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Use of Some Environmentally Safe Materials as Alternatives to the Chemical Pesticides In Controlling *Polyphagotarsonimus lauts* (Banks) mite & *Myzus persica* (Koch) aphid Which Attack Potatoes Crop.

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ABSTRACT

Two field experiments were conducted to find out the mites and aphids and their types that infest potatoes during the two successive seasons 2011and 2012, and to study the possibility of using some environmentally safe materials as alternatives to traditional pesticides, namely Boric acid, Ascorbic acid & Potassium sorpate comparing with Ortus as a chemical acaricide, to combat those dangerous pests, *polyphagotarsonemus latus* (Banks) mite & *Myzus persicae* (Koch) aphide. Population density were observed and recorded periodically every week starting from the sixth week of planting. The three compounds were applied by foliar spraying with three concentrations (1000 ppm, 2000 ppm & 3000 ppm) for each and reduction percentages of moving stages of the two pests were estimated. Ortus, Boric acid, Ascorbic acid & Potassium sorpate caused good reduction in the two pest populations. Ortus caused the highest reduction percentages (93.14 & 90.81 %) and (94.86 & 88.73 %) in the two pests mites & aphides populations during the two successive seasons 2011and 2012, respectively, while Boric acid caused the highest reduction percentages (82.08 %) and (87.95 %) in the mite population among the other three compounds, flowed by Ascorbic acid (79.3 %) & (86.29 %) during the two successive seasons, respectively. Potassium sorpate caused (53.66 &, 59.09 %) and (56.93 &, 55.11 %), the least reduction percentages in the pest populations, for each pests (mites & aphides) during the tow successive seasons (2011and 2012), respectively. Analysis of the relationship between the mites & aphid populations, and yields revealed that there was a significant reduction in yields with increase in the two pest populations. Ascorbic acid caused the highest potatoes yield, while Potassium sorpate caused the least one.

Key words: *polyphagotarsonemus latus* (Banks) mite & Aphides *Myzus persicae*, population, Ortus, Boric acid, Ascorbic acid & Potassium sorpate potatoes crops.

Introduction

Potatoes is considered one of the most important food crop allover the world, also in many parts of the world it is a staple food for local population.

Mites and Aphides are much dangerous pests infest potatoes plants, Aphids cause direct injury to potato and also transmit viral diseases that reduce yields by as much as 80% (Goffinet, 1982). However, (Raman, 1985)recorded that, most damage by aphids is caused by transmitting viruses than by feeding on the plants. Jones (1988) mention that , The broad mite has been recorded on a wide range of crops – fruit and vegetable crops throughout the tropical and sub-tropical world. Damage to pepper, eggplant, potato, citrus and some ornamentals (Dahlia, Gerbras) can be quite severe. The broad mite is considered as a pest of substantial economic importance . Also, (Gerson, 1992) add that, *Polyphagotarsonemus latus* (Banks) is one of the most injurious mites having different common names i.e. broad mite, chilli mite ,citrus silver mite, white mite and yellow tea mite. The broad mite, *Polyphagotarsonemous latus* (Banks), is extremely polyphagous, and is found on more than 60 plant families and it is considered as a pest of substantial economic importance. (Peña and Campbell, 2005) mentioned that, Leave edges curl downward. Flowers and buds become distorted and do not open. Terminal buds may be killed. As they feed, broad mites inject toxic saliva, which results in the characteristic twisted, distorted growth.While, (Wilkerson *et al* 2005, Peña and Campbell 2005, Peña *et al*. 1996) mentioned that , a number of miticides are labeled for control of this pest, insecticidal oils or soaps are usually just as effective and less toxic to the environment. For large area or greenhouse control, biological control agents are available, including several species of predatory mites, in addition, hot water treatments may be used to control the mites without injuring the plants.

In Kenya the basic problem facing potato production is low yields due to diseases and insect pests and there was a significant decrease in yield with increase in aphid populations at the Kabete site but not at the Tigoni (Kinyae *et. al.,* 1994). The national average of 4.4 tons / ha. is low compared to world average of 17tons/ ha in developed and 13 ton /ha in developing countries. It is possible to realize 40 ton / ha under research station conditions in Kenya (Lung'aho *et al*., 1997). It is therefore, necessary to control aphid populations to reduce virus spread in order to achieve optimal yields of potato in Kenya (Machangi *et al.,* 2003).

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Yield loss assessment studies were carried out in Madenur and Beekanahalli, during 2004 and 2005 on potato pests. The yield loss studies at Madenur during kharif 2004 recorded 1.14 aphids with plant protection against the initial count 27.08 aphids per plant. while mites count at Madenur with plant protection was 0.20 against the initial count of 18.52 mites per compound leaf. During kharif 2005, the aphids count was 2.81 with plant protection against the initial count 26.13 aphids per plant while it was 0.84 against the initial count of 19.80 mites. At Beekanahalli, during kharif 2005 with plant protection, the aphids count was 1.56 against initial count of 11.03 aphids per plant. Aphids, *Myzus persicae* caused on an average 6 per cent loss in yield at Madenur and 3 per cent loss in Beekanahalli. The yield loss due to mite, *Polyphagotarsonemus* latus was 26.80 per cent at Madenur and it was 4 per cent at Beekanahall (BASAVARAJU, *et al*. 2009), similarly, (Singh *et al*. (1990) and (Gibson and Valenchia, 1978)) and (Liu *et al*., 1991))reported 60 per cent yield loss due to mite infestation.

