



Interplay between natural compounds of *Mundulea sericea* bark extract in combating *Aleurodicus dispersus*, Spiralling whitefly an invasive pest of Telangana.

Dr.Zakkum Grace Beena and Prof. M. Madhavi, S.Guru swamy
Department of Zoology, Osmania University, Hyderabad- 500007, Telangana, India.

ABSTRACT

An invasive pest, Spiralling whitefly, *Aleurodicus dispersus* incidence has been noticed on Guava, Mango, papaya, Banana, coconut and pomegranate crops in Telangana, India during 2020-22, later it spread to ornamental plants. *Aleurodicus dispersus*, spiralling white fly was observed on the underside of leaves along with the presence of white waxy material honey dew around the whitefly infested area, sooty mould formation and drying of infested leaves observed in infected plants. By targeting the eggs of spiralling whiteflies, the life cycle and the population of *Aleurodicus dispersus* is reduced. This is the first study in Telangana to examine the efficacy of *Mundulea sericea* bark and leaves as a ovicidal agent against spiralling whitefly that is a major threat to Agriculture and Horticulture crops, after exposing the plant extract for 24 hrs egg mortality was observed. This discovery has significant implications for pest control, its a eco-friendly alternative to synthetic chemical insecticides.

KEYWORDS: *Mundulea sericea*, *Aleurodicus dispersus*, sootymould, eco-friendly.

Introduction

The welfare of humans is reliant on ecological sources. Spiral whitefly damage has resulted in significant losses in horticultural and decorative crop production. Due to their ravenous eating habits, the spiralling whitefly, *Aleurodicus dispersus* Russell (Hemiptera: Aleyrodidae), severely damages a variety of crop kinds. (Aiswariaya et al. 2007; Bryne et al. 1990). The most widely used insecticides are chemical and plant-based treatments; however, insect pests have evolved a resistance to several common conventional pesticides worldwide (Denholm et al., 1996). The production of guava, papaya, bananas, custard apples, and jackfruit is seriously threatened by severe infestations of this pest, which cause direct damage to the plant by taking sap from the leaves, which stunts growth, weakens plants, and lowers agricultural yield (Nasruddin & Stocks

2014). Numerous plant species worldwide remain unexplored in terms of phytochemistry. Roughly 2% of the 5,00,000 plant species have been studied phytochemically. To find numerous phytochemicals, it is therefore important to conduct phytochemical analyses of different plant species. With almost 500 species, Studies on species from the state of Andhra Pradesh are quite rare. Therefore, the goal of the current study is to qualitatively screening the leaves and bark of extracts from the Telangana region.

Morphology of Aleurodicus dispersus

The developmental biology of *Aleurodicus dispersus* Russel, has been investigated. It was found to have a cumulative developmental period of (23 - 41) days. The mean numbers of egg developing to adult have been found to be 138.1 per thousand eggs. The spread of the insect has been found to be connected to human traffics. The oviposition and feeding occurs simultaneously and occurred more on their abaxial surface of host leaves. Rainfall and temperature played a prominent role on the abundance and seasonal fluctuation of the insect and infact, regulating their population

