VG612
Determination of Fruit Fly Host Status for Red Tiger, Shadow, Gemini & Baby-lee Watermelons

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QDPI

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VG612

This report is published by the Horticultural Research and Development Corporation to pass on information concerning horticultural research and development undertaken for the watermelon industry.

The research contained in this report was funded by the Horticultural Research and Development Corporation with the financial assistance of the QFVG.

Cover price: $20.00
HRDC ISBN 1 86423 966 2

Published and distributed by:
Horticultural Research & Development Corporation
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Gordon NSW 2072
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M.D. Jess and R.J. Corcoran

Final Report

HRDC

Queensland
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Growers

ACKNOWLEDGEMENTS

This project was jointly funded by the Horticultural Research and Development Corporation and the Queensland Fruit and Vegetable Growers Association.

The researchers would like to thank Daryl O'Leary, of Chinchilla for providing organically grown watermelons for this research.

The authors would also like to acknowledge the technical assistance of John Cavallaro, Marianne Eelkema, Apollo Gomez, Leeane Heslin, Esmae Jen, Seemi Khan, Eva Okello-Okanya, Pauline Peterson and Elizabeth Pike.

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1.0 INDUSTRY SUMMARY

Watermelons grown in northern Australia may be infested with eggs and larvae of the cucumber fly. Therefore, these watermelons can not be exported to New Zealand unless they are treated in some way to ensure that no live stages of this pest are present. Previous research had indicated that watermelons at harvest were a very poor host for cucumber fly. Therefore it was considered possible that watermelons may be found to be a non-host under commercial growing conditions. This project was developed to test the host status of the cultivars Red Tiger, Shadow, Gemini and Baby-Lee which were identified as having export potential to cucumber fly. At the time this project was developed, papaya fruit fly, an introduced species was present in some watermelon growing areas near Cairns and therefore was included in the project.

Testing followed the New Zealand Ministry of Agriculture and Fisheries (NZMAF) Standard 155.02.02 "Specification for Determination of Fruit Fly Host Status as a Treatment". Products shown to be non-hosts under this testing standard may be imported without further treatment.

The papaya fruit fly was eradicated from North Queensland during the life of this project and is no longer considered a quarantine risk by New Zealand authorities.

Results of the host status tests showed that watermelons of the varieties Red Tiger, Shadow and Gemini are all hosts to cucumber fly. Damaged and undamaged fruits of each variety were infested. In contrast, Baby-lee watermelons were found to be non-hosts to cucumber fly. Fruit was only infested in the damaged state and undamaged fruit remained free of the pest.

As this research proved unsuccessful in demonstrating non-host status for watermelons of the varieties Red Tiger, Shadow and Gemini, current restrictions on their export to New Zealand will remain. Baby-Lee watermelons may be considered a non-host on the basis of these tests and presentation of these data to NZMAF may allow their export.

2.0 TECHNICAL SUMMARY

Watermelons, *Citrullus lanatus* [(Thunb.) Matsumo Nakai], grown in northern Australia may be infested with eggs and larvae of the cucumber fly, *Bactrocera cucumis* (French). Therefore these watermelons can not be exported to New Zealand unless they are treated in some way to ensure that no live stages of this pest are present. Previous research had indicated that watermelons were a very poor host for cucumber fly at harvest. Therefore it was considered possible that commercially grown watermelons may be found to be a non-host. This project was developed to test the host status of the cultivars Red Tiger, Shadow, Gemini and Baby-Lee to *B. cucumis*. At this time, papaya fruit fly, *Bactrocera papayae* (Drew and Hancock), an introduced species was present in some watermelon growing areas near Cairns and therefore was included in the project.

Testing followed the New Zealand Ministry of Agriculture and Fisheries (NZMAF) Standard 155.02.02 "Specification for Determination of Fruit Fly Host Status as a Treatment". Watermelon varieties Red Tiger, Shadow, Gemini and Baby-lee were cage trialed with gravid females of *B. cucumis* and *B. papayae*. Replicates of damaged and undamaged watermelons were placed one to a cage with gravid females, for a 24 hour period. Fruit was then held for 17 days, the fruit checked and surviving puparia recovered on days 14 and 17. Pupal numbers and adult emergence were recorded. Any survival to the pupal stage was considered to be evidence of positive host status.

