EFFICIENCY OF THREE INSECTICIDES AGAINST THE FIG BORER *HYPOTHENEMUS ERUDITUS* WESTWOOD ON FIG, *FICUS CARICA* AT DAR EL-RAMAD, FAYOUM.

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ABSTRACT

The experimentation was carried out during two successive seasons, (2015 and 2016) on mature Fig trees farm, at Dar-Ramad, Fayoum Governorate. Three chemicals, Diazenox 60%, Cidial $L_{50\ \%}$ and Renoban 48%, were tested against the bark beetle *Hypothenemus eruditus* (Westwood) on Fig trees. Three concentrations of each 1.5, 3.0 and 4.5cm^3/1-liter water were used in addition to water alone as untreated control (untreated cuts). Counting entrance and exit holes, cidial L_{50} was the most effective insecticide where no holes were observed in the treated cuts at all concentrations, in both seasons with Renoban, the number of entrance holes was low with no exit holes in the 1st season and 5.7 holes/cut on cuts treated with 4.5cm/liter in the 2nd season. Diazenox was the least efficient where, after two months of exposure, there was no difference in infestation (14.2 holes/cut) between those treated with 1.5% conc. and the untreated. Results in both season were similar.

INTRODUCTION

Bark beetles (Coleoptera: Curculionidae: Scolytinae) are a major faunal element in most forest ecosystems around the world. They are small beetles, generally 1–3 mm long, which can bore into most woody tissue and reproduce in galleries under bark or inside the seed pods of their hosts. Their feeding can disrupt sap flow causing branch or tree death and some species are known vectors of fungi, which cause serious tree diseases such as Dutch elm disease. Bark beetle species are living on dying and decaying trees, but those species that invade healthy living tissue also can become a management issue for the production systems they infest. The beetles can destroy timber and render agricultural produce unmarketable and are therefore a major quarantine concern. Indeed, scolytines are commonly intercepted by quarantine authorities, both in wood packing materials, where they comprise 93% of all insects intercepted in the USA (Haack, 2001), and in food products such as nuts. Species, *Hypothenemus eruditus* Westwood, widely distributed over the tropical and subtropical regions of the world, is also common in the Mediterranean countries, *H. eruditus* is similarly found in the husk material and less commonly inside the kernel some activity has been observed within the macadamia nut shell **(Huwer and Maddox,**

2009). *H. eruditus* (Westwood) was collected from nut and husk, Mitchell and Maddox, 2010. The record host plants for *H. eruditus* was Mangifera, Pinus, Psidium, Vitis, Ziziphus, Macaranaga, Grevillea, Macadamia, **(Wood and Bright 1992), (Zimmerman,1992)** and **Mitchell and Maddox (2010)**. In Egypt, Survey studies by **(Tadros et al., 2013)** and **(Hashim, 2009)** stated *H. eruditus* as one of the major stem boring insect pests in mango *(Mangifera indica*) orchards. And it was recorded from citrus, apple, fig, mango, pear, plum, acacia, poinciana, lebbek, mulberry, olive, poplar, sesban, peach, apricot and cycamora, by **(Batt, 1999)** and **(Batt, 2002)**. This species is widely distributed In the Americas, the range extends from Michigan (USA) to Argentina **(Wood, 2007**). This species is also remarkable for the extreme diversity of habits., recorded from hundreds of host plants and even fungal fruiting bodies, from all sorts of plant material including leaf petioles, twigs, seeds, fruits, and from manufactured products **(Wood, 1982**), this species has also been reported killing seedlings of cocoa and transplants of trees **(Browne, 1961)**. According control, it was recommended that using cidial L_{50} at the rate of 3000 ppm for controlling the *Scolytus amygdali* beetles **(El-Samni and Batt, 1991).** It was recommended that, Using Cidial L_{50} at 200 and 400 cm/100 liter was the most effective insecticides to prevent the infestation due to its repellent effect or Basodin with concentration 400cm^3/100L water was more effective in reducing the emergence of the Scolytid *Phloeotribus scarabaeoides* **(Soliman and Abd El-Latif, 2008).**

(Akflit and Çakmak, 2005) stated, that this species is considered one of the most polyphagous of all Scolytidae, having been found in a very wide range of hosts; tea, *Acacia sp.* **(Blunck, 1954)** and *Eucalyptus camaldulensis* **(IU, 2000). (Hashim, 2009)** studied the seasonal abundance and found that, *H. eruditus* started to emerge from mango trees during the second week of January and increased gradually to record five peaks , the first peak of emergence during the 2nd half of April. Infestation was doubled during only one year (2006-2007), this serious parameter imposed the need of controlling this pest year after another. This pest have little studies, this is the first study on this pest as control using insecticides.

