Insecticidal Effectiveness of Compounds from *Mammea siamensis* Kost. Against *Musca domestica* Linn.

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Abstract

Insecticidal substances from dried seeds of *Mammea siamensis* Kost. extracted with dichloromethane and fractionated by TLC were investigated. The bioassay was done in laboratory to test for the insecticidal efficiency of those fractions to the egg, maggot, pupae, and adult of the house fly, *Musca domestica* (Linn.). The crude extract of *M. siamensis* was separated by TLC on a silica plate with toluene: ethylacetate (80:20) as mobile phase into 8 fractions. The fractions with $R_f \cong 0.61$ and $R_f \cong 0.96$ tended to express insecticidal affects to the egg of the insect. A total of 61.11% of the eggs did not develop into maggots. However, there was no significant difference among these studied fractions. The $R_f = 0.96$ fractions showed the best average number of 30 % of pupae which did not develop to adults. The $R_f \cong 0.96$ and $R_f \cong 0.14$ showed 51.67 % and 45.00 % mortality in to the adult after 4 h. The $R_f = 0.14$ and $R_f = 0.96$ were re-purified by TLC using mobile phase of toluene: ethylacetate (93:7) and tested for insecticidal efficiency on the adult. The $R_f = 0.32$ (from $R_f = 0.14$) and the $R_f = 0.52$ (from $R_f = 0.96$) expressed the average number of 90 % and 95 % mortality, respectively, in 4 h.

INTRODUCTION

Botanical insecticides are useful against several insect pests in yards and gardens such as ants, aphids, beetles, caterpillars, cockroaches, fleas, flies, leafhoppers and mosquitoes. Nicotine, from the tobacco plant and azadirachtin from the neem plant are some examples of the botanical insecticide (Stoll, 1988). Pyrethrum, derived from the chrysanthemum, is another (Klass and Sheavly, 1993). The advantage of using these insecticides is that they break down into nontoxic compounds within hours or days when exposed to sunlight. The potential of these chemicals to contaminated groundwater is less than that of some synthetic insecticides.

MATERIALS AND METHODS

Plant Extract

Seeds of *M. siamensis* were dried at 50–60 °C for 72 hours and ground. 100 g of seedpowder was extracted with 250 ml of dichloromethane and evaporated by rotary evaporator to obtain the crude extract (Diagram 1).

Test for Insecticidal Activity

The tested insects, house flies were propagated and fed at every stage i.e. egg, maggot, pupae and adult at the Department of Biology, Faculty of Science, Chiang Mai University.

Different compounds were separated from the crude extract of *M. siamensis* by thin layer chromatography (TLC). 0.25 g of different bands of the compounds on TLC were crushed, dissolved in 5 ml of 10 % acetone and sprayed on all of the studied stages of the house fly.

The mortality of egg and pupae were observed when 60 % of the control had developed to the next stage. Data of the maggots were observed 1 day after the

application and data of the adults were collected 45 mins, 2 hours and 4 hours after application.

Three replications were carried out for each band. Each replication consisted of 30 insects.

Data Analysis

Data was analysed to compare the difference among the isolated compounds by the Completely Randomized Design (CRD) and the Least Significant Difference (LSD).

RESULTS AND DISCUSSION

M. siamensis compounds with $R_f \cong 0.61$ and $R_f \cong 0.96$ tended to express the insecticidal efficiency to the eggs of the insect, 61.11 % of the eggs did not develop into maggots. However, there was no significant difference of the isolated bands on the egg (Table 1). Kongtrakul (2000) and Sungvaranon (1995) mentioned that there were many factors which could effect the eggs of house flys, such as temperature and humidity. These could vary the efficacy of different bands.

None of the bands was toxic to the maggot. Pornpimol (1999) compared two methods to injure the maggot of house fly by synthetic pyrethroid. Feeding them with a mixture of the active substances gave a higher percentage of mortality than by spraying them directly.

The $R_f \cong 0.96$ fraction showed the best result to the pupae, 30.00 % of them did not develop into adults (Table 1). The efficiency of this fraction showed highly significant difference ($\propto<0.01$).

The $R_f \cong 0.96$ and $R_f \cong 0.14$ fractions showed significant difference ($\propto<0.01$) with 51.67 % and 45.00 % mortality respectively in the adult within 4 hours (Table 2 and Figure 1). These two active fractions were then re-purified by TLC and tested for the insecticidal efficiency on the adult again. The $R_f \cong 0.32$ (from $R_f \cong 0.14$) and the $R_f \cong 0.52$ (from $R_f \cong 0.96$) gave 90 % and 95 % mortality respectively in 4 hours (Table 3, Figure 2 and Table 4, Figure 3) with highly significant difference ($\propto<0.01$).

