Evaluation the Action of Aqueous Extracts of*Azadirachta indicaand Solenostemma argel* on Aphid (*Aphis craccivora*) (Homoptera: Aphididae)

By:

Yathreb Kamal Hamid Mohamed

B.Sc. (Agric.) Honors

Sudan University of Science and Technology (SUST)

College of Agriculture studies

Department of plant Protection

Supervisor

Prof: Awad KHalafala Taha

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الآية

(مثَلُ الَّذِينَ يُنْفِقُونَ أَمْوَالَهُمْ فِي سَبِيلِ اللَّهِ كَمَثَلِ حَبَّةٍ أَنْبَتَتْ سَبْعَ سَنَابِلَ فِي كُلِّ سُنْبُلَةٍ مِائَةُ حَبَّةٍ ۗ وَاللَّهُ يُضَاعِفُ لِمَنْ يَشَاءُ ۗ وَاللَّهُ وَاسِعٌ عَلِيمٌ).

...صوره البقرة الاية﴿٢٦١﴾

DEDICATION

I would like to dedicate this work

To my mother

To my father

To my brothers

ACKNOWLEDGEMENTS

Firstly and unlimited thanks to his Almighty Allah, who afford me the health and strength to complete this work.

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ABSTRACT

This study was conducted in the Entomology laboratory, Faculty of Agricultural Studies, University of KHartoum in February 2020. The purpose of this study was to evaluate inhibitory effect of*Azadirachta indica* and*Solenostemma argel* on Aphid.The study included 3 concentrations 5%, 10%, 15%, in addition to the control. The experiment showed that argel extracts are more effective than neem extrscts. The concentration 15% from argel was the most effective after 24 hours.

ملخص البحث

أجريت هذه الدراسة في معمل الحشرات بكلية الدراسات الزراعية شمبات في فبراير.كان الهدف من البحث قياس فعاليةالمستخلص المائي لنباتي النيم و الحرجل على حشرة من الفول المصري. احتوت الدراسة على ثلاثة تراكيز(5% ,10% و 15%) بالاضافه الى الشاهد , أوضحت التجارب كفاءة مستخلص نبات الحرجل على نبات النيم ,عند التركيز 15% بعد 24 ساعه من المعاملة.

CHATER ONE

1.1 INTRODUCTION

Faba bean (Vicia faba L.) is one of the most globally important legume crops. Its globalacreage declined from 3.7 to 2.1 million ha between 1980 and 2014, and yields are highlyvariable within specific countries (FAO, 2017). Despite the decreasing acreage, however,productivity per area has tended to increase, due to a reduced susceptibility to abiotic andbiotic stresses (Link et al., 2010; Sillero et al., 2010; Singh et al., 2012). The globalproduction of faba bean grain in 2014 was 4.1 million tons, which is approximately 21%greater than in 1994 (FAO, 2017). The fresh and dry seeds of faba bean are used for humanconsumption; they are highly nutritious because they have a high protein content (up to35% in dry seeds), and are a good source of many nutrients, such as K, Ca, Mg, Fe, and Zn (Lizarazo et al., 2015; Longobardi et al., 2015; Neme et al., 2015). Faba bean seeds alsocontain several other bioactive compounds, such as polyphenols (Turco et al., 2016),carotenoids (Neme et al., 2015), and carbohydrates (Landry et al., 2016). However, thechemical composition is strongly influenced by variety, as well as environmental andmanagement conditions (Mona et al., 2011; Cazzato et al., 2012; Witten et al., 2015).

Azadirachta indica commonly known as neem, is native of India and naturalized in mostof tropical and subtropical countries are of great medicinal value and distributed widespread in the world.

The chemical constituents contain many biologicallyactive compounds that can be extracted from neem, including alkaloids, lavonoids, triterpenoids, phenolic compounds, carotenoids,

steroids and ketones, biologically most active compound is azadirachtin, it is actually a mixture of seven isomeric compounds labelled as azadirachtin A-G and azadirachtin E is more effective.

The importance of the neem tree has been recognizedby the US National Academy of Sciences, which published a report in 1992 entitled 'Neem - a tree for solving global problems'. The advancement of neem research has earlier been documented.

