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ANTI- INSECT PROPERTIES OF CERTAIN PLANTS SPECIES FROM ANDAMAN AND NICOBAR ISLANDS

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Abstract

A survey conducted in Andaman and Nicobar Islands for the past one year to gathered information about potential Pesticidal plants resulted in identification of 82 plant species by the verbal information of tribes and farmers with anti insect and medicinal properties. Then, 30 plant species were validation in discussion with the scientists of Botanical survey of India, Central Island Agricultural research institute, Department of Forest and local healers of Andaman and Nicobar islands. Selected parts of all the 30 plants were extracted with distilled water and the extracts were bioassayed at 2% & 5% concentrations insecticidal and antifeedant assay against 3rd instar of rice leaf folder (*Cnaphalocrocis medinalis* Guenee-Pyralidae:Lepidoptera) by following poison food assay under laboratory conditions at 25± 2ºC and 70±5% RH. The plants selected were belonging to 23 families and out of which *Ammomum fenzlii* (83.00%) from Zingiberaceae showed strong antifeedant property at 5% concentration. Insecticidal activity was more pronounced in *Derris scandens* (Fabaceae) and *Tetracera sarmentosa* (Dilleniacea) at 2% concentration. Both the plants showed around 65% larval mortality.

Key words : Survey, Rice leaf folder, antifeedant, larval mortality.

Introduction

The Andaman archipelago is an oceanic extension of the Burmese Arakan Yoma range in the North and of the Indonesian archipelago in the South. It has 572 islands which cover an area of 8,249 sq. km^2. The climate is typical of tropical islands of comparable latitude. It is always warm, but with sea-breezes. Rainfall is irregular, usually dry during the north-east, and very wet during the south-west, monsoons (Balasubramanian, 2017). Andaman Islands are residence to four 'Negrito' tribes such as the Onge, Great Andamanese, Jarawa and Sentinelese. The Nicobar Islands are residence to two 'Mongoloid' tribes such as the Shompen and Nicobarese (Jyoti, 2015). Andaman and Nicobar islands are considered to be an authentic store house of plant diversity. 86% of the islands are covered by primary tropical forest and more than 2000 species of plants in which 1,300 are exclusively and not found in mainland of India. The present study aims to explore the potential Pesticidal plants of Andaman and Nicobar islands by conducting intensive survey among the tribes, farmers and resource persons. Then shortlisted plants were bio-assayed to validate their Pesticidal properties. Literatures on the plants selected for the study are scanty. However few workers discussed the medicinal and poisons properties as follows. The leaves and bark of *Aegiceras corniculatum* were reported as bactericide by Sucheta and Vasanth (2017). More than 100 annonaceous acetogenins have been isolated from *A. muricata* (Sejal and Jayvadan, 2016) and 131 flavonoids are isolated from 60 species of *Astragalus* (Gorai *et al*., 2016). The maximum larvicidal and pupicidal actions were recorded in hexane extract of *A. monophylla* against *S. litura* (Muthu *et al*., 2010). Crude extracts of *Avicennia marina* and *Avicennia officinalis* which contains alkaloid, flavanoid, terpenoids and phenolics (Shanmugapriya *et al*., 2012) were found effective against micro organism. Seed extract of C*aesalpinia bonducella* possessed bactericidal and fungicidal activities (Subbulakshmi, 2015). Petroleum ether and chloroform based extracts of *Calophyllum inophyllum* leaves showed promising larvicidal action on *Culex quinquefasciatus* (Rana, 2017). The different parts of *Chukrasia tabularis* (leaves, bark, fruits) were found to have ethnobotanical and medicinal significance

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along with biopesticidal activity. It was reported to contain abundance of phenolic compounds including different terpenoids and limonoids (Rajbir and Saroj, 2009). *Derris scandens* was sound against storage pests on wheat and jowar (Usha Rani *et al*., 2013). Ethanolic extact of leaves *E. agallocha* was reported to have anti-microbial, anti-cancer and anti-diabetic activities (Kaliamurthi and Selvaraj, 2016). The highest antifeedant activity was noted in the extract of *H. tiliaceus* against second instar larvae at 100mg/21cm^2 concentration (Usha Rani *et al*., 2015). *Amomum fenzlii* is used as bee repellent due to its tranquilizing property. Roots and flowers juice are used in fever and stomach disorder (Das *et al*., 2005). Ahmad *et al*., (1981) isolated and characterized tetrahydroamentoflavone from the genus *Semecarpus*.

