5. 2 +

PROGRESS REPORT NO. 6

NATURAL INSECTICIDES FOR *SPODOPTERA LITURA* FABR.

A RESEARCH PROJECT

USAID/PSTC PROGRAM

GRANT NO. 936-5542-G-00-5032-00

SUBMITTED BY

PICHAET WIRIYACHITRA

CHIANG MAI UNIVERSITY

CHIANG MAI, THAILAND

PROJECT PROFILE

Country	:	Thailand
Grant No.	:	936-5542-G-00-5032-00
Program	:	Program on Science and Technology Cooperation
Project Title	:	Natural Insecticides for *Spodoptera litura* Fabr.
Project Leader	:	Pichaet Wiriyachitra
Organization	:	Chiang Mai University
Co-investigator	:	Prachaval Sukumalanand
Total Project Budget	:	US $ 150,000
Project Duration	:	4 years
Reporting Period	:	1 June 1988 to 31 January 1989

A

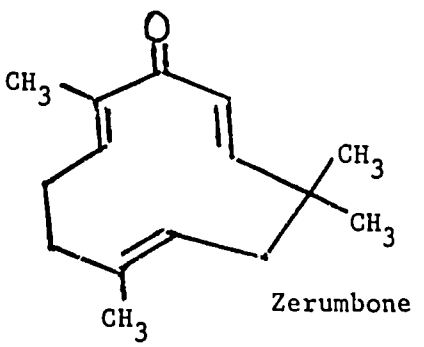
Background

In our earlier report, the steam distillates of Zingiber zerumbet was found to posses contact insecticidal activity. Since this plant is common and can be easily cultivated in Thailand, attempt has been made to further evaluate its applicability for insect control.

Zingiber zerumbet

Result and Discussion

Steam distillation of 4 kg of the tubers gave 83.25 g of cloudy oil (~ 2%). Upon standing the oil at 5°C, colourless glittering crystals formed. Spectroscopic and physical data revealed that the crystalline substance is zerumbone.



Zerumbone

Comparison of the activities of various fractions obtained from this plant indicated that zerumbone is the (or one of the) active ingredient.

Since only a moderate yield of the oil was obtained from the steam distillation, a more convenient and economical method of obtaining the active substances had to be developed.

In view of the fact that the final spraying insecticidal solutions is most convenient in the aqueous solution containing a surfactant to facilitate the spreading of the solution over the surface of target plant leaves, the spraying solutions from Z. zerumbet was then prepared by grinding the Z. zerumbet tubers in an aqueous solution containing various concentrations of sodium lauryl sulphate (SLS).

The first spraying was performed on broccoli released with 20 third instar S. litura's larvae. Three replications were used for each concentration. Broccoli leaves were sprayed until the solution started running off. Observation was made 3 hours after spraying, and the result is shown in Table 1.

Table 1. Effect of Z. zerumbet solution on S. litura larvae.

Dose	% survival
Wt. of Z. zerumbet : Wt. of H_2O (% SLS)	
1 : 4 (1)	16
1 : 3 (1)	10
1 : 2 (1)	9
0 : 0 (1)	33

Since the activity varies significantly with the proportion of the plant material to the aqueous solution, additional attempts were made to further determine the optimum proportion. Spraying was performed on broccoli released with 30 S. litura third instar larvae. Three replications were used for each formulation. The result is shown in Table 2.