From the results the compounds in the seeds of *M. siamensis* clearly expressed the insecticidal property. Balza (1989) indicated that the proanthocyanidin polymers were the piscicidal constituents in the leaves of *M. siamensis*, but the compounds from the seeds were not mentioned.

Moreover, this result corresponded to that reported by Plank (1944). He found that the powder of *M. siamensis* seed soaked in gasoline for 24 hours was very toxic to the adult house fly. However, the active compounds or the R_f of the bands separated by chromatography were not investigated.

CONCLUSION

Seeds of *M. siamensis* showed the insecticidal properties. The active compound against the pupae of house fly was from the fraction of $R_f \cong 0.96$, separated by TLC with silica gel G_{60} and the mobile phase of toluene: ethylacetate = 80:20. The $R_f \cong 0.32$ and $R_f \cong 0.52$ fractions separated by the mobile phase of toluene : ethylacetate = 93: 7 gave the highest percentage mortality in the adult house fly.

Literature Cited

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Tables

Table 1. Average and standard deviation (SD) of the percentage mortality of egg, maggot and pupae by different bands.

Bands	Egg		Maggot		Pupae	
	Average	SD	Average	SD	Average	SD
Band 1 ($R_f \cong 0.03$)	51.11	25.24	0.00	0.00	0.00 a	0.00
Band 2 ($R_f \cong 0.14$)	48.89	12.64	0.00	0.00	0.00 a	0.00
Band 3 ($R_f \cong 0.32$)	56.67	15.27	1.11	1.92	0.00 a	0.00
Band 4 ($R_f \cong 0.51$)	52.22	8.39	0.00	0.00	16.67 b	11.55
Band 5 ($R_f \cong 0.61$)	61.11	20.09	0.00	0.00	6.67 ab	11.55
Band 6 ($R_f \cong 0.71$)	43.33	31.80	0.00	0.00	5.56 ab	9.62
Band 7 ($R_f \cong 0.78$)	32.22	41.68	0.00	0.00	6.67 ab	5.77
Band 8 ($R_f \cong 0.96$)	61.11	20.09	0.00	0.00	**30.00 c**	6.67
Control	36.67	23.33	0.00	0.00	0.00 a	0.00

Table 2. Average and standard deviation (SD) of the percentage mortality of adult in different time by different bands.

Bands	45 minutes		2 hours		4 hours	
	Average	SD	Average	SD	Average	SD
Band 2 ($R_f \cong 0.14$)	**31.67 c**	2.35	**36.67 c**	0.00	**45.00 c**	2.36
Band 4 ($R_f \cong 0.51$)	21.67 b	2.35	25.00 b	2.36	36.67 b	0.00
Band 5 ($R_f \cong 0.61$)	1.67 a	2.35	5.00 a	2.36	6.67 a	0.00
Band 8 ($R_f \cong 0.96$)	**31.67 c**	2.35	**45.00 d**	2.36	**51.67 d**	2.36
Control	1.67 a	2.35	3.33 a	0.00	6.67 a	0.00

Table 3. Average and standard deviation (SD) of the percentage mortality of adult by separated bands from band 2 ($R_f \cong 0.14$).

Bands	45 minutes		2 hours		4 hours	
	Average	SD	Average	SD	Average	SD
Band 1 ($R_f \cong 0.27$)	30.00 bc	14.14	40.00 bc	0.00	50.00 c	0.00
Band 2 ($R_f \cong 0.32$)	**85.00 d**	7.07	**90.00 d**	0.00	**90.00 d**	0.00
Band 3 ($R_f \cong 0.42$)	40.00 c	14.14	60.00 c	28.28	75.00 d	21.21
Band 4 ($R_f \cong 0.48$)	25.00 abc	7.07	30.00 ab	0.00	45.00 bc	7.07
Band 5 ($R_f \cong 0.97$)	15.00 ab	7.07	20.00 ab	0.00	25.00 ab	7.07
Control	5.00 a	7.07	10.00 a	0.00	20.00 a	0.00

Table 4. Average and standard deviation (SD) of the mortality of adult at different times by separated bands from band 8 ($R_f \cong 0.96$)

