

Evaluation of Certain Chemical Fungicides for Controlling the White Garden Snail, *Theba pisana* (Muller)

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ABSTRACT: The present research was carried out during the season of 2014 for controlling the white garden snail, *Theba pisana* (Muller) under laboratory conditions by using some chemical fungicides (Copper sulfate 50%, Copper hydroxide 53.8% and Benalaxyl) with three concentrations (0.5, 0.25 and 0.125%) for each insecticides as spraying lettuce leaves and baits. The results showed that, in all concentrations, the mortality rates increased by the time and most mortality achieved over seven days post fungicides treatments, for the white garden snail, *Theba pisana* (Muller) by concentrations of 0.5%, 0.25% and 0.125%, in respectively for both treated spraying lettuce leaves and baits.

Spraying lettuce leaves of copper sulfate 50 % were achieved mortality percentages 64, 57 and 38 for concentrations (0.5, 0.25 and 0.125%), respectively while baits were achieved mortality percentages 52, 48 and 24 for the same concentrations after 7 days, in this respect. The corresponding LT_{50} (day) values were 5.21, 6.08 and 9.27 for spraying lettuce leaves and 7.03, 6.96 and 9.70 for baits at tested concentrations of 0.5%, 0.25% and 0.125%. Copper hydroxide 53.8% achieved mortality percentages 48. 32 and 17 for the same concentrations in spraying lettuce leaves but in baits achieved 28, 21 and 13 for the same concentrations after 7 days, respectively, corresponding to LT_{50} (day) values were 8.46, 8.59 and 10.27 for spraying lettuce leaves and 10.27, 9.31 and 11.32 for baits at its tested concentrations of 0.5%, 0.25% and 0.125%, in respect. Also. benalaxyl achieved mortality percentages 62, 34 and 16 for the same concentrations in spraying lettuce leaves but in baits the mortalities achieved 54, 30 and 11 for the same concentrations after 7 days, in respect, corresponding to LT_{50} (day) values of 6.24, 9.56 and 22.20 for spraying lettuce leaves while for baits the values were 7.04, 8.56 and 15.21 at its tested concentrations.

Key words: Fungicides, Toxicity, White garden snail and control of land snails.

INTRODUCTION

The terrestrial gastropods are economic pests attacking several types of plants, vegetables, horticultural plants, field crops and other plants. These animals' pests have chewing mouth parts and attack the plant parts (Godan, 1983 and Ghoneim,2006)

In Egypt, the land mollusca species are serious economic land pests attacking plants especially the northern coastal areas. This damage includes leaves, flower, fruits and stems of the agricultural plantations (Ryder and Bowen, 1977). Recently, these pests appeared to cause wide spread damage in field and orchards in many Governorates of Egypt. Moreover, the land snails require moisture conditions and they feed at night when the enough requirements of the moisture and temperature are suitable particularly during winter and spring seasons (El-Okda, 1980; Eshra, 2004; Ghoneim, 2006 and Eshra, 2013).

According to the damage caused by the land snails as well as their effect to decrease the agricultural yield quality, the control of these pests attracted the attention of many investigators. The investigators applied different methods for the

land snails' control. These methods involved agricultural practices, the application of inorganic and organic pesticides, fungicides and others (El-Okda, 1980; El-Okda *et al.* 1990; El-Shahaat *et al.*, 1995; Moran *et al.*, 2004; Eshra, 2004; El-Shahaat *et al.*, 2005; Eshra, 2013 and Eshra *et al.*, 2015)

The present investigation aims to study the molluscicidal activity of some fungicides on the white garden snail, *Theba pisana* (Muller) under laboratory conditions.

MATERIALS AND METHODS

Snail collection

Adult white garden snail, *Theba pisana* (Muller) order: Pulmonata, family: Helicidae were collected during the spring season of 2014 from some agricultural regions in Alexandria and El-Beheira Governorates and transferred into glass (60 × 40 × 40) to the laboratory for testing the fungicides efficiently at conditions of 25 ± 2°C and 65 ± 5 % RH. The aquaria were tightly covered with cloth netting and the snails were daily fed on lettuce leaves for one week for acclimatization under laboratory condition. For the experiments snails were starved for 48 hrs before assays.

