

Effects of Plant Crude-Extracts on the Cattle Tick (*Boophilus microplus*) Insecticidal Action I

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ABSTRACT

The ethanol crude-extracts from five plants species; *Acanthus ebracteatus* Vahl., *Acorus calamus* L., *Annona squamosa* L., *Luffa acutangula* Roxb., and *Stemona collinsae* Craib. having high larvicidal activity on cattle ticks, were *in vitro* bioassayed with the insecticidal activity on adult tick by dipping method. The 10% of ethanol crude-extract of *Annona squamosa* seeds had high insecticidal action. The corrected mortality of adult ticks after dipping at 48 h were 100%, 100% and 92.50% in 10%, 5% and 2% of its crude-extract respectively. The 10% of ethanol crude-extracts of *L. acutangula* seeds had moderate toxicity. The crude-extracts of *A. calamus* rhizomes and *S. collinsae* roots showed low insecticidal activity, and the crude-extract from *A. ebracteatus* and *A. squamosa* leaves had very low insecticidal activity.

INTRODUCTION

The most important external parasite of cattle in Thailand is tropical cattle tick (*Boophilus microplus*). It plays as a vector to transmit protozoan diseases (babesiosis and anaplasmosis) and is the reservoir of infectious diseases (tick-borne fever and brucellosis). The heavy infestation of ticks causes direct losses of weight gain and milk lactation, anemia and skin disease. Farmers always use synthetic chemical insecticides to control the tick. However, most synthetic insecticides are toxic to human as well as animals, and some of them have toxic residues. They are also imported products. Therefore, the insecticides derived from local plants are in great demand. The plant derived insecticides may have low toxicity to mammals and rapid reduction of the toxicity. The insecticides from plants such as pyrethrins are known to be effective insecticide and have low toxicity to mammals (Martin, 1965). The present study try to find the other common local plant extracts which can be practically useful as insecticides for the cattle tick.

MATERIALS AND METHODS

The plant parts of 0.5-1kg. were cut or ground into small pieces and immersed in 95% ethanol for at

least three days. They were re-extracted 2 or 3 times. The extracted ethanol of each plant was evaporated at 40°C by vacuum rotary evaporator. The crude-extract of five plant species having high larvicidal activity (Chungsamarnyart *et al.*, 1988): *Acanthus ebracteatus* Vahl., *Acorus calamus* L., *Annona squamosa* L., *Luffa acutangula* Roxb., and *Stemona collinsae* Craib. were bioassayed for insecticidal activity. They were diluted to 10% with solvent containing 9 parts of 1% aqueous polyoxyethylene sorbitan mono-oleate (Tween 80®) and 1 part of 100% ethanol. The dipping method was applied on ticks (engorge female) for insecticidal bioassay. The effective crude-extracts were further diluted to 5% and 2% in the same solvent. The control ticks were dipped in that solvent. The mortality rate of ticks was observed 24 and 48 h after dipping. The bioassay was 5 times replicated (20 ticks/replication) for each sample. The Abbott's formula (Abbott, 1925) was used for calculation of the corrected mortality rate of ticks.

RESULTS

The corrected mortality of ticks after dipping at 24 and 48 h were shown in Table 1. The insecticidal activity of crude-extract from the seeds of *Annona squamosa* was the highest. The 10% of ethanol crude-

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extract of *A. squamosa* seeds killed the tick 99.50% and 100% after dipping at 24 h and 48 h respectively. The more diluted crude-extract of *A. squamosa* seeds still had strong toxicity. In 5% crude-extract, the corrected mortality of ticks was 98.00% and 100% after dipping at 24 h and 48 h. The 2% crude-extract killed 86.50% and 92.50% of ticks after dipping at 24 and 48 h respectively (Table 2). The corrected mortality of ticks showed no significant difference after dipping at 24 and 48 h (Table 2).

The 10% crude-extracts of *Luffa acutangula* seeds had moderate toxicity to the cattle tick, while the extract of *Acorus calamus* rhizomes and *stemona collinsae* roots had low toxicity. The crude-extract from the leaves of *Acanthus ebracteatus* and *Annona squamosa* showed very low toxicity (Table 1). These samples had significant difference in corrected mor-

talidity rate between 24 h and 48 h after dipping (Table 1).