MATERIAL AND METHODS

The present investigation was undertaken during two successive seasons (20١٥and 20١٦) on mature Fig trees planted in two feddans farm, at Dar-Ramad Fayoum, Three insecticides, namely Cidial L_{50}, Diazenox 60% and Renoban ٤٨% at three concentrations each 1.5, 3.0 and 4.5cm^3 /liter were applied, in addition to water alone as control (untreated). Healthy Fig branches 3-4cm diam. were selected and made to 50cm long cuts. Cut extremes were covered with melted wax to reduce drying. Each six cuts (replicates) were sprayed with one concentration of each of the chosen insecticides. After complete dryness, cuts were made into six groups, Each group contains ten cuts (three treatments ×3 conc. + untreated), each cut was tied with string which were hanged on the crown of the fig tree at height 1-1.5 meter from the ground, with no contact with the tree trunk. Each group was distributed in a zone of 1.5-2 meter. This set up was made on 13/5/2015. After two weeks, cuttings were examined by counting the entrance holes which were counted, marked (painted) and recorded. These observations were repeated every two weeks until the emergence of beetles (exit holes). The study similarly repeated on 3/3/2016 before the foliage.

RESULTS AND DISCUSSION

Data given in table (1) and fig (1) showed that, after two weeks of field exposure, low number of entrance and mostly incomplete holes were found as attempts of boring of beetles that were killed by residues. The average number of entrance holes were (4.2, 2.0 and 1.2 holes per cut for Diazinox and 4.40, 1.8 and 1.2 holes per cut for Renoban, at 1.5, 3, and 4.5.cm^3 /liter concentrations, respectively. On the other hand, treated cuts with Cidial l_{50} showed no attempts of boring whereas untreated cuts had high number of entrance holes (32.4 holes/cut). After one month of field exposure, results showed that, the number of entrance holes increased to (8.6 and 7 holes/cut) for the concentration 1.5 and 3 cm^3 of Diazenox, respectively, and (6.20 holes/cut) with 1.5 cm^3 of Renoban respectively. Meanwhile cuts treated with Cidial L_{50} were still resistance to infestation which reached 35.4/cut in untreated, this material has a strong pungent odour which acts as a repellent for adult beetles thus egg laying was prevented. After six weeks of exposure (24/6//2015), there was small difference between the concentrations of Diazenox with 12.8, 10.8 and 10.6 holes/cut, also, the number of entrance holes increased to 13.0 with 1.5cm^3 Renoban, treatment but the entrance holes were still very low (0.6 holes/ cut) at 4.5cm^3/liter. After 8 weeks, no different was found in infestation between 1.5% Diazenox and the untreated (14.2 holes/cut), whereas after ten weeks entrance holes highly increased to 23.4 holes with 1.5 cm Diazenox, (20.4 holes/ cut) Renoban, and 23.2 holes /cut for untreated cuts, i.e., no different between treated cuts with Diazenox or Renoban and those untreated, meanwhile still cidial L_{50} was effective.

(A).Cidial L_{50} (B) Renoban (C) Diazenox (D). Untreated
Picture. (1): Shows entrance holes after ten weeks in the field.

After 10 weeks the most effective insecticide with 100% efficiency was cidial l_{50} at concentrations tested. After 60 days later in the laboratory, the mean number of exit holes from untreated cuts (control) was 658.4/cut, range 372 - 1200), this number was low compared to entrance holes, this is due to the high number of entrance holes which resulting in competition between beetles and overlapping tunnels **picture., 2**.