Materials and Methods

A survey was conducted among the tribes and farmers of Andaman and Nicobar Islands about the poisonous and insecticidal plants from January 2018 to December 2018. In total 82 plants were suggested by the folklore. By literature survey and in discussion with the scientists of Botanical survey of India, Central Island Agricultural research institute, Department of Forest and local healers 30 plants were shortlisted for studying their anti insect properties. The plants intended to experiment were collected with the help of local tribes and processed then brought to the Phyto-insecticide Research Laboratory, Department of Entomology, Annamalai University.

Extraction of selected plants

Around 1.5 kg of selected parts of the plants such as *Calophyllum inophyllum, Macaranga tanarius, Oroxylum indicum, Pajanelia longifolia, Pometia pinnata, Murraya paniculata,, Atalantia monophylla, Aglaia spectabilis, Chukrasia tabularis, Duabanga grandifloria, Mallotus Philippensis, Excoecaria agallocha, Rhizophora mucronata, Cerbera odollam, Hibiscus tiliaceus, Caesalpinia bonduc, Canarium euphyllum, Hornstedtia fenzlii, Orophea katschallica, Amomum fenzlii, Annona muricata, Semecarpus prainii, Alstonia kurzii, Astragalus hamosus, Derris scandens, Tetracera sarmentosa, Aegiceras corniculatum, Avicennia marina, Grewia calophylla* and *Barringtonia assiatica* were collected and shade dried for two weeks. Then the dried plant parts were powdered using electric blender (mixer) each separately. Then the powdered plant parts were packed as 100g pockets using Whatman No. 40 filter paper. These pockets were extracted with HPLC grade water at room temperature in round-bottom (5 L. capacity) stopper flasks. After 72 h, the paper packets were removed from the flasks and the extracts were labeled and stored in a refrigerator. For 100 g powder 1 L water was used to obtained 10% concentration. This was considered as stock material and used in bioassays at various dilutions.

Rearing of *Cnaphlocrocis medinalis* (Pyralidae: Lepidoptera)

The rice leaf folder, *C. medinalis*, was used as test insect and cultured in the laboratory/net house by following the rearing technique developed at IRRI by Waldbauer and Marciano (1979) with minor modifications. Pupae of *C. medinalis* collected from the rice field in and around Annamalainagar were kept for adult emergence in the laboratory under controlled conditions (25±2ºC, 70±5% RH and 12L: 12D photoperiod). Newly emerged adults were sexed and released into oviposition cages (5'×3'×3') at 1:1 ratio (10pairs/cage), inside which 60 day old potted (1'diameter) rice plants (30 tillers/pot) of variety TN1 and cotton pad dipped in 10% honey solution as oviposition substrate and adult feed respectively were kept. Every day the plants in the oviposition cage were checked and the first instars hatched out were covered by nylon mesh and transferred using a fine pointed camel hair brush to the axils of potted rice plants which were kept in net house and cultured up to pupal stage. The culture was maintain continuously and when ever needed the third instar were taken and used for experiments.

Antifeedant assay

Thirty days old seedlings of (TN1) rice raised in plastic cups were used in the bioassay. The seedlings were thinned out and one seedling/cup was maintained. Leaf area was measured using graph before treatment. The selected plant extracts (5%) were applied on the surfaces of leaves @ 1ml/side. All the leaves in seedlings were treated. Then the seedlings were air dry and enclosed with nylon mesh cage with the help of cylindrical Iron frame. Third instar of *C.medinalis* obtained from our culture were pre starved for 3h were released on the treated seedlings @ 2/seedling. Seedlings were observed after every 6 h and 12 h to record the response of the larvae. The experiment was terminated when the leaf was completely scraped in control. The seedlings in treatments were collected and the leaf scraped was measured. There were 32 treatments including absolute and positive controls and replicated 3 times. Per replication five such seedlings were maintained. Per cent leaf area protection over control was computed using the below mentioned formula and graded as indicated

Percent leaf area protection over control =

$$\frac{\text{Percent Percent protection in treatment - Percent protection in control}}{\text{100 - Percent protection in control}} \times 100$$

Insecticidal and IGR assay

The method described in antifeedant assay was followed with little modification. Instead of 5% concentration, 2% was used. Seedlings were observed once in 12 h to record the response. The larvae were allowed to feed on the treated leaves and when completely fed the exposed larvae were transferred to untreated seedlings and observed continuously till adult emergence. There were 32 treatment including absolute and positive controls. All the treatment were replicated thrice.

