Egypt. Acad. J. biolog. Sci., 3 (1): 89- 93 (2010) A. Entomology
Email: egyptianacademic@yahoo.com ISSN: 1687–8809
Received: 30/4 /2010 www.eajbs.eg.net

Effect of wetting agents on some biological activity of alum soluble powder formulations against *Aphis craccivora*.

Azza I. Mohamed and Ashraf M. A. El-kady.
Central Agricultural Pesticides Laboratory, Dokki, Giza, Egypt.

ABSTRACT

Laboratory tests were conducted to assess the insecticidal activity of Alum salt and its formulation, A_1 (Alum+ Tween) and A_2 (Alum +sodium dodecyl sulphate {SDS}) against *Aphis craccivora* stages under laboratory condition. The insecticidal effect of Alum was noticed as slight affect at 2, 4, and 6 hours of treatments in case of nymphs, adults and winged stage respectively where as it increased gradually to record the highest activity after 12 hours. Soluble powder formulations of Alum were more effective than Alum alone. This indication was noticed as increasing in effectiveness without any changes in behavior of activity. The effectiveness of formulated Alum soluble powder was affected by the type of wetting agent that used in formulated preparations. A_2 formulation (Alum +SDS) was more effective than A_1 formulation (Alum +Tween) against all stages at all exposure periods.

INTRODUCTION

Sucking insects like aphids can affect plant growth production by different ways (Schepers, 1988). The cowpea aphid, *Aphis craccivora* (Koch) has become a serious pest of crops through the world. This insect infested a wide range of plants specially *faba* bean, cowpea and pea in Egypt.

Also, the extensive use of insecticides has led to widespread development of resistance in many insect species (Wordlow *et al*., 1976; Devonshire, 1989 and Weichel, *et al.* 2003). In the past 50 years more than 500 arthropods species has become resistant to the toxicological action of insecticides and this include more than 20 resistant aphid species (Georghiou,1990).So, in this work, the purpose was studying the efficiency of Alum and its formulations as a possible sources of alternative insecticides to determine its efficacy to control the insect.

MATERIALS AND METHODS

A) Tested chemical:

Alum as a formulated soluble powder, (SP 90 %) was prepared according to method described with El- kady (2008).

B) Bioassay:

The slide- dip technique assay as described by Harlow and Lampert (1990) was used to evaluate the insecticidal activity of active ingredient (citric acid) and their formulations against bean aphid stages.

All stages were transferred by a fine paint brush. Insects were first gently touched with the brush to withdraw their proboscis from leaves, than were transferred and affixed to double faced scotch tape tuck tightly to slide on their dorsal part of the body. The slides were then dipped into active ingredient solution and their

formulation for 10 seconds and excess solution of alternative or their formulations were taken off with filter paper. Three slides (30 aphids) were used for each concentrations.

Percentage mortality was recorded 2, 4, 6 and 12 hours after treatment based on the lack of antennae and leg movement upon probing with a fine artist's paint brush.

F) Statistical analysis:

Correction of mortality, LC_{50}, confidence intervals, and slops were determined using software package "LD-P line", copyright of Dr. Ihab. M. Baker, Plant Protection Research Institute, Egypt. Increasing in effectiveness of active ingredient as resulting to formulation was determined using El-kady formula (2008):

EC_{50} of active ingredient – EC_{50} of formulation / EC_{50} of active ingredient.

RESULTS

Insecticidal activity of Alum against different stages of *Aphis craccivora* was studied under laboratory conditions. Table (1) indicated that nymphs were the most sensitive stages to Alum followed by adults and winged. The percentage mortality of nymphs was recorded after two hours from treatment where as it detected after four and six hours in case of adult and winged respectively. Generally the effectiveness of Alum against all tested stages increased by increasing the exposure periods. The LC_{50} values were 3.50, 2.50 mg/ml and complete mortality at 2, 4, 6 hours in case of nymphs while they were 1.20, 0.28 and 0.008 mg/ml at 4, 6 and 12 hours in case of winged. On the other hand, no changes were found in calculated slope values at all exposure periods in case of nymphs and winged while it changed from 0.6 ± 0.5 at four hours to 2.15 at 6 hours and return to become 0.65 ± 0.5 in case of adult. From obtained results, it could be concluded that Alum possessed insecticidal activity against *A. craccivora*. The effectiveness of Alum increased by increasing the exposure periods in all tested stages.

Table (1) Insecticidal effect of Alum as active ingredient against different stages of *Aphis craccivora* under laboratory conditions.

Stages	Exposure periods							
	2 hrs		4 hrs		6 hrs		12 hrs	
	LC_{50} mg/ml	slope	LC_{50} mg/m	slope	LC_{50} mg/m	slope	LC_{50} mg/m	slope
Nymph	3.5	0.85±0.31	2.5	0.85±0.42	CM	-	CM	-
Adult	N.E	-	1.2	0.66±0.50	0.28	2.15±0.50	0.008	0.65±0.50
Winged	N.E	-	N.E	-	15.80	0.98±0.94	14.60	0.98±0.44

CM: complete mortality. NE: not effected. - : not calculated.