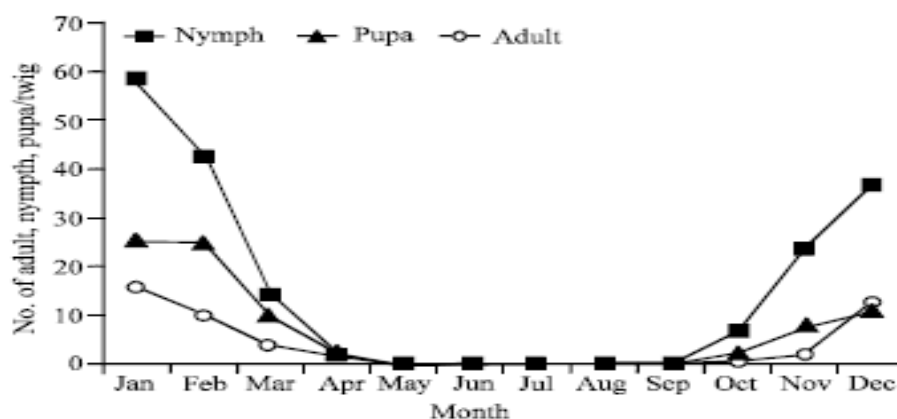
Biology

A. dispersus fed on plants by sucking plant juices from the phloem through a slender stylet as other whiteflies do (**Muniappan, 1980**) and the resultant honeydew excretions that fall on surfaces below colonies often develop a layer of sooty mould. The newly hatched nymph had functional legs and moves about before settling to feed, the second instar nymphs flattens out on the leaf whose legs and antennae become vestigial (that is, it is sessile) and cottony secretion was sparse, the third instar larva resembled the previous instar in shape but slightly larger as found in other whiteflies (Bryne et al., 1990).

Level of Infestation Assessment

Result -Maximum infestation(85-100%): Severe incidence of *A.dispersus* (pest) on the entire tree guava tree.

The observation and assessment of *A.dispersus* on guava tree, showed maximum level of infestation that ranged from 85-100 % inclusive of eggs, instar larvae and adults on all branches of the guava tree.



levels of infestation of *A.dispersus* seasonally

Grade of infestation of Aleurodicus dispersus on various host plant in different Seasons (from Sept 2021 to Dec 2022)

Sr.No	Botanical Name	Common Name	Family	Grade of infestation Nov- Feb, Mar-June,July-Oct		
1	Psidium guajava	Guava	Myrtaceae	IV	II	I
2	Musa sepientum	Banana	Musaceae	IV	II	II
3	Carcica papaya	Papaya	Caricaceae	III	III	II
4	Syzygiumcumini.	Jamun	Myrtaceae	III	II	I
5	Hibiscus rosa-sinensis	Hibiscus	Malvaceae	III	II	I
6	Solanumlycopersicum	Tomato	Solanaceae	IV	II	II
7	Solanummelanogena	Brinjal	Solanaceae	III	II	II
8	Cocosnucifera	Coconut	Arecaceae	IV	III	II
9	Annonasquamosa	Custard apple	Annonaceae	IV	III	II
10	Capsicum frutescens	Chilli	Solanaceae	III	II	I

Table - 1: life stages of A.dispersus

Stage of Whitefly	Length(mm)	Breadth (mm)
Eggs	0.27-0.29 (0.28)	0.11-0.12 (0.11)
First instar nymph	0.31-0.35 (0.33)	0.13-0.15 (0.14)
Second instar nymph	0.41-0.48 (0.44)	0.23-0.28 (0.25)
Third instar nymph	0.64-0.75 (0.69)	0.40-0.45 (0.42)
Fourth instar nymph	0.93-1.17 (1.07)	0.61-0.79 (0.71)
Adult Male	2.38-2.43 (2.40)	1.20-1.25 (1.22)
Adult female	1.80-1.90 (1.86)	1.06-1.12 (1.09)

Table - 2 : Morphometric parameters of different stages of A.dispersus

Damage is caused by the whitefly piercing the leaf and sucking the sap, when whitefly numbers are high, this leads to early death of plants. Damage is also caused by build up of sooty mould Sooty moulds (fungi) grow on the honeydew produced by the whiteflies and their nymphs as they feed. The plants do not get sufficient sunlight for normal growth.

Symptoms

- The over all vigour of the plant is lost
- distorted or damaged leaves
- yellowing or silvering of leaves
- stunted growth of plants
- premature dropping of leaves
- Honeydew /or sooty mould
- leaves rolled or folded
- Reduction in crop yield

Mundulea sericea

- *Mundulea sericea*, the cork bush, grows in deep sandy or gravelly soil, Known for preventive and chemo therapeutic agent against inflammatory diseases and Insecticidal activity. *Mundulea sericea* is available in the outskirts of city area Hyathnagar, Rangareddy, Ibrahimpatnam and Kadthal area.

Collection of plant species

- The medicinal plants were available to local villagers surrounding the forest area and also found in and around forest area of Mulugu, Siddipet district and the outskirts of city area Hayathnagar, Rangareddy, Ibrahimpatnam and Kadthal area.

Plant Species	Common name	Location	Date of collection
Mundulea sericea	Cork Bush	Outskirts of city area Hyathnagar, Rangareddy, Ibrahimpatnam and Kadthal area	13 12.2021

Phytochemical properties of *Mundulea sericea*

Mundulea sericea is known as Neelimarri in Telugu language, it is a shrub that flowers twice a year and also known for corky bark for chemo preventive and chemotherapeutic agent against inflammatory diseases and Insecticidal activity.



