Susceptibility of three passion fruit types to the white peach scale

C NEETHLING
Institute for Tropical
and Subtropical Crops
Private Bag X 11208
Nelspruit 1200
South Africa

HC DE LANGE
Technikon Pretoria
Private Bag X 680
Pretoria 0001
South Africa

Received: January 1994
Accepted: July 1995

Susceptibility of three passion fruit types to the white peach scale.

ABSTRACT
The white peach scale, *Pseudaulacaspis pentagona* (*Homoptera: Diaspididae)* has a cosmopolitan distribution. The scale is a pest of economic importance on passion fruit. Dieback of branches occurs and as a result small fruit are produced which are not suitable for marketing, and fruit production decreases. The susceptibility of seedlings and 1-year-old plants of three passion fruit types to *P pentagona* was determined. Crawlers of the scale were brushed onto passion fruit seedlings of all three types. The percentage settlement was determined by counting the adult females. The percentage flower drop of 1-year-old *Passiflora edulis* plants which were infested with *P pentagona,* was determined. Results showed that *Passiflora edulis* and *P edulis* forma *flavicarpa* are attacked by *Pseudaulacaspis pentagona*, but *Passiflora caerulea* is not. The percentage settlement was about 50% on the susceptible types. The percentage flower drop was 66% on the infested plants and 38% on the control plants.

Sensibilité de trois types de *Passiflora* à la cochenille blanche de la pêche.

RÉSUMÉ
La cochenille blanche de la pêche, *Pseudaulacaspis pentagona* (*Homoptera* : *Diaspididae)*, a une distribution cosmopolite. Elle induit des dégâts économiques importants sur la production de la grenadille : dépérissement des branches, formation de petits fruits inaptes à la commercialisation, et diminution de la production. La sensibilité à *Pseudaulacaspis pentagona* de jeunes plants appartenant à trois types différents de grenadille a été étudiée. Après infestation des semis par des larves de cochenilles, le taux de colonisation a été déterminé par comptage de femelles adultes. Le taux de chute des fleurs sur de jeunes plants de *Passiflora edulis*, infestés par *Pseudaulacaspis pentagona,* a été évalué. *P edulis* and *P edulis* forma *flavicarpa* se sont avérés sensibles à *Pseudaulacaspis pentagona*, mais pas *P caerulea*. Le taux de contamination des plants sensibles a été d'environ 50%. Le taux de chute des fleurs a varié de 38% (plants témoins) à 66% (plants infestés).

Sensibilidad de tres tipos de *Passiflora* a la cochinilla blanca del melocotón.

RESUMEN
La cochinilla blanca del melocotón, *Pseudaulacaspis pentagona (Homoptera : Diaspididae)*, tiene una distribución cosmopolita. Induce daños económicos importantes sobre la producción de la granadilla : marchitamiento de las ramas, formación de pequeños frutos ineptos a la comercialización, y disminución de la producción. Se estudió la sensibilidad a *Pseudaulacaspis pentagona* de plantones pertenecientes a tres tipos diferentes de granadilla. Después de infestación de las semillas por larvas de cochinillas, el porcentage de colonización fue determinado por conteo de hembras adultas. El porcentage de caída de las flores sobre plantones de *Passiflora edulis*, infestados por *Pseudaulacaspis pentagona*, fue evaluado. *P edulis* y *P edulis forma flavicarpa* se revelaron sensibles a *Pseudaulacaspis pentagona*, pero no *P caerulea*. El porcentage de contaminación de las plantas sensibles fue de unos 50%. El porcentage de caída de las flores varió de 38% (plantas testigos) a 66% (plantas infestadas).

Fruits, 1995, vol 50, p 305-309

KEYWORDS
Passiflora, Diaspididae, Pseudaulacaspis pentagona, damage, pest resistance.

MOTS CLÉS
Passiflora, *Diaspididae*, *Pseudaulacaspis pentagona*, dégât, résistance aux organismes nuisibles.

