and mites, *University of California, Bulletin 592*, 48 pp.

7 Munro, HK & Fouché, FA, 1936. A list of the scale insects and mealybugs and their

hostplants in South Africa. *Department of Agriculture and Forestry, Bulletin No 158,* Pretoria: Government Printer.\

8 Peck, 0, 1963. *A catalogue of the Nearctic Chalcidoidea (Insects: Hymenoptera).* The Canadian Entomologist, Supplement 30, Entomology Research Institute, Canada Department of Agriculture, Ottawa, Ontario, 1092 pp.

9 Prinsloo, GL, 1983. A parasitoid-host Index of Afrotropical Encyrtidae (Hymenoptera: Chalcidoidea). *Entomology Memoir No 60,* Department of Agriculture, Republic of South Africa. Pretoria: Government Printer, 35 pp.

10 Prinsloo, GL, 1984. An illustrated guide to the parasitic wasps associated with citrus pests in the Republic of South Africa. Department of Agriculture, *Science Bulletin No 402.* Pretoria: Government Printer, 11,9 pp.

11 Quayle, HJ, 1941. *Insects of citrus and other subtropical fruits.* New York: Comstock Publishing Company. Inc. 583 pp.

12 Robertson, CM *(In* press). Fruit fly in avocados. *Farming in South Africa,* Avocados H 2.

13 Robertson, CM & De Villiers, EA, 1986. Parasites of avocado pests bite the dust. *Information Bulletin No 168*, CSFRI. Nelspruit, South Africa, p 9.

14 Searle CM St L, 1964. A list of the insect enemies of citrus pests in Southern Africa. *Department of Agricultural Technical Ser*vices, *Technical Communication No 30.* Pretoria: Government Printer, 18 pp.

15 Schwartz, A, 1978. Vrugtevlieg en valskodlingmot by avokadoproduksie. *S Afr Avocado Growers' Assoc Yrb,* 1978, 2, 6263.

16 Viljoen, Helena M, 1986. Kokosneutstinkbesie - 'n potensiële plaag op avokado's. *S Afr Avocado Growers' Assoc Yrb,* 9, 72-74.

17 Wysoki, M & Izhar, Y, 1980. The natural enemies of *Boarmia* (Ascotis) *selenaria* Schiff (Lepidoptera: Geometridae) in Israel. *Acta Ecologica/Ecologica Applicata,* 1(4), 283-290.

18 Wysoki, M, Izhar, Y, Swirski, E, Gurevitz, E & Greenberg, S, 1977. Susceptibility of avocado varieties to the long-tailed mealybug, *Pseudococcus longispinus* (Targioni Tozzetti) (Homoptera: Pseudococcidae), and a survey of its host plants in Israel. *Phytoparasitica,* 5(3), 140-148.

19 Wysoki, M, Swirski, E & Izhar, Y, 1981. Biological control of avocado pests in Israel. *Protection Ecology,* 3. 25-28.

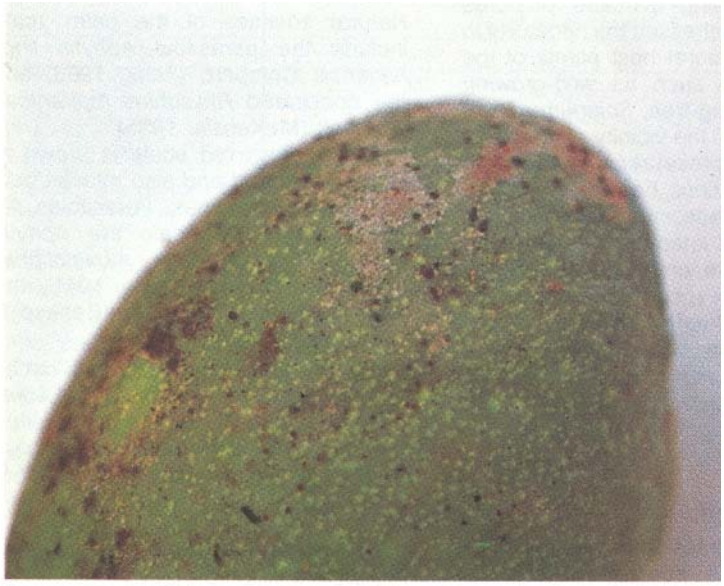

Fig 1 A pale brown colouring on the skin is caused by thrips. The insects' excreta appear as small black spots.