Results and Discussion

In the antifeedant assay, out of thirty plants tested, highest per cent leaf area protection over control was seen in *Amommum fenzlii* and *Semercarpus prainii*. *A. fenzlii* which belonging to the family Zingiberaceae was reported to have 'bee repellant' property by Das *et al*., (2005). Ahmad *et al*., (1981) earlier reported that *Semercarpus prainii* nut contain tetrahydroamentoflavone and naringein. In the present study, other than the above mentioned two plants, five other plants such as *Oroxylum indicum, Atalantia monophylla, Cerbera odollam, Canarium euphyllum* and *Astragalus hamosus* recorded medium inhibition. Our results are in accordance with the reports of Muthu *et al*., (2010) who explained that hexane extract of *Atalantia monophylla* at 5% concentration showed significant antifeedant and larvicidal activity of 70.89 and 85.33% respectively. In our experiments at 5% concentration of water extract of *A.monophylla* showed 77.33% antifeedancy which is higher than the efficacy exerted by hexane extracts of *A.monophylla*. Further, 85.33% larvicidal activity was reported by hexane extracts of *A.monophylla* but our results 7% mortality at 2% of water extract of *A.monophylla*. *Cerbera odollam* were recorded to have 72.39% of antifeedant. Weak inhibition was recorded in twenty one treatments. In our study *Calophyllum inophyllum* leaves extracts showed only 47.90%

Rating Scale	
Per cent leaf area protection	**Grade**
>80	Strong Inhibition (++++)
50-80	Medium Inhibition (+++)
20-50	Weak Inhibition (++)
<20	Insignificant inhibition (+)

(Rani and Arivudainambi, 2013)

Table 1: Antifeedant assay of certain botanicals against larvae of *C. medinalis*.

Treatment (5% concentration)	Part extracted	Per cent leaf area protection	Antifeedant grading over control
Calophyllum inophyllum	Leaves	47.90	(++)
Macaranga tanarius	Leaves	30.71	(++)
Oroxylum indicum	Bark	73.86	(+++)
Pajanelia longifolia	Bark	42.59	(++)
Pometia pinnata	Leaves	47.17	(++)
Murraya paniculata	Leaves	36.19	(++)
Atalantia monophylla	Leaves	77.33	(+++)
Aglaia spectabilis	Bark	33.27	(++)
Chukrasia tabularis	Leaves	30.53	(++)
Duabanga grandifloria	Stems	47.35	(++)
Mallotus Philippensis	Leaves	37.47	(++)
Excoecaria agallocha	Leaves	37.84	(++)
Rhizophora mucronata	Bark	27.42	(++)
Cerbera odollam	Leaves	72.39	(+++)
Hibiscus tiliaceus	Leaves	32.54	(++)
Caesalpinia bonduc	Seeds	32.90	(++)
Canarium euphyllum	Leave	74.23	(+++)
Hornstedtia fenzlii	Leaves	48.06	(++)
Orophea katschallica	Leaves	47.17	(++)
Amomum fenzlii	Leaves	83.00	(++++)
Annona muricata	Leaves	21.39	(++)
Semecarpus prainii	Nuts	81.90	(++++)
Alstonia kurzii	Leaves	25.41	(++)
Astragalus hamosus	Leaves	78.98	(+++)
Derris scandens	Roots	15.53	(+)
Tetracera sarmentosa	Roots	16.44	(+)
Aegiceras corniculatum	Leaves	42.22	(++)
Avicennia marina	Leaves	44.78	(++)
Grewia calophylla	Bark	36.01	(++)
Barringtonia assiatica	Bark	25.77	(++)
Positive control -Neem commercial formulation (1500ppm azadiractin)	-	81.87	(++++)
Control	-	0.00	(+)