PALABRAS CLAVES
Passiflora, *Diaspididae*, *Pseudaulacaspis pentagona*, daños, resistancia a las plagas.

introduction

According to EBELING (1959) and ANNECKE and MORAN (1982), *Passifloraceae* originated in Brazil. This family includes 550 species and 12 genera of which only 50 to 60 species are edible (BEAL and FARLOW, 1982). There are 26 regions in the world which are suitable for the production of passion fruit (WINKS *et al*, 1988). The white peach scale, *Pseudaulacaspis pentagona* (Targioni-Tozzetti) (TARGIONI-TOZZETTI, 1886a and b, 1871), is a pest of economic importance on the purple passion fruit, *Passiflora edulis* Sims, and, to a lesser extent, on the yellow passion fruit, *Passiflora edulis* forma *flavicarpa* Degener (EBELING, 1959; GREATHEAD, 1971; LIEBREGTS *et al*, 1989). Not much is known about the susceptibility of *Passiflora caerulea* L (red passion fruit) to *Pseudaulacaspis pentagona*. *Passiflora caerulea* is not planted commercially as it does not grow as vigorously as *P edulis*, and does not bear edible fruit. According to BEAL and FARLOW (1982), it is recommended as a rootstock for *P edulis* because of its resistance to nematodes (*Meloidogyne* spp) and low temperatures (WILLERS, 1987). The white peach scale excretes an enzyme while feeding and the plant cells die. When scale populations are very high, dieback of the branches occurs; yellowing of leaves are also an indication of scale infestations. Pulp production decreases and small fruits are produced which are unsuitable for marketing.

The aim of this study was to determine if *Passiflora edulis* forma *flavicarpa* and *P caerulea*, in comparison to *P edulis*, was susceptible to *Pseudaulacaspis pentagona*, and whether contaminated plants showed a drop in yield or not.

materials and methods

obtaining seedlings

Seeds of three passion fruit species or form, *Passiflora edulis*, *P edulis* forma *flavicarpa* and *P caerulea*, were planted separately in plant containers (400 x 350 mm diameter). The soil used in the containers was fumigated with methyl bromide 980 g/kg plus chloropicrin 20 g/kg fumigation applicator for the control of nematodes and soil fungi. These containers were then placed in a glasshouse with a temperature of 25 ± 3°C and a relative humidity of 65 ± 7.5%. Seedlings were then irrigated when necessary. When the seedlings had a stem diameter of 10 to 15 mm, 30 were selected from each of the three species or form as data plants. At this stage, the height of the plants differs between 200 to 300 mm.

Pseudaulacaspis pentagona crawler observations

Approximately 2,000 crawlers were brushed onto the three passion fruit species or form studied. These crawlers were reared on *Cucurbita moschata* Duch at a temperature of 25 ± 3°C with a relative humidity varying between 65 and 75% with a 13 h daylight.

The development of the crawlers was examined three times per week with a magnifying glass. This was done to determine which of the species were susceptible to *Pseudaulacaspis pentagona*. The females were counted randomly on five areas (400 mm^2) per plant to determine the percentage infestation on the three passion fruit species or form. These areas were determined by using a standard index card and in the middle a 20 x 20 mm square cut out. This card then placed on the stem of the plants; in this way the female scales were counted. Intervals of 100 mm were applicable between the areas. A T-test with two independent values was used to analyze the data.

infestation of one-year-old plants

In a second trial, one-year-old engrafted plants were used. One plant of each species or form was planted together in an asbestos container (900 mm in diameter) – in total 18 plants (six containers x three plants) – and irrigated when necessary. After six months, two techniques were used to infest the plants with crawlers.

With the first technique, scale-infested branches were cut into lengths of 40 mm. These contaminated branches with scales were obtained from a glasshouse culture reared on *P edulis* at a temperature of 25 ± 3°C with a relative humidity between 65 and 75%. These branches were then tied to each of the nine plants (in three containers) by using sewing thread (photo 1).

In the second experiment, 12 paper funnels were attached to the stems of each of the nine other plants (photo 2). The crawlers were then brushed into the funnels.