Pesticides are widely used throughout the world in agriculture to protect crops and in public health to control diseases. Nevertheless exposure to pesticides can represent a potential risk to humans, (Kumar and Kumar, 2007).

In the game of baseball, no home runs are scored without touching first base. In the strategies of integrated pest management, mineral nutrition is first base. Optimizing mineral nutrient levels especially at critical stages when pest populations are threatening is both cost effective and agronomically sensible. Therefore, there is often a correlation between N applications (stimulation of growth) and pest attack. Boron deficiency reduces the resistance to pest attack in the same ways it reduces resistance to fungal infections. It is used in the synthesis of flavanoids and phenolic compounds, which are a part of the plant's biochemical defense system, (Timothy M. Spann and Arnold W. Schumann, 2010). Al-Amery M. M., *et al*. (2011) reported that, the relationship between boron and dry matter yield on sunflower was linear,and add, that boron is also required for pollen germination and pollen tube growth. Ender Büyükgüzel, (2013) mentioned that, Boric acid (BA) is widely used as an insecticide, acaricide, herbicide, and fungicide. Its action on animals is still not fully known and understood. We examined the effect of boric acid on larvae of greater wax moth (Galleria mellonella). The chemical appeared to be toxic for larvae . We suggest that boric acid has a broad mode of action, which may affect exposed larvae, and even if sublethal, they may lead to disturbances within exposed populations. While,Harper *et al*. (2012) reported that, Boric acid alters biological functions of various animals, including insects. Therefore, it is often used as a pesticide. It belongs to the oldest insecticides used in agriculture. It can be used against various insects, like cockroaches, ants, termites, fleas, and other insects. BA is also used for in-hive trapping in natural beekeeping (*Handbook for Natural Beekeeping*), since it is regarded as one of the least-toxic pesticides and as essentially non-toxic to honey bees. It acts as an absorber of insect cuticle wax and stomach poison of still unclear mode of action. Besides, BA is a component of various non-pesticidal mixtures; it is an important raw material of wood preservatives, a fire retardant, and for manufacturing glass, light bulbs, porcelain enamel, or ceramic glazes. It can be released into the environment during coal burning and power generation. It is used as a drug to treat fungal infections, too.

Kotur, (2013) foliar application of boron is also known to enhance crop growth, number of fruits, fruit size and yield of many crops. This technology was tested in some farmers fields in Bangalore on ash gourd, Pumpkin, and bitter gourd. Shagholi *et al.* (2013) stated that spray the element boron is also positive and has a significant effect on dry matter production of corn .Mesbah *et al.* (2002), mention that, Spraying Ascorbic acid alone or in sequence with Polymex; Potasin-F followed by Copper sulphate gave promising results for the control of *Osmia nubilalis*. Jitendra Singh, (2010). Supplying plant with adequate nutrition is an important aspect of maintaining the health and performance that result in increased crop yield . Resistance to disease and insect attack. Increase drought. tolerant. And enhanced crop quality.

In Egypt, potato is considered as one of the most important and economic vegetable crops. It can be grow in almost any season and in most of country, except during very hot months in July and August. Also, it gained a considerable importance as an export crop to European markets as one of the national income resources (El-Sirafy *et al*., 2008 ; El-mougy, 2009). The cultivated area with potatoes during all seasons (summer, winter and nili) of 2009 on republic level reached was about 329721 feddans which yielded about 3659284 tons with an average of 11.098 tons/feddan. (Ministry of agriculture and land reclamation economic affairs sector). El-Helaly, *et al.* (2012). Pesticides are very danger to humans and the environment.

Thus, the purpose of this study was to examine the effect of using some materials as alternatives to the chemical pesticides in controlling *Polyphagotarsonimus lauts* (Banks) mite & aphides which infest potatoes plants to avoid the bad effects of the pesticides on the human and potatoes yield.

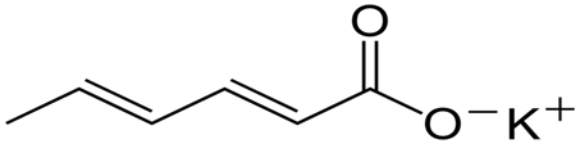
Material and Methods

Two open field experiments were conducted at Beny-Swif Governorate. A.R.E..Potatoes variety Lady Rossetta, (*Solanum tuberosum* L), was raised on 1 &3,October of 2011 & 2012, respectively. The experiments were conducted in complete Randomized design .Seedling of potatoes plants were tested for infestation of

mites and Aphides. Populations of the mite *Polyphagotarsonemous Latus* (Banks), (Acari: Tarsonemidae) and Aphide, (*Aphis craccivora* Koch) were counted on one compound leaf of plants at 30 day after germination at intervals of seven days up to six weeks and due to high infestation they were sprayed with the three compounds namely Boric acid, L. Ascorbic acid and Potassium sorbate with three different doses for each (1000 ppm, 2000 ppm & 3000 ppm) and Ortus (50 cm. / 100 L.) as a chemical control .The alive mites & aphides were counted weekly, till six tested counts after spraying and pooled as final count. Yields from both treated and untreated crops were recorded and compared.

