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Effects of Thai Plant Extracts on the Oriental Fruit Fly[1] III. Attractancy Test

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ABSTRACT

Attractive potency tests were made on 487 extracts of 231 kinds of plants among which 205 were identified and 26 were unknown species. The rates of competitive attractiveness were determined from the number of the Oriental fruit fly, *Dacus dorsalis* Hendel, which entered at 1, 6, 12 and 24 hours in to traps in an olfactometer in which one gm equivalent of each plant extract was placed in each trap. Eight day old flies of both sexes were used in this experiment.

Plants extracts which demonstrated highly attractive to the test flies were *Crinum asiaticum* Linn., *Dieffenbachia sequine* Schott., *Nerium indicum* Mill., *Ocimum sanctum* Linn., *Thitonia diversifolia* Gray, and *Vallaris graba* Ktze.

Plants among which their extracts exhibited moderate attractive potency were *Bixa orellana* Linn., *Curcuma comosa* Roxb., *Cymbopogon flexuosus* Nee & Stend., *Datura metel* Linn., *Elsholtzia blanda* Benth., *Holmoskioldia sanguinea* Retz., *Homalomena* sp., *Lantana camara* Linn., *Melia azederach* Linn., *Momordica charantia* Linn., *Monstera deliciosa* Liebm., *Murraya paniculate* Jack, *Musa sapientum* Linn., *Nerium indicum* Mill., *Ocimum gratissimum* Linn., *Poinciana pulcherima* Sw., *Quisquallis indica* Linn., *Ruellia tuberosa* Linn., *Terminalia catappa* Linn., *Thysanolaena maxima* Kty., and *Vallaris glaba* Ktze. Among unidentified plants, Chang-Kan, En-Luang, and Kha-Pa were included in this case.

INTRODUCTION

The aim of the attractancy test was to search for plants containing active principles that attract both sexes of adult fruit flies, *Dacus dorsalis* Hendel, before they reach the sex maturing stages or definitely before the female flies lay their eggs. Any chemical or substance which possess such property will help tremendously to safe-gaurd of fruits from the larval damage because the flies can be trapped and destroyed befor their eggs are deposited. Results of our experiment on the oviposition rate of the female flies indicated that they did not deposit their eggs until reaching the age of 11 days old. Adult flies at eight days old were, therefore, used in this experiment. The emphasis of the search was aimed at high attractive potency so that competitive tests were employed.

MATERIALS AND METHODS

Extraction procedures of plant materials are described elsewhere (Areekul, *et al.*, 1988). Four hundred and eighty seven extracts from 231 kinds of plants, comprising 205 known and 26 unidentified species were assessed. Fifty, eight-day-old flies of each sex were fully fed with the yeast protein hydrolysate-sugar solution before being transferred to an olfactometer for each test. The equipment consisted of a hexagonal plastic cage 27 inches wide and 6

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inches high (Figure 1.). The flies were released through a hole at the center of the olfactometer and were allowed to respond to six volatile extracts from six kinds of plants, each extract being located in a small trap box around the periphery of olfactometer cage. The trap boxes, each 3 × 7 × 3 inches, contained screen lids which allowed a flow of air to pass through the test plant extracts. Two ml of each plant extract which equaled to one gm equivalent of plant, was used in each treatment. The extract, in each cage, was placed on cotton wool in a petridish inside each trap box.

The number of flies which entered each trap box was counted at 1, 6, 12 and 24 hours after release. The choice of extracts for each test was made at random and the experiment was repeated four times. The percentage competitive attractiveness of each plant extract was determined as the number of flies from the 100 released, which entered each trap box.

Fresh whole ripe fruit of banana was used as a standard in the study, as it was attractive to both male and female fruit flies. The % relative competitive attractiveness of this fruit was 39.00%, regarded as moderately high. The rates of attractiveness for the various plant extracts were related to this and classified as follows : class VH = 50% - more very high, class H = 40-49% high, class MH = 30-39% moderately high, class M = 20-29% moderate, class ML = 10-19% moderately low, class L = 1-9% low, and class N = 0% ineffective.

Results and Discussion

The percentages relative competitive attractiveness of 487 extracts of 231 kinds of tested plants were classified as follows : 1 very high, 1 high, 5 moderately high, 30 moderate, 101 moderately low, 253 low, and 96 ineffective. Only results of the extracts that demonstrated class moderate and high are shown in Table 1.

