

Invasion of greedy scale crawlers (*Hemiberlesia rapax*) onto kiwifruit from taraire trees

R. H. BLANK, M. H. OLSON AND D. S. BELL

Agricultural Research Division, MAF, P.O. Box 943, Whangarei, New Zealand

ABSTRACT

Taraire (*Beilschmiedia tarairi*) trees are commonly found in association with kiwifruit orchards on the free draining volcanic soils in Northland. Greedy scale *Hemiberlesia rapax* (Comstock) (Hemiptera: Diaspididae) were monitored from taraire leaves in 1985-86. A small stand (100 × 250 m) of taraire adjacent to a kiwifruit (*Actinidia deliciosa*) orchard was estimated to contain 1-4 million mature scale. Greedy scale crawler activity on the taraire was assessed using sticky tape traps. Aerial dispersal of crawlers was monitored in the kiwifruit orchard adjacent to the taraire using sticky glass traps. Potted kiwifruit trap plants, which had been kept free of scale, were placed in the orchard to measure crawler dispersal and settlement. Two main periods of crawler release, aerial dispersal and settlement occurred in November-January and March-May. These results show that greedy scale can invade kiwifruit orchards in high numbers from adjacent host plants such as taraire.

Keywords: Greedy scale; *Hemiberlesia rapax*; taraire, *Beilschmiedia tarairi*; kiwifruit; crawlers; invasion; monitoring.

INTRODUCTION

Greedy scale is an important quarantine pest on kiwifruit. In some years greedy scale can be a major cause of rejection of fruit for export and whole crops may be rejected.

Greedy scale can rapidly build up numbers on stems, leaves and fruit of kiwifruit if no pesticides are applied. Each adult female scale can produce up to 120 eggs which hatch into the mobile crawler (Ferguson 1979; Dale 1981). These yellow crawlers move to new sites and settlement occurs after 2-5 days (Berry 1983). The piercing mouthparts of the crawler are inserted into the plant tissue and a silken white pad is spun over the insect. This is the 1st settled white cap stage (1st instar) which moults into the yellow cap (2nd instar) and black cap (3rd instar) stages which are also sessile. The black cap stage enlarges and develops eggs to become the mature scale.

The life cycle of greedy scale is normally completed on the 1 host plant. New generations of scale often develop close to the mature scale. It has been postulated that crawlers may be transported in the wind between host plants (Ferguson 1974, 1979; Dale 1981; Berry 1983), but no evidence has been presented to support this idea.

Greedy scale can be found on a wide range of woody perennial hosts including fruit trees, ornamentals, shrubs and native trees (Ferguson 1979; Dale 1981; Spiller & Wise 1982). Many of these host plants, such as gorse, privet, manuka, hakea, willow, barberry, oak, lacebark, poplar and kamahi may be found close to kiwifruit orchards. In Northland, kiwifruit orchards commonly occur adjacent to large areas of native bush. Some orchards utilise the native bush as a natural shelter from wind. The taraire is the dominant tree of the native bush on the free draining volcanic soils in Northland and often occurs in pure stands; greedy scale are found on taraire. This study investigates the potential for aerial invasion of greedy scale from stands of taraire trees into adjacent kiwifruit orchards.

MATERIALS AND METHODS

A stand of taraire trees (100 × 250 m) surrounded by a non-producing kiwifruit orchard at Maunu near Whangarei was used in this study. Leaves from taraire trees were assessed with the aid of a microscope for greedy scale stages at 3-6 weekly intervals in the 1985-86 season. Two hundred and forty leaves were assessed at each sampling from 8 trees (i.e. 30 leaves per tree).

The activity of crawlers on taraire was assessed using sticky tape traps placed around small branchlets (approximately 40 mm circumference) and smeared with grease (Snow White Petrolatum). Eight tape traps were placed on lower branches (2-3 m height) of trees in a north and east aspect giving a total of 16 traps. Tape traps were removed and examined under a microscope for crawlers at 3-6 weekly intervals. Traps were relocated in the same position after each sampling.

The aerial dispersal of crawlers was assessed using greased glass traps placed on wooden structures in the kiwifruit orchard at canopy height (1.8 m). Twelve glass traps were placed at regular intervals amongst 2 blocks of kiwifruit 20-50 m from the taraire. Each trap consisted of 2 glass plates with a greased (Snow White Petrolatum) area of 50 × 300 mm in total. Glass plates were held in a yellow painted plywood frame. At each sampling, 300 areas (5 × 5 mm) selected from the middle of the 2 glass plates were examined with the aid of a microscope for crawlers. Traps were relocated in the same position after each 3-6 weekly sampling.