Results of the host status tests showed that watermelons of the varieties Red Tiger, Shadow and Gemini are all hosts to *B. cucumis*. Damaged and undamaged fruits of each variety were infested. In contrast, Baby-lee watermelons were found to be non-hosts to *B. cucumis*, with fruit being infested only in the damaged state.

For *B. papayae*, the variety Red Tiger was found to be a host. However, Gemini, Shadow and Baby-lee watermelons are non-hosts, only being infested when fruit was damaged.

Since *B. papayae* was eradicated from North Queensland during the life of this project it is no longer considered a quarantine risk by New Zealand authorities.

As this research proved unsuccessful in demonstrating non-host status for the varieties Red Tiger, Shadow and Gemini in respect of *B. cucumis*, current restrictions on their export to New Zealand will remain. Baby-Lee watermelons may be considered a non-host on the basis of these tests and presentation of these data to NZMAF may allow their export.

3.0 INTRODUCTION

New Zealand is free of fruit flies and has a strict quarantine policy covering the importation of potential fruit fly host products. Essentially this policy prohibits the importation of fresh fruit-fly-host commodities unless they are guaranteed free of fruit fly by some treatment process. The New Zealand Ministry of Agriculture and Fisheries (NZMAF) consider both area freedom from fruit flies and demonstrated non-host status of a particular commodity as being acceptable treatments.

Undamaged watermelons have been shown to be difficult or impossible to infest with fruit flies experimentally (Heather *et al* 1995). Therefore it was considered possible that non-host status could be a viable quarantine treatment for watermelons grown commercially. Furthermore, some watermelons have been shown to be non-hosts for *Bactrocera facialis* and *Bactrocera xanthodes* from the Pacific Island of Tonga and this research has been accepted by New Zealand (Heimoana *et al* 1996), which has allowed access into that country.

To facilitate this testing process, NZMAF have developed a testing procedure which must be followed in order to demonstrate non-host status. Experiments were conducted in conformance with the "Specification for Determination of Fruit Fly Host Status as a Treatment" (Anon, 1994).

Host records show that members of the family Cucurbitaceae may be susceptible to infestation in Australia by the cucumber fly, *Bactrocera cucumis* (French) and the recently introduced exotic species *Bactrocera papayae* (Drew and Hancock), commonly known in Australia as the papaya fruit fly. At the time this project was undertaken both of these species had quarantine pest status and restricted the export of fruit and vegetables from Northern Australia. Therefore both of these species were tested in this series of experiments.

The aim of this project was to determine the host status of watermelons of the varieties Red Tiger, Shadow, Gemini and Baby-lee for cucumber fly and papaya fruit fly. These varieties were identified as having export potential for New Zealand by industry representatives. If watermelons are shown to be non-hosts using the NZMAF Standard, they may be allowed to enter New Zealand without the need for any further treatment.

4.0 MATERIALS AND METHODS

4.1 Test insects

In the first season adults of the cucumber fly (*Bactrocera cucumis*) and papaya fruit fly (*Bactrocera papayae*) were housed at the Queensland Department of Primary Industries (QDPI) laboratories, Sturt St, Cairns, and in the final season at the QDPI Laboratories at 21 Redden St, Cairns. Adults used in these trials had been in culture for 30 months but had been supplemented with wild flies so that at the time of testing it was less than 12 months since new biological material had been added.

Adult flies were held in cubic cages with sides of 0.7 metres covered on the sides and top with nylon mesh of 2 mm aperture. Each cage contained its own water supply system which consisted of a cut poly-pipe extended through the middle of the cage containing cat litter to absorb the water. The cage also contained sugar (sucrose) cubes and autolysed brewer's yeast as food.

