# THE SCALE INSECTS OF SOME TROPICAL FRUIT PLANTS IN GREENHOUSES OF THE BOTANICAL GARDEN IN LUBLIN (POLAND)

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**Abstract**

The aim of presented investigations was to determine the composition of scale insects species and intensity of their occurrence on some tropical plants of greenhouses. The investigations were carried out in the greenhouses of the Maria Curie Skłodowska Botanical Garden in Lublin during the years 2002—2004. Ten species belonging to seven genera of tropical fruit plants were observed: *Ficus*, *Musa*, *Eugenia*, *Ananas*, *Feijoa*, *Citrus*, and *Eriobotrya*. The quantitative analysis of the studied material was performed making use of the following ecological indicators: number, frequency, and density. Identification of scale insect species was performed on the basis of microscope sliders.

Four species of scale insects belonging to two families were observed on tropical fruit plants: *Pseudococcidae* (*Pseudococcus maritimus, Planococcus citri*) and *Coccidae* (*Coccus hesperidum*, *Saissetia coffeae*). The scale insects were noted on nine species of tropical plants, they were not observed on *Ananas comosus*. The observed scale insects are typical polyphagous and all of them are considered as harmful pests in greenhouses. However, two species — *P. citri* and *S. coffeae* — seem to be of major importance as pests of tropical fruit plants in observed greenhouses.

**Key words**: scale insects, tropical fruit plants, greenhouses, botanical garden, number, frequency, density.

## Introduction

The scale insects are a group of insects, which occur in all climatic zones; however, in tropical and subtropical zones they are the most serious pests. Scale insects occupy citrus, pineapple, coffee and tea plantations (Kosztarab, 1996; Ben-Dov, Hodgson, 1997).

Some of them have been noted for years in Polish greenhouses. Currently, over 40 species of scale insects have been observed on various plant species cultivated in greenhouses in Poland (Koteja, 1996). These are cosmopolitic and polyphagous species, spread through trade and exchange of plant material. Polyphagous species occupying new areas often become a dangerous pest, mainly due to the lack of natural enemies, great reproductive potential (parthenogenesis) and specific morphological structure (protective shields, waxy powder and threads, sclerotized dorsal side) making chemical control difficult (Dziedzicka, 1988b; Łagowska, 1995a; Ben-Dov, Hodgson, 1997).

The main injury caused by scale insects is the ingestion of plant sap, resulting in the loss of plant vigour, poor growth, leaf drop, dieback of twigs, or sometimes the death of the plant. Moreover, while piercing plant tissue, the saliva secreted by the insect may be toxic for the plant and produce chlorotic yellowing of leaves, discoloration of leaves and fruits, and deformation of plants. Some species of scale insects can transmit plant virus diseases, and by injuring the plant surface enable the entry of other pathogens (Dziedzicka, 1988b; Kosztarab, 1996). Through excreting honeydew coating plant surfaces, assimilation and photosynthesis are inhibited which results in poor growth, poor development of plants, leaf drop, less sugar in fruits, and also spoil the appearance of ornamental plants. In addition, dust and other contaminants settle on honeydew, but primarily sooty moulds grow which coat the plant surface with a black layer. Honeydew also attracts other insects (ants), the presence of which decreases the aesthetic value of plants.

## Materials and Methods

The studies were conducted in the greenhouses of the Maria Skłodowska University Botanical Garden in Lublin during during the years 2002—2004. During this period, chemical, biological and mechanical plant protection was carried out. The plants observed were cultivated in greenhouses of the total area of 270 $m^2$. The studies covered 10 tropical plant species of edible fruits, belonging to 7 genera: *Ananas, Citrus, Eriobotrya, Eugenia, Feijoa, Ficus,* and *Musa*. In the study, 30 centimetre long fragments on each plant were selected at random. Observations of the selected fragments (twigs, leaves) were made every 14 days. In order to identify species, several individual scale insects were collected from each examined plant, and fixed microscopic specimens were prepared by Williams and Kosztarab method (1972).

Quantitative analysis of the collected material was conducted with the use of ecological indicators: numbers, frequency (percentage of samples in which an individual species occurred — Szujecki, 1980), density (number of species present in an individual environment on a defined surface unit — Górny, Grüm, 1981). The density of scale insects on examined plant fragments was carried out based on a 5-degree scale: 0 — lack of scale insects; I — single scale insects; II — up to 25% of surface affected by scale insects; III — up to 50% of surface affected by scales; IV — up to 100% of surface affected by scales (mass density).

## Results and Discussion

Based on the results of studies conducted on 10 tropical plant species, 4 scale insect species, belonging to 2 families, were observed: *Pseudococcidae — Pseudococcus maritimus* (Ehrh.) (grape mealybug), *Planococcus citri* (Risso) (citrus mealybug), *Coccidae — Coccus hesperidum* L. (brown soft scale), and *Saissetia coffeae* (Walker) (hemispherical scale).