Bands	45 minutes		2 hours		4 hours	
	Average	SD	Average	SD	Average	SD
Band 1 ($R_f \cong 0.14$)	25.00 a	7.07	30.00 a	0.00	35.00 b	7.07
Band 2 ($R_f \cong 0.52$)	**85.00 b**	21.21	**90.00 b**	14.14	**95.00 c**	7.07
Band 3 ($R_f \cong 0.94$)	10.00 a	14.14	15.00 a	7.07	25.00 ab	7.07
Control	0.00 a	0.00	10.00 a	0.00	15.00 a	7.07

Figures

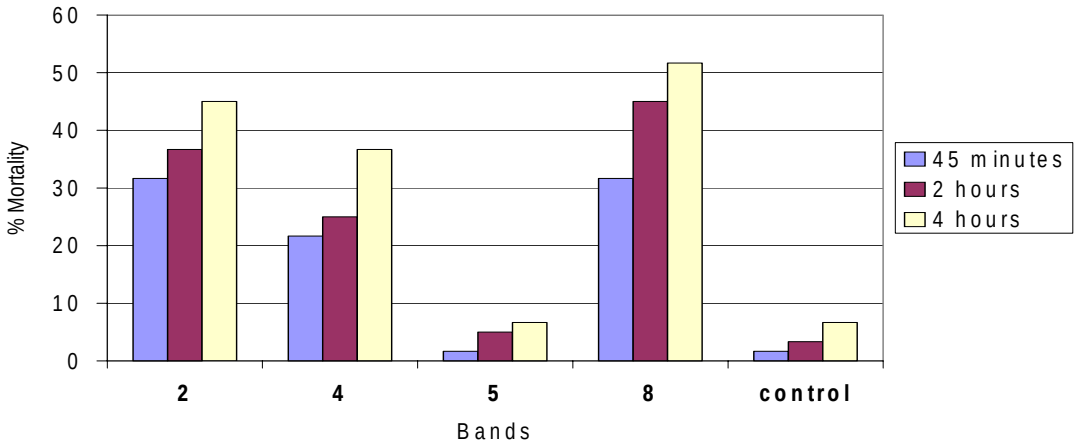


Fig. 1. Percentage mortality of adult by band 2, 4, 5 and 8.

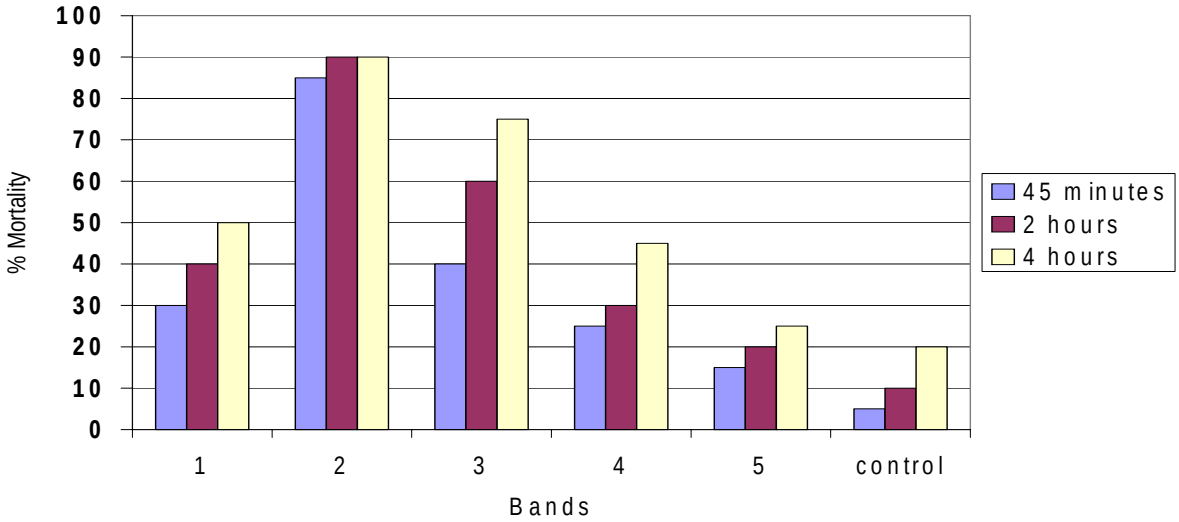


Fig. 2. Percentage mortality of adult by separated bands from band 2.