The plant Solennostemma argel Del. Hayenne (Asclepiadaceae), is a desert plantindigenous to Africa, used in traditional medicine worldwide, particularly in Africancountries (Sudan, Libya, Chad, Egypt and Algeria), Saudi Arabia and Palestine. (Elkamali HH , Khalid SA.1996 Ahmed MM. 2004., Ahmed MA.2007. , Shayoub M, Haj E , Makawy A, Rasha R, Mona A. 2013).

This plant is regarded as the richest source in Sudan and locally called Hargel, it isindigenous in the northern region [Orange RA.1982], widely spread in the places between Dongola andBarber, particularly around Abu Hamad area [Elkamali HH, Khalid SA. 1996]. Sudanese are used Hargel plant intraditional medicine as antiinflammatory, anti-spasmodic, anti-rheumatic agent, carminativeand as an anti-diabetic [,Shayoub M, Haj E, Makawy A, Rasha R, Mona A2013.Kamel MS, Ohtani K, Hasanain HA, Mohamed H, Kasai R, Yamasaki K. ,1982. , Hassan H, Hame A, El-Emary, Springue I, Mitome H, Miyaoka H.2001.Idris TIM, Ibrahim AMA, Mahdi EM, Taha AK.2011.]. The plant can used as anti-nutrition factors [Murwan K, Sabah E, Murwa A.2010] andanticancer [Hanafi N, Mansour S.2010].

1.2 Objectives of the Study

1.Evaluation the effectof aqueous extracts of neem and argel on the Aphids.

CHAPTER TWO

LITERATURE REVIEW

2.1 Classification of Argel

Class: Magnoliopsida

Order:Gentian ales

Family:Asclepiadaceous

Scientific name:*Solenostemma argel*

English name: Argel

2.1.1 Geographical Distribution of Argel

Solenostemma argel is a desert plant, which is of wide spread in central and North's parts of the Sudan, Egypt, Libya, Chad, Algeria, Saudi Arabia and Palestine. However, Sudan is regarded as the richest source of this plant (Orange, 1982).

2.1.2 Botanical Description of Argel

The plant is an erect herbaceous perennial plant that grows up to 60-100 cm tall, with several vigorousstems. The leaves are, oval, leathery and covered with fine hairs. It has numerous flowerswith whitepetals, and a strong smell, flowering period extends from March to June. The fruits are boxshape about 5-2 cm-wide, green with violet lines; they contain pubescent seeds .

2.1.3 Ecology of Argel

The plant grows in extremely dry conditions with a yearly rainfall of around 50-100 mm.It grows on the gravelly soils of wadis and on the stony and pebbly soils of regs.

2.1.4 Chemical Composition of Argel

The chemical composition of leaf of the hargel is Moisture 4.4 % Protein 15% Ash 7.7% Oil 1.6 % Crude fiber6.5% Carbohydrates 64.8 % . The findings indicated that moisture content of leaf is 4.4% which is lower than those values obtained by El-Kamali (1991).Protein content (15%) of leaf studied is coincided with those given by El-Kamali (1991). Whereas, crude oil of leaf studied is 1.6%.and the ash content is 7.7%. The crude fiber of the leaf studied is 6.5% while total carbohydrates of sample investigated is 64.8%.

2.1.5 Insecticidal Properties of Argel

Plants comprise a rich pool of phytochemicalcompounds that can be used to replace syntheticchemical insecticides (Ghosh *et al*. 2012). Kishore etal. (2011) reported the efficacy of phytochemicalsagainst mosquito larvae and described the mosquitolarvicidal potential of compounds such as alkynes,alkenes, alkanes, fatty acids, essential oils, terpenes,steroids, lactones, isoflavonoids, pterocarpans. alka-loids, and lignans. They also reported the isolation ofseveral bioactive insecticides from various plantsagainst different mosquito species such as octaco-sane, geranial, azadirachtin, alpha-terpinene, marme-sin, and pipermonaline.