The presence of scale insects was noted on 9 plant species belonging to the families: *Moraceae, Musaceae, Myrtaceae, Rosaceae, Rutaceae*. Scales insect did not occupy *Ananas cosmosus*. *P. citri*, which was observed on 6 plant species, was characterised by the largest number of host plants. *P. maritimus* and *S. coffeae* were noted on 3 species of hosts (Table 1). *C. hesperidum* was observed on the smallest number of host species (2); however, its total number on these plants was the highest (1036 individuals), compared to the remaining 3 species of scale insects. *P. maritimus* was characterised by the smallest total number of individuals (692) (Fig. 1).

Table 1

Occurrence of scale insects on 10 species of tropical fruit plants, their number and density

| Species of scale insects | Species of tropical plants | Number of individuals of scale insects | Density |
|---|---|---|---|
| *Pseudococcus maritimus* (Ehrh.) | *Musa* sp. L. | 359 | III |
| | *Eugenia uniflora* L. | 290 | III |
| | *Eribotrya japonica* (Thunb) | 43 | I |
| *Planococcus citri* (Risso) | *Ficus carica* L. | 147 | I |
| | *Feijoa sellowiana* O. Berg | 99 | I |
| | *Citrus grandis 'Pompela'* (L.) | 276 | II |
| | *Citrus limon* (L.) Burm. F. | 329 | III |
| | *Citrus reticulata* Blanco | 12 | I |
| | *Citrus paradis 'Grapefruit'* (Swingle) | 90 | II |
| *Coccus hesperidum* L. | *Citrus reticulata* Blanco | 387 | III |
| | *Citrus paradis 'Grapefruit'* (Swingle) | 649 | III |
| *Saissetia coffeae* (Walker) | *Eugenia uniflora* L. | 2 | I |
| | *Feijoa sellowiana* O. Berg | 875 | III |
| | *Citrus grandis 'Pompela'* (L.) | 100 | II |

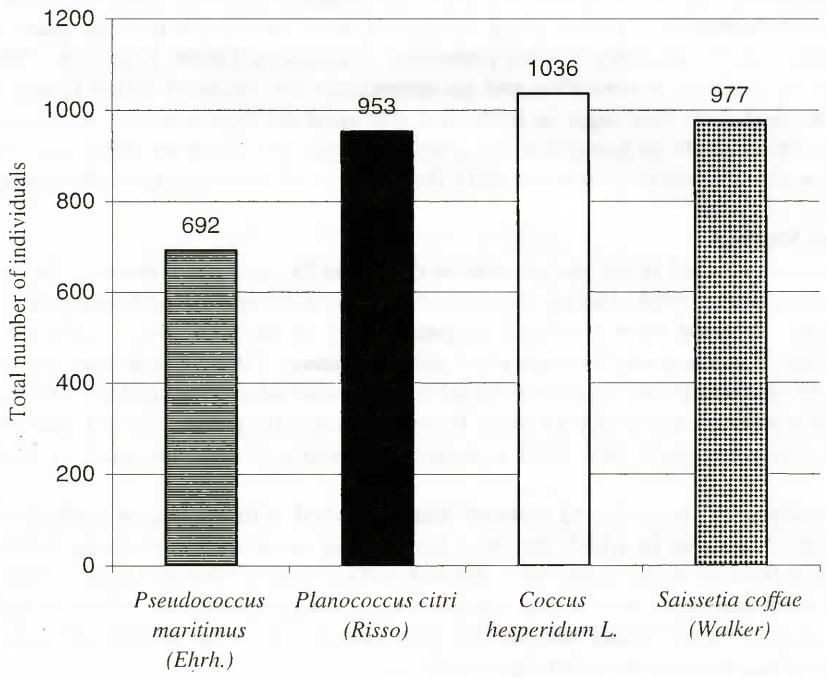


Fig. 1. The total number of scale insects on tropical fruit trees in the greenhouse of the Botanical Garden Lublin

Among scale insects observed on this group of plants, the following species of *Coccidae* family appeared in abundance on individual hosts: *S. coffeae* — the greatest number occurred on *Feijoa sellowiana* (875 individual scales)

and *C. hesperidum* — on *Citrus paradis 'Grapefruit'* (649 individual scales). The species *S. coffeae* on *Eugenia uniflora* was found in the smallest number — 2 individual scales (Table 1).

Frequency of individual species varied in the greenhouses in the study. In the group of scale insects found on tropical plants it was the highest for the species *P. maritimus* on *Musa banan* (F = 100%) and *C. hesperidum* on *Citrus reticulata* (F = 90%), whereas the lowest frequency was noted for *S. coffeae* species on *Eugenia uniflora* (F = 10%). The frequency of scale insects on the remaining plant species ranged from 30 to 85% (Fig. 2).

On the examined plants, the colonies of scale insects occurred in classes I, II and III of density, while their appearance in mass (class IV) was not observed. On the majority of plants, class III of scale insects density was noted (Table 1).