The flies were held in a controlled environment room with temperature and humidity maintained at approximately 26°C and 70% RH. They were cultured on a carrot based, semi-artificial diet as described by Heather and Corcoran (1985).

4.2 Test Fruits

Four varieties of watermelon were used for this research. Red Tiger, Shadow, Gemini and Baby-lee, were all sourced from an organic grower so as to be free from insecticides or other chemicals which may have been detrimental to the development of fruit flies. Fruit availability was a problem for this research, causing these experiments to run over two seasons.

Ripe bananas, papaws and apples used for control fruit and for fecundity tests were also sourced from organic growers so as to be free from insecticides.

4.3 Fecundity Tests

A fecundity test was completed on each source cage 0-2 days prior to use in fruit trials to determine the mean number of eggs laid per female.

Fifty females 2 to 4 weeks of age, were placed in a 30x30x30cm cage with water and sugar cubes. An apple half (*B. papayae*) or a small papaw half (*B. cucumis*) was placed into the cage as an oviposition receptacle, and left for 24 hours. After 24 hours the dome was removed, the eggs were collected and counted on black filter paper and held on moist sponge in a sealed plastic container at 26°C, 70% RH. At 96 hours the eggs were examined and the number of hatched eggs was recorded.

In some situations, hollow fruit failed to elicit oviposition in *B. cucumis*. This could lead to a significant underestimation of oviposition potential. Therefore, in situations where oviposition into hollow fruit was low, the potential number of eggs laid was estimated from the culturing records for that cohort of flies.

4.4 Treatment

4.4.1 Flies per cage

The number of flies required per cage and per trial was determined from the fecundity test and the weight of the fruit using the calculation:

$$\frac{\text{Minimum number eggs/largest fruit wt.}}{\text{No. eggs laid /female}} = \text{No. females required per replicate.}$$

To ensure that a minimum of 250 and maximum of 500 eggs laid per 500g was achieved (as per New Zealand MAF Standard), the largest fruit's weight per trial was required. This ensured adequate infestation of all replicates. Mature watermelons lay within a small weight range, therefore, the maximum egg load was also not exceeded per replicate.

In most trials the number of females exceeded that necessary for minimum egg load, although less than the maximum threshold. This was to account for the occurrence of some adult mortality in small cages, which depended on the colony's vigour at the time of infestation.

4.4.2 Damaged Fruit

Five replicate watermelons were washed, weighed and punctured fifty times (per replicate) using a standard steel pin (1mm diameter). Punctures were distributed over the exposed fruit skin. Control fruit consisting of papaw for *B. cucumis* or banana for *B. papayae* was also weighed and the replicate pin-holed fifty times. One watermelon was placed in each of 5 cages 30x30x30cm containing gravid female flies, a water source and sucrose. The control was placed in an identical cage, also with gravid female flies, a water source and sucrose. Fruit remained in the cage for 24 hours.

4.4.3 Undamaged Fruit.

Five replicate watermelons and a control consisting of papaw for *B. cucumis* or banana for *B. papayae* were washed and weighed. One watermelon was placed in each of 5 cages 30x30x30cm containing gravid female flies, a water source and sucrose. The control was placed in an identical cage, also with gravid female flies, a water source and sucrose. Fruit remained in the cage for 24 hours.

4.5 Post Treatment

After 24 hours exposure, damaged and undamaged watermelons were removed and held individually on gauzed crisper boxes to allow excess fluid to drain away from the fruit. The crispers were then placed over sawdust, as a pupation medium at 26 ± 2°C, 70% RH to allow development. Control batches were also held separately at 26 ± 2°C, 70% RH to allow development.

Fruit was cut open and inspected and the sawdust sieved 14 days after infestation and then held a further three days before the final sieve at 17 days. All puparia recovered were counted, and held at 26°C, 70% RH containing moist sawdust to allow adults to eclose.

5.0 RESULTS

5.1 Fecundity Tests: *B. cucumis* and *B. papayae.*

A fecundity test to determine the number of eggs laid in an apple dome for samples of 50 female *B. cucumis* and *B. papayae* in 24 hours are presented in Tables 1 and 2, respectively.