Table 2: Insecticidal assay of certain botanicals against *C.medinalis.*

Treatment (2% concentration)	Part extracted	Cumulative percent		
		Larvalmortality	Pupal mortality	Adult emergence
Calophyllum inophyllum	Leaves	26.66(30.77)^{def}	26.66(30.77)^{bc}	46.66(43.06)^{efg}
Macaranga tanarius	Leaves	7(11.55)^{h}	7(11.55)^{de}	86.66(72.27)^{bc}
Oroxylum indicum	Bark	0.5(4.05)^{h}	0.5(4.05)^{e}	100(90.00)^{a}
Pajanelia longifolia	Bark	13.5(19.05)^{fg}	7(11.55)^{de}	80(63.40)^{cd}
Pometia pinnata	Leaves	26.66(26.55)^{ef}	0.5(4.05)^{e}	80(63.40)^{cd}
Murraya paniculata	Leaves	33.33(34.99)^{cde}	20(26.55)^{bc}	46.66(43.06)^{efg}
Atalantia monophylla	Leaves	7(11.55)^{gh}	7(11.55)^{de}	86.66(72.27)^{bc}
Aglaia spectabilis	Bark	26.66(30.77)^{def}	20(26.55)^{bc}	60(46.90)^{defg}
Chukrasia tabularis	Leaves,	33.33(30.77)^{def}	33.33(30.77)^{bc}	46.66(43.06)^{efg}
Duabanga grandifloria	Stems	7(11.55)^{gh}	0.5(4.05)^{e}	93.33(81.13)^{ab}
Mallotus Philippensis	Leaves	40(39.21)^{bcde}	26.66(30.77)^{bc}	33.33(34.99)^{fgh}
Excoecaria agallocha	Leaves	33.33(34.9)^{cde}	13.5(19.05)^{cd}	60(46.90)^{defg}
Rhizophora mucronata	Bark	33.33(34.9)^{cde}	13.5(19.05)^{cd}	60(46.90)^{defg}
Cerbera odollam	Leaves	7(11.55)^{gh}	7(11.55)^{de}	93.33(72.27)^{bc}
Hibiscus tiliaceus	Leaves	7(11.55)^{gh}	0.5(4.05)^{e}	93.33(81.13)^{ab}
Caesalpinia bonduc	Seeds	13.5(19.05)^{fg}	13.33(19.05)^{cd}	73.33(59.18)^{cde}
Canarium euphyllum	Leave	7(11.55)^{gh}	7(11.55)^{de}	86.66(72.27)^{bc}
Hornstedtia fenzlii	Leaves	7(11.55)^{gh}	7(11.55)^{de}	86.66(72.27)^{bc}
Orophea katschallica	Leaves	0.5(4.05)^{h}	7(11.55)de	93.33(81.13)^{ab}
Amomum fenzlii	Leaves	0.5(4.05)^{h}	13.33(19.05)^{cd}	86.66(72.27)^{bc}
Annona muricata	Leaves	60(50.74)^{ab}	33.33(34.99)^{b}	7(11.55)^{hi}
Semecarpus prainii	Nuts	53.33(46.90)^{abc}	33.33(34.99)^{b}	13.5(19.05)^{hi}
Alstonia kurzii	Leaves	40(39.21)^{bcde}	26.66(30.77)^{bc}	33.33(34.99)^{fgh}
Astragalus hamosus	Leaves	0.5(4.05)^{h}	13.33(19.05)^{cd}	86.66(72.27)^{bc}
Derris scandens	Roots	66.66(54.96)^{a}	33.33(34.99)^{b}	0.5(4.05)^{h}
Tetracera sarmentosa	Roots	66.66(54.96)^{a}	20(26.55)^{bc}	13.5(19.05)^{hi}
Aegiceras corniculatum	Leaves	33.33(34.99)^{cde}	26.66(30.77)^{bc}	40(39.21)^{fg}
Avicennia marina	Leaves	40(39.21)^{bcde}	0.5(4.05)^{e}	60(50.74)^{def}
Grewia calophylla	Bark	13.5(19.05)^{fg}	60(50.74)^{a}	26.66(30.77)^{gh}
Barringtonia assiatica	Bark	46.66(43.06)abcd	20(26.55)^{bc}	33.33(34.99)^{fgh}
Positive control -Neem commercial formulation (1500ppm azadiractin)	-	0.5(4.05)^{h}	26.66(30.77)^{bc}	73.33(59.18)^{cd}
Control	-	0.5(4.05)^{h}	0.5(4.05)e	100(90.00)a

Values are mean of three replications.
Values in parentheses are arc sine transformed.
Values with various alphabets differ significantly.

antifeedancy and considered as weak antifeedancy. In contrast to our finding Rana *et al*. (2017), observed repellency of *Calophyllum inophyllum* leaf extract against *Aphis* spp. *Hibiscus tiliaceus* which recorded weak antifedancy at 5% concentration but Usha Rani *et al*., (2016) observed the highest per cent antifeedant activity in the extract of *H. tiliaceus* (Table 1).

Derris scandens and *Tetracera sarmentosa* have shown 66.66% of larval mortality table 2 which is comparatively high among other treatments. The reports of Usha Rani *et al*., (2013) also showed the same effect and concluded that prenylated isoflavones present in *Derris scandens* were responsible for the mortality. *Annona muricata* gave larval mortality of 60% and our findings correlated with the findings of Sejal and Jayvadan (2016). Highest pupal mortality of 60% was recorded in *Grewia calophylla*. The present findings coincide with the findings of Khanal *et al*., (2016). Very low adult emergence was seen in *Derris scandens* and *Annona*

muricata.

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