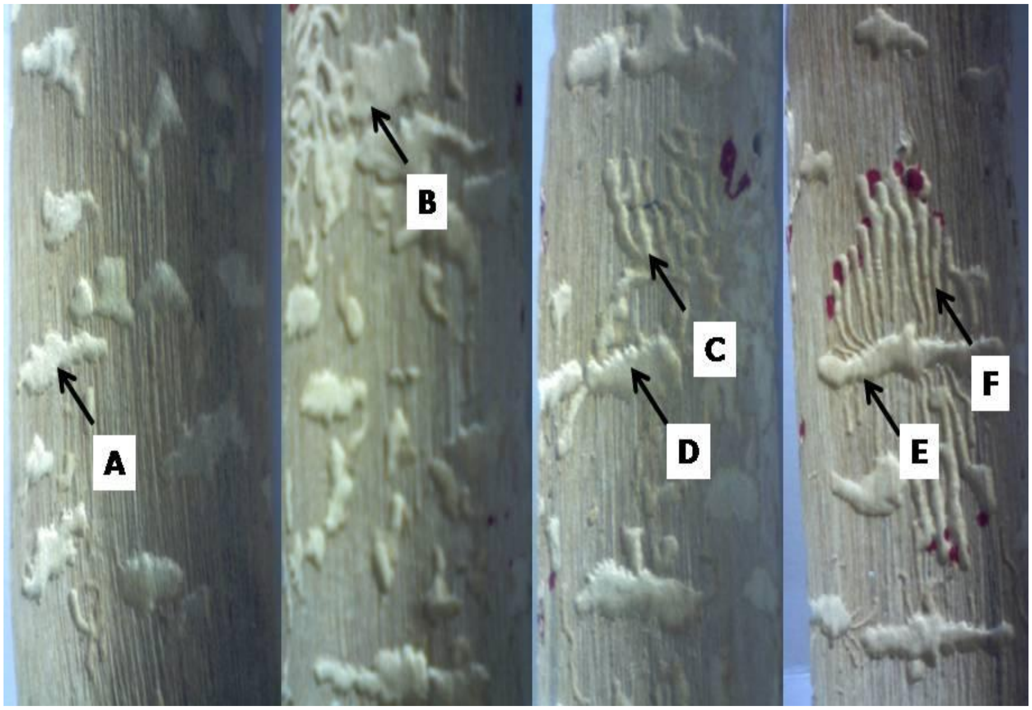
Tunnel of the larvae
Main tunnels

Picture. (2): Untreated cut after peeling, showing overlapping of tunnels.

Mean no. of beetles from treated cuts with Diazenox 1.5 cm^3, 3.5 and 4.5cm^3 was 219.6, 143.6 and 85.8 respectively. Unexpectedly number of exit holes was low as a result of **1)** Number of entrance holes didn't result in progeny through the first two weeks of exposure, insecticide killed beetles at the beginning of the holes. **2)** After wood peeling, it was noticed that, the newest infestations (In the latest month of exposure) didn't result in progeny as a result of dryness of wood (beetles bore the main tunnel alone) (**picture. 3: E, F**). According to Renoban, it is clear that, Renoban was more efficient than Diazenox based on number of entrance holes and exit holes, since the mean number of exit holes was (79 holes/cut) and (13 holes /cut) from treated cuts with 1.5 cm^3 and 3 cm^3 /liter respectively, number of exit holes from treated cut with 4.5cm^3/liter was zero, when wood peeling, there is the main tunnels alone, **picture. (3, A).** After 10 weeks of exposure in field, the high temp. caused dryness of cuts which leads to fail of the beetles in complete its generation, while insecticides (Diazenox & renoban) lost its effective. For this reason there is lot of the main tunnels alone. **Picture 2: E, F).**

The second year (before foliage): in general, infestation was lower than the 1st year in untreated or treated cuts with Diazenox or Renoban. No difference among the efficient of the three insecticides between the two years. It is clear that, cidial L_{50} was the most effective insecticide to obtain 100% reduction followed by renoban where, number of entrance holes was low and number of exit holes was zero and 5.7 holes/cut from treated cuts with 4.5cm/liter in the 1st and 2nd year respectively. **(Table 2 and Fig. 2).**

In conclusion, Cidial could be recommended at conc. 1.5cm^3/1 liter water or Renoban at concentration 4.5 cm^3 /liter water. The use of Diazenox at any concentration is not recommended.



Picture (3) (A, B, D, C): Main tunnels alone (through the latest month) as a result of dryness. (E, F): main tunnels and the beginning of neonate larvae tunnels (there is damage) without exit holes.

Table (1): Residual effects of Diazenox and Renoban at three given concentrations on the number of entrance and exit holes of the fig beetles at dates indicated during 2015 season.