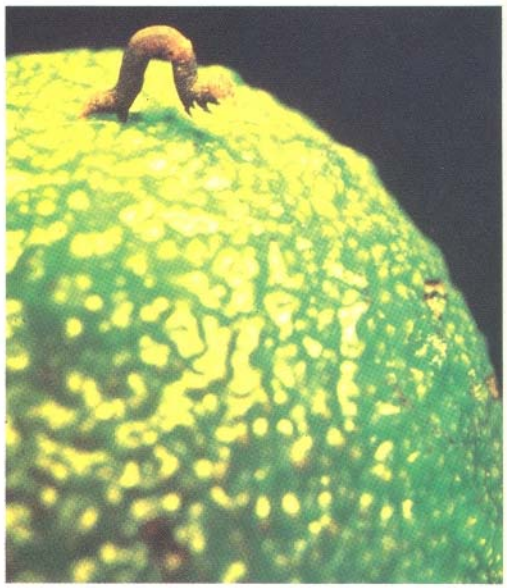

Fig 2 A looper on a fruit.

Fig 3 Looper damage on the skin of a young fruit.

ı adult coconut bug.

Fig 5 Sunken lesions as a result of feeding by a coconut bug.

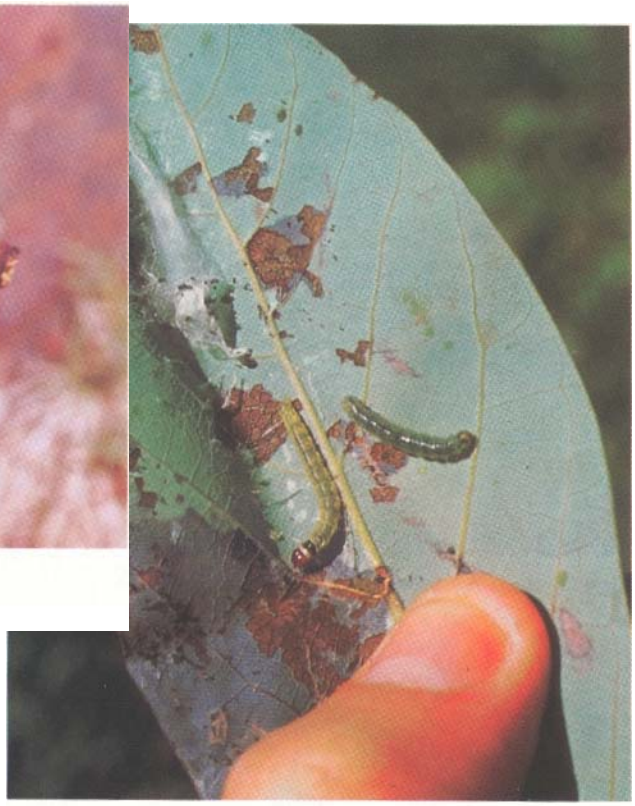

Fig 6 Citrus leaf rollers and lesions caused by feeding on a leaf.

Fig 7 Lesions on a fruit caused by a citrus leaf roller.

mould on avocado leaves as a result
art-shaped scale infestation.

Fig 9 Heart-shaped scale on a leaf.

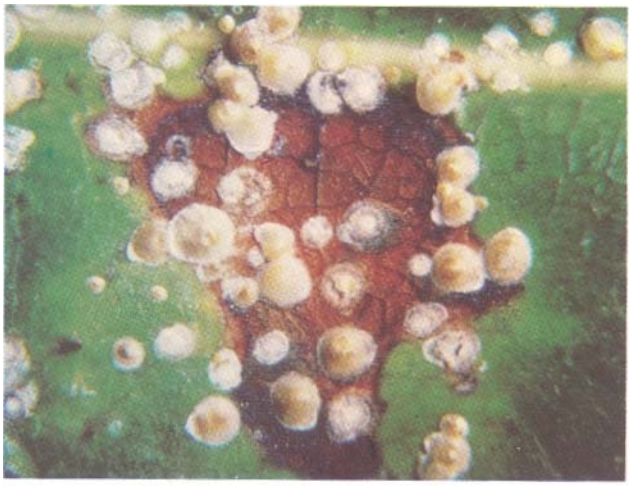

Fig 10 Avocado leaf infested with palm scale.