Fungicides used

Copper sulfate 50% (Cupral 50%® WP), Copper hydroxide 53.8% (Kocide 2000. 53.8%) and Benalaxyl (Galben copper®) with three concentrations (0.5, 0.25 and 0.125%). These fungicides sprayed on the land snails with the same concentrations (0.5, 0.25 and 0.125%) and the obtained baits was colored using an aqueous solutions of these fungicides. The chosen substances were wheat bran (fine fraction) and fine fraction of sawdust in a mixture of (1:1 w/w). The obtained baits was coloured using an aqueous solution of a blue paint substance (0.5%) as colour attractant for gastropods (El-Okda *et al.*, 1989).

Laboratory molluscicidal activity of certain fungicides

The laboratory work was carried out in sealed plastic vessels (22 × 15 × 10 cm) with five replicates, each contain 10 snail individuals. The tested of treatments were 18 (9 for spraying lettuce leaves and 9 for baits) plus untreated check as control. The 1st treatment was carried out to evaluate the efficiency of Copper sulfate 50 % with 3 concentrations 0.5, 0.25 and 0.125% using the technique of lettuce leaves which have been sprayed with this fungicide. The 2nd treatment included Copper hydroxide 53.8 % with the same concentrations 0.5, 0.25 and 0.125% and using the same technique of lettuce leaves which have been sprayed with this fungicide and baits. Also, the 3rd treatment included Benalaxyl with the same concentrations 0.5, 0.25 and 0.125% and using the same technique of lettuce leaves which have been sprayed with this fungicides and baits.

Moreover, in the previously carried out tests, the killed snails' individuals were removed daily and the accumulative mortality effects were recorded after 1, 3, 5 and 7 days after treatments. The mortality percentages were corrected using Abbott's

formula (Abbott, 1925) and then exposed to the angular transformation. Also, the lethal time (LT₅₀) for 50% mortality was estimated.

RESULTS AND DISCUSSIONS

The efficiency of some copper fungicides against the white garden snail, *Theba pisana* (Muller) was determined by feeding snails on sprayed lettuce leaves under laboratory conditions. The obtained results are shown in **Table (1) and Fig (1)**, the calculated mortality values percentage as commutative effect up to 7 days after treatment, gradually increased with time. The deduced mortality values comprised 64, 57 and 38% after 7 days from feeding snails on the treated leaves with copper sulfate 50 % fungicide at the concentrations of 0.5%, 0.25% and 0.125%, respectively. The corresponding LT₅₀ (day) values were 5.21, 6.08 and 9.27. The estimated % mortality values for the lower efficient copper hydroxide 53.8% amount to 48, 32 and 17 %, respectively, corresponding to LT₅₀ (day) values of 8.46, 8.59 and 10.27 at its tested concentrations of 0.5%, 0.25% and 0.125%, in respect.

While the tested concentrations of benalaxyl fungicide (0.5%, 0.25% and 0.125%) gave mortality values of 62, 34 and 16% corresponding to the calculated LT₅₀ (day) values of 6.24, 9.56 and 22.20, in respect.

Table (1). Toxicity of some fungicides sprayed against the white garden snail, *Theba pisana* (Muller) under laboratory conditions.

	Concentrations %	% Mortality as cumulative effect after*				LT ₅₀ (day)
		0-1 day	0-3 day	0-5 day	0-7 day	
Copper sulfate 50 %	0.5	8.0	34.0	42.0	64.0	5.21 (4.39-6.24)
	0.25	0.0	27.0	35.0	57.0	6.08 (5.28-7.02)
	0.125	0.0	18.0	24.0	38.0	9.27 (7.12-12.21)
Copper hydroxide 53.8 %	0.5	2.0	3.0	18.0	48.0	8.46 (6.92-10.41)
	0.25	0.0	1.0	6.0	32.0	8.59 (7.34-10.06)
	0.125	0.0	0.0	4.0	17.0	10.27 (7.75-13.65)
Benalaxyl	0.5	0.0	12.0	28.0	62.0	6.24 (5.63-6.92)
	0.25	0.0	11.0	25.0	34.0	9.56 (7.35-12.56)
	0.125	0.0	7.0	12.0	16.0	22.20 (10.20-51.39)

* Each value is corrected by Abbott's Formula and is an average of 5 replicates (each contain 10 snail individuals).

