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PESTICIDAL EFFICIENCY OF SOME INORGANIC SALTS AGAINST SUCKING PESTS INFESTING *PHASEOLOUS VULGARIS* (L.) SEEDLINGS

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Abstract

Two different experiments were carried out to evaluate the pesticidal efficiency of some inorganic salts contained toxic moiety in its molecules against sucking pests infesting *Phaseolous vulgaris*. The first experiment was done in pots at salt concentrations 0.05, 0.2 and 0.8%, while the second experiment was carried out in open field at 0.2% of each salt. The tested salts were: ammonium floride, barium nitrate, sodium phosphite and potassium bromate. Results obtained indicated that concentration of 0.2% of each salt was suitable for controlling spider mite: *Tetranychus urticae,* aphis: *Aphis gossypii* and jasside: *Empoasca lybica* without any phytotoxic effect against *Phaseolous vulgaris* seedlings.

INTRODUCTION

The most common conventional insecticides are related mainly to 4 groups: chlorinated hydrocarbon, organophosphorus, carbamates and pyrethroids. Most of these pesticides are high in cost, importing, hazard to man and animals and become less effective against pests as a result of building cross resistance in pests. Therefore, efforts should be directed towards new groups of insecticides. Previous studies indicated that inorganic salts proved their efficiency in controlling some key pests, i.e. snails (Nakhla and El-Sisi, 1995), cotton leafworm larvae (El-Sisi and Farrag, 1989), cotton leafworm pupae (Sharaboy, 1987), and cutworm (Badr *et al.*, 1996).

The present investigation aimed to evaluate the pesticidal efficiency of some inorganic salts. They are characterized by cheep in cost ad easily in preparation from their primary parent materials. Also, each salt molecule contained two different moiety, one is poisoning against survive creature moiety such as: floride, bromate, barium and phosphite (Spencier, 1968; Gleason *et al.*, 1969; Tomlin, 1994), while the other is fertilizing element such as nitrogen (ammonium and nitrate), phosphour (phosphite) and potassium. Such structure may achieve pesticidal activity against sucking pests infesting *Phaseolous vulgaris* and fertilization.

MATERIALS AND METHODS

The following inorganic salts were tested

1. Ammonium floride (NH_4F): poisoning group is floride.
2. Barium nitrated $Ba(NO_3)_2$: poisoning group is barium.
3. Sodium phosphite NaH_2PO_3: poisoning group is inorganic phosphourus.
4. Potassium bromate $KBrO_3$: poisoning group is bromine.

Two different experiments were conducted to evaluate the pesticidal efficiency and phytotoxic effect of the tested inorganic salt: first in pots planted with seedlings of *P.vulgaris* June 1, 1999. Each salt was tested at three concentrations 0.05, 0.2 and 0.8% (wt/v.) into 3 replicates for each. The second experiment was conducted in the open field according to the Ministry of Agriculture protocol (19), at July 4, 1999 by using one rate only (0.2%) in 1/100 feddan with all tested inorganic salts. Spraying was done by using hand plastic sprayer 2 litres capacity, infestation was assessed before spraying and then after 2, 5, 8, l l and 14 days from spraying by collecting 10 leaves from each treatment and untreated pots. Inspection was done under binocular in laboratory to determine the number of each of the considered sucking pests per leaf. The pesticidal efficiency was calculated as a reduction percentage occurred in the population of each pest as a result of treatment according to the equation adopted by Hendersson and Tilton (1955).

$$\%R = \left(1 - \frac{C_b}{C_a} X \frac{T_a}{T_b} \right) 100$$

where C_b= mean alive number of pest/ leaf in untreated pot before spraying.
C_a= mean alive number of pest/ leaf in untreated pot after spraying.
T_b= mean alive number of pest/ leaf in treatment before spraying.
T_a= mean alive number of pest/ leaf in treatment after spraying.

On the other hand, phytotoxic effect was determined by recording any flamming, curl and colour changes occurred in leaf of *P. vulgaris* seedlings.

RESULTS AND DISCUSSION

Results of pots experiments are shown in tables 1 and 2 which indicated that the tested salts proved high insecticidal efficiency against spider mite: *T.urticae* and. aphid: *A.gossypii* when used at 0.2% and 0.8% as they achieved high initial effect 70% and residual effect 20 % reduction population after two weeks . Phytotoxic studies showed that the tested salts caused slight phytotoxic effect when they sprayed at 0.8% as

they slowing flamming and colour change in leaf at this concentration. This phytotoxic effect may be due to osmotic force that cause plasmolysis to plant cell by losing a part of its water content (Steward,1958).0n the other hand, no any phytotoxic effect was observed at 0.05% and 0.2%, therefore concentration of 0.2% is suitable for controlling sucking pests without phytotoxic effect.