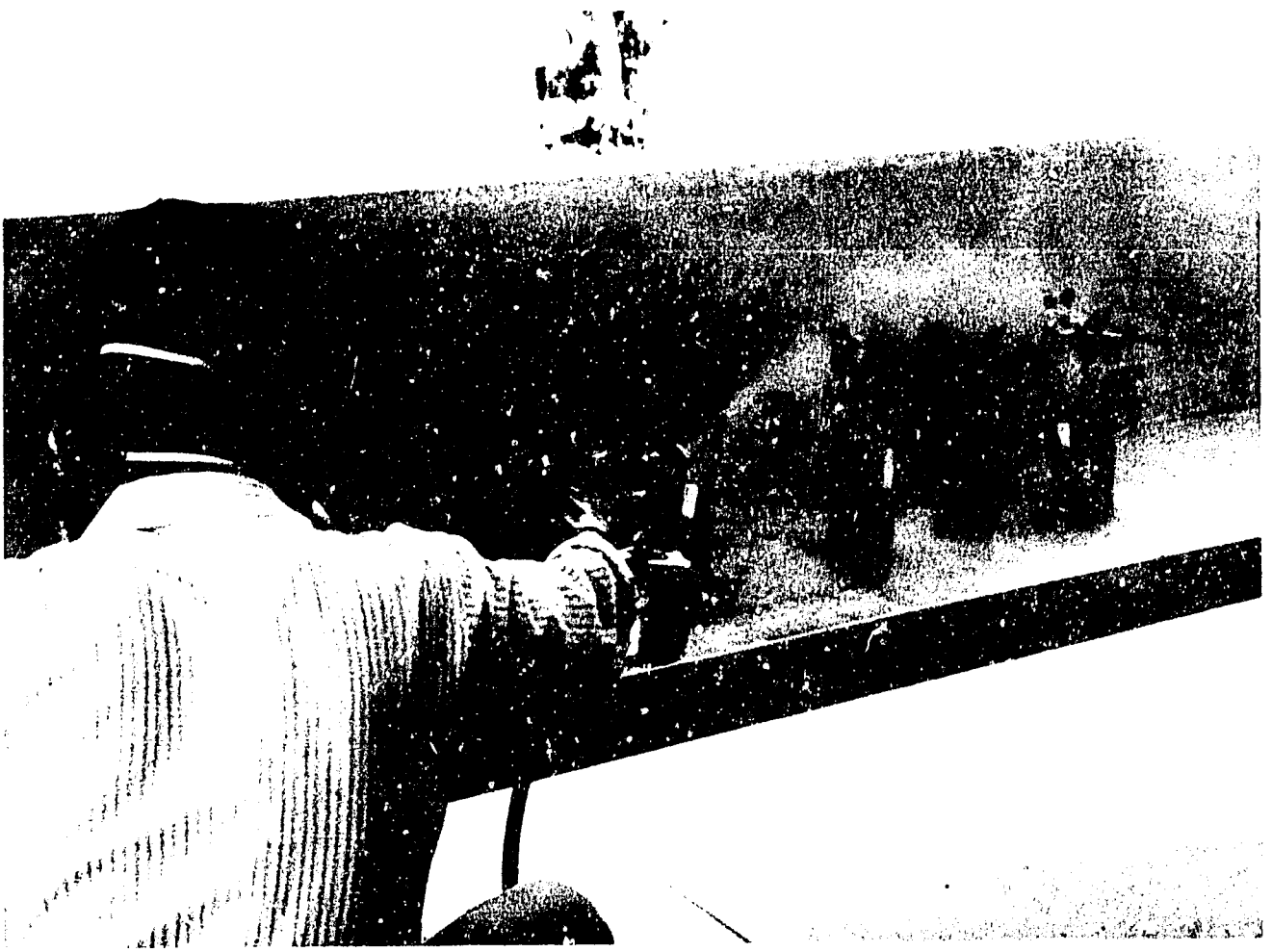
Table 2. The effect on *Z. zerumbet* solution on *S. litura* larvae.

Dose	% survival		
Wt. of *Z. zerumbet* : Wt. of H_2O (% SLS)	15 hr	24 hr	48 hr
1 : 4 (2)	3.33	3.33	4.17
1 : 3 (2)	4.17	7.50	8.33
0 : 0 (2)	15.83	14.17	12.50
1 : 4 (1)	6.67	5.85	5.83
1 : 3 (1)	3.33	4.17	1.67
1 : 2 (1)	5.00	5.83	6.67
0 : 0 (1)	24.17	17.50	20.00
- - - - -	- - -	- - -	- - -
1 : 2 (0.25)	10.00	11.67	6.67
1 : 2 (0.50)	4.17	2.50	2.50