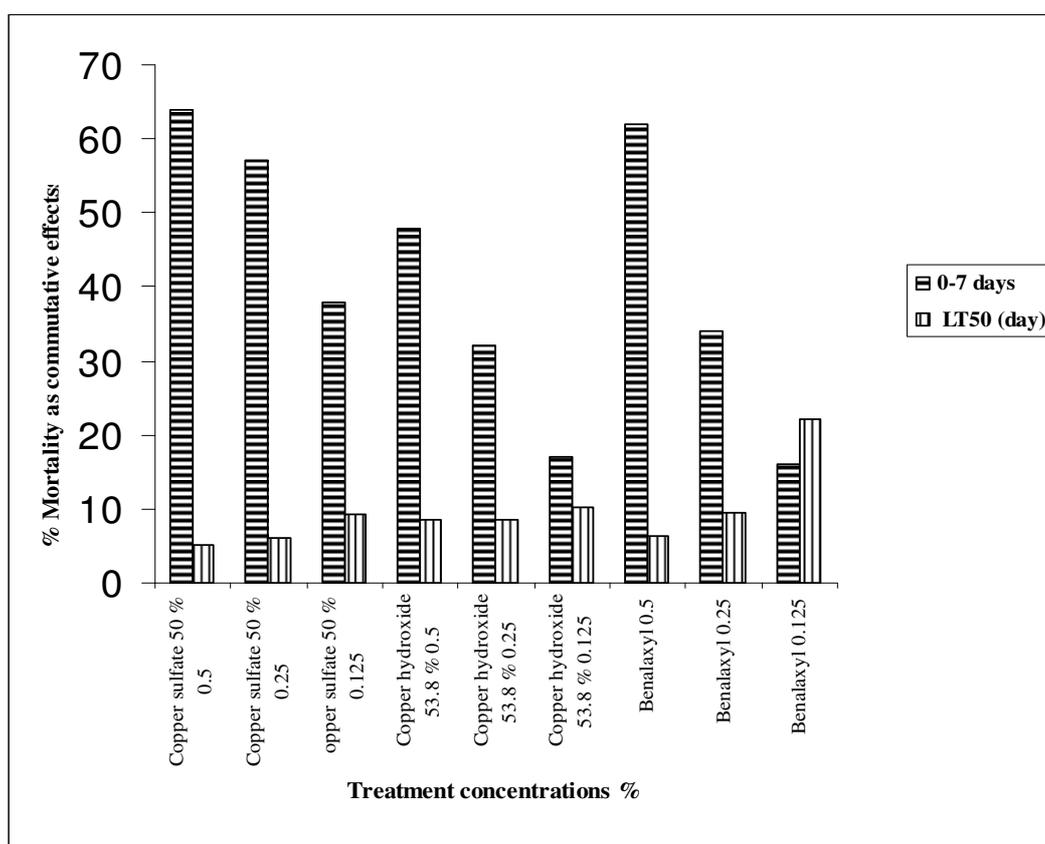


Fig. (1). Toxicity of some fungicides sprayed against the white garden snail, *Theba pisana* (Muller) under laboratory conditions.

Also, the results in **Table (2)** and illustrated in **Fig. (2)**. showed that. the toxicity of prepared poison baits of certain tested fungicides against the white garden snail, *Theba pisana* (Muller). The commutative % mortalities values amounted to 52, 48, 24, 28, 21, 13, 54, 30 and 11 after 7 days of feeding on the prepared baits of copper sulfate 50 %, copper hydroxide 53.8% and benalaxyl, respectively. These results corresponded to LT_{50} (day) values of 7.03, 6.96, 9.70, 10.27, 9.31, 11.32, 7.04, 8.86 and 15.21 for copper sulfate 50 % in concentrate (0.5, 0.25 and 0.125), copper hydroxide 53.8% in concentrate (0.5, 0.25 and 0.125%) and benalaxyl in concentrate of (0.5, 0.25 and 0.125%), in respect.

From these findings it could be seen that the highest toxicity effect was revealed for copper sulfate 50% bait (0.25% and 0.5%) and benalaxyl bait (0.25% and 0.5%) followed by copper hydroxide 53.8 % baits (0.25%), copper sulfate 50% bait (0.25%), copper hydroxide 53.8% baits (0.5%), copper hydroxide 53.8% baits (0.125%) and benalaxyl baits (0.125%), while the remaining fungicides gave less efficacy.

Remarkably, from the above mentioned results it could be revealed that the applications of inorganic salts (particularly copper compounds) either by foliar

sprays of lettuce leaves or baits were effective against the white garden snail, *Theba pisana* (Muller).