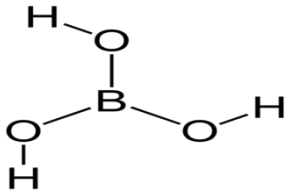
The statical analysis of variance was adopted and L.S.D. values were used to determine the significance between the treatments. All agricultural practices were manipulated as recommended except using of the tested compounds. Each treatment was replicated four times.

POT**ASS**IUM SORBATE ($C_6H_7KO_2$):



Potassium sorbate is very soluble in water. It is primarily used as a food preservative. Potassium sorbate exhibits low toxicity with similar to that of table salt.

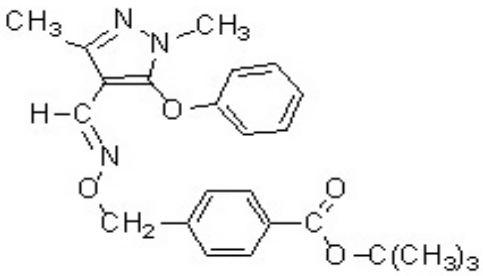
BORIC acid (H_3BO_3) :



Boric acid is a weak acid that is used as an eye wash ,a disinfectant, and flame retardant, among other uses as insecticides, acaricides, algaecides, herbicides, fungicides and as wood preservatives. (Perelygin & Chistyakov, 2006).

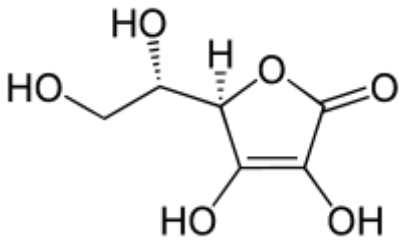
ORTUS (C24H27N3O4):

Common name (Fenpyroximate), Specification: 95%TC, 5%SC Molecular weight: 421.5



Fenpyroximate

ASCORBIC ACID ($C_6H_8O_6$):



Is a naturally occurring organic compound with antioxidant properties. Humans require it as part of their nutrition.

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Result and Disscution

Data in Figures (1& 2) indicated that,mites *Polyphagotarsonemous Latus* (Banks), belonging to the family Tarsonemidae were found to be associated with potatoes plants and they were confined at the upper surface of leaves. Among these, *aphide* was observed to be abounded causing conspicuous damage symptoms to the plants. It was observed that the mite appeared on the potatoes plant leaves in very low numbers associated with more aphides population ,started from first week of October and go on to rise by elapse the time tell the first week of November when recorded their highest infestation during the fifth week of the two successive seasons (2011 & 2012). The result of present investigation regarding the population dynamics of *each* mites (*Polyphagotarsonemus latus*) and aphids *(Myzus persicae).* Mites & aphides populations recorded their peaks on potatoes plants during October and December and recorded (107 & 78 indeveduals / leave) and (129 & 89 indeveduals / leave) for the two pests in the two successive seasons (2011 & 2012), respectively. Then it was necessary to reduce the severity of infestation by spraying with the tested compounds.