B. cucumis females laid an average of 43, 38 or 56 eggs each for Red Tiger, Shadow, Gemini and Baby-lee fecundity tests, respectively (Table 1). Red Tiger trials contained the largest fruit and 155 females were used for each replicate. Shadow and Gemini watermelons used 134 and 74 females per replicate respectively, with the largest Shadow watermelon weighing in at 7 774g and the largest Gemini at 4 898g. Each control for these 3 varieties used 25 females (Table 1). Culturing data from the cage used for Baby-lee trials indicated that an average of 56 eggs were laid per female. As the largest fruit weighed 4 587g and 5 374g for damaged and undamaged trials respectively, 50 females were used per replicate. The same number of females were used for controls, which would serve to indicate the level of infestation which was possible from 50 gravid females if the fruit was a suitable host (Table 1).

Table 1: Fecundity of female *B. cucumis* as measured by their oviposition rate in hollow papaw over a 24 hour period. Fifty females were chosen at random as a representative sample of the population used in subsequent host testing.

Variety	Date	Total number of eggs laid	Number of eggs laid per female	Largest fruit used per trial (g)	Minimum no. eggs required/ largest fruit	Number of females used per test fruit	Fruit weight control (g)	Number of females used per control
Red Tiger	08.02.99	2 132	43	10 116	5 250	155	624	25
Shadow	09.02.99	1 916	38	7 774	4 000	134	761	25
Gemini	09.02.99	1 916	38	4 898	2 500	74	766	25
Baby-lee	13.02.98	N/A	56	4 587	2 500	50	538	50
Baby- lee	17.02.98	N/A	56	5 374	2 750	50	777	50

B. papayae females laid an average of 49, 45, 47 or 48 eggs each for Red Tiger, Shadow, Gemini and Baby-lee fecundity tests, respectively (Table 2). Red Tiger trials contained the largest fruit and 115 females were used for each replicate. One hundred females per replicate were used for the Shadow trials. This was due to the low number of eggs laid per female, combined with the large fruit weight (Table 2). Gemini watermelons used 75 females per replicate, with the largest watermelon weighing in at 5 500g. In comparison, Baby-lee used only 53 and 43 females for

damaged and undamaged trials respectively. The number of females used in controls ranged between 11 and 20 across the 4 varieties (Table 2).

Table 2: Fecundity of female *B. papayae* as measured by their oviposition rate in hollow apple over a 24 hour period. Fifty females were chosen at random as a representative sample of the population used in subsequent host testing.

Variety	Date	Total number of eggs laid	Number of eggs laid per female	Largest fruit per trial (g)	Minimum no. eggs required/ largest fruit	Number of females required per test fruit	Fruit weight controls (g)	Number of females required per control
Red Tiger	27.03.98	2468	49	10 404	5 250	115	991	15
Shadow	04.03.98	2244	45	8 932	4 500	100	691	12
Gemini	28.01.99	2368	47	5 500	5 750	75	704	20
Baby-Lee	13.02.98	2385	48	4 362	2 250	53	780	11
Baby-Lee	17.02.98	2380	48	3 572	2 000	43	709	12

5.2 Host Status Tests: *Bactrocera cucumis*

5.2.1 Red Tiger Watermelons

Damaged and undamaged Red Tiger watermelons are hosts to *B. cucumis* as eggs were able to survive to pupate and to emerge as adults (Table 3). Puparia were recovered in each of 5 replicates from the damaged trial with a cumulative total of 1 610 puparia, however only 8 were recovered in a single replicate of the undamaged trial. Control fruit (papaw) yielded high numbers of puparia with 940 and 1 064 puparia produced from the damaged and undamaged trials, respectively (Table 3).

Temperature fluctuated between 24 and 28°C over 24 hours with 75 % RH at 3pm (Table 4).