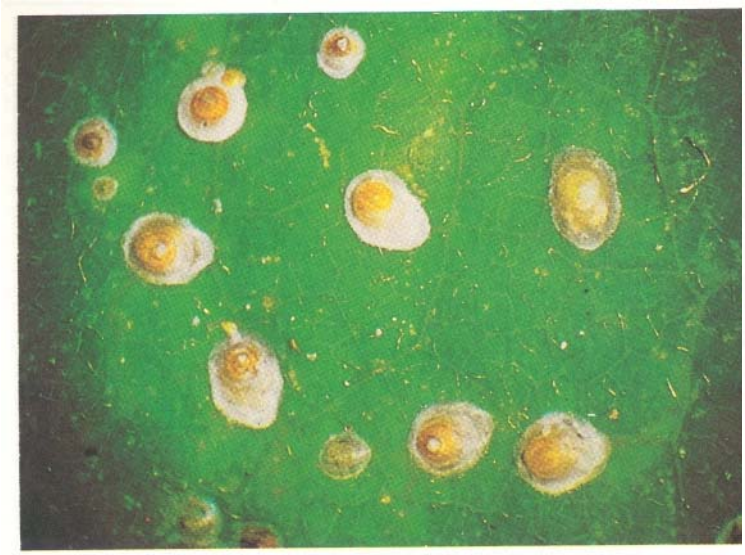

Fig 11 Avocado leaf infested with Spanish red scale.

Fig 12 Long-tailed mealybug on a young leaf.

Fig 13 Natal fruit fly.

Fig 14 Eggs of the Natal fruit fly are laid in clusters under the skin. Here the skin has been removed to expose the eggs.

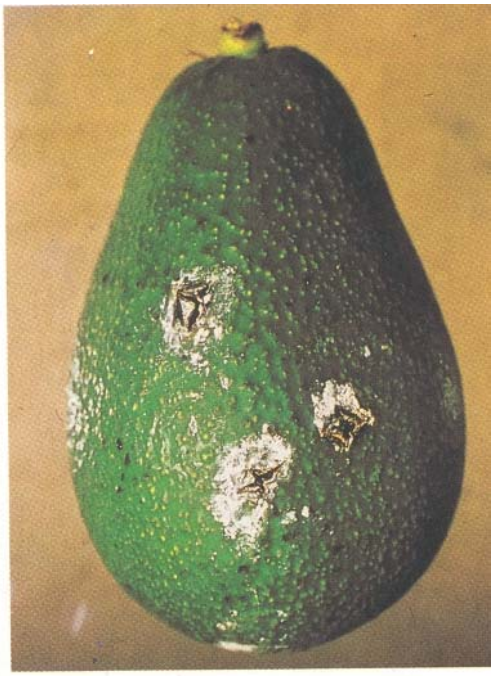

Fig 15 Mature avocado with star-shaped cracks in the skin surrounded by white powder indicates the sting marks of the fruit fly.

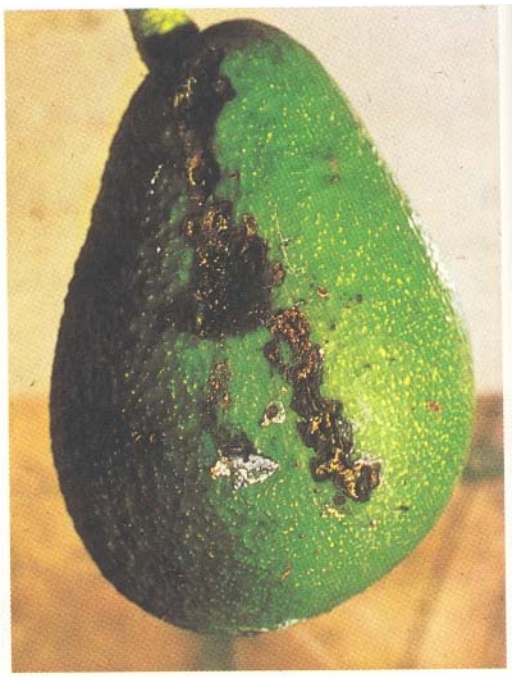

Fig 16 A larva of the false codling moth has damaged the skin of this young fruit. The larva never completes its development in avocado fruit.