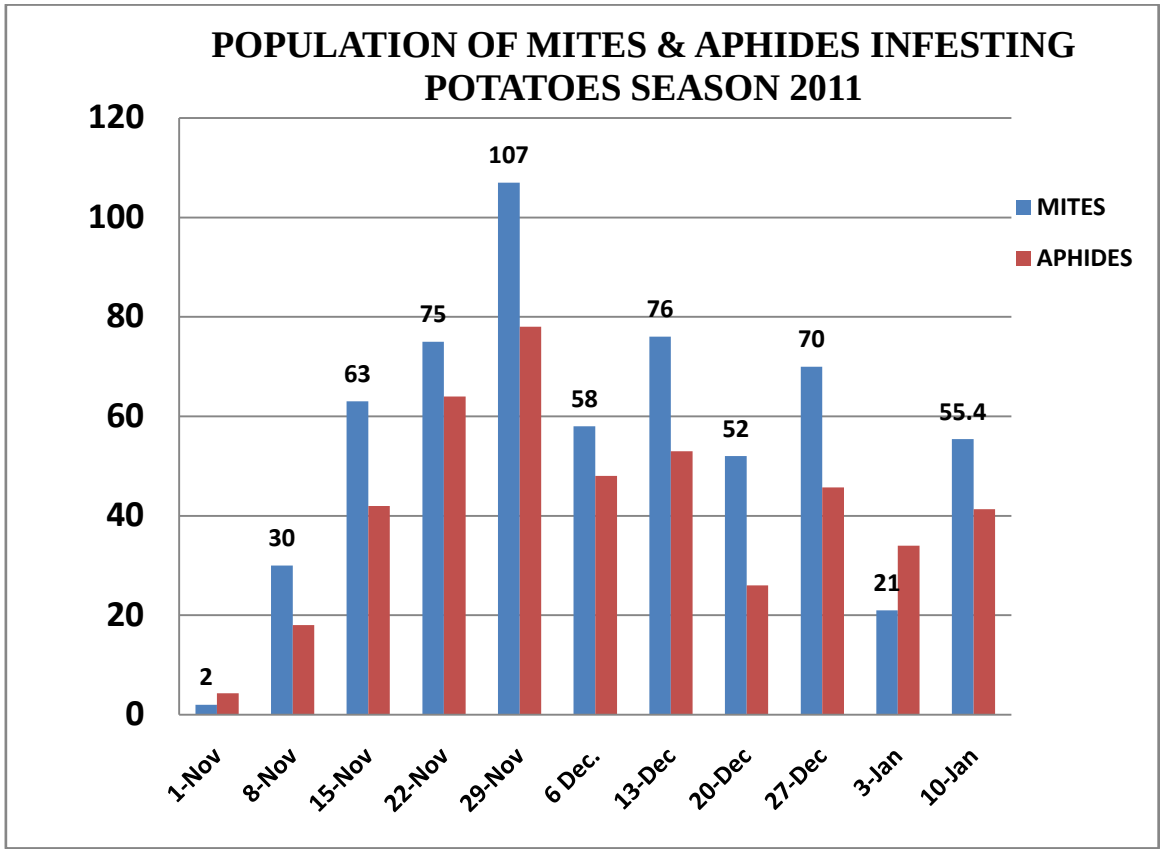

Fig. 1: Population of mites *Polyphagotarsonemus luts* (Bank) & aphides *Muzus persicae* Infesting Potatoes plant during season 2011.

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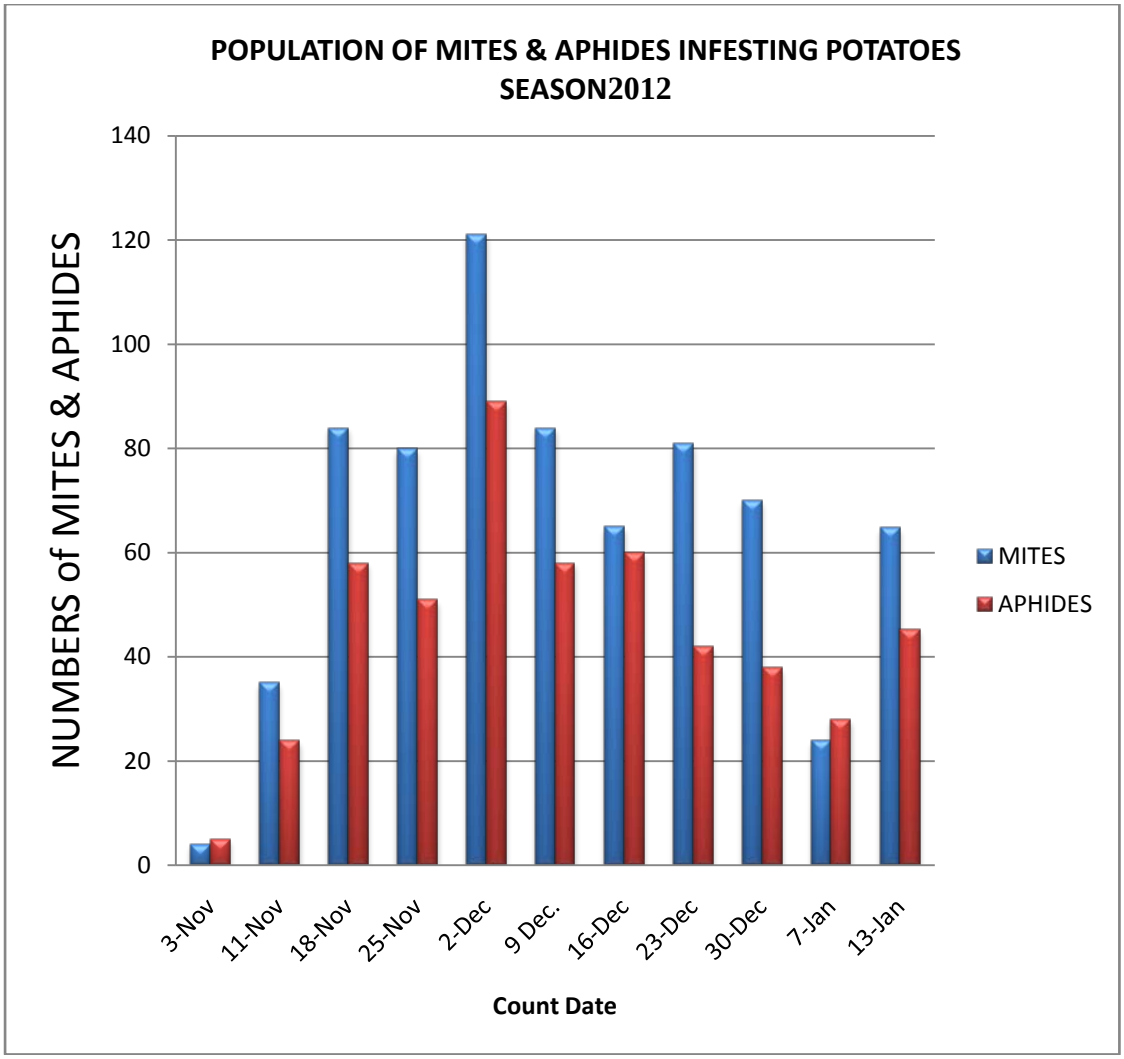

Table & Fig. 2: Population of mites *Polyphagotarsonemus luts* (Bank) & aphides *Muzus persicae* (Koch) Infested Potatoes plant during season 2012.

