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## The effectiveness of some plant extracts and insecticides for control thrips (Thysanoptera : Thripidae) in pummelo cv. Tubtimsiam

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**Abstract** The main problems in pummelo qualitative production are thrips, that destroy young leaves, flowers and young fruits. The damage was found that fine leaf margins roll upward bend on both sides, brown marks leaves. If the outbreak occurs during young fruit stage, it may cause fruit-retarded, rough scarring on fruit surface. The efficiency of the different insecticides was done using neem and tobacco extracts, petroleum oil, the mix of these substances as an alternative treatments to replace synthetic insecticides. The experiment was conducted in 4-5 years old trees at Tubtimsiam pummelo plantation in Nakhon Si Thammarat Province. The result showed that the highest effectiveness was abamectin 98.67%, and followed by imidacloprid, petroleum oil mix tobacco, petroleum oil mix neem extract (azadirachtin 0.1%), neem extract (azadirachtin 0.1%), petroleum oil, tobacco and water spraying, was giving 95.54 89.53 88.14 86.14 84.56 77.19 and 76.69 % respectively, compared with non-treated control. The average percentage of leaf damage after application treatment at 7, 14 and 21 days were found that all treatments were significant differences from non-treated leaf damage.

**Keywords:** neem, petroleum oil, abamectin, imidacloprid

### Introduction

Tubtimsiam Pomelo is the local fruits of Pakpanang, Nakhon Si Thammarat, Thailand, that one of the well-known and economically important pomelo for domestic consumption and exporting (DOA, 2013), it also has been registered for geographical indication that Pakpanang basin is the one and the only source of “Tubtimsiam Pakpanang” (DOAE, 2013). For the commercial pomelo fruits, these should have big round fruit with knot, smooth green skin with the tiny oil glands, thin pink peel with tight row of small pink to red shrimp-like flesh, juicy and sour-sweet taste and dark green leaves cover with soft hair (Sukkaard, 2010). Fruits weight average were 1,800-2,000 g. The Tubtimsiam Pomelo’s demand has been gradually and continuously increasing in the domestic and international

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markets such as China, Taiwan, Malaysia, Brunei and Singapore (DOAE, 2013). The problem of qualitative production are the pest. Thrips is the important insect pest, for Tubtimsiam pomelo production that severe damage on young fruit, young shoot and young leaves. Thrips feeding severe on developing fruit initiation damage after petal loosing which make grey scarring or bleaching, fruit retarded, disfigure and distorted fruits. On the young leaf, the damage were disfigure leaf such as small, narrow, rough and distort leaf. Thrips epidemic on the pomelo orchard all the year, the time for epidemic depend on shooting leaf and setting fruit, especially at the time when hot and long dry period. Therefore, it is necessary to study the effectiveness for controlling thrips, that useful for the farmer orchard in Pakpanang district.

### Materials and methods

The testing was conducted on 4-5 years Tubtimsiam pomelo farmer's orchard in Pakpanang, Nakhon Si Thammarat province, Thailand. Randomized Complete Block Design (RCBD) was performed with 9 treatments, 4 replications (1 tree / replication). Random sampling was used and knocked off the thrips from young shoots on the white plate with 15 young shoots per tree. If the outbreak of thrips was occurred, when the young shoots were damaged, disfigure leaf such as small, narrow, rough and distort leaf, more than 50% of the sampling shoots /tree/orchard, the insecticides were treated by preparing insecticides at recommended dose and non-treated control as follows:-

|    |   |                 |
|----|---|-----------------|
| T1 | tobacco extract (3%)  | 600 g.          |
| T2 | Thai neem extract (aza. 0.5%)                               | 100 ml.         |
| T3 | petroleum oil 83.9% EC                                      | 40 ml.          |
| T4 | imidacloprid 10% SL   | 10 ml.          |
| T5 | Abamectin 10% SL  | 20 ml.          |
| T6 | petroleum oil 83.9% EC 40 ml. + tobacco extract (3%)        | 600 g. :<br>P+T |
| T7 | petroleum oil 83.9% EC 40 ml.+Thai neem extract (aza. 0.5%) | 100 ml. :P+TN   |
| T8 | water spraying (every 3 days)                               |                 |
| T9 | non-treated control   |                 |

The thrips damage was recorded on the young leave stage. The assessment level of leaf damage percentage was done as Assessment level of leaf damage percentage: Full scar rought on the leaf surface = 100%, 3 out of 4 scar rought on the leaf surface = 75%, 2 out of 4 scar rought on the leaf surface = 50%, 1 out of 4 scar rought on the leaf surface = 25%.