Mundulea sericea leaves



Mundulea sericea bark

Plant crude extraction and isolation of secondary metabolites

Standard methodologies were followed (Crude extraction-Hot water((Liu *et al.*, 2009; Shupe and Liu, 2009) and cold water(Robert Hammellet *al.*, 2022) for the crude extraction. Fresh and healthy leaves and bark, M. Sericea were collected,washed with running water several times to discard dirt and any impurities.Leaves and bark were thoroughly checked for any kind of disease, then shade dried for two weeks at 27 ° C(RT27 +2C°) to remove dampness. crispy leaves and bark were finely grinded by using electrical blender, samples were preserved in air tight Ziplock bags for subsequent utilization.

Qualitative Analysis of plant material, Soxhlet extraction: The leaves bark of the plant was dried completely 3 gms of the samples(Leaf and bark) was taken in the thimble cap and extracted constantly the secondary metabolites with various extracts such as Ethanol (90%), methanol(90%), aqueous and biochemical screening protocols executed were based on former work done with plant investigation .The leaves and bark of M. Sericaea using methanol as extract was subjected to soxhlet extraction (Thenmozhi. M. *et al*, 2010.) Boiling point range 65°C for 6h.The plant extracts were run through Rotary evaporator and the residues of leaves and bark of Mundulea sericea were obtained. The residues were made into stock solution and dilutions of 25,50, 100, 200, 400 ppm were prepared .

The current research investigation was carried out in leaves and bark of M. Sericea findings revealed plant (leaves and Bark) are rich in carbohydrates,cardioglycides, terpenoids, alkaloids,tannins, flavonoids.(Methanol extract)

Phytochemical screening results

Phytoconstituents	Types of Test	Leaf and bark extract of <i>Mundulaesericae</i>			
		Acetone	Methanol	Ethanol	Aqueous
Terpenoids	Salkowski	+	+	+	–
Alkaloids	Mayer's	+	+	-	–
Flavonoids	Sulphuric acid Test	+	+	+	+
Tannins	Ferric chloride test	+	–	+	–
Carbohydrate	Molisch's test, Fehling's test, Benedict's test:	+	–	+	–
Quinones	sodium hydroxide Test	+	+	+	+
Glycosides	Hydrochloric acid Test	+	+	+	+

Table: 3 Phytochemical screening of *Mundulea sericea*

ACUTE TOXICITY EVALUATION AND MORTALITY

Acute toxicity can be measured by taking into account the rate of mortality after a defined period of time as the increasing toxicant dosages (**Ramade 1987**). The LC₅₀ (median lethal concentration) is the most important parameter which causes 50% deaths in the population being studied. The eggs, Pupa and adults of *A. dispersus* were subjected to various concentrations for 24 hrs in the current investigation. The Mortality percentage was reported and statistical analysis was analyzed.

Direct Contact Method

For the evaluation of each plant extract, as per the protocol given by (**R.R Chand et al., 2019**) 10 adult *A. dispersus*, egg and pupa were gathered from infested guava tree and were kept in petridish. Acute toxicity level of *A. dispersus* (adult, egg and pupa), methanolic botanical extracts was determined by straight contact

application.1ml of conc, 25ppm, 50ppm, 100ppm, 200ppm 400ppm were prepared from stock solution,in replicates of 5. After 24 hours the mortality is recorded, a control was also subjected., % mortality and Statistical analysis was calculated according to Abbott’s formula.(1987)