Data in figures (3,4,5 & 6) showed the numbers of all rest alive of the two pests population on the infected plant after treated with the tested compounds. The tested compounds caused high reduction in the two pest populations. ORTUS caused the highest reduction percentage reached to (93.14 & 94.86 %) and (90.81 & 88.73 %) in the mite and aphide populations during the two successive seasons 2011 & 2012 respectively, followed by Boric acid and ascorbic acid at concentrations of 3000 ppm which recorded reduction 82.1 & 79.3 % in mites population, respectively in first season 2011.While in the second season 2012, boric acid caused the highest reduction with the concentration of 3000 ppm when recorded 87.9 % reduction in mites population followed by Ascorbic acid at concentration of 2000 ppm when recorded 86.29 % reduction in mites population. Also, figures (5 & 6) showed that ascorbic acid caused the higher reduction percentages in aphid *Muzus persicae* populations than Boric acid, throw the three concentrations of tested material used and the highest reduction percentage was at 3000 ppm of ascorbic acid reached to 77.5 % in the opposite of 76.29 % ,for Boric acid during the first season 2012, While during the second season 2013, Data obtained showed that, at the concentration 3000 ppm ,Boric acid caused the higher reduction percentages in aphid population than ascorbic acid when caused (81.55 %) reduction in aphid population While ascorbic acid caused highest reduction percentages in aphid *Muzus persicae* population (76.2 %) with the concentration of 2000 ppm and there are no significant differences between the results during the two seasons.

Potassium Sorpat (P.S.) caused the least reduction percentage in the tow pests (the mites and the aphides), ranged between (40.79 – 53.66 and 37.79 & 55.4 %) and (46.46 - 56.9 & 40.15 - 55.11 %),during the two successive seasons (2011 & 2012), respectively. Analysis of the relationship between the mites & aphid populations, and yields revealed that Sprayed plants had significantly lower mites & aphid populations than unsprayed plants and there was a significant reduction in potatoes yield with increase in the two pest populations. These results are in the harmony with (Kinyae *et. al.*, 1994). who found that,there was a significant

decrease in yield with increase in aphid populations at the Kabete site but not at the Tigoni ,and with BASAVARAJU, et al. (2009) who found high reduction in the two pest populations with the plant protection against the initial counts and reported that, *Myzus persicae* caused an average 6 percent loss in yield at Madenur and 3 percent loss in Beekanahalli. The yield loss due to mite, *Polyphagotarsonemus* latus was 26.80 percent at Madenur and it was 4 percent at Beekanahall. Similarly, (Singh *et al*. (1990) and (Gibson and Valenchia (1978) and Liu *et al*., (1991) reported 60 percent yield loss due to mite infestation.

As a general conclusion, it is found that there is a significant liner relationship between the concentrations of the studied compounds and reduction percentages in each of the mite and aphid populations, and this relationship reflected on final yield as affected by the tested compounds. This general conclusion applicable to the three concentrations with the exception in the second season where the concentration of 2000 ppm of ascorbic acid recorded the highest rate of decline in the mites population, also it was observed that, potassium sorbate at the concentration of 2000 ppm caused more reduction percentage than its other concentrations, but this anomaly in the behavior may be due to other factors that may be due to the biochemical nature of these materials, for example, ascorbic acid considered as antioxidants material caused problems and damage in the stomach of mites. This conclusion is compatible with. Given the numbers studied lesions found that there is an inverse moral relationship between them and the amount of yield and the back of the direct effect of the tested compounds and the variations with each other in their impact on the final crop in comparison with the control crop. The linear relationship between the percentage rates of decline in the number of pests and crop gross amount of each transaction. Although that ascorbic acid came in third place in terms of its impact on the suppression of mites populations of other transactions but it achieved the highest final yield, and potassium sorpate caused its effects by two technics change in the PH of leaf surface in addition of potash property of K element and as plant nutrant, these is in agreement with Jitendra Singh, (2010), who mentioned that, Supplying plant with adequate nutrition is an important aspect of maintaining the health and performance .that result in increased crop yield, resistance to disease and insect attack. Increase drought tolerant and enhanced crop quality. Also, Boric acid acts as a killer when insects come into contact with it.

