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Effect of Plant Extracts on Nymphal Development of Jassid, *Amrasca Devastans* Dist. on Sunflower under Laboratory Conditions

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Abstract:

The mortalities among the newly hatched nymph influenced significantly (P<0.05) by the neem extract used. Neem leaf extract had the highest mortality i.e. 17.25/leaf (86.25%), while nymphal mortality by Dhatura leaf extract, Eucalyptus leaf extract and Neem solution were 16.50 (82.50%), 15.75 (78.75%) and 14.00/leaf (70%) respectively as compared to lowest mortality (12.25/leaf) in control (61.25%). Regardless of botanical extracts. The jassid mortality was higher (27.75%) at first instar nymphal stage, while the mortality reduced in the second, third and fourth instar nymphal stages i.e. (22.00, 17.75 and 8.25%) respectively. The adult activities of jassid showed that neem leaf extract treated adults females had lowest fecundity (7 eggs per female), while fecundity prolonged to 9, 11, 14 and 18 eggs when treated with Dhatura leaf extract, Eucalyptus leaf extract, neem solution and control, respectively. The egg hatching was delayed upto 5 days under neem leaf extract and Dhatura leaf extract, and early eggs hatching in 4, 4 and 3 days was recorded in Eucalyptus, neem solution and untreated leaves, respectively. Egg fertility was highest (61%) in control; while fertility reduced to 55.00, 54.00, 50.00 and 42 percent

when treated with Dhatura leaf extract, Eucalyptus leaf extract, Neem solution and Neem leaf extract, respectively. Minimum adult longevity (4 days) was recorded under Neem leaf extract, while the adult longevity prolonged for 5, 6, 6 and 8 days under neem solution, Dhatura leaf extract, Eucalyptus leaf extract and control, respectively. It is recommended that Neem leaf extract and Dhatura leaf extract may preferably be used to check the nymphal development of jassid and to reduce survival of jassid adult on sunflower.

Key words: Plant extracts, Jassids, development and sunflower.

Introduction

Jassid, *Amrasca devastans* Dist. is one of the noxion pests of sunflower crop. The Sunflower, *Helianthus annus* L. is one of the most important oil crops globally (Skoric *et al.,* 2007). Sunflower was introduced in Pakistan in the 60's and at present has become a major oilseed crop of the country (Anonymous, 2008). The low yield of sunflower may be attributed to several reasons such as occasional adverse climatic conditions, poor agronomic methods of cultivation, non-availability of improved seed and damage caused by insect pests. There are several insect pests, which ravage sunflower both in the field as well as in the warehouses and inflict severe losses (Mukhtar, 2009). The pests ravaging this crop include cutworms *(Agrotis* spp.), green stink bug (*Nezara viridula* nnaeus), American bollworm (*Helicoverpa (Heliothis) armigera*), cotton aphid *(Aphis gossypii* Glov), potato aphid (*Lacrosiphum euphorbiae* Thos), cabbage semi-looper *(Plusia orichalcea* Fab.), sunflower caterpillar *(Perigea capensis* G), head caterpillar (*Tathmopoda theoris* Mayr), melon fly *(Dacus Cucurbitae* Coq.), whitefly *(Bemisia tabaci Genn*), yellow flower thrips *(Ankliniella sulphurea* S.), several species of army worms,

grasshoppers, termites, brown bruchid *(Caryedon gonaga* bricius), saw toothed beetle *(Oryzaephilus* spp.) (Aslam, 2000).

Among these insect pests, whiteflies, loopers and jassids are regular pest and are appearing on different local genotypes of sunflower in Pakistan (Rafiullah, *et al.* 1998). However, jassid *Amrasca devastans* appears with a huge density (Ashfaq and Aslam, 2001), in all seasons of sunflower crop (Kakakhel *et al.* 2000). Mukhtar (2009) considered jassid as one of the major insect pests, which sucked the sap from leaves of plant of all genotypes of sunflower. Besides, they also inject toxic material into the tissue of the plant (Sattar *et al.,* 1984). Subsequently, various chemical reactions are being taken place within the plant that has adverse impact on plant's normal chemistry. This might cause certain physio-chemical abnormalities. The jassids cause the leaves to turn yellow in patches and even turn white at the edges. The damage reduces the number of leaves available for consumption, and may also reduce their nutritional content. Both adults and nymphs cause damage to plant leaves by sucking plant sap. Due to that the edges of leaves become crinkling, which is the characteristic feature of jassid attack (Hormchan *et al.,* 2001). Jassid populations are influenced by rainfall. High rainfall causes many deaths of nymphs and adults (Tsatsia and Jackson, 2010).