Date		No. of entrance holes/ cut										After two months (In lab.)	
Treatment	Concentration	57/5		10/6		24/6		8/7		22/7		No. of exit holes/ cut	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Diazenox	1.5 cm/liter	4.20	1-6	8.60	1-27	12.80	1-24	14.20	4-30	23.40	10-44	219.6	153-281
	3.0 cm/liter	2.00	0-5	7.00	0-25	10.80	0-29	10.20	7-15	13.20	7-21	143.6	15-321
	4.5 cm/liter	1.20	0-4	1.80	0-4	10.60	2-23	11.80	6-22	18.20	8-28	85.8	0-165
Renoban	1.5 cm/liter	4.40	0-13	6.20	0-17	13.00	2-28	9.00	4-13	20.40	4-62	79	0-135
	3.0 cm/liter	1.80	0-5	1.80	0-5	4.00	0-8	4.60	0-16	10.40	8-14	13.4	0-55
	4.5 cm/liter	1.20	0-6	0.60	0-2	0.60	0-1	1.60	0-4	6.80	1-12	0	0
Untreated	0.0	32.40	16-76	35.40	12-86	19.00	7-36	14.20	3-18	23.20	10-42	658.4	372-1200

Table (2): Residual effects of Diazenox and Renoban at three given concentrations on the number of entrance and exit holes of the fig beetles at dates indicated during 2016 season.

Date		No. of entrance holes/ cut										After two months (In lab.)	
Treatment	Concentration	17/3		31/3		14/4		28/4		12/5		No. of exit holes/ cut	
		Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range
Diazenox	1.5 cm/liter	4.00	0-10	1.83	0-7	3.17	0-5	3.33	0-10	3.67	0-8	73.3	6-155
	3.0 cm/liter	2.67	1-5	2.5	0-6	2.33	0-6	1.83	0-4	4.67	2-11	49.7	0-116
	4.5 cm/liter	1.33	0-5	1.33	0-4	0.67	0-2	1.00	0-2	2.00	0-6	18	0-48
Renoban	1.5 cm/liter	3.5	0-٨	1.67	0-3	1.33	0-3	0.67	0-2	3.33	0-10	25.8	0-85
	3.0 cm/liter	1.67	1-3	0.17	0-1	0.17	0-1	1.17	0-3	2.17	0-7	5.8	0-19
	4.5 cm/liter	0.33	0-2	0.17	0-1	0.33	0-2	0.33	0-1	0.67	0-2	5.7	0-20
Untreated	0.0	14.00	10-18	8.33	2-12	4.17	1-8	4.83	1-13	7.67	1-20	219.2	151-280

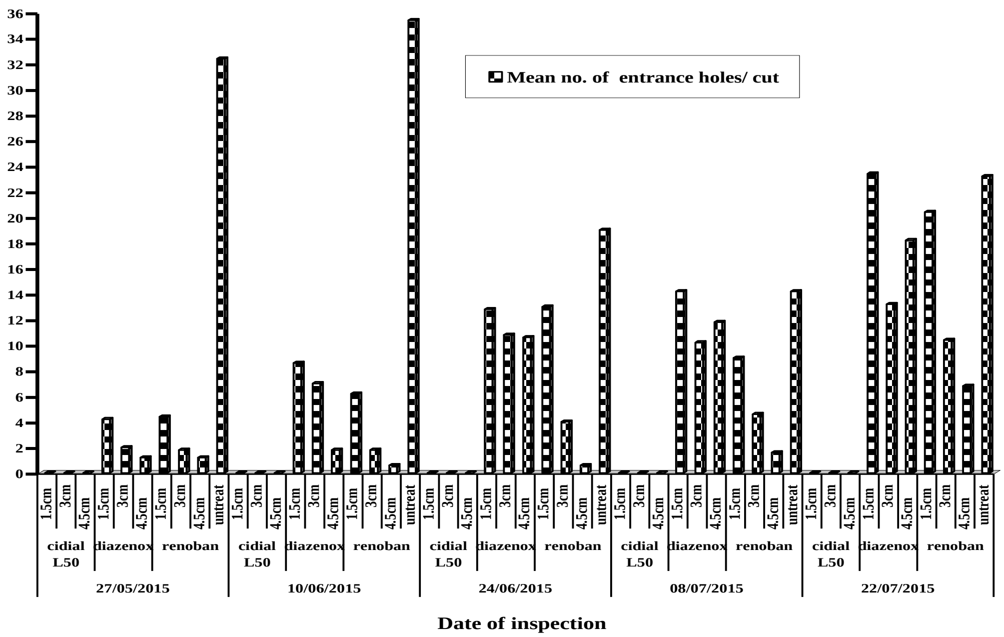


Fig.(1): The mean number of entrance holes for the fig borer *Hypothenemus eruditus* every two weeks per treated cut with the three tested insecticides in competiton with untreated through the first year (2015) .