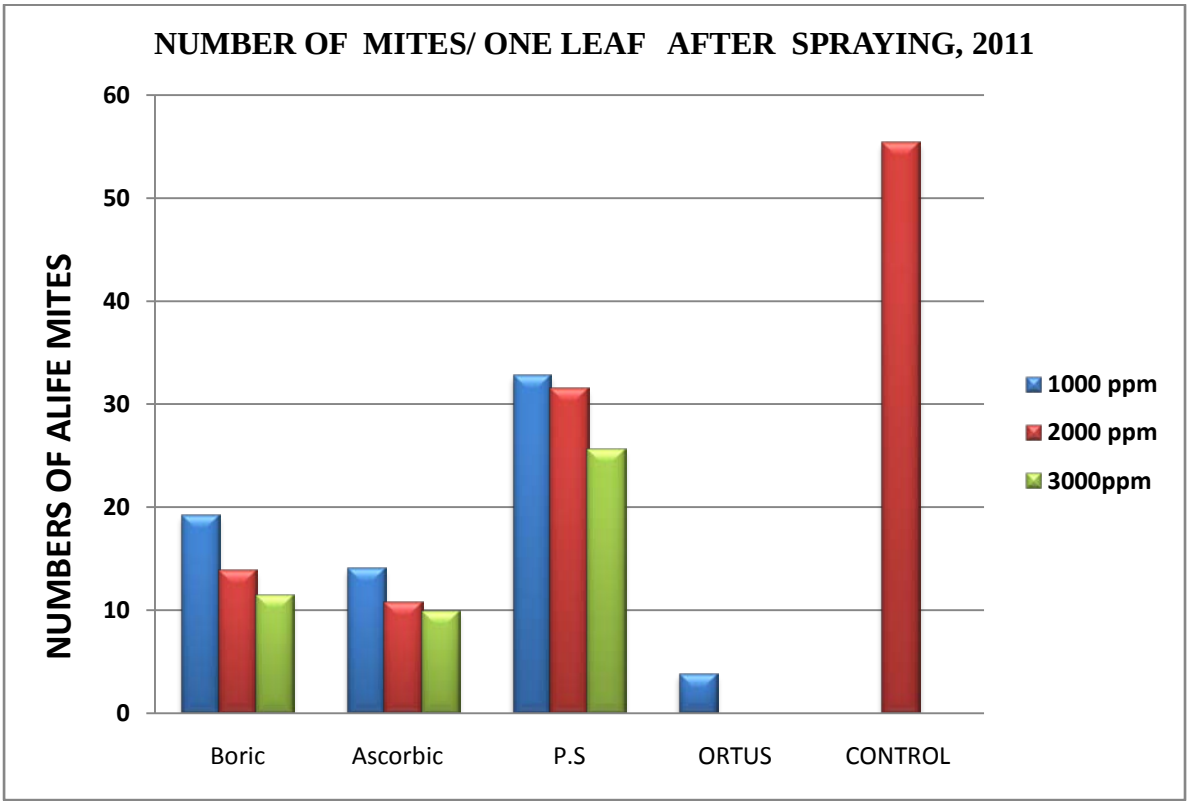

Fig. 3: Mean Numbers of *Polyphagotarsonemus luts* (Bank) Mites Infested potatoes plants/leaf after spraying with the three tested compounds during season 2011.

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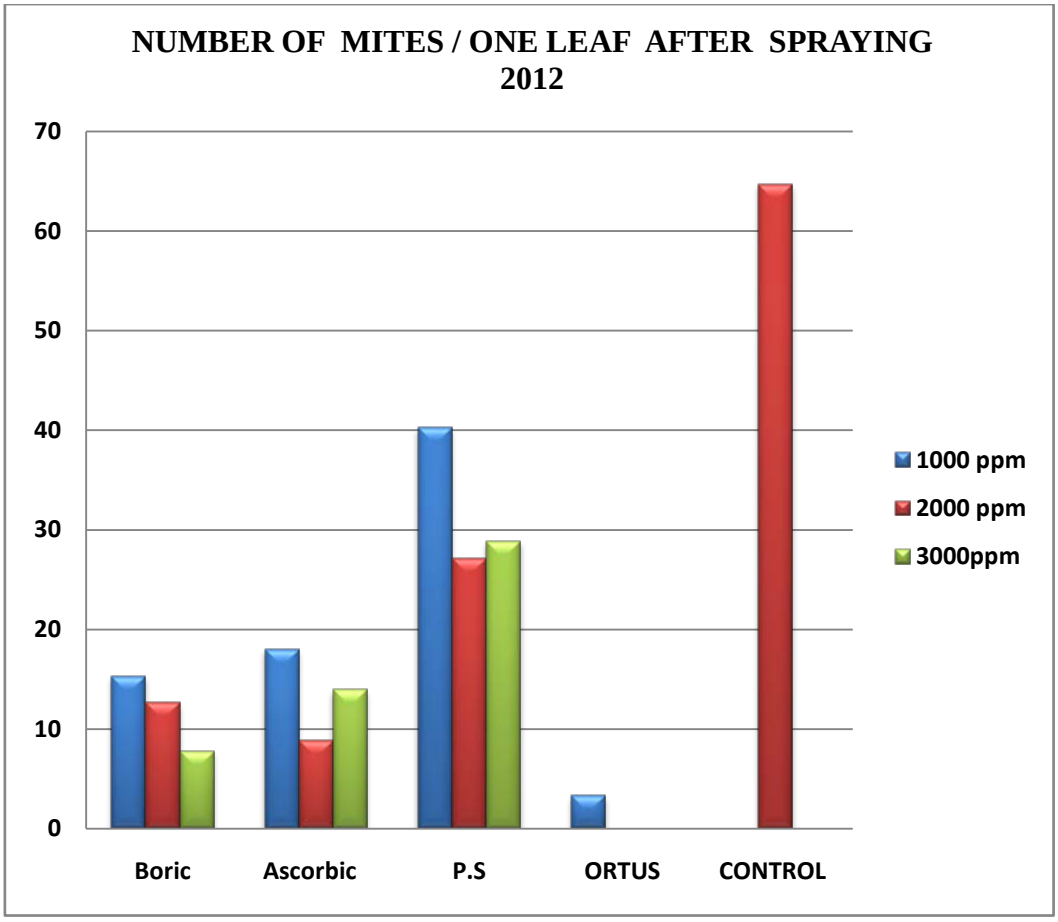