2.2 Classification of Neem

Kingdom: Plantae

Division: Magoliophyta

Order: Rutales

Sub order: Rutinae

Family: Meliaceae

Scientific name: *Azadirachta indica.*

2.2.1Geographic Distribution of Neem

A native to east India and Burma, it grows in much of south East Asia and West Africa, and more recently Caribbean and south and Central America. In India it occursnaturally in Siwalik Hills, dry forests of Andhra Pradesh, Tamil Nadu and Karnataka to an altitude of approximately 700 m. It is cultivated and frequently naturalized throughout the drier regions of tropical and subtropical India, Pakistan, Sri Lanka, Thailand and Indonesia. It is also grown and often naturalized in Peninsular Malaysia, Singapore, Philippines, Australia, Saudi Arabia, Tropical Africa, the Caribbean, Central and South America.

2.2.2. Botanical Description of Neem

It is a tree 40-50 feet or higher, with a straight trunk and long spreading branches forming a broad round crown; it has rough dark brown bark with wide longitudinal fissures separated by flat ridges. The leaves are compound, imparipinnate, each comprising 5-15 leaflets. The compound leaves are themselves alternating with one another. It bears many flowered panicles, mostly in the leaf axils. The selel are ovate and about one cm long with sweet scented white oblanciolate petals.

It produces yellow drupes that are ellipsoid and glabrous, 12-20 mm long. Fruits are green, turning yellow on ripening, aromatic with garlic like odour. Fresh leaves and flowers come in March-April. Fruits mature between April and August depending upon locality.

2.2.3. Ecology of Neem

It can grow in regions with an annual rainfall below 400 mm, but in such cases it depends largely on ground water levels. Neem can grow in many different types of soil, but it thrives best on well drained deep and sandy soils. It is a typical tropical to subtropical tree and exists at annual mean temperatures of 21–32 °C (70–90 °F). It can tolerate high to very high temperatures and does not tolerate temperature below 4 °C (39 °F). Neem is one of a very few shade-giving trees that thrive in drought-prone areas e.g. the dry coastal, southern districts of India, and Pakistan. The trees are not at all delicate about water quality and thrive on the merest trickle of water, whatever the quality. In India and tropical countries where the Indian diaspora has reached,it is very common to see neem trees used for shade lining streets, around temples, schools and other such public buildings or in most people's back yards. In very dry areas the trees are planted on large tracts of land.

2.2.4.Chemical Compositionof Neem

Neem is a versatile tree containing large number of chemically and biologically active compounds. At present, more than 100 triterpenoids have been isolated from neem. The constituents of neem can be classified as isoprenoids and other nonisoprenoid compounds.

Isoprenoid compounds include the diterpenoids and triterpenoids, whereas the non-isoprenoids includes the phenolics, carbohydrates, proteins and sulphur compounds. Among the triterpenoids, bitterness of neem is due to the presence of azadirachtins, a group of limnoids. Azadirachtin A was the first member isolated by Butterworth and Morgan (1968) from neem seeds. So far, fourteen analogues of Azadirachtin were reported from neem i.e. fromAzadirachtin A to K, Vepaol, Isovepaol and 11 - methoxy azadirachtin.

Azadirachtin, a tetranortriterpenoid from A. indica was reported to be a good insect growth inhibitor of plant origin (Rembold et al., 1982).

2.2.5.Insecticidal Properties of Neem

Its strong antifeedant, insect growth regulatory and reproductive effects are now well understood and documented. Antiffedancy varies markedly between species with mosquitoes being particularly sensitive to azadirachtin. The mode of action of azadirachtin lies in (i) effects on deterrent and other chemoreceptors resulting in antifeedancy and (ii) direct effects on most other tissues studied resulting in an overall loss of fitness of the insect.

CHAPTER THREE

MATERIALS AND METHODS

3.1.Plant Collection

Fresh leaves of neem (*Azadiracta indica*) were collected from Zalingei area in Central Darfur State. The seeds were then cleaned, de-shelled and subsequently the kernels and hulls were separated manually. The kernels were dried, ground to fine powder and stored in glass vials until used.

Leaves of argel (*Solenostemma argel*) were purchased from Omdurman market. The dried leaves were ground, powdered, stored at 4ºC and protected from light prior to further use.