Normal eggs observed



Clusters of eggs



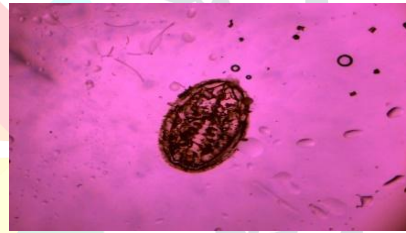
Egg before treatment



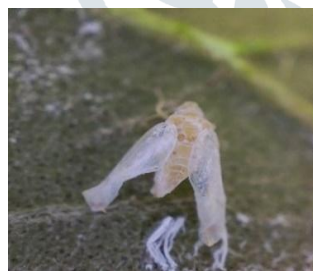
Egg after treatment



Nymph before treatment



Nymph after treatment



Adult (Female) before treatment



Adult (Female) after treatment

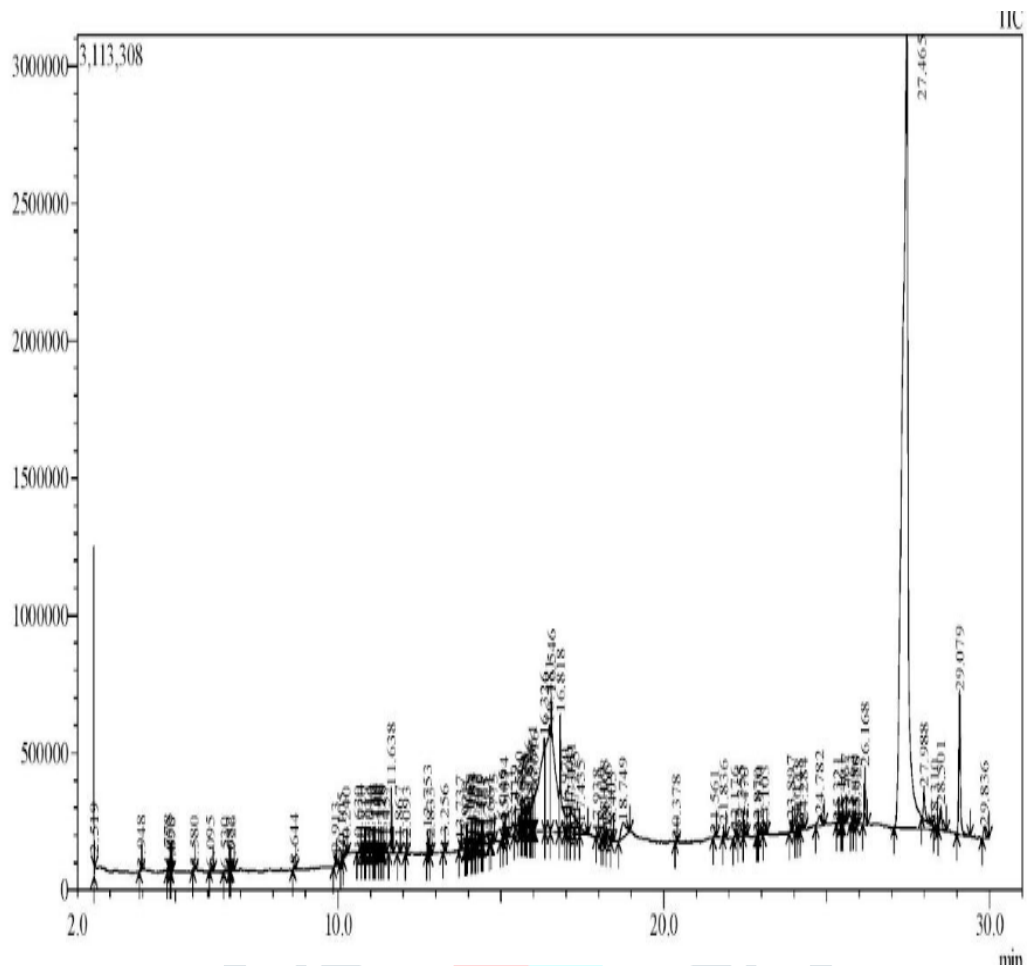
Figure Direct Contact Method Egg, Pupa, Adult *A.dispersus* (Female) and Mortality observed under 40X Stereozoom Microscope, Magnus.