Greedy scale crawlers cannot be positively identified using taxonomic features. Crawlers from a laboratory colony of greedy scale and from scale on kiwifruit were yellow, oval-shaped (0.17 × 0.12 mm), with no obvious eye spots and with a characteristic outline of the alimentary tract. Crawlers collected in the field were considered to be greedy scale if they had these features. A number of crawlers of different sizes, shapes and with features such as red and black eyespots were commonly recovered in traps but were considered to be different species.

The aerial dispersal and settlement of crawlers was assessed using kiwifruit plants grown in pots. These trap plants were regularly sprayed with diazinon to exclude greedy scale and were examined carefully before placing out in the kiwifruit orchard adjacent to the taraire. A total of 12-24 plants containing 70-487 leaves were placed at regular intervals throughout 2 kiwifruit blocks. Plants were replaced at 3-4 weekly intervals and leaves examined for greedy scale using a microscope.

Kiwifruit plants, in the blocks where crawler invasion was monitored and trap plants

sited, were sprayed with 5 applications of diazinon in September-November. These sprays were successful in killing overwintering scale as of 215 scale examined on kiwifruit plants 97% were found to be dead.

RESULTS

Samples of scale from taraire leaves were identified by Ms C. F. Butcher as greedy scale. Greedy scale are predominantly found on the petiole of taraire leaves or close-by the 1st 20-50 mm of the main leaf vein on both the upper and lower leaf surface. Occasionally, scale may be found on the distal parts of the leaf or on the woody twigs. Infestations of up to 20 scale per leaf may be found, but 1-5 scale/leaf is more common. The densities of mature and white cap stages monitored on taraire leaves are shown in Fig. 1. The presence of mature scales indicates periods when crawlers may be released,

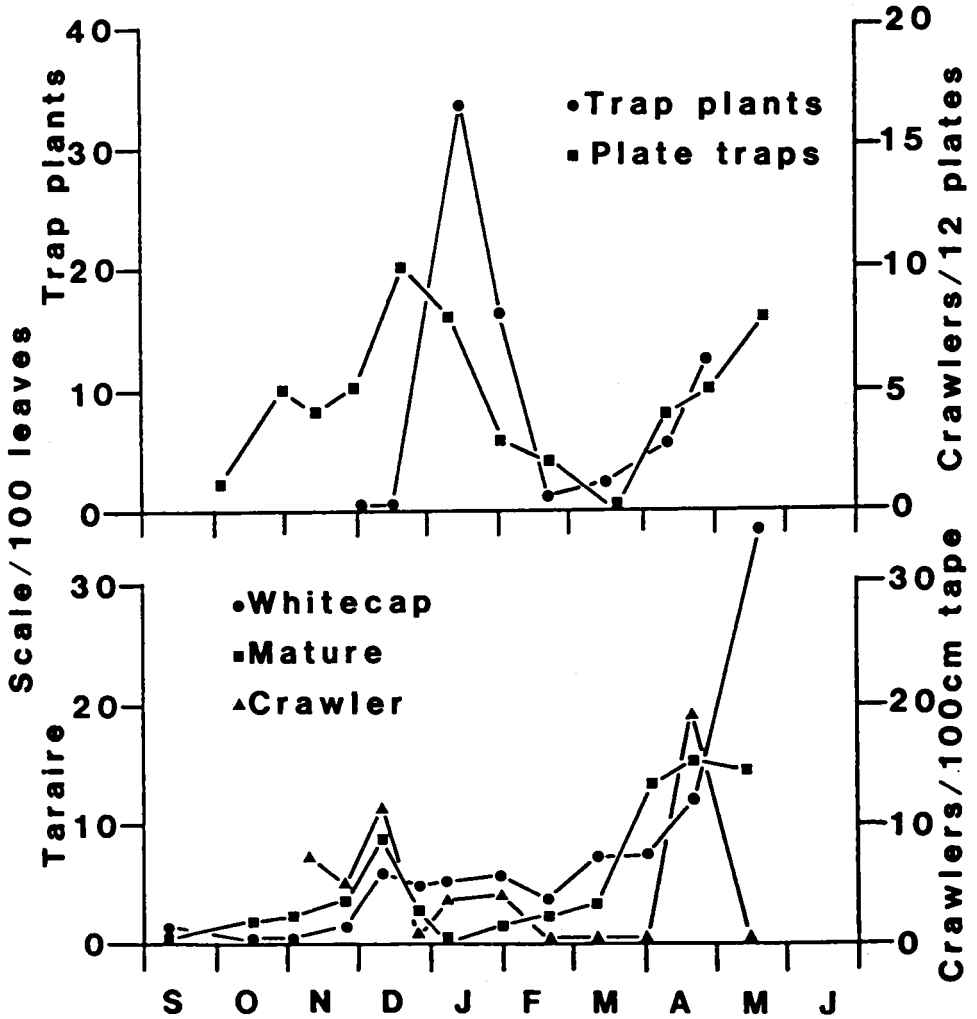


Fig. 1: The relationship between greedy scale on taraire and the invasion of kiwifruit by aerially-disposed crawlers.