Publications retaled to plants which were used in this experiment for their attractiveness to insects are quite limited. The only plant which has been recorded to contain the active principles attracted to the Oriental fruit fly is the citronella, *Cymbopogon nardus*. The plant contains methyl eugenol which is a very powerful attractant for male Oriental fruit flies (Steiner, 1952). However, none of the plant substance attracted to female flies of this species has been reported elsewhere. For other insects, few records were made as follows. Colorado potato beetles, *Leptinotarsa decemlineata*, at 2-3 weeks old were slightly attracted by the odor of the celery, *Apium graveolens* (de Wilde *et al.*, 1969). Our test reveals that the volatile fraction from fresh leaves of this plant attracted adult fruit flies but was mild in potency. The oil from sunflower seeds, *Helianthus annuus*, as well as the castor of *Ricinus communis*, were said to be highly attractive to leaf-cutting ants (Cherrett, 1969). None of the extracts from these plants showed their attractive potency to the Oriental fruit fly in our tests.

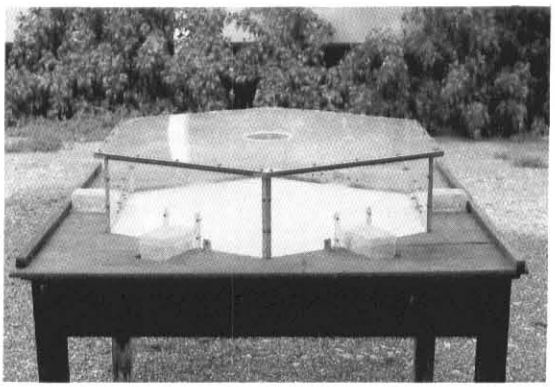

Figure 1. The olfactometer used in the attractancy test.

Extracts from plants which demonstrated highly attractive to the Oriental fruit fly were the volatile fraction of fresh leaves of *Crinum asiaticum* and the oil extracted from leaves of the red variety of *Ocimum sanctum*. The latter and also the oil extracted from the whole plant except roots of the white variety of *Ocimum sanctum* were observed to attract almost male flies. Besides oil of the white variety of *O. sanctum*, other plant extracts which demonstrated moderate high attractive potency, were the petroleum extracts from leaves of *Dieffenbachia sequine*, and flowers of *Nerium indicum*, water

Table 1. Relative competitive attractiveness of extracts from tested plants to 8 day old adult flies.

Plant Part and Species	Extraction Method and Fraction	% Relative Competitive Attractiveness at Hours				Sex %		Class
		1	6	12	24	M	F	
Bixa orellana								
Fresh Fruits	Rolling-P.Ether	2.0	8.0	13.0	28.0	17.0	11.0	M
Crinum asiaticum								
Fresh Leaves	Distill.-Cond.	0.0	15.0	18.0	57.0	34.0	23.0	VH
Curcuma comosa								
Dried Rhizomes	Soxhlet-Residum	4.0	6.0	9.0	22.0	13.0	9.0	M
Cymbopogon flexuosus								
Fresh Leaves	Distill-Oil	0.0	15.0	21.0	21.7	20.0	1.7	M
Datura metel								
Dried Leaves	Rolling-P.Ether	1.0	17.0	24.0	27.0	10.0	17.0	M
Dieffenbochia sequine								
Dried Leaves	Soxhlet-P.Ether	2.0	12.0	28.0	35.0	20.0	15.0	MH
Elsholtzia blanda								
Fresh Whole Plants	Distill.-Water	3.3	5.0	11.5	20.3	10.3	10.0	M
Holmskioldia sanguinea								
Fresh Leaves	Rolling-P.Ether	0.0	0.0	5.0	21.0	10.0	11.0	M
Lantana canisa								
Fresh Leaves	Distill.-Oil & Water	2.0	7.5	15.0	24.5	15.5	9.0	M
Melia azedarach								
Fresh Leaves	Distill.-Water	1.0	11.0	13.0	20.0	12.0	8.0	M
Momordica charantia								
Fresh Whole Fruits	Rolling-P.Ether	0.0	1.0	8.0	27.0	17.0	10.0	M
Fresh Pulps & Seeds	Rolling-P.Ether	0.0	3.0	10.5	28.0	15.5	12.5	M
Monstera deliciosa								
Fresh Leaves	Distill.-Water	0.0	2.5	8.5	20.5	12.5	8.0	M
Murraya paniculata								
Fresh Leaves	Distill.-Cond.	0.3	3.8	5.0	19.8	11.0	8.8	M
Musa sapientum (Hom variety)								
Fresh Riped Fruits	Whole Fruits	1.5	23.5	34.0	39.0	20.5	18.5	MH
Fresh Riped Pulps	Distill.-Cond.	3.0	13.0	22.0	22.0	9.0	13.0	M
	Distill-Water.	1.0	4.0	8.0	29.0	17.0	12.0	M
Musa sapientum (Nom Wa variety)								
Fresh Riped Fruit Skin	Distill-Water	0.0	5.0	13.0	24.0	10.0	14.0	M
Nerium indicum								
Fresh Flowers	Rolling-P.Ether	0.0	3.0	12.0	37.0	18.0	19.0	MH
Dried Flowers	Soxhlet-P.Ether	6.0	11.0	17.0	23.0	14.0	9.0	M
Ocimum canum								
Fresh Whole Plants	Distill.-Oil	4.8	15.0	18.0	23.0	22.3	1.5	M

Table 1 (Cont.)