The number of thrips and a young leaf damage before spraying and after spraying once a week for 3 times were recorded.

The collected data were analyzed statistically for analysis of variance to determine the significant difference among the treatment and Duncan's Multiple Rang Test (DMRT) were used to differentiate of treatment means. The effectiveness of methods at the last spray compared with the non-treated control were calculated by Henderson and Tilton's formula (Henderson and Tilton, 1995).

Effectiveness of methods(%) =  $\frac{C_2 T_1 - C_1 T_2}{C_2 T_1} \times 100$  , where

$C_1$  and  $C_2$  : Numbers of thrips per shoot before and after spray in non treated control

$T_1$  and  $T_2$  : Numbers of thrips per shoot before and after spray in each methods

## Results

### *Mean number of thrips per shoot before and after spray in demonstration orchard*

The results showed the mean number of thrips per shoot of all methods were not significant difference from the non-treated control, with the mean number of thrips were 3.57-4.55 thrips per shoot (Table 1). After 7 days of the first spray, the mean numbers of thrips was found that the non-treated control was the highest numbers of thrips (3.87 thrips per shoot), followed by water spray (2.47 thrips per shoot), which not significant difference from the non-treated control. For tobacco 3%, Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC, imidacloprid 10%SL, abamectin10% SL, petroleum oil 83.9% EC + tobacco (3%): P+T, petroleum oil 83.9% EC +Thai neem extract (aza. 0.5%); P+TN resulted the numbers of thrips were 2.33 1.94 1.18 1.19 1.29 1.47 and 1.38 thrips per shoot, respectively, which significantly different from non-treated control. After the second spray, the average numbers of thrips was found that the non-treated control was the highest numbers of thrips (3.04 thrips per shoot), followed by tobacco3%, Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC , imidacloprid 10%SL, abamectin10% SL, P +T , P +TN and water spraying which the numbers of thrips were1.52 1.37 0.97 0.67 0.62 1.07 1.05 and 1.51 thrips per shoot, respectively. After the third second spray, the average numbers of thrips was found that the non-treated control which was the highest numbers of thrips (3.35 thrips per shoot), followed by tobacco3%, Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC, imidacloprid 10%SL, abamectin10% SL, P +T, P +TN and water spraying, which the

numbers of thrips were 0.73 0.44 0.49 0.14 0.05 0.39 0.42 and 0.75 thrips per shoot, respectively.

The effective treatment after the last spray were abamectin 10% SL followed by imidacloprid 10%, P +TN , P +T, Thai neem extract (aza. 0.5%), petroleum oil 83.9% EC, tobacco (3%) and water spraying, with 95.54 89.53 88.14 86.14 84.56 77.19 and 76.69 % , respectively.

**Table 1.** Mean number of thrips per shoot before and after spray at various interval and the effectiveness of treatment (%) after the last spray compared with control (non-treated)

| Treatment  | Mean number of thrips / shoot <sup>1/</sup> |                    |                   |                   | effectiveness after the last spray (%) |
|--|---|--------------------|-------------------|-------------------|--|
|  | before spray <sup>2/</sup>                  | 7 days after spray |                   |                   |  |
|  |   | 1 <sup>ST</sup>    | 2 <sup>nd</sup>   | 3 <sup>rd</sup>   |  |
| T1: tobacco extract (3%) 600 g.  | 3.63  | 2.33 <sup>b</sup>  | 1.52 <sup>b</sup> | 0.73 <sup>b</sup> | 77.19                                  |
| T2: Thai neem extract (aza. 0.5%) 100 ml.  | 3.60  | 1.94 <sup>b</sup>  | 1.37 <sup>b</sup> | 0.44 <sup>b</sup> | 86.14                                  |
| T3: petroleum oil 83.9% EC 40 ml.  | 3.60  | 1.18 <sup>b</sup>  | 0.97 <sup>b</sup> | 0.49 <sup>b</sup> | 84.56                                  |
| T4: imidacloprid 10% SL10 ml.  | 3.57  | 1.19 <sup>b</sup>  | 0.67 <sup>b</sup> | 0.14 <sup>b</sup> | 95.54                                  |
| T5: abamectin10% SL 20 ml.   | 4.27  | 1.29 <sup>b</sup>  | 0.62 <sup>b</sup> | 0.05 <sup>b</sup> | 98.67                                  |
| T6: P +T ; petroleum oil 83.9% EC 40 ml. + tobacco extract (3%) 600 g.           | 3.73  | 1.47 <sup>b</sup>  | 1.07 <sup>b</sup> | 0.39 <sup>b</sup> | 88.14                                  |
| T7: P +TN ; petroleum oil 83.9% EC 40 ml. +Thai neem extract (aza. 0.5%) 100 ml. | 4.55  | 1.38 <sup>b</sup>  | 1.05 <sup>b</sup> | 0.42 <sup>b</sup> | 89.53                                  |
| T8: water spraying   | 3.65  | 2.47 <sup>ab</sup> | 1.51 <sup>b</sup> | 0.75 <sup>b</sup> | 76.69                                  |
| T9: control (non-treated)  | 3.80  | 3.87 <sup>a</sup>  | 3.04 <sup>a</sup> | 3.35 <sup>a</sup> | -                                      |
| F-test   | ns  | **                 | **                | **                |  |
| C.V.(%)  | 26.38                                       | 38.17              | 43.38             | 54.42             |  |