Fig. 4: Mean Numbers of Mite *Polyphagotarsonemus luts* (Bank) Infested potatoes/leaf after spraying with the three tested compounds during season 2012.

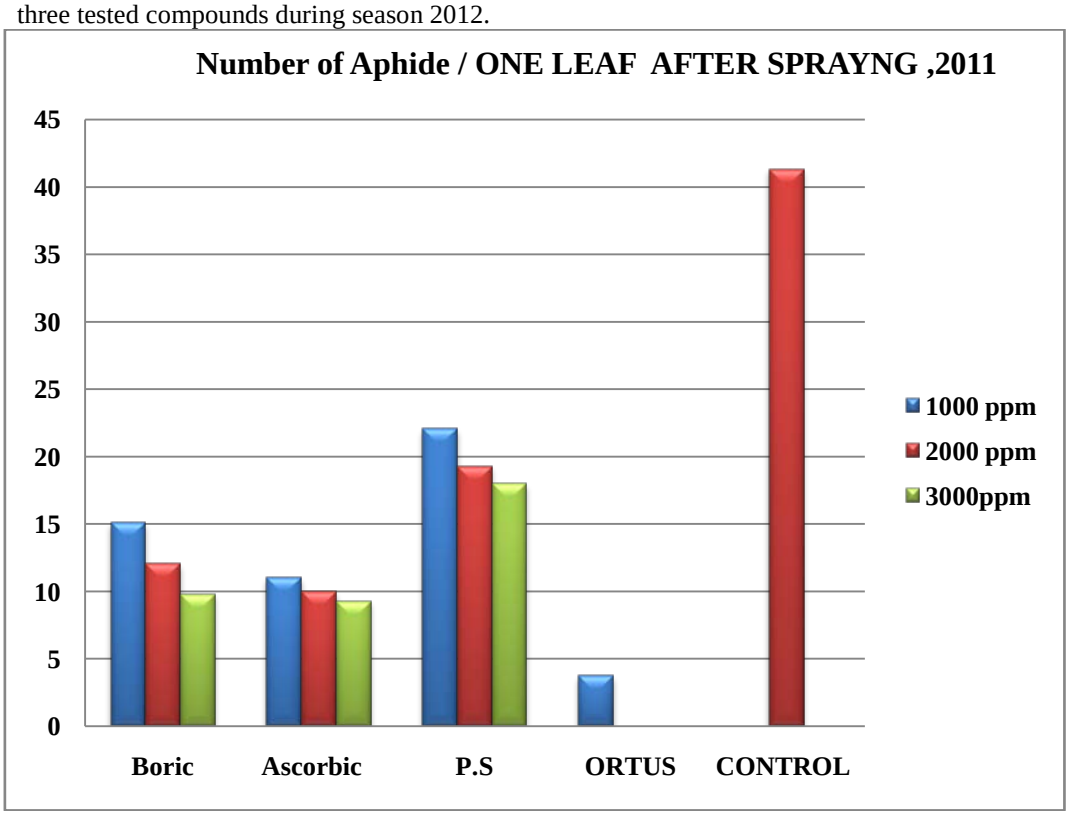

Fig. 5: Mean Numbers of Aphide *Muzus persicae* Infested potatoes plants / leaf, after spraying with the three tested compounds during season, 2011.