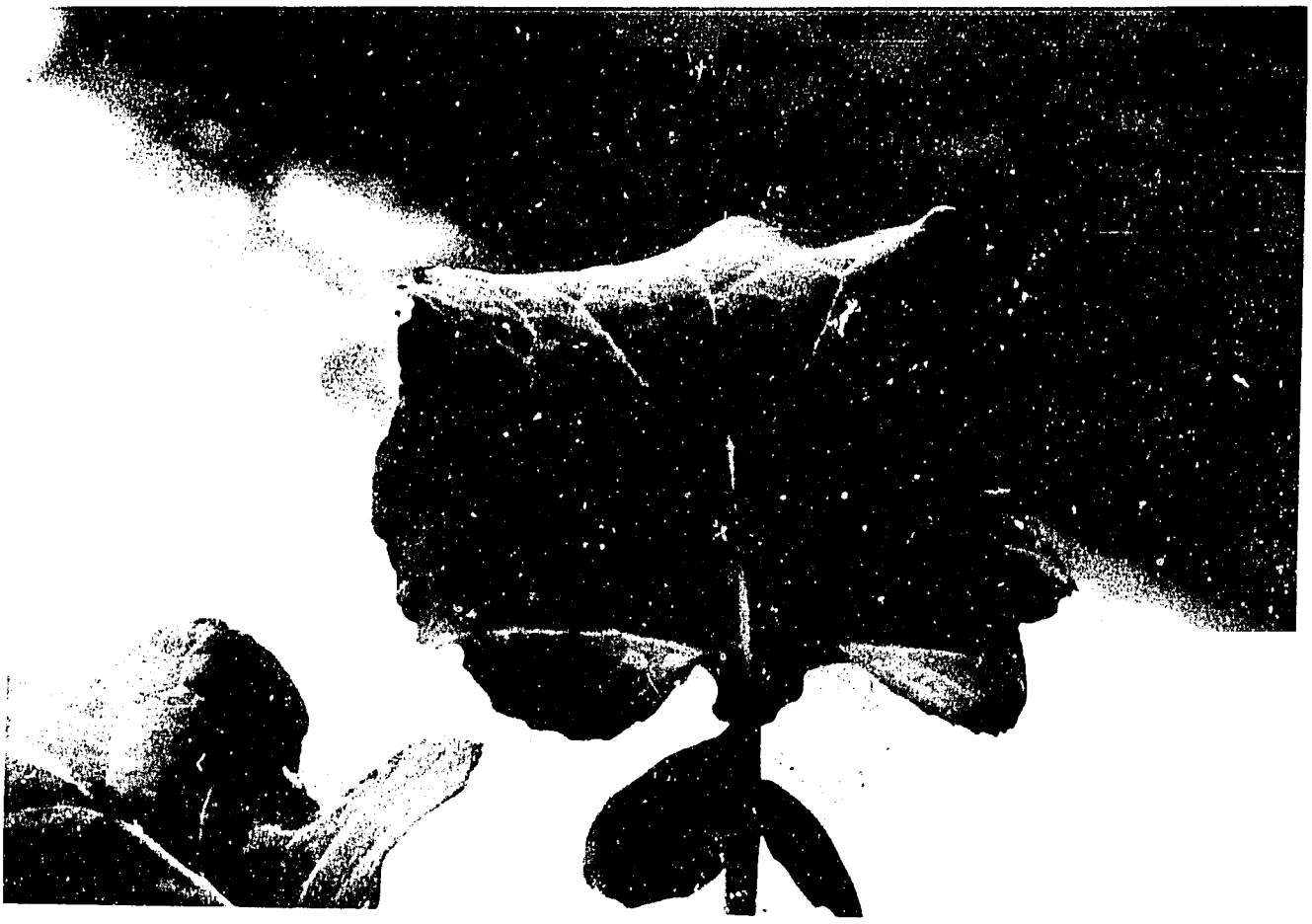
No conclusion can be drawn on which is the most appropriate or most effective formulation to be used for testing in the field. Further experiments were done with another series of formulations. 20 *S. litura* third instar larvae were left on each broccoli leave. The leaves were then sprayed with the formulation until the solution started running off. The results are shown in Table 3.