3.2. Preparation of the Plant Aqueous Extract

The aqueous extracts of powder of A.indica and S. argel leaves were prepared by adding 25g of each powder to 250 ml of distilled water in 500ml conical flask. The mixtures were left to stand for 24 hours at room temperature, according to the method described by the Environmental and National Resources and Desertification Research Institute (ENRDRI). The mixtures were then thoroughly shaken by shaker within a period of 24 hours. The mixtures were then filtered using clean muslin cloth. The filtrates (stock solutions, 25w/v) were kept in the refrigerator at 4 ºC for bioassay. Four concentrations (5%, 10%, 15% and 20%) from each extract were prepared and used in the bioassay.

3.3.Insect Collection

aphids were collected from the field of faba bean from Khartoum university and taken into laboratory.

3.4.Data Recording

From each extract 5,10,15ml was taken with the help of medical syringes in which filter paper , tissue and leaves were dipped. After 10 min of drying, these were placed into petri dishes.

3.4.1.Filter Paper Method

Filter paper was placed upside down in each petri dish, 20 aphids (1st, 2nd and 3rd, 4th instars separately) were released on each filter paper by means of camel hair brush . There were total 25 petri dish in a single replication, The mortality of the specimens was determined at the interval of 6, 12, and 24 hours after the application.

Plate No.1. Aphiscraccivora.

Plate No.2. Colonies of Aphid on broad bean.

Plate No.3. Direct damage of aphids.

CHAPTER FOUR

RESULTS

4.1Table (1): Mean percent mortality of aphid treated with neem and argel water extract (6) hours after treatment application

Treatment	Mean percentage mortality
Neem 5%	36.6%
Neem 10%	65%
Neem 15%	50%
Argel 5%	56.6%
Argel 10%	55%
Argel 15%	56.6%
Control	1.6%

The results in 6hr show that neem 10% gave the best result. The mortality percentage was 65%. The least effect was 50% given by concentration 15% from neem

4.2Table (2): Mean percent mortality of aphid treated with neem and argel water extract (12) hours after treatment application

Treatment	Mean percentage mortality
Neem 5%	50%
Neem 10%	61.6%
Neem 15%	71.6%
Argel 5%	68.3%
Argel 10%	58.3%
Argel 15%	71.6
Control	10%

The results in 12hr show that both neem and argel concentration 15% gave the best result. The mortality percentage was 71.6%

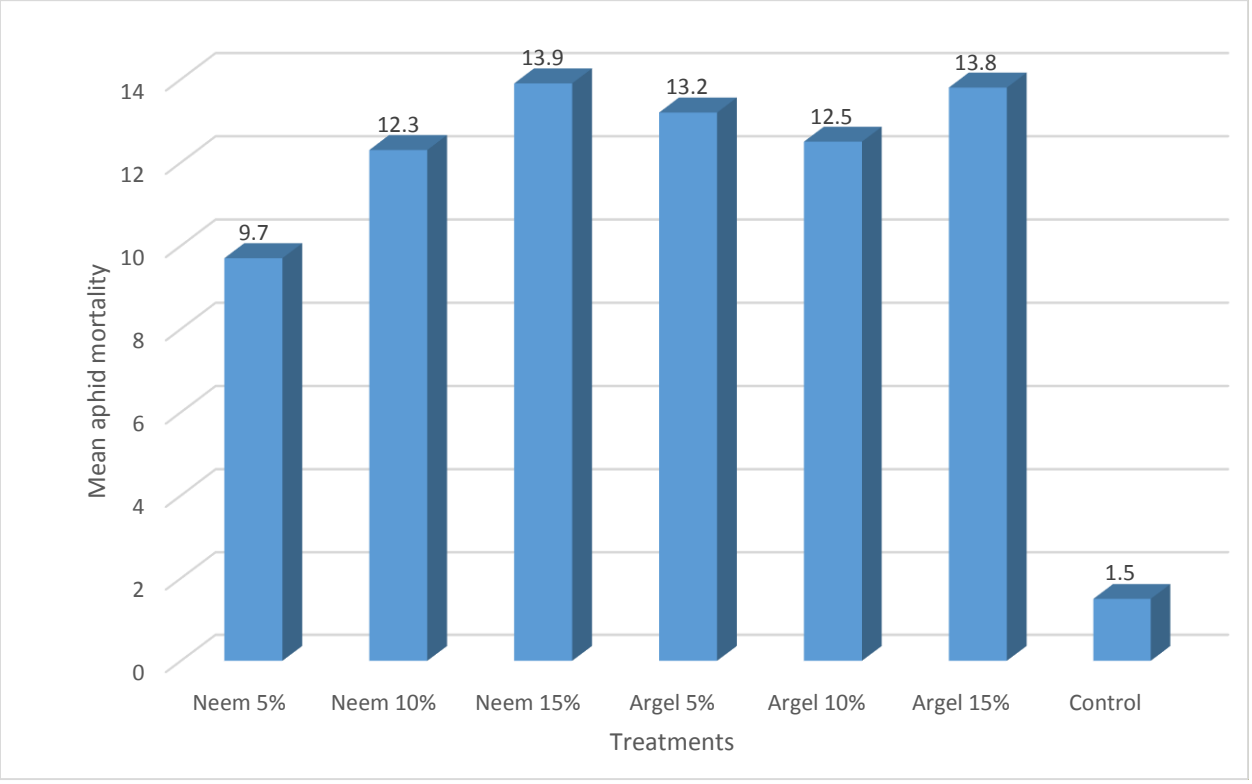
The least effect was 50% given by concentration 5% from neem.