Results of the second experiment at 0.2% in open field against the existed pests: spider mite : *T.urticae*, white fly: *Bemisia tabaci* and jasside: *E. lybica* are shown in tables 3-8. According to Ministry of Agriculture recommendation, succeeded pesticides against vegetable pests should achieve initial effect 70% and residual effect 40% after one week or 20% after two weeks . Depending on this limitation, the obtained results could be discussed as the following.

Results in table 3 indicated that the tested salts had moderately initial effect against egg of *T.urticae* less than recommendation, sodium phosphite showed the highest effect followed by barium nitrate, potassium bromate and ammonium floride . On the other hand, barium nitrate and potassium bromate showed suitable residual effect while sodium phosphite, ammonium florid showed low residual effect less than recommendation .

Data in table 4 indicated that all tested salts showed succeeded initial and residual effect against adults of *T.urticae* comply with the Ministry of Agriculture recommendation (1993). Potassium bromate showed the highest initial effect and ammonium floride showed the lowest initial effect, but in the case of residual effect ammonium floride showed the highest residual effect and potassium bromate showed the lowest residual effect .

The effect of the tested materials against eggs and larvae of *B.tabaci* is shown in tables 5 and 6 which clearly shown that all tested salts showed moderately initial and residual effect less than recommendation, while they showed good initial effect against pupae of this pest, table 7 comply with recommendation. Barium bromate showed the highest effect followed by ammonium floride, sodium phosphite and potassium bromate, while all tested salts did not show any residual effect against pupae of *B. tabaci* . According to the obtained results it could be said that the tested salts succeeded in controlling pupal stage of *B . tabaci* as they have moderately controlling effect against both egg and larval stages and they did not have suitable residual effect as protectants against egg, larval and pupal stages of this pest .

Table 8 showed the effect of the tested materials against *E. lybica*, the obtained

results indicated that all tested salts gave high initial and residual effect agreed with the Ministry of Agriculture recommendation, sodium phophite showed the highest initial effect followed by potassium bromate, ammonium floride and barium nitrate.

The toxic effect of the inorganic salts is due to their effect as stomach poison as retaining of midgut epithelium protoplasm (Spencer, 1968; Gleason *et al.*, 1969; Tomlin, 1994). Therefore, their effect against feeding stages is higher than nonfeeding stages (eggs), also, the toxic effect may be due to losing a part of insect water content as a result of osmotic force (Steward, 1958).

As conclusion, the results of the two experiments proved that concentration of 0.2 % of all tested salts was effective for controlling aphid, spider mite and jasside that infested *P. vulgaris* seedling crop without showing any phytotoxic effect.

Table 1. Effect of the tested materials against spider mite, *T. urticae* in pots experiment.

Treatment	Conc %	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
			No./leaf	%R*	5	8	11	14 days	Total	Mean	%R
Ammonium floride	0.05	2.0	0.4	84.76	10.8	17.6	15.0	13.2	56.6	14.15	1.77
	0.20	4.2	0.4	92.74	8.6	16.8	14.4	11.0	50.8	12.70	58.02
	0.80	3.0	0.2	94.92	6.0	11.0	12.0	7.6	31.2	7.80	63.90
Barium nitrate	0.05	5.4	1.8	74.60	12.4	13.6	10.6	8.2	44.8	11.20	71.20
	0.20	4.0	1.0	80.95	10.0	10.6	9.0	7.9	37.5	9.25	67.90
	0.80	6.0	1.0	87.30	7.8	9.0	8.4	7.6	32.8	8.20	81.02
Sodium phosphite	0.05	5.0	1.6	75.62	4.4	6.6	6.2	5.2	22.4	5.60	84.45
	0.20	4.8	0.6	90.47	3.0	7.0	5.8	4.6	20.4	5 10	89.39
	0.80	6.4	0.4	99.86	4.0	5.8	4.8	4.0	18.6	4.65	89.91
Potassium bromate	0.05	5.6	3.0	59.18	6.2	14.0	16.2	4.2	50.6	12.65	68.64
	0.20	4.2	1.0	81.86	9.4	12.4	10.8	2.8	35.4	8.85	70.75
	0.80	4.4	0.4	93.07	5.0	7.0	6.6	6.6	25.2	6.30	80.12
Untreated		3.2	4.2		21.4	2 7	19.4	24.0	92.2	23.05	

R*: Reduction percentage.