Table 3. The effect of *Z. zerumbet* solution on *S. litura* larvae.

Dose	% Mortality
Wt. of *Z. zerumbet* : Wt. of H_2O (% SLS)	
1 : 2 (1)	100
1 : 3 (1)	100
1 : 4 (1)	100
0 : 0 (1)	85



Spraying of *Z. zerumbet* formulation.



The result: 3 hours after spraying.

The concentration used, obviously, was excessive.

In order to further determine the most appropriate concentration, a stock solution was made from a mixture of 1 : 2 of Z. zerumbet : H_2O (4% SLS). Half dilution was used to obtain a series of formulations from the stock solution. Spraying of these formulation was then made on 20 third instar larvae on each broccoli leave until the solution started running off. Twelve replications were used for each treatment. The results are shown in Table 4.

Table 4. Effect of *Z. zerumbet* on *S. litura*.

Dose Wt. of *Z. zerumbet* : Wt. of H_2O (% SLS)	% Mortality
1 : 2 (4)	not tested
1 : 4 (2)	"
1 : 8 (1)	"
1 : 16 (0.5)	89.59
1 : 32 (0.25)*	92.92
1 : 64 (0.125)	66.25
1 : 128 (0.063)	not tested

*The formulation affecting 92.92% mortality was then chosen for testing in the field together with a formulation of *Eupatorium odoratum* which is a common weed.

Field trial

Location	:	Tambon Mae Fak Ampur Sunsai Chiang Mai
Plot size	:	1 x 3 m. containing two rows of 60 days cauliflowers, 10 in each row. Sixty 3rd instar larvae were released on each plant.
Formulation used	:	T_1, Z. zerumbet : H_2O (% SLS) = 1: 2 (4) diluted to 1 : 32 (0.25) T_2, E. odoratum : H_2O (% SLS) = 1 : 2 (5) diluted to 1 : 32 (0.32) T_3, water
Replications	:	2 plots (4 rows) were used. Each row was taken as a replication.
Spraying method	:	with fan-head 3 K sprayer once each day for two consecutive days.
Observation of results	:	1 hr, 3 hr, 24 hr and 48 hr after spraying

Field trial

The results are shown in Table 5, 6.

Table 5. Result of Field test of Z. zerumbet.

Time after spraying	Average number of larvae remined on treated plant (and on control plant)				
	Rep 1	Rep 2	Rep 3	Rep 4	$\bar{X}$
1 hr	22.3(49.9)	19.4(50.4)	22.4(42.0)	23.4(32.9)	22.0(43.8)
3 hr	26.7(40.6)	22.0(36.0)	13.5(40.4)	14.2(28.4)	19.1(36.4)
24 hr	10.9(38.3)	10.2(33.6)	11.3(37.5)	15.1(24.7)	11.9(33.5)
48 hr	4.8(28.3)	2.5(17.6)	6.5(27.5)	5.5(34.0)	4.8(26.9)

Table 6. Result of Field test of *E. odoratum*.

Time after spraying	Average number of larvae remained on treated plants (and on control plants)				
	Rep 1	Rep 2	Rep 3	Rep 4	$\bar{X}$
1 hr	16.3(49.9)	15.1(50.4)	11.9(42.0)	15.6(32.9)	14.7(43.8)
3 hr	18.8(40.6)	11.5(36.0)	12.1(40.4)	5.2(28.4)	11.9(36.4)
24 hr	17.2(38.3)	13.5(33.6)	10.7(37.5)	10.4(24.7)	12.9(33.5)
48 hr	10.8(28.3)	7.0(17.6)	5.8(27.5)	4.7(34.0)	7.1(26.9)

Observation & Conclusion from field trial

1) *Z. zerumbet* formulation is more efficacious than *E. odorata* formulation. The result, however, is far less satisfactory than that obtained in the laboratory.

2) Larvae on upper side of leaves are more severely affected than those hiding underneath.

3) A method of effective spraying which will give better contact insect hiding underneath leaves should render more satisfactory result.