

## ***Artificial Exposure of Different Avocado Cultivars to Fruit Flies***

**T Brink • W P Steyn • M De Beer**

*Institute for Tropical and Subtropical Crops, Private Bag X11208, Nelspruit 1200*

### **OPSOMMING**

*Twee vrugtevliespesies kom voor in avokado boorde in Suidelike Afrika, naamlik die Mediterreense-, Ceratitis capitata (Wiedemann) en die Natalse vrugtevlies, Ceratitis rosa Karsch. C. capitata eiers is in pluk-ryp (harde) vrugte van die kultivars Hass, Fuerte, Ryan, Rinton en Edranol kunsmatig geplaas, om oorlewing te bepaal na koelopberging. Plukryp (harde) Fuerte en Hass vrugte is in hokke met C. capitata geplaas en daarna in koelopberging geplaas. Hass vrugte met verskillende voginhoud is ook kunsmatig aan C. capitata en C. rosa blootgestel en die ontwikkeling van larwes is genoteer. Geen oorlewing is gevind by blootgestelde Hass vrugte met verskillende voginhoud nie. Resultate het aangetoon dat avokado's nie 'n geskikte gasheer vir vrugtevlies is nie. Vrugte wat uitgevoer word vanaf Suid-Afrika ondergaan 'n periode van vier weke koelopberging teen 5,5 - 6,5°C en resultate dui daarop dat vrugtevlies nie die periode sal oorleef nie.*

### **ABSTRACT**

*In Southern Africa both the Mediterranean fruit fly, Ceratitis capitata (Wiedemann) and the Natal fruit fly, Ceratitis rosa Karsch occur in avocado orchards. Tree mature (hard) fruit of the cultivars Hass, Fuerte, Ryan, Rinton and Edranol were picked and artificially infested with C. capitata eggs to determine their survival after cold storage. Tree mature Fuerte and Hass fruit were also placed in cages with C. capitata and afterwards kept in cold storage. Hass fruit with different moisture contents were also exposed to C. capitata and C. rosa fruit flies and possible larval development was monitored. Results indicate that the avocado is not a suitable host for fruit fly development, although dead larvae could occasionally be found in some cultivars. Fruit that are exported from South Africa undergo a four week period of cold storage at 5,5 - 6,5°C and results indicate that fruit flies will not survive this period.*

### **INTRODUCTION**

Countries such as Japan and the United States, parts of which are climatically suitable for fruit fly establishment, impose quarantine restrictions against countries likely to carry fruit flies to within their boundaries. Quarantine regulations imposed by an importing country can either deny a producing country a potential market, or force the producing country to carry out expensive disinfestation treatment.

In Southern Africa the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) and the

Natal fruit fly, *Ceratitis rosa* Karsch occur in avocado orchards (Du Toit *et al.*, 1979). Both these species are indigenous to Africa. *C. capitata* occurs in many countries of the world while *C. rosa* has only been recorded in Africa, Mauritius and Reunion (White & Elson-Harris, 1992).

Du Toit and Tuff in (1980) artificially exposed Fuerte avocado fruit at four different stages of development, to *C. capitata* and *C. rosa*. They found that *C. rosa* could lay eggs in avocado, but that larvae do not develop. No eggs of *C. capitata* were found in the exposed fruit. Fruit fly damage by the insect's ovipositor develops into a typical crack or star shaped lesion (Du Toit *et al.*, 1979). De Villiers and Van den Berg (1987) state that under normal orchard practices no larval development takes place in the avocado fruit. According to Du Toit and De Villiers (1990) fruit fly larvae do not develop in the fruit of commercial avocado cultivars.

Fruit fly disinfestation of many fruits requires additional post-harvest handling. The methods used need to be effective, non-damaging and environmentally friendly. Heat and cold treatments can be used for this purpose. The objective of this study was to determine if:

- *C. capitata* eggs could survive standard cold storage practices in different cultivars, and if
- *C. capitata* and *C. rosa* larvae could develop to maturity in avocados.