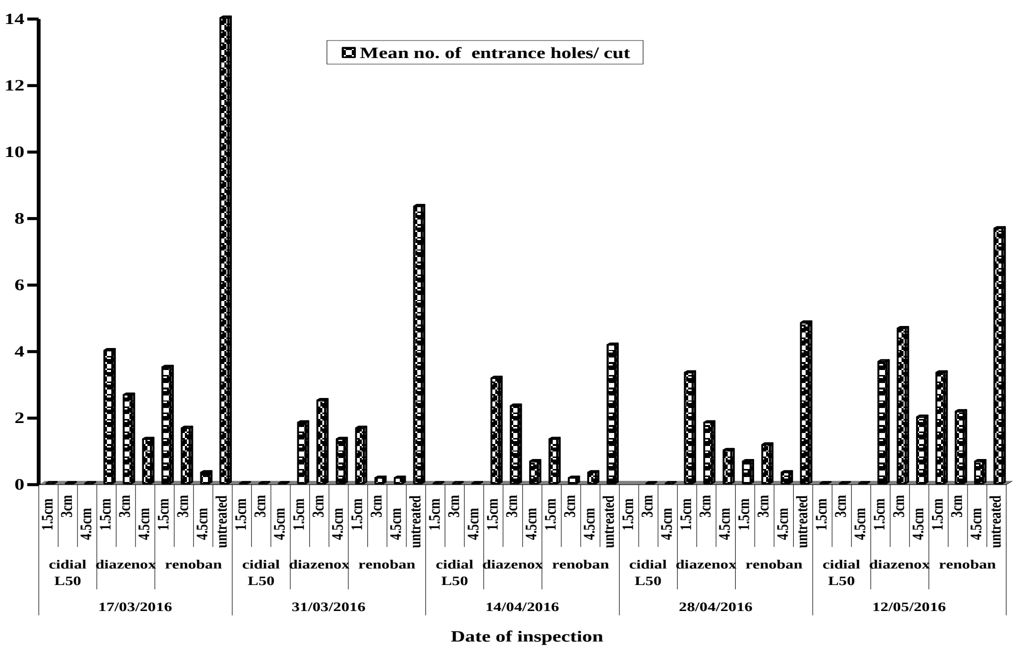


Fig. (2): The mean number of entrance holes for the fig borer *Hypothenemus eruditus* every two weeks per treated cut with the three tested insecticides in competiton with untreated through the second year (2016) .

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كفاءة ثلاثة مبيدات حشرية ضد خنفساء قلف التين (هيبوثينيموس إيروديتوس ويستوود)على أشجار التين الرمادي، فيكس كاريكا في دار الرماد، الفيوم

هدى رجب خليل علي
معهد بحوث وقاية النبات، مركز البحوث الزراعية، وزارة الزراعة

تم إجراء هذا البحث خلال موسمين متتاليين (٢٠١٥ و ٢٠١٦) على أشجار التين الناضجة المزروعة في منطقة دار الرماد، واكمل الجزء المعملي من الدراسة في قسم وقاية النبات، كلية الزراعة جامعة الفيوم. تم اختيار ثلاث مواد كيميائية ضد خنفساء القلف (هيبوثينيموس إريوديتوس (ويستوود) على أشجار التين (في مساحة فدانين). كانت ديازينوكس ٦٠٪، سيديال L_{50}% و رينوبان ٤٨٪ مع ثلاثة تركيزات ١.٥ و ٣ و ٤.٥ سم/ ١ لتر ماء بالإضافة إلى استخدام المياه وحدها ككنترول (قطع غير معالجة). اعتمادا على ثقوب الدخول والخروج، كان سيديال L_{50} المبيد الحشري الأكثر فعالية في خفض الاصابة بنسبة ١٠٠٪ خلال العامين، حيث كان متوسط عدد ثقوب الدخول والخروج صفرا في القطع المعالجة بــ سديال L_{50} في جميع التركيزات، يليه رينوبان حيث كان عدد ثقوب الدخول منخفضة وكان عدد ثقوب الخروج صفر و ٥.٧ ثقب / قطعة على القطع المعاملة بــ ٤.٥سم/ لتر في السنة الاولى و الثانية على التوالي. في حين كان ديازينوكس60% الأقل كفاءة حيث بعد شهرين في الحقل لا يوجد فرق في نسبة الإصابة بين ١.٥٪ ديازينوكس وغير المعالجة (١٤.٢ ثقوب / قطع). بشكل عام، لا يوجد فرق بين كفاءة المبيدات الثلاث بين السنتين.