5.2.2 Shadow watermelons

Damaged and undamaged Shadow watermelons are hosts to *B. cucumis* as eggs were able to survive to pupate and to emerge as adults (Table 3). Puparia were recovered in each of 5 replicates from the damaged trial with a cumulative total of 6 571 puparia, and in 3 of 5 replicates in the undamaged trial with a cumulative total of 2 266 puparia. Control fruit (papaw) yielded high numbers of puparia with 1 924 and 1 186 puparia produced from the damaged and undamaged trials, respectively (Table 3).

Temperature fluctuated between 24 and 28 °C over 24 hours with 75% RH at 3pm (Table 4).

5.2.3 Gemini watermelons

Damaged and undamaged Gemini watermelons are hosts to *B. cucumis* as eggs were able to survive to pupate and to emerge as adults (Table 3). Puparia were recovered in each of 5 replicates from the damaged trial with a cumulative total of 1 060 puparia, and in 4 of 5 replicates in the undamaged trial with a cumulative total of 997 puparia. Control fruit (papaw) yielded high numbers of puparia with 1 470 and 1 286 puparia produced from the damaged and undamaged trials, respectively (Table 3).

Temperature fluctuated between 24 and 28 °C over 24 hours with 75 % RH at 3pm (Table 4).

Table 3: The number of *B. cucumis* puparia recovered for undamaged and damaged replicates from four watermelon varieties; Red Tiger, Shadow, Gemini and Baby-lee. Papaws were used as control host fruits in all replicates.

Test Fruit	Damaged Fruit			Undamaged Fruit		
	Date	No. puparia recovered	Adult eclosion	Date	No. puparia recovered	Adult eclosion
Red Tiger (1)	09.02.99	382	324	09.02.99	8	5
Red Tiger (2)	09.02.99	61	46	09.02.99	0	0
Red Tiger (3)	09.02.99	33	29	09.02.99	0	0
Red Tiger (4)	09.02.99	298	252	09.02.99	0	0
Red Tiger (5)	09.02.99	836	771	09.02.99	0	0
Red Tiger Control	**09.02.99**	**940**	**858**	**09.02.99**	**1064**	**980**
Shadow (1)	10.02.99	1288	1251	10.02.99	999	915
Shadow (2)	10.02.99	1516	1305	10.02.99	0	0
Shadow (3)	10.02.99	1808	1727	10.02.99	39	29
Shadow (4)	10.02.99	348	291	10.02.99	1228	1178
Shadow (5)	10.02.99	1611	1375	10.02.99	0	0
Shadow Control	**10.02.99**	**1924**	**1661**	**10.02.99**	**1186**	**1079**
Gemini (1)	11.02.99	27	22	11.02.99	0	0
Gemini (2)	11.02.99	239	224	11.02.99	118	101
Gemini (3)	11.02.99	545	486	11.02.99	40	39
Gemini (4)	11.02.99	73	70	11.02.99	834	815
Gemini (5)	11.02.99	176	144	11.02.99	5	5
Gemini Control	**11.02.99**	**1470**	**1209**	**11.02.99**	**1286**	**1121**
Baby-lee (1)	13.02.98	26	13	17.02.98	0	0
Baby-lee (2)	13.02.98	543	405	17.02.98	0	0
Baby-lee (3)	13.02.98	584	412	17.02.98	0	0
Baby-lee (4)	13.02.98	3	1	17.02.98	0	0
Baby-lee (5)	13.02.98	20	9	17.02.98	0	0
Baby-lee Control	**13.02.98**	**731**	**456**	**17.02.98**	**187**	**167**

5.2.4 Baby - lee Watermelons

Damaged Baby-lee watermelons are a host to *B. cucumis*. Pupae were recovered in each of 5 replicates with a cumulative total of 1 176 pupae (Table 3). A total of 731 pupae were produced from the control fruit.

Undamaged Baby-lee watermelons are not a host to *B. cucumis*. No pupae were recovered from the 5 replicates (Table 3). A total of 187 pupae were produced from the control fruit (papaw).

Temperature fluctuated between 24 and 28 °C over 24 hours with 75 % RH at 3pm, for both damaged and undamaged Baby-lee watermelon trials (Table 4).