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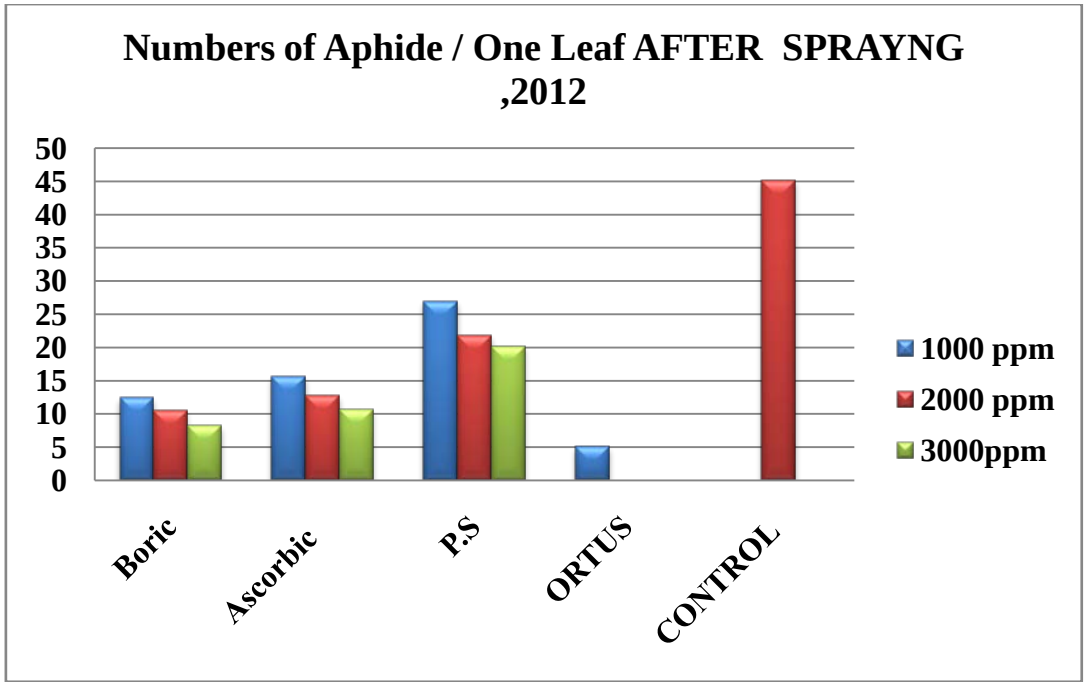

Fig. 6: Mean Numbers of Aphide *Muzus persicae* Infested potatoes plants / leaf, after spraying with the three tested compounds during season, 2012.

Data in the table (1) showed that, all tested compounds applications gave significant increases in yield compared to the control.Their was a bright relationship between the treatments and the yield of potatoes. Ascorbic acid recorded the highest yield (11787 KG / Fed) and recorded (45.5 %) increase in the yield over the control yield ,at concentration of 3000 ppm, flowed by ORTUS (11630 Kg / Fed) recorded 43.6 % increase in the yield over the control yield and Boric acid (11147 Kg / Fed) recorded 37.6 % increase in the yield over the control yield at the first season, 2011. Also, at the second season ,2012 Ascorbic acid recorded the highest yield (11800 KG / Fed) and recorded (68.6 %) increase in the yield over the control yield ,at concentration of 3000 ppm, flowed by Boric acid and ORTUS (11293 & 11270 Kg / Fed) recorded (61.3 & 61.1 %) increase in the yield over the control yield respectively, with insignificant deference between them. Spraying with the concentrations of the tested compounds, caused reduction in the two pest populations which reflected on the production of the potatoes yield. in all stats during the two seasons, as the tested compound concentration increase from 1000 to 3000 ppm, the reduction percentage of pest populations increase, so at 3000 ppm Ascorbic acid recorded the highest effects than other tested compounds, followed by ORTUS and Boric acid, while Potassium sorpat (P.S.)recorded the least effect on mites *Polyphagotarsonemus luts* (Bank) and aphide *Muzus persicae* during the two successive seasons season , 2011& 2012. The compounds could be arranged in descending order as follows: Ascorbic acid, ORTUS, Boric acid and Potassium Sorpat (P.S.).Potatoes yield produced as affected by Ascorbic acid treatment was more significant than which produced as affected by Ortus, Boric acid and Potassium Sorpat (P.S.), and the same results recorded during the second season 2012. There was no significant deference between the two concentrations 2000 and 3000 ppm of Potassium Sorpat (P.S.).

Table 1: Mean potatoes yield (K.g. / Feddan) and increasing percentage in yield, as affected by controlling mites *Polyphagotarsonemus luts* (Bank) and aphide *Muzus persicae* during the two successive seasons, 2011 & 2012.

TREATMENTS	CON.	SEASON 2011		SEASON 2012	
	1000 ppm	10480	29.4	10320	47.4
	2000 ppm	10740	32.6	10840	54.9
Boric	3000 ppm	11147	37.6	11293	61.3
	1000 ppm	10960	35.3	11300	61.4
	2000 ppm	11573	42.9	11440	63.4
Ascorbic	3000 ppm	11787	45.5	11800	68.6
	1000 ppm	9060	11.9	7840	12
	2000 ppm	9600	18.5	8060	15.1
P.S.	3000 ppm	9630	18.9	8340	19.1
ORTUS	50 Cm. / 100 L.	11630	43.6	11270	61.1
CONTROL	NO ADDTION	8100		7000	
L.S.D. at 0.0 5 %		474.43		585.27	

There were insignificant deferences between the two yields produce from ascorbic and ORTUS treatment, while There were significant differences between all of Ascorbic and ORTUS and all of Boric acid and Potassium Sorpat (P.S.) treatments at the first season 2011,while There were insignificant deferences between Boric acid ,Ascorbic, Potassium Sorpat (P.S.) and ORTUS treatments at concentration of 3000 ppm at the second season 201 2.

There are a bright effect on plant health and growth due to treatment with the tested compounds in suppression the infestation of the two pests which was reflected on yield production.

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