Observations on the plants were carried out three times per week over a period of six months to determine on which species or form *Pseudaulacaspis pentagona* became established. On five areas of 400 mm^2, which was chosen randomly on each plant, the adult female scales were counted and classed according to the standards presented in table I, which was determined beforehand, by using areas of 400 mm^2. The measurements of an adult female scale are 2.1 mm in length and a width of 2.0 mm.

scale-infested *Passiflora* seedling observation

In a third trial, scale-infested *Passiflora* seedlings were cultured and reared in a glasshouse with a temperature of 25 ± 3 °C and a relative humidity varying between 65 and 75%. A medium scale infestation was visible on all the seedlings used. Twenty seedlings per species or form studied were planted in asbestos containers (900 mm in diameter). Every second week, for a period of 12 months, general observations such as plant growth height, flowering, fruit bearing, etc, were carried out to determine the effect of the scale on the three different *Passiflora* types.

percentage of flower drop measurements

To investigate the effect of the scale infestations, the percentage of flower drop was carried out on infested plants of *P edulis* and then compared to those of the control plants. Ten plants per treatment were used, in total 20 plants. Other factors which could influence the outcome of the results were eliminated by using a gauze cage over the flowers. At each plant, a gauze cage (200 x 190 mm in diameter) was hung. The gauze covering the cage had a grid size of 0.05 mm^2. A shoot with five flowers was placed in each cage of all 20 plants. Over a period of 22 days, daily observations were carried out.

results

seedling infestation

The number of seedlings infested with *Pseudaulacaspis pentagona* are given in table II. Scale infestations of 57.5 and 49.0% were found on *Passiflora edulis* and *P edulis* forma *flavicarpa*, respectively. No infestations were found on *P caerulea*.

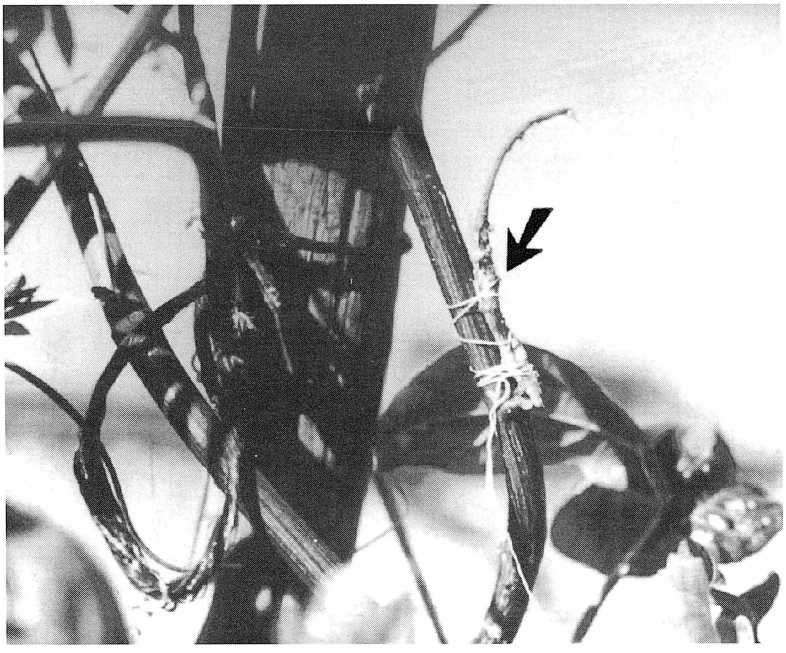


Photo 1
Granadilla branch (arrow), which was infested with Pseudaulacaspis pentagona, *is attached to an uncontaminated passion fruit plant.*