## **MATERIALS AND METHODS**

### **Experiment I**

One hundred tree mature (hard) fruit of each of the cultivars Hass, Fuerte, Ryan, Rinton and Edranol were used to determine the survival of *C. capitata* eggs in avocado fruit. Five small holes were made in each fruit with a sharp knife. Each hole was filled with approximately 50 fresh *C. capitata* eggs and the openings were sealed with Prestik. The total number of *C. capitata* eggs that were exposed to cold storage in each cultivar was 25 000. The fruit were stored between 6,5 and 5,5°C for four weeks, depending on the moisture content of the fruit. The storage temperatures used and moisture content of the different cultivars are given in table 1. Moisture content determinations were done prior to each treatment to determine the maturity of the fruit. After the cold storage period, fruit were placed at 25°C for a week and examined for the presence of *C. capitata* larvae. The control groups received similar treatments except that the fruit did not undergo cold storage treatment but were kept at a constant temperature of 25°C for two weeks. Ten fruits were used in each control group.

**Table 1**

The percentage fruit moisture and the storage temperatures of the different cultivars

<i>Cultivar</i>	<i>Average percentage fruit moisture (<math>\pm</math> SE)</i>	<i>Storage temperature</i>
Hass	70,71 ( $\pm$ 0.34)	5,5°C
Fuerte	70,65 ( $\pm$ 0.71)	5,5°C
Edranol	73,81 ( $\pm$ 0.61)	6,5°C
Ryan	62,61 ( $\pm$ 0.50)	5,5°C
Rinton	75,91 ( $\pm$ 0.37)	6,5°C

## Experiment 2

Tree mature Fuerte fruit (n = 24) with a moisture content of 70,64% were placed in a cage for 24 hours with approximately 5 000 *C. capitata* adults. Afterwards 12 of the fruit were placed in cold storage at a temperature of 5,5°C for four weeks. After the cold storage period fruit were placed at 25°C for a week and examined for the presence of *C. capitata* larvae. The other 12 fruits were kept at 25°C and examined for the presence of *C. capitata* larvae after two weeks. A similar trial was done with Hass fruit with a moisture content of 70,71%.

## Experiment 3

Hass fruit with a moisture content of 64,90% were used in the following experiment. Fruit were placed in cages with either *C. capitata* or *C. rosa* adults. Since mass rearing of *C. rosa* has not been achieved, wild strains of this species were obtained from guava fruit. Approximately 300 fruit flies were kept in the *C. rosa* cage, while 5 000 fruit flies were in the *C. capitata* cage. Three avocados were placed in each cage respectively: directly, one week and two weeks after harvest. Fruit were exposed to the fruit flies for a period of 24 hours and examined for the presence of larvae 1 week after exposure.

## DISCUSSION

No *C. capitata* eggs or larvae were found to survive cold storage at between 5,5 and 6,5°C for four weeks. *C. capitata* eggs that were artificially placed in fruit and kept at room temperature did not develop into larvae, except in the case of the cultivar Ryan. Ryan was the cultivar with the lowest moisture content. It seems that as the fruit ripens and the moisture content drops, the fruit of this cultivar may become more susceptible and larvae may develop more easily. When fruit were placed in *C. capitata* and *C. rosa* cages, only dead *C. rosa* larvae were found in the fruit. This indicated that the tree mature avocado fruit is not a suitable host for fruit fly development. These results support the findings of Du Toit *et al* (1979).

The above-mentioned results indicate that the avocado is not a suitable host for fruit fly

development, although dead larvae could occasionally be found in some cultivars. Fruit which is exported from South Africa by sea go through a four week period of cold storage and the present results indicate that fruit flies will not survive this temperature regime.

## RESULTS

### Experiment 1

No *C. capitata* survived the cold storage at 5,5 to 6,5°C in the five different cultivars. No *C. capitata* larvae were present in the control groups except in the case of Ryan where 32 live larvae were found.

### Experiment 2

No *C. capitata* survived cold storage in the Hass or Fuerte fruit. No live larvae were found in the Hass or Fuerte fruit placed at 25°C. In one of the Fuerte fruit two dead larvae were found.

### Experiment 3

No live *C. capitata* or *C. rosa* larvae were found in the Hass fruit, however eight dead *C. rosa* larvae were found in the fruit exposed directly after harvest.

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