Table 4: Temperature and humidity data for Controlled Temperature Rooms holding *B. cucumis* Host Status Testing experiments over a 24 hour period. Shown in order of variety.

Variety	Date	Temperature °C		Relative Humidity %RH (at 3pm)
		Minimum	Maximum	
Red Tiger	09.02.99	24	28	75
Red Tiger/Shadow	10.02.99	24	28	75
Shadow/Gemini	11.02.99	24	28	75
Gemini	12.02.99	24	28	75
Baby-lee	13.02.98	24	28	75
Baby-lee	14.02.98	24	28	75
Baby-lee	17.02.98	24	28	75
Baby-lee	18.02.98	24	28	75

5.3 Host Status Tests: *Bactrocera papayae*

5.3.1 Red Tiger Watermelons

Damaged and undamaged Red Tiger watermelons are hosts to *B. papayae* as eggs were able to survive to pupate and to emerge as adults (Table 5). A cumulative total of 201 puparia were recovered in each of 5 damaged replicates. Few puparia were produced in the undamaged trial with a cumulative total of 15 puparia from 2 replicates. Control fruit (which consisted of bananas for damaged trials and papaw for undamaged trials) yielded 226 and 492 puparia from the damaged and undamaged trials, respectively (Table 5).

Temperature fluctuated between 24°C and 28°C over 24 hours, with 70% RH at 3pm (Table 6).

5.3.2 Shadow Watermelons

Damaged Shadow watermelons are hosts to *B. papayae* (Table 5). Puparia were recovered in 3 of 5 replicates with a cumulative total of 518 puparia (Table 5). However, undamaged Shadow watermelons are not a host to *B. papayae* as no eggs laid survived to the pupal stage. Control fruit (bananas) yielded 321 and 403 puparia from the damaged and undamaged trials, respectively (Table 5).

Temperature fluctuated between 24 and 28 °C over 24 hours with 80% RH at 3pm (Table 6).

5.3.3 Gemini Watermelons

Damaged Gemini watermelons are host to *B. papayae* (Table 5). A cumulative total of 29 puparia were recovered in 2 of 5 replicates (Table 5). However, undamaged Gemini watermelons are not a host to *B. papayae* as no eggs laid survived to the pupal stage. Control fruit (bananas) yielded 721 and 972 puparia from the damaged and undamaged trials, respectively (Table 5).

Temperature fluctuated between 25 and 29 °C over 24 hours with 70 % RH at 3pm (Table 6).

Table 5: The number of *B. papayae* puparia and adults recovered from damaged and undamaged replicates of four watermelon varieties; Red Tiger, Shadow, Gemini and Baby-lee. Each control of host fruits consisted of bananas unless stated otherwise.

Test Fruit	**Damaged Fruit**			**Undamaged Fruit**		
	Date	**No. puparia recovered**	**Adult eclosion**	**Date**	**No. puparia recovered**	**Adult eclosion**
Red Tiger (1)	27.03.98	37	25	27.03.98	0	0
Red Tiger (2)	27.03.98	17	9	27.03.98	0	0
Red Tiger (3)	27.03.98	77	34	27.03.98	0	0
Red Tiger (4)	27.03.98	27	13	27.03.98	9	4
Red Tiger (5)	27.03.98	43	28	27.03.98	6	4
Red Tiger Control	**27.03.98**	**226**	**146**	**27.03.98**	**492 papaw**	**439**
Shadow (1)	04.03.98	312	179	04.03.98	0	0
Shadow (2)	04.03.98	201	154	04.03.98	0	0
Shadow (3)	04.03.98	0	0	04.03.98	0	0
Shadow (4)	04.03.98	0	0	04.03.98	0	0
Shadow (5)	04.03.98	5	3	04.03.98	0	0
Shadow Control	**04.03.98**	**321**	**113**	**04.03.98**	**403**	**342**
Gemini (1)	01.02.99	7	7	01.02.99	0	0
Gemini (2)	01.02.99	0	0	01.02.99	0	0
Gemini (3)	01.02.99	0	0	01.02.99	0	0
Gemini (4)	01.02.99	0	0	01.02.99	0	0
Gemini (5)	01.02.99	22	15	01.02.99	0	0
Gemini Control	**01.02.99**	**721**	**616**	**01.02.99**	**972**	**753**
Baby-lee (1)	13.02.98	0	0	17.02.98	0	0
Baby-lee (2)	13.02.98	0	0	17.02.98	0	0
Baby-lee (3)	13.02.98	6	4	17.02.98	0	0
Baby-lee (4)	13.02.98	1	1	17.02.98	0	0
Baby-lee (5)	13.02.98	22	12	17.02.98	0	0
Baby-lee Control	**13.02.98**	**148**	**89**	**17.02.98**	**497**	**400**