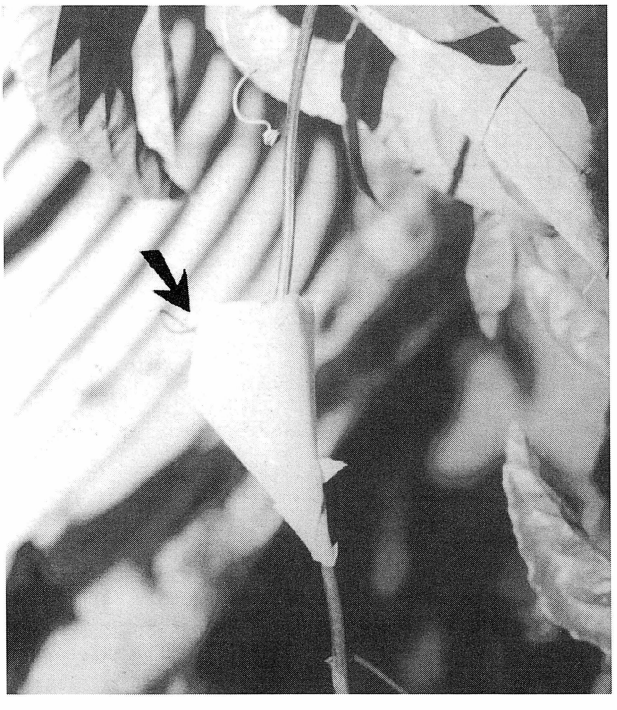


Photo 2
With a funnel (arrow), crawlers of Pseudaulacaspis pentagona *were brushed onto an uncontaminated passion fruit plant.*

Table I
Norms which were used for counts of *Pseudaulacaspis pentagona* on granadilla plants.

Number of adult female scales per 400 mm²	*Infestation*
0 – 15	Light
16 – 25	Medium
26 and more	Heavy

Table II
Percentage infestations of *Pseudaulacaspis pentagona* on seedlings of the three passion fruit species.

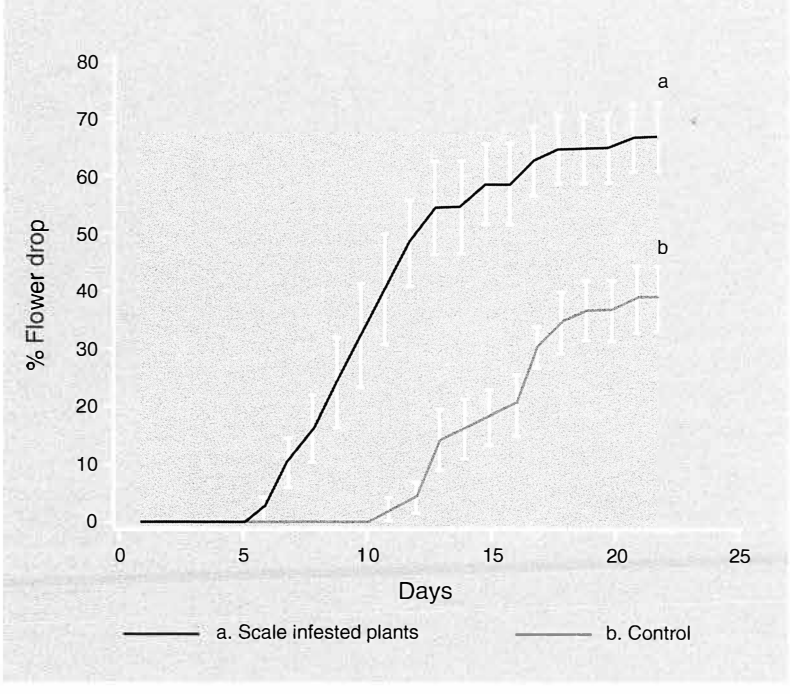
Specie	*n*	*x*	*SE*
Passiflora edulis	29	57.6	4.4
P edulis forma *flavicarpa*	29	49.0	3.9
P caerulea	29	0	0

n = number of replicates, x = average, SE = standard error.

crawler settlement on one-year-old plants

With the first technique, where 40 mm branch cuttings were tied to the three different passion fruit species or form, no settlement of crawlers was observed. However, with the second technique, where the funnels were used to infest the three passion fruit types, settlement of the crawlers was observed on *P edulis* and *P edulis* forma *flavicarpa*. Over a period of three months, medium to heavy infestations were noted on the above-mentioned species.