The importance of plant extracts is highly recognized as botanical pesticides in the field of agriculture because they are cheap, safe and sound, hazardless, non-residual, and highly effective against various insect pests. They have been used for crops like cotton, rice, okra, chickpea, safflower, sunflower and numerous vegetables against many insect pests of economic importance such as bollworms, fruit borers, aphids, jassids, thrips, whitefly, leaf hopper, diamond back moth etc. They act as repellant, anti-feedant and even certain chemicals, which inhibit the growth of insects that eventually influenced insect population. Apart from Neem, Huing (Asfoetida), Dhatoora

(Thorn apple) and Tobacco based products, Eucalyptus extracts are also effectively used for controlling the population of sucking complex (Hashmi, 1994). Since, biopesticides have been used in the field for many years against many insect pests. It is therefore become the need to test these extract against individual insect pest in the laboratory so that to measure their effect on the life of insect pests.

The present study was carried out on the effect of some plant extracts on nymphal development of Jassid under laboratory conditions. The output of the present investigations will be useful in making the decisions for IPM strategies against jassid.

Materials and Methods

The study was carried out under laboratory condition (27±2^{0}C) during the year 2010 to investigate the effect of some plant extracts on nymphal development of jassid. The experiment was conducted in the laboratory of Entomology Department, Faculty of Crop Protection, Sindh Agriculture University Tandojam.

Material Used

- Plastic Jars
- Muslin Cloth
- Camel hair Brush
- Magnify Glass
- Scissor
- Mardin and pestle
- Microscope.

Treatments

T1	Neem (*Azadirachta indica*) (Extract will be taken by grinding the leaves)
T2	Safaida (*Eucalyptus terticornis*)
T3	Dhatura (*Dhatura stramonium*)
T4	Neem solution (extract by boiling the leaves)
T5	Control

Preparation of extract

Two kilograms of fresh leaves each of the Datura, Neem and Eucalyptus were collected and processed for getting their extract. The leaves of each plant species were taken separately

and grounded with 50 ml water and filtered through muslin cloth. In case of neem solution, neem leaves were boiled in 500 ml water to prepare 250 ml solution.

As the process of extracts preparation completed, the collected fresh leaves of sunflower were dipped in each of the solution for a period of 30 seconds. The soaked sunflower leaves were then left to dry. Then leaves petiole was put in a separate plastic glass jars (5inch high and 1½ inch diameter with narrow mouth having fresh water in it) so that the leaves would not dry up soon. Ten 1st instars of jassid were put on these leaves. Four replication were recorded kept of each extract. After each 4 days interval, the leaves were replaced by fresh ones repeating the same soaking with the extracts and the jassid instars were transferred on to them from the previous ones. This process of experimentation continued up to 5th instar.

The observations were taken on nymphal mortalities and time spent by the instar on daily basis. At the transform liar of each instar into next stage, the mortality was accumulated to compare the efficacy of botanical extracts as well as for the comparative analysis of efficacy of plant extracts with control. Similarly, survival of 1st instar to the adult stage was also calculated by deducting the deaths in each stage.

After completion of nymphal development, the adult survivors were then keenly observed at 5 hours intervals till their death separately on each treatment. The emerging adults were kept in the jars 8" width x 12" height, same way as nymphs were kept on the leaves of sunflower having leaf petiole dipped in water. The mouths of the jars were kept closed with muslin cloth. So as the adults would escape. There were 4 replications for each extract. Emergence/hatching of eggs (days), Fertility percentage and adult longevity (days) activities were studied for the adult jassid survivors. The data thus collected were subjected to statistical analysis using analysis of variance to know the significance of differences in jassid

mortality for different botanical extracts, and LSD (Least Significance Difference) test was also employed to compare different treatments for their efficacies against jassid.