<sup>1/</sup> average from 4 replications, ns non-significantly (p>0.05) \*\* significantly different (P<0.01)

<sup>2/</sup> number in the column with same letters not significantly different (p>0.05)

<sup>3/</sup> Effectiveness of methods(%) =  $\frac{C_2 T_1 - C_1 T_2}{C_2 T_1} \times 100$  (Henderson and Tilton, 1995)

C<sub>1</sub> and C<sub>2</sub> : Numbers of thrips per shoot before and after spray in non-treated control

T<sub>1</sub> and T<sub>2</sub> : Numbers of thrips per shoot before and after spray in each treatment

***The percentage of leaf damage before and after spray in demonstration orchard***

The study of leaf damage from thrips before sprayed, the result showed that the leaf damage all methods were not significantly different from the non-treated control, the average of leaf damage were 10.10-13.58 % per shoot. After the first spray, the average of leaf damage was found that the non-treated control was the highest damage of 12.52 % per shoot. The leaves were damaged by water spraying and tobacco 3% were 10.51 and 10.43 %, respectively when compared to the non-treated control.

**Table 2.** The average percentage of leaf damage per shoot before and after spray at various interval and the effectiveness of treatment (%) after the last spray compared with non-treated control

| Treatment  | percentage of leaf damage per shoot |                     |                    |                    | effectiveness after the last spray (%) |
|--|-------------------------------------|---------------------|--------------------|--------------------|--|
|  | before spraying<br>2/               | 7 days after spray  |                    |                    |  |
|  |                                     | 1 <sup>st</sup>     | 2 <sup>nd</sup>    | 3 <sup>rd</sup>    |  |
| T1: tobacco extract (3%) 600 g.  | 12.80                               | 10.43 <sup>ab</sup> | 6.47 <sup>b</sup>  | 3.38 <sup>b</sup>  | 67.13                                  |
| T2: Thai neem extract (aza. 0.5%)<br>100 ml.   | 11.41                               | 8.67 <sup>bc</sup>  | 5.75 <sup>b</sup>  | 2.73 <sup>bc</sup> | 70.21                                  |
| T3: petroleum oil 83.9% EC 40 ml.  | 10.28                               | 7.68 <sup>c</sup>   | 5.37 <sup>b</sup>  | 2.67 <sup>bc</sup> | 67.67                                  |
| T4: imidacloprid 10% SL 10 ml.   | 11.10                               | 7.65 <sup>c</sup>   | 3.46 <sup>b</sup>  | 1.10 <sup>cd</sup> | 87.77                                  |
| T5: abamectin 10% SL 20 ml.  | 13.16                               | 7.51 <sup>c</sup>   | 3.89 <sup>b</sup>  | 0.42 <sup>d</sup>  | 96.12                                  |
| T6: P +T<br>; petroleum oil 83.9% EC 40 ml.<br>+ tobacco extract (3%) 600 g.               | 12.08                               | 8.08 <sup>bc</sup>  | 4.78 <sup>b</sup>  | 2.21 <sup>bc</sup> | 77.22                                  |
| T7 : P +TN<br>; petroleum oil 83.9% EC 40 ml.<br>+Thai neem extract (aza. 0.5%)<br>100 ml. | 12.25                               | 8.13 <sup>bc</sup>  | 4.51 <sup>b</sup>  | 2.55 <sup>bc</sup> | 74.19                                  |
| T8: water spraying   | 12.76                               | 10.51 <sup>ab</sup> | 6.89 <sup>ab</sup> | 4.00 <sup>b</sup>  | 60.94                                  |
| T9: control (non-treated)  | 13.58                               | 12.52 <sup>a</sup>  | 10.33 <sup>a</sup> | 10.90 <sup>a</sup> | -                                      |
| F-test   | ns                                  | **                  | **                 | **                 |  |
| C.V.(%)  | 15.84                               | 13.68               | 32.32              | 27.01              |  |