The effectiveness of Alum formulations A_1 (Alum + Tween) and A_2 (Alum + SDS) was evaluated on different stages of *Aphis craccivora* under laboratory conditions table (2). Generally there are arrogation relationship were found between concentrations of tested formulations and their effectiveness against nymphs, adult and winged insects. On the other hand the both formulations showed a slight activity at two hours from treatment this activity increased gradually to record the highest effectiveness after 12 hours. According to LC_{50} values, the descending order of insecticidal activity of both formulations on tested stages was nymphs, adult and winged. With another point of view type of wetting agent that used in preparation of Alum as Sp formulation play an important role in their effectiveness at all exposure periods as found in case of nymphs that was more sensitive to A_1 formulations than

A_2. The LC50 values of A_1 were 1.99, 0.46 and 0.009 mg/ml and completely mortality at 2, 4, 6 and 12 hours where as they were 6.10, 0.10, 0.034 and complete mortality at the same exposure periods in case of A_2 formulation. On contrast formulation A_2 was more effective against adult than A_1, the LC_{50} values were 13.90, 0.99, 0.084 and 0.003 at 2, 4, 6 and 12 hours in case of A_2 while they were 13.90, 3.44, 0.97 and 0.oo4 at 2, 4, 6 and 12 hours in case of A_1.

Table (2) Evaluation of Alum as SP formulations against different stages of Aphis craccivora under lab conditions.

Stages	Formulation code	Exposure periods							
		2 hrs		4 hrs		6 hrs		12 hrs	
		LC_{50} mg/ml	slope	LC_{50} mg/ml	slope	LC_{50} mg/ml	slope	LC_{50} mg/ml	slope
Nymphs	A_1	1.99	0.99±0.35	0.46	0.68±0.30	0.009	0.59±0.53	CM	-
	A_2	6.10	0.43±0.43	0.11	0.53±0.42	0.034	0.93±0.52	CM	-
Adult	A_1	13.90	0.64±1.03	3.44	1.11±0.52	0.97	0.62±0.30	0.004	1.38±0.32
	A_2	13.90	0.64±1.03	0.99	0.67±0.30	0.084	1.02±0.33	0.003	0.70±0.63
Winged	A_1	NE	-	NE	-	13.2	0.98±0.94	1.20	0.68±0.31
	A_2	NE	-	5.20	1.35±0.93	1.10	1.45±0.47	0.209	0.64±0.30

CM: complete mortality. NE: not effected. -: not calculated.
(Alum+Tween). A_2= (Alum + SDS). A_1=

Data in table (3) showed comparison between effectiveness of alum as active ingredient and their SP formulations against different stages of *A. craccivora* under laboratory conditions. The increase in effectiveness as resulting to formulation was calculated at 12 hrs from treatment. No changes were found between active ingredient (Alum) and both formulations A1, A2 against nymphs. On contrast both formulations increased effectiveness of Alum against adult winged while A2 formulation caused increasing in Alum effectiveness against adult and winged more than A1. The percentages increase in effectiveness was 50 and 62.5% in case of A1 and A2 formulations against adult stage, respectively while it was 91.80 and 98.60% against winged.

Table (3) Increase in effectiveness of formulated Alum after 12 hours from treatment.

Stages	**Formulation code**	**% Increasing**
Nymph	A_1	CM - no change
	A_2	CM - no change
Adult	A_1	50
	A_2	62.5
Winged	A_1	91.8
	A_2	98.6

A1: (Alum+ Tween 20) A2: (Alum+SDS)

DISSCUSION

The *in vitro* experiments clearly show that Alum possessed insecticidal activity against all stages of *Aphis craccivora* (nymph, adult and winged). The insecticidal effect of Alum as active ingredient was noticed as slight effect at 2, 4 and 6 hours in case of nymphs, adult and winged respectively. This effect was increased gradually to record the highest activity at 12 hours from treatment. The above indication may be due to: a).The mode of action.

b) The sensitivity of tested stages as follow:

1- Mode of action of Alum: -

Depending on our observation, Alum acts on tested insects through dehydration of insect water content. On the other hand tested population consisted of individuals varied in their tolerance to this action. So the sensitive individuals will be died directly while the individuals that were more tolerance will need more exposure time to die, the increase of Alum activity with increasing of exposure periods against tested pest was recorded by El-kady, 2008, Mohamed *et al*. 2009 and El-kady, A.M.A. *et al*., 2010.