5.3.4 Baby - lee Watermelons

Damaged Baby-lee watermelons are hosts to *B. papayae* (Table 5). A cumulative total of 29 puparia were recovered in 3 of 5 replicates (Table 5). A total of 148 puparia were produced from the control fruit (bananas).

Temperature fluctuated between 23 and 25 °C over 24 hours with 68 % RH at 3pm (Table 6)

Undamaged Baby-lee watermelons are not hosts to *B. papayae*. There were no puparia recovered in any of 5 replicates (Table 5). A total of 497 puparia survived from the control fruit (bananas).

Temperature fluctuated between 25 and 26 °C over 24 hours with 68 % RH at 3pm (Table 6).

Table 6: Temperature and humidity data for Controlled Temperature Rooms holding *B. papayae* Host Status Testing experiments over a 24 hour period. Shown in order of variety.

Variety	Date	Temperature °C		Relative Humidity RH% (at 3pm each day)
		Minimum	Maximum	
Red Tiger	27.03.98	24	28	70
Red Tiger	28.03.98	24	28	70
Shadow	04.03.98	24	28	80
Shadow	05.03.98	24	26	80
Gemini	01.02.99	25	29	70
Gemini	02.02.99	25	29	70
Baby-lee	13.02.98	24	25	68
Baby-lee	14.02.98	24	25	68
Baby-lee	17.02.98	25	26	68
Baby-lee	18.02.98	25	26	68

6.0 DISCUSSION

The results of these experiments show that of the watermelon varieties Red Tiger, Shadow and Gemini, all are hosts for the cucumber fly (*B. cucumis*) under the conditions used in these experiments. Baby-lee watermelons however, were not infested and can be considered non-hosts for cucumber fly.

Red Tiger, Shadow and Gemini watermelons are all hosts to *B. cucumis* given that each variety produced survivors in damaged and undamaged replicates (Table 4). Infestation was variable but the high pupal recovery in some undamaged replicates indicates that each variety can be a host under these conditions to *B. cucumis*. In contrast, Baby-lee watermelons are a non-host to *B. cucumis* given that although

puparia were produced from the damaged replicates, undamaged replicates remained free from infestation. While there is no immediate explanation for host status to be variety dependent, it is likely to be a result of fruit characteristics such as skin thickness, hardness or fruit ripeness, which is an influencing factor for a variety of other cultivars (Armstrong, 1994).

This research proved successful in obtaining non-host status for watermelons of the Baby-lee variety to *B. cucumis*. Current restrictions on the export of Red Tiger, Shadow, and Gemini watermelons to New Zealand will remain, however presentation of these data to the NZMAF may allow this variety to be exported without further treatment.

For *B. papayae*, the variety Red Tiger was found to be a host. However Gemini, Shadow and Baby-lee watermelons are non-hosts only being infested when fruit was damaged.

Since *B. papayae* was eradicated from North Queensland during the life of this project it is no longer considered a quarantine risk by New Zealand authorities. These data are still important in that should similar exotic incursions affect Queensland in future, the current host status list may indicate target commodities for research, and subsequent re-opening of export markets for those commodites, with less delay. It has also provided comparative data between *B. papayae* and *B. cucumis*, where the majority of influencing variables have been the uniform.

7.0 REFERENCES:

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