Our results agree to a great extent with those obtained by **El-Wakil and Mesbah (1995)**, those evaluated the low concentrations of copper sulfate solutions (0.25, 0.5, 1.0 and 1.5 g/liter water) for three times for each tested concentration on the infestation rate of the white garden snail, *Theba pisana* (Muller) snails in *Vicia faba* L. Results showed a significant decrease in the numbers of counted snails among different treatments. The concentration of 1.0 and 1.5 g/liter water exhibited the highest effects in decreasing the same percentage number of snails at the end of experiment by 96.56%, besides the determined significant differences in the productivity of different treated plants. In particular the concentration of 1.5 g/liter water copper sulfate solution gave the highest productivity of plants and decrease in the number of occurring snails. Also, **Speiser and Kistler (2002)** found that pellets containing 1.0% iron phosphate reduced leaf loss of lettuce, increased the number of marketable lettuce heads and reduced numbers of the slug, *Arion lusitanicus*.

Moran et al. (2004) found that copper hydroxide gave promising efficiency against land gastropoda. Also, copper compounds such as oxides and salts are effective repellents (**Godan, 1983**). Copper complex compounds containing mainly copper silicates, which has been registered in Australia for management of land snails, has been demonstrated to have significant repellency (**Davis et al., 1996**). Baits of kocide 2000, copper hydroxide (5% cu) and acrobat copper (5% cu) gave 37% mortality after 5 days of application in apple orchard (**El-Shahaat et al., 2009**).

Results of **Abo El-Ftooh (2012)** showed that the percentages of mortalities of the snail, *M. cantiana* depended on concentration and exposure time. Higher concentration of the tested pesticides gave the higher percentages of the mortality. Generally, the pesticides, selecron® 72%, cidial® 50% and copper sulfate® 1% exhibited the higher mortality %, while pesticides of galben "c" ® 46% recorded the lower mortality %. Also, the results showed that the application of selecron® 72% and cidial® 50% were important to control land snail, and enhancing yield.

Eshra (2014) reported that copper hydroxide was the most toxic compound against *E. vermiculata* followed by methomyl and urea fertilizer after 72 hrs of evaluation were LC₅₀ values were 3.31%, 3.75% and 40.88%, respectively.

Table (2). Toxicity of some fungicides baits against the white garden snail, *Theba pisana* (Muller) under laboratory conditions.

Concentrations %	% Mortality as cumulative effect after*				LT ₅₀ (day)	
	0-1 day	0-3 day	0-5 day	0-7 day		
Copper sulfate 50 %	0.5	3.0	6.0	38.0	52.0	7.03 (5.97-8.31)
	0.25	0.0	0.0	22.0	48.0	6.96 (6.41-7.57)
	0.125	0.0	0.0	18.0	24.0	9.70 (7.65-12.34)
Copper hydroxide 53.8 %	0.5	0.0	3.0	12.0	28.0	10.27 (7.79-13.63)
	0.25	0.0	0.0	4.0	21.0	9.31 (7.58-11.45)
	0.125	0.0	0.0	3.0	13.0	11.32 (7.75-16.61)
Benalaxyl	0.5	0.0	6.0	17.0	54.0	7.04 (6.31-7.86)
	0.25	0.0	1.0	21.0	30.0	8.86 (7.30-10.80)
	0.125	0.0	0.0	8.0	11.0	15.21 (8.31-28.30)

* Each value is corrected by Abbott's Formula and is an average of 5 replicates (each contain 10 snail individuals).