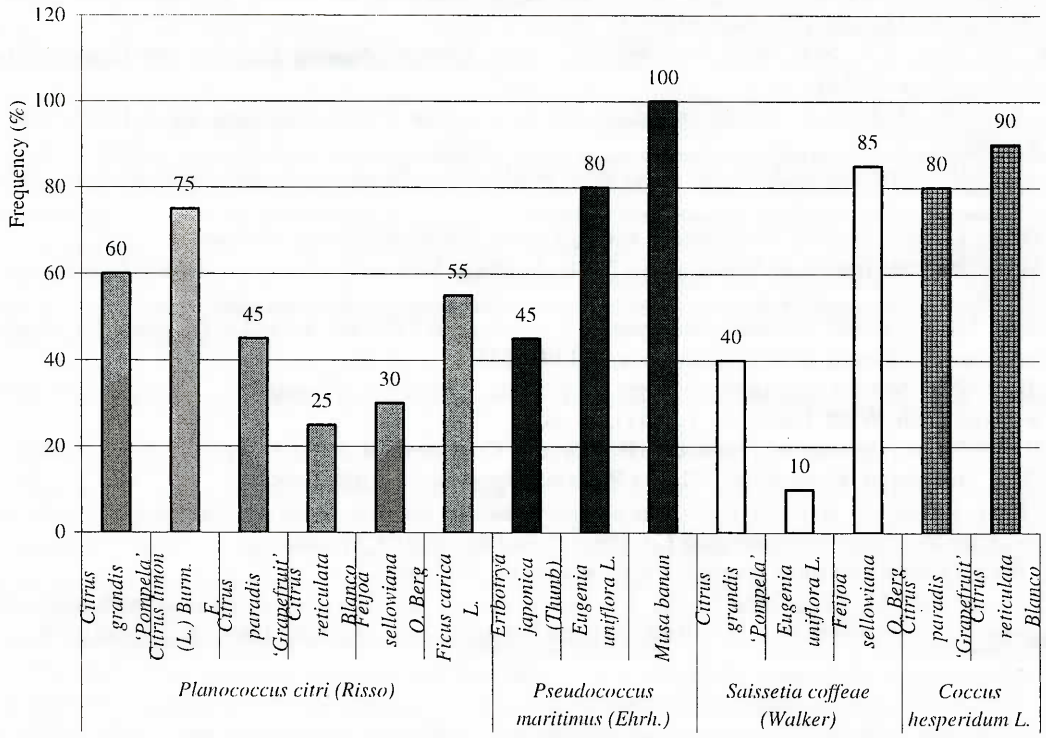


Fig. 2. The frequency (%) of scale insects occuring on some tropical fruit plants

Scale insects were found in the greenhouses despite intensive plant protection being carried out. According to literature (Dziedzicka, 1988b; Łagowska, 1995b), scale insects are present even in the best maintained greenhouses due to their peculiar morphology and biology.

The found species belong to most abundant and dangerous scale insects observed in Poland's greenhouses (Łagowska, 1995a, b; Dziedzicka, 1988a, b). According to literature reports, the *Pseudococcidae* family in Poland is represented by 5 greenhouse species, whereas *Coccidae* — by 9 scale insect species (Dziedzicka, Madro, 1999; Koteja, 1996). Studies conducted in the greenhouses of the Botanical Garden in Lublin on 10 tropical plant species showed the presence of 2 species from *Pseudococcidae* family and 2 species from *Coccidae* family. The presence of scale insects from the *Diaspididae* family, which is represented in Poland by 27 greenhouse species (Koteja, 1996), during the studies was not observed.

Among scale insects noted on tropical plants in the greenhouses of the Maria Skłodowska Curie Botanical Garden, *P. citri* occurred on the greatest number of plant species. This species was noted on plants of *Citrus* and *Ficus* genera, which was confirmed by literature reports (Ben-Dov, 1993; Ben-Dov, Hodgson, 1997; Dziedzicka, 1988a; Łagowska, 1995b).

All the scale insects observed were cosmopolitic and polyphagous species and occurred in almost every greenhouse (Dziedzicka, 1988b). Although all plants in the study grew in the same environmental conditions, making a compact composition, they were occupied by scale insects to a various degree. These insects appeared on 9 host plant species. The only species on which no scale insects were found was *Ananas comosus*. During the two years of the study, the presence of scale insects on this plant was not noted, although literature reports mention *Ananas* genus as a host for more than 10 species, including *Coccus hesperidum* and *Planococcus citri.*

While investigating the occurrence of scale insects on several plant species it may be presumed that the host species exerts a great effect on their occupancy. An example may be *S. coffeae*, the numbers of which on *E. uniflora* were the smallest (2 individual scale insects), while it was many times higher on *F. sellowiana* (875 individual scale insects). According to Piechota (1981), certain properties of plants may condition their defensive reaction. These are the features of morphologic structure (height and shape of plants, size of leaves, occurrence of hairs and furrows on leaf surface), anatomical structure (number and size of stomatal apparatuses, thickness and degree of lignification of cellular

walls, as well as thickness of sclerenchyma's conducting tissue), or physiological reaction (synchronisation of the development phase of a plant with the requirements defined by life cycle of an insect). Tingle and Copland (1988) investigated the effect of host plant on *P. citri* population.

The present study showed that the condition of the host plant is one of major factors affecting the size of this species population. Occupancy on individual plant species may also be affected by specific odorous substances produced by them, which by attracting scale insects parasites result in the plants being less affected by these insects (Van Alphen, Ren, 1990).

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