Figure 1
Percentage flower drop (Passiflora edulis) *as happens with* Pseudaulacaspis pentagona *infestations.*



infested seedling observation

Infested seedlings from the glasshouse which were planted into asbestos containers, showed symptoms of poor plant growth, yellowing of leaves and poor flowering; hardly any fruit set was noted.

percentage of flower drop

The results, obtained from the trial in which the percentage of flower drop of scale-infested plants was compared to the control plants with no scale infestation, showed that there was a 66% flower drop of the plants with a scale infestation in comparison to the control in which there was a 38% flower drop (fig 1).

conclusion

Scale infestations of 57 and 49% were recorded on *Passiflora edulis* and *P edulis* forma *flavicarpa,* respectively, which showed that both *Passiflora* types are susceptible to *Pseudaulacaspis pentagona*. The technique using funnels to infest the plants with *Pseudaulacaspis pentagona* resulted in a medium to heavy scale infestation on *Passiflora edulis* and *P edulis* forma *flavicarpa*. No infestation of the scale was noticeable on *P caerulea* neither with seedlings nor with one-year-old plants infested with both techniques. Infested seedlings which were planted out in asbestos containers showed symptoms of yellowing of the leaves, poor plant growth and poor fruit set over a period of three months. Infested *P edulis* with *Pseudaulacaspis pentagona* showed a 66% flower drop in comparison to the control plants in which a flower drop of 38% was recorded.

These results confirmed the important effect of the white peach scale infestation on *Passiflora edulis* crop decreasing; moreover, in addition to its resistance to nematodes and low temperatures, *P caerulea* was revealed to be not very susceptible to this pest. Its use as a rootstock for *P edulis* has then to be greatly encouraged.

acknowledgments

This forms part of a Masters Diploma in Technology to be submitted to the Technikon Pretoria, Pretoria, 0001, Republic of South Africa.

references

Annecke DP, Moran VC (1982) *Insects and Mites of Cultivated Plants in South Africa*. Durban, Republic of South Africa, Butterworths, 383 p

Beal PR, Farlow PJ (1982) Passion fruit (*Passifloraceae*). *Austr Hort (Horticulture Centre Redlands Research Station Department of Primary Industries)* 80, 57-65

Ebeling W (1959) *Subtropical Fruit Pests*. Berkley, CA, USA, University of California Division of Agricultural Sciences, Zeus Co Printers, 436 p

Greathead DJ (1971) *A Review of Biological Control in the Ethiopian Region.* London, UK, Technical Communication 5 Farnham, Royal Commonwealth Agricultural Bureaux Commonwealth Institute of Biological Control, Gilbert Printers Ltd, 162 p

Human NB (1986) *Delamination of Areas Climatically Suitable for Six Irrigated Subtropical Crops in the Eastern Transvaal*. Republic of South Africa, University of the Orange Free State, MSc (Agric) Dissertation of thesis, Bloemfontein, 227 p

Liebregts WJMM, Sands DPA, Bourne AS (1989) Population studies and biological control of *Pseudaulacaspis pentagona (*Targ-Tozz) (*Hemiptera: Diaspididae)* on passion fruit in Western Samoa. *Bull Entomol Res* 79, 163-171

Schulze BR (1979) *Klimaat van Suid-Afrika*. Pretoria, South Africa, Deel 8 Algemene Oorsig Weerburo, Departement van Vervoer, 330 p

Targioni-Tozzetti A (1871) *Cocciniglie degli agrumi in Italia specialmente in Sicilia*. Florence, Italy, Stazione Entomologica Agraria di Firenze, 32 p

Targioni-Tozzetti A (1886a) Sull' insetto che danneggia i gelsi *Revista di Bachicoltura* 18, 3

Targioni-Tozzetti A (1886b) La Diaspis pentagona (Targioni) *Revista di Bachicoltura* 18, 3

Willers P (1987) Red granadilla rootstock and nematodes resistance. *CFSRI Inf Bull* 178, 6

Winks CW, Menzel CM, Simpson DR (1988) Passion fruit in Queensland. 2. Botany and cultivars. *Queensland Agric J* 114, 217-224