Table 2. Effect of the tested materials against aphid, *A. gossypii* in pots experiment.

Treatment	Conc %	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
			No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	0.05	1.6	0.8	93.31	8.4	12.0	12.2	10.0	42.6	10.56	77.69
	0.20	2.0	0.8	94.55	7.6	10.4	11.0	8.80	32.4	8.10	86.30
	0.80	1.4	0.2	98.05	2.0	7.6	9.4	7.4	26.4	6.6	84.06
Barium nitrate	0.05	0.8	0.6	89.77	4.2	13.2	12.2	9.6	39.2	9.8	58.59
	0.20	1.1	0.8	90.80	3.0	13.6	11.0	9.2	36.8	9.2	71.73
	0.80	0.8	0.2	96.59	2.2	8.2	6.8	7.6	24.8	6.2	73.80
Sodium phosphite	0.05	0.6	0.6	86.36	4.0	14.6	11.6	10.6	40.8	10.2	42.53
	0.20	0.8	0.6	85.98	2.6	10.6	10.4	9.6	33.2	8.3	64.92
	0.80	0.6	0.2	95.45	2.0	7.4	7.0	7.6	24.0	6.0	66.20
Potassium bromate	0.05	1.0	0.4	94.55	4.8	10.8	9.0	5.2	29.8	7.45	74.81
	0.20	1.0	0.0	100.00	26	8.6	8.4	9.4	29.0	7.25	75.49
	0.80	0.1	0.0	100.00	1.6	7.8	6.2	5.8	21.4	5.35	80.84
Untreated		0.6	4.4		11	17.8	16.4	25.8	71.0	17.75	

% R: Reduction percentage.

Table 3. Effect of the tested materials against eggs of *T. urticae* in open field experiment

Treatment	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
		No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	11.3	6.8	47.24	6	10.9	22.1	32.4	71.4	17.85	8.63
Barium nitrate	14.9	7.9	53.52	8.7	12	15	29.7	65.4	16.35	36.53
Sodium phosphite	10.5	4.7	60.76	7.2	10.8	19.4	25.4	62.8	15.7	13.52
Potassium bromate	7.4	4	52.61	9.0	10.1	16.8	28.4	64.3	16.08	25.68
Untreated	12.8	14.6		9.5	19.8	26	33.2	88.5	22.12	

% R: Reduction percentage.

Table 4. Effect of the tested materials against nymphs and adults of *T. urticae* in open field experiment

Treatment	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
		No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	13.5	5.7	70.13	5.7	7.6	20.2	23.3	56.8	14.2	58.87
Barium nitrate	11.7	4.5	72.79	6.9	7.5	13.1	22.0	49.5	12.38	58.62
Sodium phosphite	9.1	3.5	72.79	7.1	7.8	15.6	26.8	57.3	14.33	38.42
Potassium bromate	7.8	2.6	76.42	7.1	10.1	16.8	24.5	58.5	14.63	26.66
Untreated	7.5	10.6		7.6	16.4	20.0	32.7	76.7	19.18	

% R: Reduction percentage.

Table 5. Effect of the tested materials against eggs of *B. tabaci* in open field experiment

Treatment	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
		No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	10	5.2	32.28	5.1	9.6	17.2	33.1	65	16.25	1.62
Barium nitrate	10.4	5.7	28.62	5.8	10.5	16.4	34.2	66.9	16.73	2.61
Sodium phosphite	8.7	3.7	44.61	6.1	10.4	26.6	31.0	74.1	18.53	-28.94*
Potassium bromate	6	3.2	30.54	11.7	12.8	27.8	30.8	83.1	20.78	-109.67
Untreated	11.2	8.6		21.6	28.6	9.7	14.1	74.0	18.5	

% R: Reduction percentage.

* Negative number mean increasing infestation in treatment than untreated one.

Table 6. Effect of the tested materials against larvae of *B. tabaci* in open field experiment

Treatment	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
		No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	6.9	3.0	26.28	4.1	3.1	6.8	13.1	27.1	6.78	10.88
Barium nitrate	8.3	4.6	6.02	4.6	5.4	8.4	12.6	31.0	7.75	15.31
Sodium phosphite	7.1	2.0	52.24	5.2	3.8	11.5	13.4	33.9	8.48	8.33
Potassium bromate	5.8	3.0	12.29	4.1	6.0	13.2	18.2	41.5	10.38	-62.32
Untreated	7.8	4.6		4.9	5.7	11.8	12.0	34.4 .	8.6	

% R: Reduction percentage.

Table 7. Effect of the tested materials against pupae of *B. tabaci* in open field experiment.