Plant Part and Species	Extraction Method and Fraction	% Relative Competitive Attractiveness at Hours				Sex %		Class
		1	6	12	24	M	F	
Ocimum sanctum								
Fresh Whole Plants								
White Variety	Distill.-Oil	15.0	20.5	25.8	31.3	31.0	0.3	MH
Red Variety	Distill.-Oil	18.0	25.5	40.3	46.8	45.0	1.8	H
Poinciana pulcherima								
Dried Flowers	*Soxhlet-P.Ether*	2.0	9.0	17.0	29.0	12.0	17.0	M
Quisqualis indica								
Fresh Leaves	Distill.-Cond.	1.3	10.5	13.5	21.3	12.8	8.5	M
Ruellia tuberosa								
Dried Roots	Soxhlet-Residium	1.0	11.0	15.0	20.0	11.0	9.0	M
Terminalia catappa								
Fresh Seeds	Distill.-Oil	1.0	4.0	8.0	22.0	17.0	5.0	M
Thysanolaena maxima								
Fresh Rhizomes	Distill.-Cond.	3.3	11.3	15.8	20.5	7.5	13.0	M
Fresh Leaves	Distill.-Cond.	1.3	5.8	13.3	22.3	10.3	12.0	M
Fresh Stems	Distill.-Water	3.0	5.0	8.0	20.0	14.0	6.0	M
Tithonia diversifolia								
Yellow Petals	Distill.-Water	10.0	11.0	16.0	31.0	16.0	15.0	MH
Vallaris graba								
Fresh Branches	Distill.-Water	1.3	7.3	10.8	22.5	11.8	10.8	M
Fresh Leaves & Branches	Distill-Cond.	3.0	9.0	17.5	30.5	13.5	17.0	MH
	Distill.-Water	3.5	9.0	13.3	20.0	10.5	9.5	M
Chang-kan								
Fresh Rhizomes	Distill.-Cond.	M 4.5	9.5	16.0	20.5	10.0	10.5	
En-Luang								
Fresh Rhizomes	Distill.-Cond.	0.3	3.5	11.8	24.0	10.3	13.8	M
Kha-Pa								
Fresh Rhizomes	Distill.-Oil Water	2.0	19.0	19.0	21.0	13.0	8.0	M

fraction of the yellow petals of *Thitonia diversifolia*, and volatile fraction of leaves and branches of *Vallaris graba*.

Plants which their extracts exhibited their potency of moderate attractiveness were the petroleum extract of fresh fruits of *Bixa orellana*, the residuum from soxhlet extract of dried rhizomes of *Curcuma comosa*, oil of fresh leaves of *Cymbopogon flexuosus*, petroleum ether extract of dried leaves of *Datura metal*, water fraction of distillation of fresh whole plants (excluded roots) of *Elsholtzia blanda*, petroleum extracts of fresh leaves of *Holmskioldia sanguinea* and dried rhizomes of *Homalomena* sp., oil plus water fraction of fresh leaves of *Lantana camara*, water fraction of leaves of *Melia azedarach*, cold petroleum ether extract of fruits of *Momordica charantia*, water fraction of leaves of *Monstera deliciosa*, volatile fraction of leaves of *Murraya paniculata*, water and volatile

fractions of fruits of *Musa sapientum*, petroleum ether extract of dried flowers of *Nerium indicum*, oil extracted from whole plants except roots of *Ocimum gratissimum*, petroleum ether extract of dried flowers of *Poinciana pulcherima,* volatile fraction of fresh leaves of *Ouisqualis indica*, residuum from distillation of dried roots of *Ruellia tuberosa*, oil of fresh seeds of *Terminalia catappa,* volatile fractions of rhizomes and leaves and water fraction of fresh stems of *Thysanolaena maxima*, water fraction of fresh branches of *Vallaris glaba*. Among unidentified plants, they included volatile fractions of fresh rhizomes of Chang-Kan and En-Luang, and oil plus water fraction from the distillation of Kha-Pa rhizomes.

SUMMARY

Results of the attractancy tests of 487 extracts of 231 kinds of plants against 8 days old flies indicated that the numbers of extracts containing attractive principles ranging from very high to ineffective were as follows : 1 very high, 1 high, 5 moderately high, 30 moderate, 101 moderately low, 253 low, and 96 ineffective. Two or more categories may be included in some plants depending upon the solvents and methods of extraction.

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