Results

In order to investigate the effect of some plant extracts on nymphal development of jassid, the study was carried out as under:

Nymphal mortality

Neem leaf extract had the highest mortality i.e. 6.00, 5.75, 4.75 and 0.75/leaf at first, second, third and fourth instar, respectively while the overall mortality was 17.25/leaf out of 20. Dhatura leaf extract had the jassid mortality of 5.25, 4.75, 4.00 and 2.50/leaf at first, second, third and fourth instar, respectively with an overall mortality of 16.50/leaf.

Eucalyptus leaf extract caused jassid mortality of 6.00, 4.25, 3.50 and 2.0/leaf at first, second, third and fourth instar, respectively with an overall mortality of 15.75/leaf.

Neem solution resulted jassid mortality of 5.25, 4.00, 3.00 and 1.75/leaf at first, second, third and fourth instar, respectively with an overall mortality of 14.00/leaf. However, the lowest jassid mortality of 5.25, 3.25, 2.50 and 1.25/leaf at first, second, third and fourth instar, respectively was recorded in control with an overall mortality of 12.25/ leaf. It was observed that neem leaf extract was most effective against jassid at all nymphal stages, followed Dhatura extract, Eucalyptus leaf extract and neem solution. Regardless of botanical extracts or control, the jassid mortality was higher at first instar nymphal stage, while the mortality reduced significantly ($P<0.05$) in the second, third and fourth instar nymphal stages, respectively. Mortalities among the newly hatched nymph influenced significantly ($P<0.05$) by the

type of the extract used in this laboratory experiment. The botanical extracts significantly reduced nymphal development of jassid on sunflower leaves in the laboratory as compared to control.

Table-1 Mortality of jassid instars on sunflower leaves sprayed with various plant extracts under laboratory conditions

Instars	Neem Extract	Dhatura Extract	Eucalyptus Extract	Neem solution	Control	Average motility	%age
1st	6.00	6.00	5.25	5.25	5.25	5.55	27.75
2nd	5.75	4.25	4.75	4.00	3.25	4.40	22.00
3rd	4.75	3.50	4.00	3.00	2.50	3.55	17.75
4th	0.75	2.00	2.50	1.75	1.25	1.65	8.25
Total	**17.25 a**	**15.75 c**	**16.50 b**	**14.00 d**	**12.25 e**	-	-

	Treatments	**Instars**
S.E.±	0.0339	0.0379
LSD 0.05	0.2134	1.5690
LSD 0.01	0.2830	2.0860
CV%	15.99	

Table-2 Analysis of variance for Table-1

Source of variation	d.f.	Sum of squares	Mean squares	F. Ratio	Prob.
Days	3	1.271	0.424	18.4776	0.0000**
Treatments(a)	4	1.020	0.255	11.1240	0.0000**
Instars(b)	3	10.134	3.378	147.3096	0.0000**
A x b	12	1.230	0.102	4.4689	0.0001**
Error	57	1.307	0.023	-	-
Total	79	14.962	-	-	-

** Highly Significant

Mortality percentage

Mortalities percentage of jassid nymph was significantly ($P<0.05$) influenced by different botanical extracts. Neem leaf extract resulted highest mortality of 86.25 percent; while Dhatura leaf extract ranked second resulting 82.50 percent nymphal mortality of jassid in the laboratory kept on sunflower. Eucalyptus leaf extract ranked third with 78.75 percent mortality; while among botanical extracts and pesticides, the neem solution ranked fourth with 70 percent jassid nymphal mortality. However, the lowest nymphal mortality of 61.25 percent was recorded in case control (Table-3). The coefficient of variation was 11.42 percent indicating considerable variation in mortality between replicates. The variation in jassid nymphal mortality between Neem leaf extract, Dhatura leaf extract, and Eucalyptus leaf extract was non-significant ($P>0.05$), while significant ($P<0.05$) when compared with neem solution and control.