4.3Table (3): Mean percent mortality of aphid treated with neem and argel water extract (24) hours after treatment application

Treatment	Mean percentage mortality
Neem 5%	60%
Neem 10%	70%
Neem 15%	73.3%
Argel 5%	73.3%
Argel 10%	73.3%
Argel 15%	78.3%
Control	8.3%

The results in 24hr show that argel 15% gave the best result. The mortality percentage was 78.3%. The least effect was 60% given by concentration 5% from neem.

The result of this study showed that the extracts of both plants resulted in significant (P≤0.05) mortality of aphid (Figure1). This result agrees with that obtained by soliman, et al., (2005).



4.4 Figure (1): Mean mortality of aphid kept in filter paper sprayed with neem and argel water extract.

CHAPTER FIVE

5.1DISCUSSION

This study was conducted to investigate the effect of argel and neem aqueous extract on the aphid pest. The result obtained by this experiment showed that, the different concentrations of aqueous extract of name and argil. They are have different effectiveness in the mortality percentage of aphid.The name highest impact found in concentration 15% after 24hours, the least effect was given by 5% after 24hours. The argel highest impact found in concentration 15% after 24hours, the least effect was given by 10% after 6hours from the applications.These results are similar to those obtained by Stark & Rangus (1994) forAcyrthosiphon pisum (Harris) nymphs exposed to bean plants treated with Margosan-O, a commercial neem formulation.

5.2 CONCLUSIONS

*****The Argel leaf powder was also effective to controlling aphid on concentration 15% after 24hr from application.

*****The Neem leaf powder was also effective to controlling aphid on concentration 10% after 6hr from application.

5.3RECOMMENDATIONS

*****More studies are also needed to confirm the present results, and more research to determine mode of action and active ingredients of neem and argel.

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APPENDICES

Appedix (1): Number of mortality of aphid (Aphis craccivora) after treatment by aqueous extract of the neem plant.

Replication 1	Aqueous extract effect	Con5%	Con10%	Con15%	Control
	After 6hrs	9	9	14	1
	After 12hrs	10	10	14	2
	After 24hrs	11	12	14	3
Replication 2					
	After 6hrs	8	10	12	0
	After 12hrs	11	12	13	3
	After 24hrs	14	15	13	3
Replication 3					
	After 6hrs	5	11	13	0
	After 12hrs	9	16	16	1
	After 24hrs	11	17	17	1

Appedix (2): Number of mortality of aphid (Aphis craccivora) after treatment by aqueous extract of the argel plant.

Replication 1		Con 5%	Con 10%	Con 15%	Control
	After 6hrs	13	11	13	1
	After 12hrs	14	12	18	1
	After 24hrs	15	16	18	1
Replication 2					
	After 6hrs	11	12	10	0
	After 12hrs	14	13	12	1
	After 24hrs	15	14	15	2
Replication 3					
	After 6hrs	10	10	12	0
	After 6hrs	13	11	13	1
	After 24hrs	14	14	14	2