Mortality of egg *A.dispersus* (*Mundulea sericea* Methanol Bark)

Conc (ppm)	24hrs % Mortality	Mean	Std Deviation	Std error	LC50 (ppm)	LCL-UCL(ppm)	Regression equation	R ²	X ²
Control	0	0.00	0.000	.421	98.347	73.066-131.870	Y=2.69+1.35x	0.971	1.509
25	10.58	2.00	.707						
50	17.31	2.20	.837						
100	25.19	5.80	.447						
200	33.04	6.40	.548						
400	39.70	7.80	.447						

Mortality data of *A.dispersus* Adult (Female) *Mundulea sericea* Methanol Bark

Conc (ppm)	24hrs % Mortality	Mean	Std Deviation	Std error	LC50(ppm)	LCL-UCL(ppm)	Regression equation	R ²	X ²
Control	0	0.00	0.000	.426	115.655	85.415-160.772	Y=-2.63+1.28*X	0.976	1.130
25	9.97	1.80	.447						
50	16.11	3.20	.837						
100	23.41	4.80	.837						
200	30.93	5.60	.548						
400	37.68	7.80	.447						



Compound	Area	Area(%)	R-Time	Peak #
BIS 2hydroxy 3-Isobutyrophanate	36434543	59.34	27.465	95
Benzene propionic acid,3,5 bis(Derivative of Isoquercetin)	4180820	6.81	16.546	61
Di butyl phthalate	1531247	2.49	16.818	62
Alpha -amyryin	36	3.25	29.079	99
7,9 -Di-tert-butyl-I-oxaspir(4,5)deca-6,9-dione	4159759	6.77	16.326	59
Hexadecanoicacid,methyl ester	3360451	5.47	16.515	60
I- Nonadecene	593838	0.97	17.151	65
Cis-9-Hexadecenal	572682	0.93	18.749	73
Gamma-sitosterol	480726	0.78	27.988	96
8- Pentadecanone	415097	0.68	15.961	57

Table 2: Major compounds of GCMS Mundulesericea leaves

GC/MS analysis of *Mundulea sericea* leaf extract detected 100 compounds. The main defined components are ten and listed in Table according to their retention times and their percentage composition.

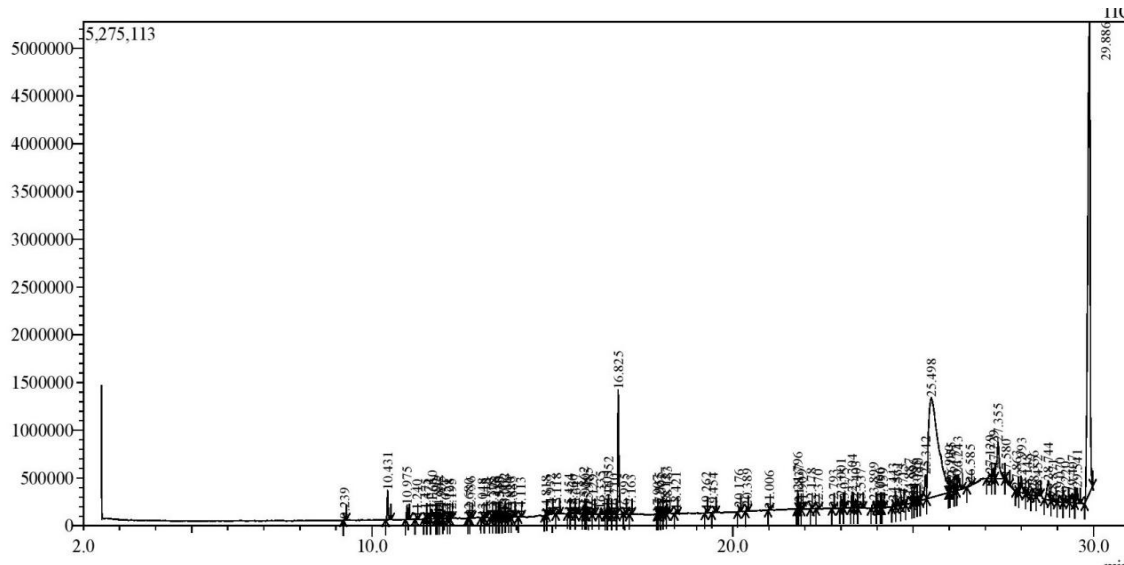


Fig 2 : Chromatogram of GCMS- *Mundulea sericea* Bark

Compound	Area	Area(%)	R.Time	Peak*
15-hydroxy-7oxodehydroabieticacid Methyl	2310002	36.99	29.975	100
Androstan	19470338	31.18	25.498	79
Stigmastrol	2036604	3.26	27.355	87
2,4 Bis 4-Methoxyphenyl2-Propylmethox	1109564	1.78	25.140	78
Dibutylphthalate	2817974	4.51	16.825	42
Gamma -sitosterol	27.863	0.98	612100	90
1,6 -Dimethylphenazine	26.243	0.98	612579	81
Stigmast-1-en-3-one	29.541	0.90	562405	99
2(1H -Phenanthrenone,3,4 4a9,10 10a hexane	26.055	0.98	467160	74
Rotenone	27.229	0.63	394081	86

Table: 2 GCMS of *Mundulea sericea* Bark major compounds

Results

The chromatographic spectra showed corresponding peaks indicating the presence of compounds and retention time. Hence leaves and bark of *Mundulea sericea* are insecticidal in function.