Table-3 Average mortality percentage of jassid nymph on sunflower leaves sprayed with various plant extracts under laboratory conditions

Treatments	Replications				% age
	R1	R2	R3	R4	
Neem leaf extract	90.00	85.00	80.00	90.00	86.25 a
Dhatura leaf extract	80.00	85.00	80.00	85.00	82.50 a
Eucalyptus leaf extract	75.00	80.00	85.00	75.00	78.75 a
Neem solution	60.00	80.00	85.00	55.00	70.00 ab
Control	65.00	65.00	50.00	65.00	61.25 b

S.E.±	3.8676
LSD 0.05	12.760
LSD 0.01	17.400
CV%	17.40

Table-4 Analysis of variance for Table-3

Source of variation	d.f.	Sum of squares	Mean squares	F. Ratio	Prob.
Replicates	3	83.750	27.917	0.3733	0.9231^{NS}
Treatments	4	1632.500	408.125	5.4568	0.0097**
Error	12	897.500	74.792	-	-
Total	19	2613.750	-	-	-

** Highly Significant

NS Non-Significant

Adult activities

The jassids survived and emerged as adults were examined for their adult activities such as fecundity, egg hatching period, fertility percentage and adult longevity.

Fecundity

The results (Table-5, Fig-3) showed that adults on sunflower leaves soaked with neem leaf extract had the lowest fecundity of 7 eggs, while the adult fecundity increased to 9 and 11 eggs when these were kept on sunflower leaves treated with Dhatura leaf extract and Eucalyptus leaf extract, respectively. Among treatments, the highest adult fecundity of 14 eggs was noted when sunflower leaves were treated with neem solution, while overall highest fecundity of 18 eggs was recorded in adults kept on untreated sunflower leaves (control).

Nymphal emergence/Egg hatching (days)

The nymphal emergence/hatching of eggs was delayed upto 5 days when sunflower leaves were treated with neem leaf extract and Dhatura leaf extract, equally (Table-5, Fig-4); while the hatching of eggs was noted equally in four days, when these were kept on sunflower leaves treated with Eucalyptus leaf

extract and neem solution, respectively. However, the minimum period in hatching of eggs (3 days) was recorded in control.

Fertility percentage

The egg fertility percentage of the adults jassids survived was examined and the results (Table-5, Fig-5) showed highest (61%) fertility in the eggs laid by the adults of untreated sunflower leaves; while fertility percentage was 55.00, 54.00 and 50.00 of those adults which emerged from the nymph reared on sunflower leaves soaked with Dhatura leaf extract, Eucalyptus leaf extract and Neem solution, respectively. However, Neem leaf extract remained most effective to reduce fertility of eggs (42%).

Adult longevity

The adult lived a minimum life of 4 days of those which emerged from the nymphs reared on sunflower leaves soaked with Neem leaf extract, while the life prolonged for 5, 6 and 6 days of those, which emerged from the nymphs sunflower leaves soaked with neem solution, Dhatura leaf extract and Eucalyptus leaf extract, respectively. However, the adults of untreated leaves of sunflower lived maximally for 8 days (Table-5).

Table-5 Adult activities such as fecundity, emergence hatching days fertility and longevity.

Treatments	Fecundity	Emergence/ hatching (days)	Fertility (%)	Adult longivity (days)
Neem leaf extract	7.00	5.00	42.00	4.00
Dhatura leaf extract	9.00	5.00	55.00	6.00
Eucalyptus leaf extract	11.00	4.00	54.00	6.00

Neem solution	14.00	4.00	50.00	5.00
Control	18.00	3.00	61.00	8.00

Discussion

Using pesticides on large scale for combating insect pests has also caused severe problems for human health, particularly in third world countries; where the farmers use pesticides without considering the instructions of human health concern. Different plant extracts such as neem, heenge, eucalyptus, akk, dhatura etc. are being used on large scale against varieties of insect pests (Khaskheli, 2007). The present study was carried out on the effect of some plant extracts on nymphal development of Jassid under laboratory conditions.