2- Sensitivity of tested stages:

As a base, morphological and physiological characteristic differ from stage to another stage. These characteristics may be play an important role in tolerance degree of each stage against Alum. So, nymph was more sensitive to Alum action than adult and winged. Soluble powder formulations of Alum was more effective than Alum alone this indication was noticed as increasing in effectiveness without any changes in behavior of activity that started slightly and increased gradually to record the highest activity after 12 hours from treatment. On the other hand, there were changes founded in the time of effectiveness detection. The effectiveness of Alum alone was recorded at 4 hours against adult while it changed to 2 hours in case of A1 (Alum+ Tween) and A2 (Alum + SDS) formulations. Also the same indication was noticed with A2 formulation which showed effectiveness against winged at 4 hours while the effect of Alum alone was recorded at six hours. These indications may be due to the role of wetting agents that used in preparation of Alum as SP formulation. Wetting agents reduced surface tension of spray droplet that spread on the body surface of *A. craccivora* stages providing more coverage for toxicant by decreasing contact angle of spray drops on body surface. With other view wetting agent may be facilitate the penetration of active ingredient to reach its target and achieve its action.

The effectiveness of Alum soluble powder formulation was affected by the type wetting agent (noionic or aionic). A_2 formulation (Alum+SDS) was more effective than A1 formulation (Alum+Tween) against all stages at all exposure periods except their effect against nymphs at 2 and 6 hours. Surfactants are made up of surface-active molecules, with a hydrophilic and hydrophobic portion. The ability of surface tension depends on the hydrophilic-hydrophobic relationships and the propensity of molecules to arrange them selves at the interfaces of different phases (i.e. between the droplets and the air and or between the droplets and the plant surface) Van Valkenburg, 1982 and Mukerjee and Mysels, 1971.

REFERANCES

Devonshire, A. L. (1989). Resistance of aphid to insecticides, pp 123-139. In A.K. Minks and P. Harrewjn {eds}, Aphids: biology, natural enemies and control. Elsevier, Amsterdam.

El-kady, A. M. A. (2008). Formulation and Determination the Nematicidal activity of alum and citric acid against root knot nematode, *Meloidogyne incognita*. J. Agric. Sci. Mansoura Uni., 33(1): 533- 539.

El-kady, A. M. A.; Azza, I. M. and Aziza, H. M. (2010). Insecticidal activity of citric acid and its soluble powder formulations against *A. craccivora* .Egypt Acad. J. Biol. Sci., 2(1): 7-12.

Georghiou, G. P. (1990). Overview of insecticides resistance .pp 18-41. In: Green, agrochemicals from fundamental research to practical strategies. Washington DC, American Chemical Society.

Harlow, C. D. and Lampert, E. P. (1990). Resistance mechanisms in two color forms of the tobacco aphid (Homoptera: Aphididae). J. Econ. Entomol., 87: 187-192.

Mohamed, G. E. H.; El-kady, A. M. A. and Moharum, F. A. (2009). Evaluation of soluble powder formulation of Alum and Citric acid as alternative pesticides against mealy bugs under field conditions. Egpt.Acd.J.Biolog. Sci., 1(1):69-72.

Mukerjee, P. and Mysels, K. D. (1971). Critical Micelle concentrations of aqueous surfactant systems. National Bureau of standereds Washington DC, PP. 1-21.

Schepers, A. (1988). Control of aphids, chemical control, pp89-121. In Aphids: their biology, natural enemies and control; world crop pests, 2C, A.k.Minks and P. Harrewijn {eds}. Elsevier, Amsterdam.

Van Valkenburg, J. W. (1982). Adjuvant for herbicides, ed. R. H. hodgson. Weed Sci. Soc. Amer., PP.1-9.

Weichel, l. and Nauen R. (2003) .Monitoring of insecticide resistance in damson hob aphid, *Phorodon humuli* (Homoptera; Aphididae) from German hop gardens. Pest management Science, 59: 991-998.

Wordlow, L. R.; Ludlam, F. A. B. and Bradley, L. F. (1976). Pesticide resistance in glasshouse whitefly Trialeurodes vaproariorum.Pestic. Sci. 7:320-324.

ARABIC SUMMARY

تأثير المواد القابلة للبلل علي التغيرات البيولوجية لملح الشبه ضد آفة من الفول.

عزة إسماعيل محمد - أشرف محمود عبد الباسط القاضى
المعمل المركزي للمبيدات - مركز البحوث الزراعية الدقى - جيزة- مصر

تناول هذا البحث تحضير صور تجهيزية لملح الشبة علي صورة مساحيق قابلة للذوبان فى الماء وتم دراسة تأثير المادة الفاعلة وكذلك المستحضرات المختبرة (alum+tween) و (alum+SDS) (sodium dodecyl sulphate) ضد آفة من الفول *Aphis craccivora* تحت الظروف المعملية وقد أظهرت هذه المواد فاعلية ضد الأطوار المختبرة وكانت أعلي تأثيرا علي الطور اليرقى فالطور البالغ ثم الطور المجنح. و قد تم أخذ النتائج بعد ٢، ٤، ٦ و ١٢ ساعة من المعاملة حيث أظهرت أعلي تأثيرا بعد١٢ ساعة من المعاملة وقد كان الطور اليرقى أكثر الأطوارحساسية تلي ذلك الطور البالغ ثم الطور المجنح الذى أعتبرأشد الأطوارمقاومة.