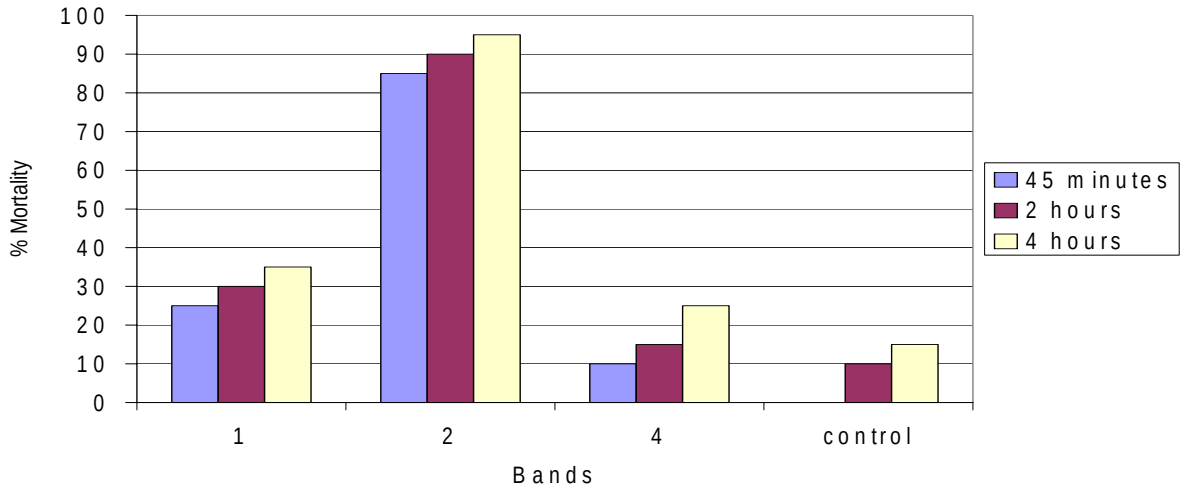
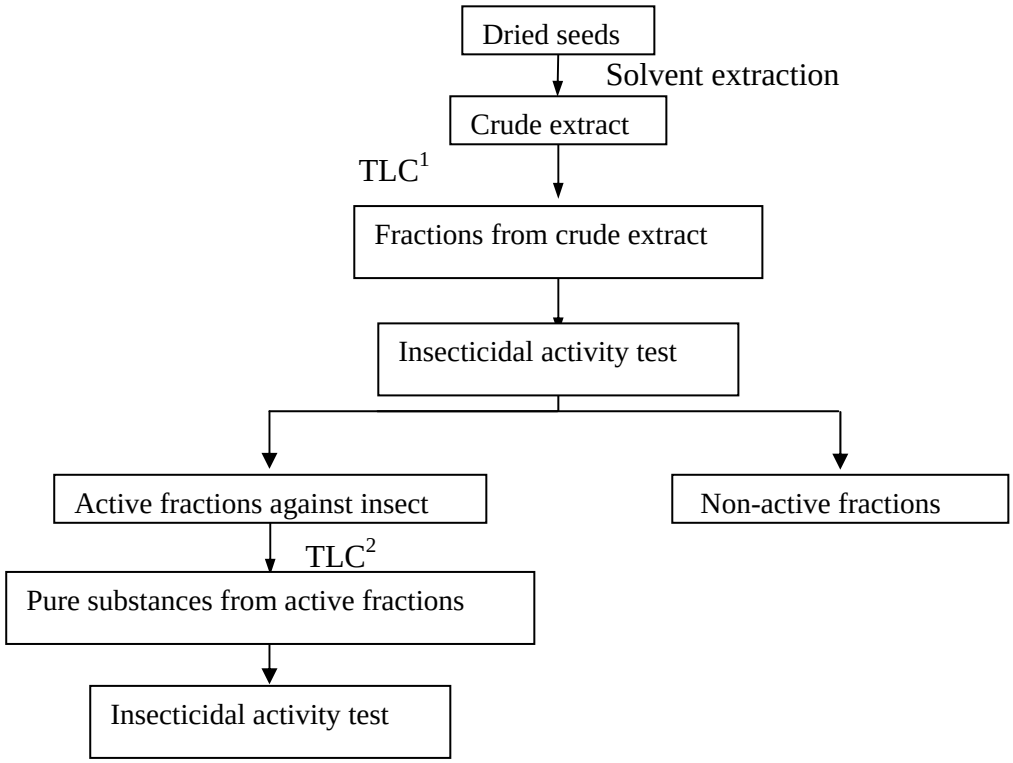


Fig. 3. Percentage mortality of adult by separated bands from band 8.



TLC
Stationary phase : silica gel G_{60}
Mobile phase of TLC^1 : Toluene : Ethylacetate = 80:20
Mobile phase of TLC^2 : Toluene : Ethylacetate = 93: 7

Diagram 1. Seed extraction procedure.