The findings of the present research indicated that Neem leaf extract had the highest mortality (17.25/leaf), followed by Dhatura leaf extract (16.50/leaf), Eucalyptus leaf extract (15.75/leaf), Neem solution (14.00/leaf); while lowest mortality (12.25/leaf) in control. Regardless of botanical extracts, the jassid mortality was higher at first instar nymphal stage, while the mortality reduced in the second, third and fourth instar nymphal stages. These results are further confirmed by Simawat *et al*. (1996) who reported that plant products based on neem extracts were effective to control *Amrasca devastans*; while Anaso and Lale (2002) determined the economics of spraying neem kernel extract against sucking complex and found most effective to control jassid infestation on sunflower. In a similar study, Mishra and Mishra (2002) evaluated the efficacy of some botanical pesticides against the insect pests including jassid, *Amrasca devastans* and found that Multineem and Neemax lowered insect pest infestation

considerably. Moreover, Rao and Rajendran (2002) found that extract of neem seed kernel (NSKE) *Azadirachta indica* gave superior control of *Amrasca devastans*. In India, Singh *et al.* (2002) determined the efficacy of neem azadirachta indica-baded pesticides against jassids, *A. biguttulla biguttula*and ranked first in a number of other products used; while Bindu *et al.* (2003) used neem based pesticides against *Amrasca devastans* and two sprays proved to be effective to control the insect pests.

Mortalities percentage of jassid nymph was significantly ($P<0.05$) influenced by different botanical extracts and neem leaf extract resulted highest mortality of 86.25 percent; followed by Dhatura leaf extract (82.50%), Eucalyptus leaf extract (78.75%), neem solution (70%) and lowest (61.25%) in control. Singh and Kumar (2003) determined the efficacy of neem *Azadirachta indica* based pesticides against jassid and found significant control of the pest. However, Kumar (2004) studied the effect of different neem-based formulations and reported remarkable effect against jassid. In Pakistan, Gadehi (2006) applied various neem products against sucking insect pests and neem based pesticides significantly controlled the jassid population; while Brethapet (2007) in India evaluated some botanical pesticides against sucking complex and found effective control these insect pests, Dutt (2007) used neem and dhatura extracts against sucking complex and reported that neem and dhatura were considerably effective to control these pests.

The adult activities of jassid showed that neem leaf extract treated adults had lowest fecundity (7 eggs], while fecundity prolonged to 9, 11, 14 and 18 eggs when treated with Dhatura leaf extract, Eucalyptus leaf extract, neem solution and control, respectively. In a similar study, Elling *et al*. (2002) found that the proportion of emerged adults was only significantly reduced when eggs had been treated 5 and 7 days

after oviposition, respectively. In all neem treatments the time until adult emergence was significantly delayed.

The egg hatching was delayed up to 5 days under neem leaf extract and Dhatura leaf extract, and early eggs hatching in 4,4 and 3 days was when treated with Eucalyptus leaf extract, neem solution and control, respectively. These results are in line with those of Gaspari *et al.* (2007) who used botanical extracts to against various insect pests and reported that adults fed on an extract-containing sucrose diet laid significantly fewer eggs with poor hatching. There was no egg laying when the moths were fed on a sucrose diet containing 6, 8 and 10% neem and 10% bakain extracts. Egg fertility was highest (61%) in control; while fertility reduced to 55.00, 54.00, 50.00 and 42 percent when treated with Dhatura leaf extract, Eucalyptus leaf extract, Neem solution and Neem leaf extract, respectively. Minimum adult longevity (4 days) was recorded under Neem leaf extract treatment, while the adult longevity prolonged for 5, 6, 6 and 8 days under neem solution, Dhatura leaf extract, Eucalyptus leaf extract and control, respectively. These results are further supported by Nagwa *et al.* (2000) who reported reduction in hatchability for egg-masses directly sprayed with the tested extracts was positively proportional with concentration and negatively with the age of the eggs. 5; treating the newly hatched nymph with the seed oil extracts.

Conclusions

- Neem leaf extract had the highest mortality, followed by Dhatura, Eucalyptus leaf extract, Neem solution as compared to control.
- The 1st instars were influenced more by botanical extracts, then other subsequent instars with respect to mortality.

- The neem leaf extract highly influenced the fecundity and fertility of egg followed by Dhatura leaf extract, Eucalyptus leaf extract, neem solution and control.
- The neem leaf extract delayed the incubation period of egg.
- Minimum adult longevity was recorded under Neem leaf followed by Dhatura leaf extract, Eucalyptus leaf extract and control.

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