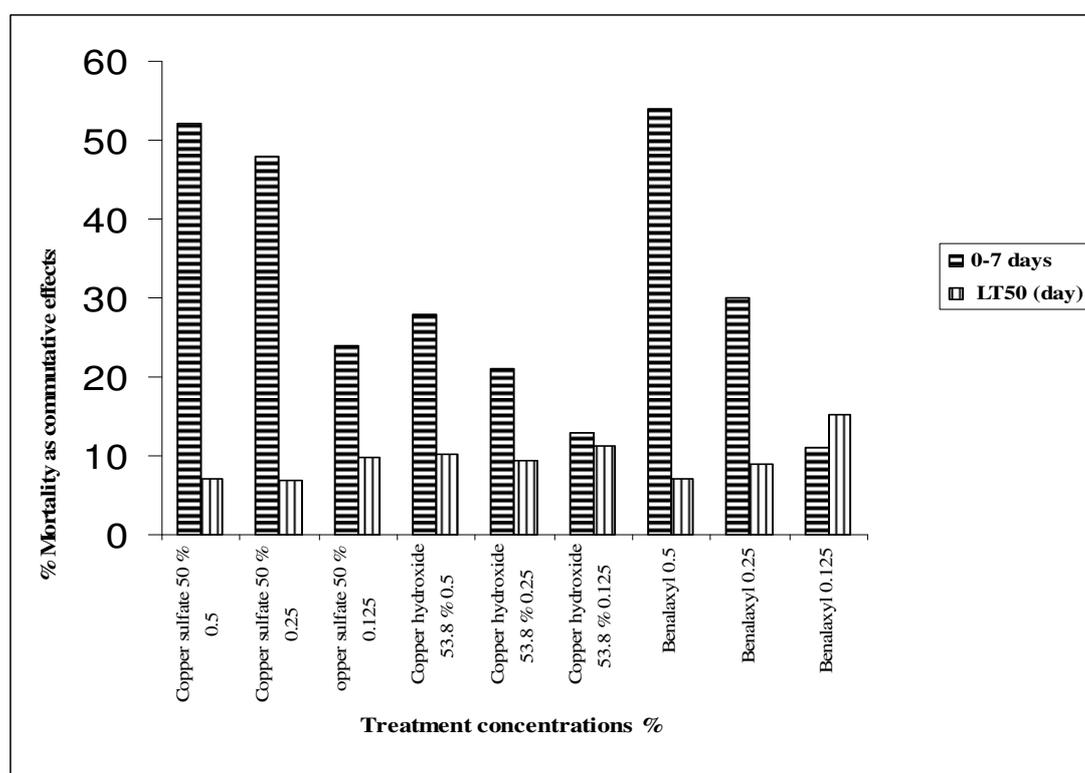


Fig. (2). Toxicity of some fungicides baits against the white garden snail, *Theba pisana* (Muller) under laboratory conditions.

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المخلص العربي

تقييم بعض المبيدات الفطرية لمكافحة قوقع الحدائق الأبيض

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أجريت التجربة أثناء موسم ٢٠١٤ لمكافحة قوقع الحدائق الأبيض تحت الظروف المعملية باستخدام بعض المبيدات الفطرية (كبريتات النحاس ٥٠% ، هيدروكسيد النحاس ٥٣,٨% والبينالاكسيل) بثلاثة تركيزات ٠,٥ ، ٠,٢٥ ، و ٠,١٢٥ لكل منهم لرش أوراق الخس والطعوم. النتائج أظهرت انه بزيادة التركيزات تزداد نسبة الموت وكذلك مع زيادة وقت التعريض للمعاملة وأن أعلى نسبة موت كانت بعد ٧ أيام من المعاملة بالمبيدات الفطرية لقوقع الحدائق الأبيض باستخدام التركيزات ٠,٥ ، ٠,٢٥ ، و ٠,١٢٥ على الترتيب لكلا المعاملتين رش أوراق الخس والطعوم. رش أوراق الخس بكبريتات النحاس أعطى نسب موت ٦٤ ، ٥٧ و ٣٨% للتركيزات ٠,٥ ، ٠,٢٥ ، و ٠,١٢٥ على التوالي بينما الطعوم أعطت نسب موت ٥٢ ، ٤٨ و ٢٤% لنفس التركيزات بعد ٧ أيام، في المقابل كانت قيمة LT_{50} هي ٥,٢١ ، ٦,٠٨ و ٩,٢٧ يوم لرش أوراق الخس بكبريتات النحاس و ٧,٠٣ ، ٦,٩٦ و ٩,٧٠ يوم للطعوم لنفس التركيزات على التوالي. ولكن هيدروكسيد النحاس ٥٣,٨% أعطى نسب موت ٤٨ ، ٣٢ و ١٧ لنفس التركيزات في حالة رش أوراق الخس و ٢٨ ، ٢١ و ١٣ في حالة الطعوم لنفس التركيزات بعد ٧ أيام من المعاملة وكانت قيمة LT_{50} هي ٨,٤٦ ، ٨,٥٩ و ١٠,٢٧ يوم لرش أوراق الخس بهيدروكسيد النحاس ٥٣,٨% و ١٠,٢٧ ، ١٠,٢٧ و ٩,٣١ و ١١,٣٢ يوم للطعوم لنفس التركيزات على التوالي. أيضاً البينالاكسيل أعطى نسب موت ٦٢ ، ٣٤ و ١٦ لنفس التركيزات في حالة رش أوراق الخس بالبينالاكسيل و ٥٤ ، ٣٠ و ١١ للطعوم لنفس التركيزات بعد ٧ أيام من المعاملة وكانت قيم LT_{50} هي ٦,٢٤ ، ٩,٥٦ و ٢٢,٢٠ يوم لرش أوراق الخس بالبينالاكسيل و ٧,٠٤ ، ٨,٥٦ و ١٥,٢١ يوم للطعوم عند نفس التركيزات على الترتيب.