Treatment	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
		No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	4.1	1.1	78.00	5.6	8.5	26.7	29.2	70.0	17.5	-156.79
Barium nitrate	7.9	1.1	88.58	5.4	8.4	20.1	30.8	64.7	16.18	-23.22
Sodium phosphite	5.3	1.5	76.79	7.2	8.9	21.6	32.5	70.2	17.55	-99.21
Potassium bromate	4.5	1.4	74.49	12.3	12.1	27.3	31.8	83.5	20.88	-97.21
Untreated	8.2	10.0		9.5	9.4	15.4	20.2	54.5	13.63	

% R: Reduction percentage.

Table 8. Effect of the tested materials against pupae of *E. lybica* in open field experiment

Treatment	Pre-treatment count (no./leaf)	Initial effect after 2 days		Residual effect No./ leaf after						
		No./leaf	%R	5	8	11	14 days	Total	Mean	%R
Ammonium floride	1.2	0.4	85.86	2.3	1.2	2.3	2.4	8.2	2.05	28.61
Barium nitrate	0.8	0.3	84.09	2.2	0.6	2.2	4.4	9.4	2 35	22.76
Sodium phosphite	1.2	0.2	92.93	1.2	0.8	2.3	3.9	8.2	2.05	28.61
Potassium bromate	2.3	0.5	90.78	1.3	1 4	4.1	3.2	10.0	2.50	45.57
Untreated	1.4	3.3		2.6	2.5	4.6	3.7	13.4	3.35	

% R: Reduction percentage.

REFERENCES

1. Badr N.A., A.G. El-Sisi, S.M. Radwan and S.A. Moustafa. 1996. Evaluation of some inorganic salts for controlling the black cutworm, *Agrotis ipsilon,* J. Agric Sci. Mansoura Univ., 21(2): 773-778.

2. El-Sisi A.G. and R.M. Farrage. 1989. Formulation and biological effects of copper carbonate against the Egyptian cotton leafworm, *Spodoptera littoralis.* Agric. Res. Rev., 67 (1): 29-35.

3. Gleason M.N., R. E. Gosselin, H. C. Hodge and R. P. Smith. 1969. Clinical toxicology of commercial products. Acute poisoning. 3rd ed, The Williams and Wilkins Co., Baltimore. Library of congress, cataloge card number 68-22712, U.S.A.

4. Henderson C.F. and E.W. Tilton. 1955. Test with acaricides against the brown wheat mite. J. Econ. Entomol, 48: 157-161.

5. Ministry of Agriculture. 1993. Protocols of evaluation the efficiency of pesticides in Egyptian cultures, p. 85.

6. Nakhla J.M. and A.G. El-Sisi. 1995. Evaluation of some inorganic salts against the small garden snail *Theba pisana* (Mulle). Egypt. J. Agric. Res., 73 (2): 365-379.

7. Aziza Sharaby. 1987. Screening of certain inorganic salts as possible sterlants against the lesser cotton leafworm, *Spodoptera exigua* (Hubn.) by pupal treatment Bull. ent. Soc. Egypt., Econ. Ser., 16: 269-282.

8. Spencer, E.Y. 1968. Guide to the Chemicals used in Crop Protection. 5th ed., Canada Dept. of Agric., pp 483.

9. Steward F.C. 1958. Plant Physiology. Vol. II. Plant in relation to water and solutes. Academic Press, London.

10. Tomlin, C. 1994. The pesticide manual. Incorporating the agrochemical handbook, 10th ed., The Royal Society of Chemistry, Crop Protection Publications, pp. 1341.

الكفاءة الإبادية لبعض الأملاح غير العضوية ضد الآفات الثاقبة الماصة التى تصيب بادرات الفاصوليا

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أجريت تجربتين مختلفتين لتقييم الكفاءة الإبادية لبعض الأملاح غير العضوية والتى تحتوى على شق سام فى جزيئاتها ضد الآفات الثاقبة الماصة التى تصيب بادرات الفاصوليا، أجريت التجربة الأولى فى الأصص تحت تركيزات ٠,٠٥ و٠,٢ و٠,٨ ٪ بينما كانت التجربة الثانية فى الحقل بتركيز ٠,٢ ٪ فقط. الأملاح التى استعملت هى : فلوريد الأمونيوم، نترات الباريوم، فوسفات الصوديوم وبرومات البوتاسيوم. أوضحت النتائج المتحصل عليها أن تركيز ٠,٢٪ كان مناسباً لمكافحة العنكبوت الأحمر ومن القطن والجاسيد دون إحداث أى تأثير سام على بادرات الفاصوليا.