The major compounds obtained from Methanol extract of *Mundulea sericea* Leaves was found to be valuable biological control tool on the adult and pupa of *A. dispersus* compounds identified are, Bis 2 hydroxy 3-Isobutyrophanate, Benzene propionic acid, 3,5 bis (derivative of Isoquercetin), Di Butyl phthalate, Alpha amyryin, 9, Di, teotbutyl, oxaspir (4,5) deca, 6,9 dione, hexadeconic acid, I Nonadeciene.

Insecticidal significance of isolated compounds

The seasonal incidence of spiralling whitefly *A. dispersus* indicated that the population of spiral whitefly was found to be high during Nov to March 2021, and low during summer, April and May. The detectable results of acute toxicity level, confirms (rutin, Isoquercetin and quercetin) at different concentrations (25, 50, 100, 200 and 400 ppm) had marked mortality rate, along with Rotene, Stigmasterol, 2,4 Bis 4-Methoxyphenyl 2-Propylmethox, Dibutylphthalate. (*Mundulea sericea* Bark) BIS 2hydroxy 3-Isobutyrophanate, Benzene propionic acid, 3,5 bis (Derivative of Isoquercetin) Di butyl phthalate, Alpha –amyryin (*Mundulea sericea* Leaves).

Conclusion

This study offers a novel approach for increasing crop output as well as a more effective substitute for controlling insect pest populations (Spiraling whitefly), because therapeutic plants are widely available, using botanical pesticides to control pests is perfect and ideal. Interplay between natural compounds of *Mundulea sericea* leaves and bark extracted resulted in the mortality of *Aleurodicus dispersus*.

REFERENCES

Aishwariya, K. K., Manjunatha, M., Naik, M. 2007b. Seasonal incidence of spiralling whitefly *Aleurodicus dispersus* Russell and its natural enemies in relation to weather in Shimoga. *Karnataka Journal of Agricultural Sciences*, 20(1): 146-148.

Aiswariaya, K.K., Manjunatha, M. and Naik, M. 2007b. Seasonal incidence of spiraling whitefly *Aleurodicus dispersus* Russell and its natural enemies in relation to weather in Shimoga. *Karnataka Journal of Agricultural Sciences*, 20(1): 146-148.

Berlinger, M.J. 1980. A yellow sticky trap for whiteflies, *Trialeurodes vaporariorum* and *Bemisia tabaci* (Aleyrodidae). *Entomological experiment and application*, 27: 98-102.

Berlinger, M.J. 1986. *Host Plant Resistance to Bemisia tabaci*. *Agric. Ecosystem Environ.* 17: 69-82.

Bhaduri N., Ram S. and Patil B.D. (1985) Evaluation of some Plant extracts as Protectants against the pulse

beetle *C. maculatus* infesting cowpea seeds. *Journal of Entomological Research* 9, 183-187.

Laprade, S. and Gerdas, V.H. (1998) Management of the spiralling whitefly *Aleurodicus dispersus* Russell (Homoptera, Aleurodidae) in banana (*Musa AAA*) using insecticides and oil. *Corbanana* 22, 89–94. Google Scholar

Lopez, V.F., Kairo, M.T.K. and Carl, K.R. (1997) Strengthening of biological control for the spiralling whitefly, *Aleurodicus dispersus* Russell (Hemiptera: Aleyrodidae). Technical Report, CAB International. 70 pp. Google Scholar

Megir-Gumbek, (1987) Study on control of whitefly, pp. 83–84. Annual Report of Research Branch Department of Agriculture 1986–1987. Google Scholar (Miao *et al.*.,2022) Springer, Journl of plant Research.