DISCUSSION

There are many previous reports on the insecticidal activity of sugar apple, *Annona squamosa*. The seed oil of *A. squamosa* has high insecticidal activity against beetles, pumpkin and cabbage aphids, houseflies (Naidu *et al.*, 1953), egg-plant lace bug (Reddy, 1958), human head-lice (Puapatanakul, 1980), and leafhopper (Mariappan and Saxena, 1983). However, the seed oil has far inferior in toxicity against the adults of houseflies, mosquitoes, flour beetle, and the larvae of wooling bear, case-bearing clothes, comparing with pyrethrins and DDT (Cheema *et al.*, 1958; and Mukerjea and Govind, 1958). The

Table 1 *In vitro* insecticidal effects of 10% ethanol plants extracts on engorge female ticks; *Boophilus microplus*

Scientific Name (and Thai name)	Part of Plants	Corrected mortality (Mean, %)*	
		24 hr	48 hr
<i>Acanthus ebracteatus</i> Vahl. (Ngoege-plaa-maoo)	Leaf	1.500 cd	3.000 cd
<i>Acorus calamus</i> L. (Waan-num)	Rhizome	23.500 cd	41.000 bc
<i>Annona squamosa</i> L. (Noi-naa)	Seed	99.500 a	100.000 a
	Leaf	0.000 e	7.000 de
<i>Luffa acutangula</i> Roxb. (Boab-leeam)	Seed	43.000 bc	52.000 b
<i>Stemona collinsae</i> Craib (Non-taai-yaak)	Root	8.000 de	56.000 b
Mean (%)**		29.250 B	43.167 A

* LSD .05 = 20.2901; LSD .01 = 26.6649

** LSD .05 = 10.8856; LSD .01 = 8.2834

C.V. = 45.21%

Table 2. Effect of various concentration of *Annona squamosa* seeds extract on engorge female ticks

Concentration of extract	Corrected mortality (Mean, %)*	
	24 h	48 h
10%	99.500 a	100.000 a
5%	98.000 a	100.000 a
2%	86.500 b	92.500 b

* LSD .05 = 7.2562, LSD .01 = 9.8963, C.V. = 8.10%

toxicity of the seed oil and its petroleum ether extracts on fruit flies is also poor, but aqueous fractions of water distillation of the seed and fruit skin has moderate toxicity (Areekul et al., 1987). Most previous works have been carried out by using the non polar-solvent extracts of the seed. In the present work, the polar-solvent extracts (ethanol crude-extract) of the seed were bioassayed. It was shown that the polar-solvent extract of *A. squamosa* seeds was more intensive in insecticidal activity. The extract showed very high toxicity on ticks within 24 h after dipping (Table 1 and 2), and showed no significant difference in corrected mortality between 24 h and 48 h after dipping (Table 2). The comparison in toxicity with DDT or pyrethrins and further purification of the effective compounds and determination of the chemical structure are under studying. The effective insecticidal substances on the tick might differ in chemical structures as reported in previous works (Fujimoto et al., 1988) which found in petroleum ether extract of the seed.

The ethanol extract of rhizomes of *Acorus calamus* and *Stemona collinsae* had low insecticidal activity and non acute toxicity (Table 2), but it has high larvicidal activity on tick (Chungsamarnyart et al., 1988). This ethanol (polar solvent) extract of *A. calamus* might be different toxic compounds from the petroleum ether (non-polar solvent) extract which has high toxicity to housefly and mosquito (Dixit et al., 1956; Mukerjee and Govind, 1959). The petroleum ether extract of this plant also showed low toxicity to the fruit fly (Areekul et al., 1987).

The toxic compounds in the ethanol extract of *Stemona collinsae* root in this experiment might be a rotenoid compound; stemonal which has larvicidal activity on mosquitoes (Phan-urai, 1977).

The crude-extract of *Luffa acutangula* seeds have been traditionally used for intestinal round worm as an anthelmintic and insecticide (Anonymous, 1975). The ethanol crude-extract of this seeds had high larvicidal action (Chungsamarnyart et al., 1988), but it had variable insecticidal activity on the adult tick. It showed the moderate toxicity (Table 1).

CONCLUSION

Among ethanol extracts from five plants having high larvicidal activity, the crude-extract of *Annona squamosa* seeds had the highest insecticidal activity on adult cattle ticks. This effective insecticidal compound might be practically useful since it could be extracted with polar solvents.

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