whilst an increase in the white cap density indicates periods after crawler settlement. Greedy scale has 2 generations each year. In the 1985-86 season, crawlers probably were released by matures from November-December and again in March-April. The presence

of white cap and mature scale throughout the season indicates that a low level of crawler release may also occur at almost any time of the year.

In the study area, approximately 90% of the stand of bush (250 × 100 m) was taraire giving a canopy of 28000 m². Quadrat counts gave a density of 960 leaves/m². An estimated 27 million taraire leaves were infested with 1-4 million live mature scale at periods when crawlers may be released (Fig. 1). If each mature scale can produce 120 crawlers, then even if only a small proportion become airborne the potential for invasion of the adjacent kiwifruit is massive.

There were 2 main periods of crawler activity on taraire in spring-early summer and autumn as evidenced by crawlers collected on tape traps (Fig. 1). The aerial dispersal of crawlers followed a similar pattern as shown by crawlers recovered from sticky traps placed in the orchard. The recovery of greedy scale on potted kiwifruit 'trap plants' did not commence until late December but otherwise gave a similar pattern with 2 peaks. The greedy scale recovered on the trap plants were mainly white cap (1st instar) stages but occasionally yellow cap (2nd instar) were recovered in mid-summer.

DISCUSSION

This study has shown that greedy scale are found in high numbers on taraire and that crawlers can be dispersed aerially to infest adjacent kiwifruit plants. It is probable that kiwifruit orchards adjacent to other host plants harbouring high numbers of greedy scale may similarly be at risk from aerial invasion of crawlers. The distance that crawlers may be dispersed has not been investigated in this study. Results of insecticide trials (Blank unpublished) suggest that kiwifruit orchards with no major greedy scale host close-by may also be infested with airborne crawlers but at much lower levels.

Removal of alternative greedy scale host plants in the immediate vicinity of kiwifruit orchards could reduce the risk of crawler invasion. However, if crawlers can be carried in the wind for long distances, then invasion will still occur. Orchardists will still need to rely on insecticides to protect the crop from invasion of scale.

Current spray programmes recommend from 7-9 insecticide applications throughout the season to control greedy scale and leaf roller caterpillars. A reduction in the number of spray applications has been advocated where sprays are timed to coincide with periods of major leaf roller invasion (Wearing *et al.* 1980). A reduction in insecticide applications could, however, expose kiwifruit orchards to the risk of greedy scale invasion unless the reduced number of insecticide applications are also timed to coincide with periods when crawler invasion occurs. Further work is in progress to establish critical times for greedy scale control.

ACKNOWLEDGEMENTS

Our thanks to Mr M. L. Atkins for the use of his orchard. To Mrs J. M. Kelly for assistance with monitoring of greedy scale.

REFERENCES

- Berry, J. A., 1983: Aspects of the ecology and control of the greedy scale [*Hemiberlesia rapax* (Comstock)]. Unpublished M.Sc. Thesis, Auckland University, New Zealand.
- Dale, P. S., 1981: Greedy scale biology, damage and control on kiwifruit. *Aglink HPP 32*, Ministry of Agriculture and Fisheries, Wellington, New Zealand.
- Ferguson, A. M., 1974: Biology of greedy scale; *Hemiberlesia rapax* (Com.) on kiwifruit, *Actinidia chinensis*. *Proceedings of the Kiwifruit Seminar, Tauranga*: 20-26.
- , 1979: Greedy scale, *Hemiberlesia rapax* (Comstock), life cycle. *DSIR Information series No. 105/31*.
- Sale, P. R., 1974: The greedy scale problem and pest control of kiwifruit. *Proceedings of the Kiwifruit Seminar, Tauranga*: 29-35.
- Spiller, D.; Wise, K. A. J., (compilers; revised and edited by Dale, P. S.; Maddison, P. A.), 1982: A catalogue (1860-1960) of New Zealand insects and their host plants. *New Zealand DSIR bulletin No. 231*, 260 p.
- Wearing, C. H.; York, M.; O'Kane, P., 1980: Supervised spraying of lepidopterous pests of kiwifruit in the Bay of Plenty. *Proceedings of the 33rd N.Z. Weed and Pest Control Conference 1980*: 100-104.