<sup>1/</sup>average from 4 replications, ns non-significantly (p>0.05) \*\* significantly different (P<0.01)

<sup>2/</sup>number in the column with same letters not significantly different (p>0.05)

<sup>3/</sup>Effectiveness of methods(%) =  $\frac{C_2 T_1 - C_1 T_2}{C_2 T_1} \times 100$  (Henderson and Tilton, 1995)

C<sub>1</sub> and C<sub>2</sub> : Percentage of leaf damage per shoot before and after spray in non-treated control

T<sub>1</sub> and T<sub>2</sub>: Percentage of leaf damage per shoot before and after spray in each treatment

Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC, imidacloprid 10%SL, abamectin10%SL, P +T , P +TN showed the average leaf damage of 8.67 7.68 7.65 7.51 8.08 and 8.13%, respectively. After the second spray, the average of leaf damage was found that the non-treated control which the highest damage of 10.33 % per shoot, and the leaf damage of water spraying was 6.89%. Tobacco (3%) ,Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC, imidacloprid 10%SL, abamectin10% SL, P +T and P +TN showed the average of leaf damage were 6.47 5.75 5.37 3.46 3.89 4.78 and 4.51 %, respectively, significantly different from non-treated control. After the third spray, the average of leaf damage was found that the non-treated control was the highest damage of 10.90 % per shoot. For water spraying, tobacco (3%), Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC , imidacloprid 10%SL, abamectin10% SL, P +T and P +TN revealed the averaged leaf damage of 4.00 3.38 2.73 2.67 2.21 2.55 1.10 and 0.42 %, respectively, significantly different from non-treated control. The effective treatment after the last spray were abamectin10% SL (96.12%) followed by imidacloprid 10%, P +TN, P +T, Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC, tobacco (3%) and water spraying were 87.77 77.22 74.19 70.21 67.67 67.13 and 60.94 %, respectively, compared with non-treated control (Table 2).

## Discussion

Result showed that the effective treatment to control thrips after the last spray were abamectin10%SL, followed by imidacloprid 10%, petroleum oil 83.9% EC +Thai neem extract (aza. 0.5%), petroleum oil 83.9% EC + tobacco (3%), Thai neem extract (aza. 0.5%), petroleum oil 83.9%EC, tobacco (3%) and water spraying. Application plant extracts petroleum oil and insecticide treatments were less number of thrips and the average percentage of leaf damage than water spraying. Ngampongsai (2006) studied on the thrips outbreak and damage on mangosteen in the southern of Thailand. The study found that spraying water on the canopy every 2-3 days interval could not significantly reduce rough scar on fruit surface as compared to insecticide imidacloprid, but significantly differently ( $P < 0.01$ ) compared to control. Sukkarom *et al.* (2010) found that using chemical substance such as abamectin, imidacloprid and oil substance could control citrus insect pest and affect to quality on the leaf and fruit surface. The chemical substances made significantly lower symptom level and

damage quality from canker disease insect pest such as thrips, red mites, scale insect than water spraying. Wu *et al.* (2005) reported that the chemical control was effective control measures and their continue used that faced negative effect to the natural biological system and led to dramatic resurgences in insect pest outbreak. Xiao *et al.* (2011) reported that some species of thrips, *Scirtothrips dorsalis* was developed resistance against chemical pesticides such as monocrotophos, dimethoate etc. So that, the alternative method with non-chemical is the good way to replace synthetics insecticides by integrated pest management could reduce insect resistance and toxic pollution in environment . Sukkarom *et al.* (2010) reported that insect pest control with a wrap, traps and integrated with chemicals affected to increase the quality of harvested pomelo.

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